



# Forests of Michigan, 2015

This resource update provides an overview of forest resources in Michigan based on inventories conducted by the U.S. 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 2015 inventory, estimates for current variables such as area, volume, and biomass are based on 6,672 plot samples collected from 2010-2015. Change variables such as net growth, removals, and mortality are based on 6,094 samples collected in 2005-2010 and 2010-2015. Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005) and O’Connell et al. (2015) 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 (Table 1 and Pugh et al. [2012]). 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 19.2-percent increase in average annual mortality of trees on forest land (Table 1). A 259-percent increase in ash (*Fraxinus americana*, *pennsylvanica*, and *nigra*) mortality is the predominate factor.

**Table 1.—Michigan forest statistics, 2015 and 2010. 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.**

	2015 Estimate	Sampling error (percent)	2010 Estimate	Sampling error (percent)	Change since 2010 (percent)
<b>Forest Land</b>					
Area (thousand acres)	20,311	0.6	20,003	0.4	1.5
Number of live trees (million trees)	14,176	1.4	13,966	1.0	1.5
Aboveground biomass of live trees (thousand oven-dry tons)	869,761	1.0	819,363	0.8	6.2
Net volume of live trees (million ft <sup>3</sup> )	34,968	1.1	32,489	0.8	7.6
Annual net growth live trees (thousand ft <sup>3</sup> /yr)	739,683	2.8	760,246	2.0	-2.7
Annual mortality of live trees (thousand ft <sup>3</sup> /yr)	415,689	3.6	348,594	2.4	19.2
Annual harvest removals of live trees (thousand ft <sup>3</sup> /yr)	369,868	6.5	363,617	4.9	1.7
Annual other removals of live trees (thousand ft <sup>3</sup> /yr)	12,923	25.2	12,140	24.4	6.5
<b>Timberland</b>					
Area (thousand acres)	19,324	0.7	18,984	0.5	1.8
Number of live trees (million trees)	13,454	1.5	13,248	1.1	1.6
Aboveground biomass of live trees (thousand oven-dry tons)	824,391	1.1	776,695	0.8	6.1
Net volume of live trees (million ft <sup>3</sup> )	33,117	1.2	30,748	0.9	7.7
Net volume of growing stock trees (million ft <sup>3</sup> )	30,337	1.2	28,343	0.9	7.0
Annual net growth of growing stock trees (thousand ft <sup>3</sup> /yr)	651,750	2.7	682,497	1.9	-4.5
Annual mortality of growing stock trees (thousand ft <sup>3</sup> /yr)	324,780	4.1	263,519	2.6	23.2
Annual harvest removals of growing stock trees (thousand ft <sup>3</sup> /yr)	326,555	6.6	319,463	5.0	2.2
Annual other removals of growing stock trees (thousand ft <sup>3</sup> /yr)	12,926	24.4	16,237	20.0	-20.4



# 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). Most is privately owned (69 percent) and a plurality of it occurs in the western Upper Peninsula (44 percent).

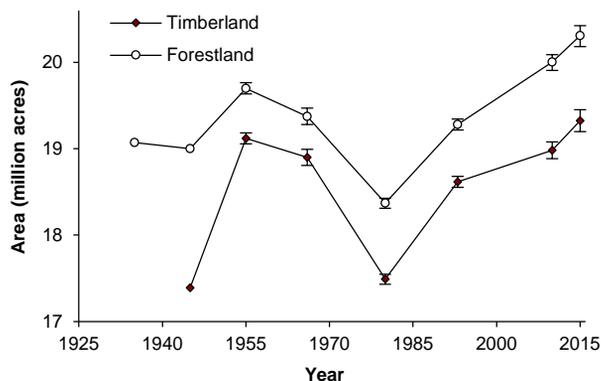


Figure 1.—Forest land and timberland by year, Michigan.

