



Forests of Michigan, 2013

This publication 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. Since 1999, FIA has employed an annual inventory measuring data on a nominal 20 percent of sample plots each year. For the 2013 inventory, estimates for current variables such as area, volume, and biomass are based on 6,528 plot samples collected from 2009-2013. Change variables such as net growth, removals, and mortality are based on 6,145 samples collected in 2004-2008 and resampled in 2009-2013. Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005) and O’Connell et al. (2013) 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 creating uncertainty in associated trends; however, the latest inventory shows a notable 15.8 percent increase in average annual mortality of trees on forest land (Table 1).

Table 1.—Michigan forest statistics, 2013 and 2008. Volumes are for 5-inch and larger diameter trees. Number of trees and biomass are for 1-inch and larger diameter trees. Sampling errors and error bars shown in tables and figures in this report represent 68 percent confidence intervals.

	2013 Estimate	Sampling error (percent)	2008 Estimate	Sampling error (percent)	Change since 2008 (percent)
Forest Land					
Area (thousand acres)	20,357	0.6	19,821	0.4	2.7
Number of live trees (million trees)	14,240	1.4	14,028	0.9	1.5
Aboveground biomass of live trees (thousand oven-dry tons)	866,200	1.0	796,130	0.7	8.8
Net volume of live trees (million ft ³)	34,654	1.1	31,553	0.7	9.8
Annual net growth of live trees (thousand ft ³ /yr)	747,664	2.8	764,884	2.1	-2.3
Annual mortality of trees (thousand ft ³ /yr)	394,313	3.7	340,453	2.3	15.8
Annual harvest removals of live trees (thousand ft ³ /yr)	339,794	6.6	358,149	4.9	-5.1
Annual other removals of live trees (thousand ft ³ /yr)	12,435	31.2	14,068	20.6	-11.6
Timberland					
Area (thousand acres)	19,354	0.7	18,849	0.4	2.7
Number of live trees (million trees)	13,526	1.5	13,353	0.9	1.3
Aboveground biomass of live trees (thousand oven-dry tons)	820,107	1.1	756,718	0.7	8.4
Net volume of live trees (million ft ³)	32,781	1.2	29,921	0.8	9.6
Net volume of growing stock trees (million ft ³)	30,145	1.2	27,703	0.8	8.8
Annual net growth of growing stock trees (thousand ft ³ /yr)	675,345	2.7	690,454	2.0	-2.2
Annual mortality of growing stock trees (thousand ft ³ /yr)	301,511	4.1	263,048	2.6	14.6
Annual harvest removals of growing stock trees (thousand ft ³ /yr)	298,216	6.7	316,887	5.0	-5.9
Annual other removals of growing stock trees (thousand ft ³ /yr)	15,108	28.2	22,941	17.8	-34.1



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 19.4 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 (excludes 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 predominate forest-type group (Fig. 3). Most is privately owned (69 percent) and a plurality of it occurs in the northern Lower Peninsula (44 percent).

Spruce/fir is the most abundant softwood forest-type group and the northern white-cedar forest type accounts for 52 percent of the group. The plurality of the spruce/fir group (48 percent) occurs in the eastern Upper Peninsula and the majority of it is privately owned (53 percent).

Families and individuals, corporations, and other private entities own the majority of forest land (45.0, 13.5, and 3.4 percent, respectively). The state of Michigan, U.S. Forest Service, National Park Service, and other public groups own the remainder (21.0, 13.4, 1.1, and 2.7, respectively).

Michigan’s forests have been maturing as can be seen in the distribution of timberland by stand-size classes (Fig. 4). Since the 1935 inventory, the acreage of large-diameter stands has been increasing. Until the 2008 inventory, the acreage in small-diameter stands was declining. The acreage of medium-diameter stands has been declining since the 1966 inventory.

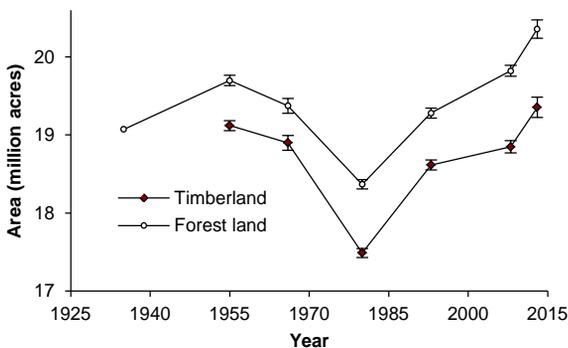


Figure 1.—Forest land and timberland by year, Michigan.

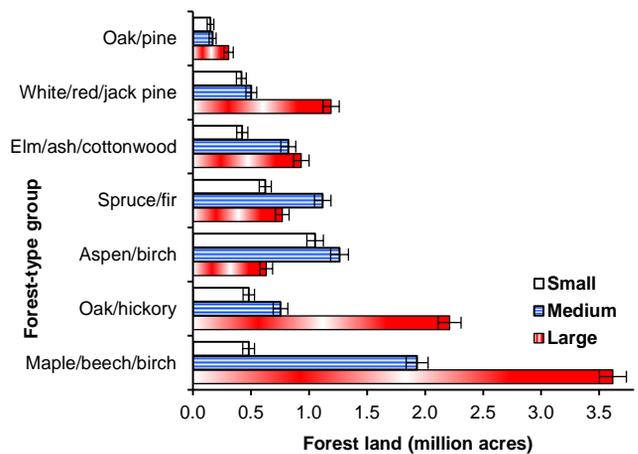


Figure 3.—