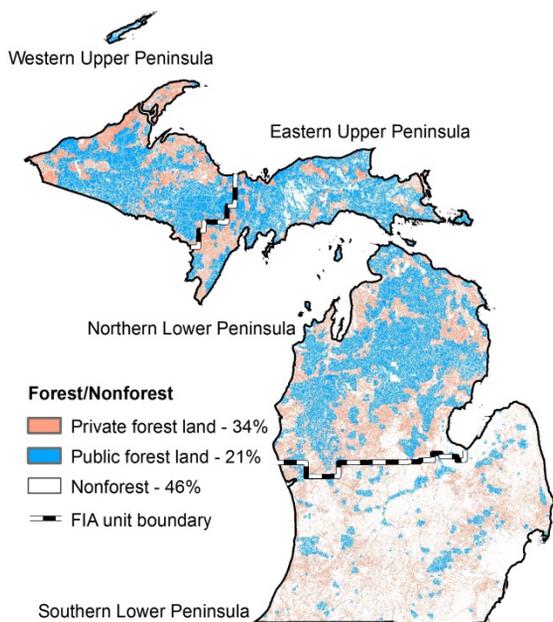


Figure 2.—FIA unit boundaries and area of forest/nonforest with forest identified by major ownership group, Michigan 2015.

Spruce/fir is the most abundant softwood forest-type group and the northern white-cedar forest type accounts for 53 percent of the group. The plurality of the spruce/fir group (47 percent) occurs in the eastern Upper Peninsula and the majority of it is privately owned (55 percent).

Families and individuals, corporations, and other private entities own the majority of forest land (44.5, 14.3, and 3.3 percent, respectively). The State of Michigan, U.S. Forest Service, National Park Service, and other public groups own the remainder (20.7, 13.6, 1.1, and 2.5, 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, contrary to the acreage in small-diameter stands. Small-diameter acreage leveled over the 2010 and 2015 inventories. The acreage of medium-diameter stands has been declining since the 1966 inventory.

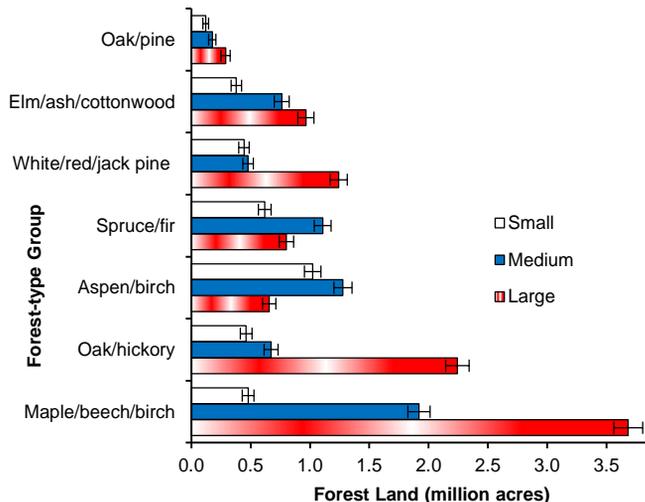


Figure 3.—Forest land by stand-size class (based on tree size) for top seven forest-type groups, Michigan 2015. Large trees are at least 11.0 and 9.0 inches in diameter for hardwoods and softwoods, respectively. Medium trees are at least 5.0 inches in diameter but smaller than large trees. Small trees are less than 5.0 inches in diameter.

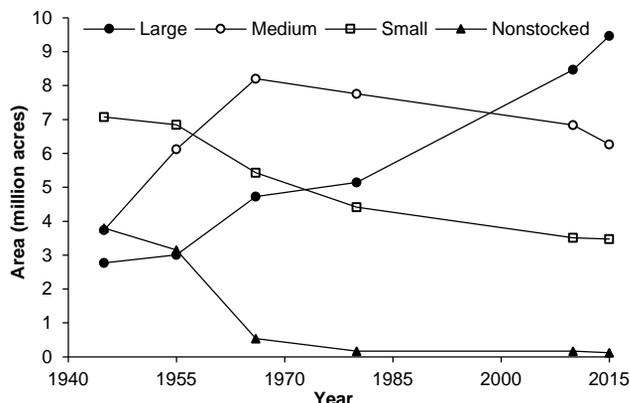


Figure 4.—Timberland by stand-size class and year, Michigan.

## 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 3,522 million live trees (at least 5-inch diameter) on forest land accounting for approximately 34,968 million ft<sup>3</sup> of volume and 786.5 million oven-dry tons of aboveground biomass. Estimates for volume and biomass each increased by 7.6 and 6.9 percent, respectively, since the 2010 inventory.

Contributing to this increase, notable gains in volume were observed for balsam fir (9 percent; *Abies balsamea*), northern white-cedar (11 percent; *Thuja occidentalis*), red maple (13 percent; *Acer rubrum*), white spruce (14 percent; *Picea glauca*), eastern hemlock (14 percent; *Tsuga canadensis*), black oak (21 percent; *Quercus velutina*), eastern white pine (22 percent; *Pinus strobus*), silver maple (35 percent; *A. saccharinum*), and black cherry (36 percent; *Prunus serotina*).

Total net growth has not varied appreciably since the 2010 inventory (Table 1). Disregarding net growth attributed by reversions (change from nonforest to forest), net growth for live trees on forest land rose 6 percent from the 2010 to 2015 inventory (6.82 to 6.43 million ft<sup>3</sup>). In contrast, reversion growth declined by 51 percent due to an overestimation in the 2010 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). Ash and American beech (*Fagus grandifolia*) have experienced large increases in mortality at 259 and 98 percent, respectively. Mortality for paper birch (*Betula papyrifera*) has declined by 23 percent since the 2010 inventory but still exceeds growth. 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 dropped nearly 3 percent since the 2010 inventory. Succession and management challenges are contributing to the low to negative net growth in birch.

Eastern white pine, eastern hemlock, and balsam fir, each shade-tolerant species, experienced gains in net growth since 2010 (35, 51, and 109 percent, respectively), while silver maple saw a gain in net growth of about 43 percent.

Quaking aspen (*Populus tremuloides*) and black oak have noticeably lower mortality since the 2010 inventory (20 and 61 percent reductions, respectively), while white spruce experienced gains in mortality by about 81 percent.

Given the variability in estimates of removals it is difficult to determine if total average annual removals actually differed from the 2010 to 2015 inventory. However, the red pine (*P. resinosa*) annual harvest removal estimate increased by 51 percent, while estimates decreased for jack pine (*P. banksiana*) and eastern white pine by 39 and 55 percent, respectively.

**Table 2.—Number, net volume, aboveground biomass (oven-dry), net growth, mortality, and harvest removals of live trees on forest land, Michigan 2015 (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	440	5,052	156,678	102,655	18,223	61,082
Red maple	476	4,789	129,170	125,640	20,590	53,807
Northern white-cedar	465	2,936	47,216	45,491	12,015	10,275
Red pine	223	2,448	44,228	73,085	6,313	40,816
Eastern white pine	104	1,754	30,068	64,511	7,250	2,531
Northern red oak	94	1,706	52,165	54,327	2,778	16,808
Quaking aspen	183	1,614	36,243	36,988	41,768	35,535
Bigtooth aspen	120	1,312	28,420	35,871	20,543	16,993
Black cherry	95	1,142	29,175	34,509	10,548	12,461
Eastern hemlock	75	1,101	21,207	19,952	5,023	6,162
Yellow birch	56	628	18,589	315	11,002	7,142
Green ash	56	489	14,926	-38,774	62,662	3,950
American beech	39	556	16,599	-5,832	17,077	9,262
White ash	30	410	12,190	-9,666	26,758	5,855
Black ash	58	312	10,320	-4,186	15,084	893

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

# National Woodland Owner Survey

The National Woodland Owner Survey (NWOS at [www.fia.fs.fed.us/nwos](http://www.fia.fs.fed.us/nwos)), conducted by FIA, studies private forest landowners' attitudes, management objectives, and concerns. The summaries reported here (Table 3) are based on the responses from 271 family or individual forest ownerships in Michigan surveyed between 2011 and 2013 (Butler et al. 2016). The results pertain only to ownerships with at least 10 acres of forest land.

There are an estimated 192,000 of these ownerships across Michigan, collectively accounting for 8.4 million acres. The average forest holding size is 44 acres; 76 percent of these ownerships own less than 50 acres of forest land, but 62 percent of the land is in holdings of at least 50 acres.

The primary reasons for owning forest land are related to wildlife, aesthetics, and privacy. Timber production is usually a low priority and most owners have not participated in traditional forestry management or assistance programs in the last 5 years. Only 8 percent have a written management plan but 48 percent felt that receiving management advice would be helpful.

## 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: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p.

Butler, B.J.; Hewes, J.H.; Dickinson, B.J., [et al.]. 2016. **USDA Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013**. Res. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p.

O'Connell, B.M.; LaPoint, E.B.; Turner, J.A.; Ridley, T.; Pugh, S.A.; Wilson, A.M.; Waddell, K.L.; Conkling, B.L. 2015. **The Forest Inventory and Analysis Database: Database description and user guide version 6.0.2 for Phase 2**. U.S. Department of Agriculture, Forest Service. 758 p. (<http://www.fia.fs.fed.us/library/database-documentation/>)

Pugh, S.A. 2013. **Michigan's forest resources, 2012**. Research Note NRS-165. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p.

Pugh, S.A.; Pedersen, L.D.; Heym, D.C.; Piva, R.J.; Woodall, C.W.; Barnett, C.J.; Kurtz, C.M.; Moser, W.K. 2012. **Michigan's Forests 2009**. Resour. Bull. NRS-66. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 68 p. [DVD included].

The fate of forests lies primarily in the hands of those who own and control the land. There are significant opportunities to help family forest owners increase their engagement and stewardship. Projects such as Tools for Engaging Landowners Effectively (<http://www.engaginglandowners.org>) can help the conservation community develop and implement assistance programs more effectively and efficiently.

**Table 3.—Summary of responses to NWOS (Butler et al. 2016).**

Ownership response	Acres (percent)	Owners (percent)
Uses woodland property as primary residence	54	58
Is retired	58	50
Is 55 years old or older	81	73
Is 65 years old or older	51	42
Has owned land for more than 25 years	58	48
Has an annual income below \$100,000	71	75
Receives no income from the wooded land	79	89
Has posted land to restrict public access	73	66
Plans to improve wildlife habitat in next 5 years	60	51
Wants their wooded land to stay wooded	94	95
Is likely or extremely likely to sell or give away land in the next 5 years*	22	14
Felt getting advice on how to transfer land to next generation would be helpful or very helpful*	47	43
Felt that timber production was an important or very important reason for owning forest land*	33	20
Felt that enjoying beauty or scenery was an important or very important reason for owning forest land*	79	83
Has cut or removed trees for sale in past 5 years	30	20
Has cut or removed trees for own use in past 5 years	57	56
Plans to cut trees for sale in next 5 years	30	15
Plans to cut trees for own use in next 5 years	57	50
Has not received forest management advice in past 5 years	73	87
Has a written management plan	17	8
Is not familiar with cost share programs	63	79
Is not familiar with forestry related tax programs	64	80
Felt getting advice on woodland management would be helpful or very helpful*	52	48
Felt getting advice on more favorable tax policies would be helpful or very helpful*	67	63

\*owners rated the topic as very helpful/important or helpful/important on a five-point Likert scale.

### How to Cite This Publication

Pugh, Scott A.; Paulson, Charles; Butler, Brett J. 2016. **Forests of Michigan, 2015**. Resource Update FS-79. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 4 p.

### Contact Information

Scott A. Pugh, Forester  
 USDA Forest Service  
 Northern Research Station  
 410 MacInnes Drive  
 Houghton, MI 49931  
 Ph: 906-482-6303 x.17 / Fax: 906-482-6355  
[spugh@fs.fed.us](mailto:spugh@fs.fed.us)  
 Northern FIA: <http://nrs.fs.fed.us/fia/>  
 National FIA: <http://fia.fs.fed.us>

USDA is an equal opportunity provider and employer

The published report is available online at <http://treesearch.fs.fed.us>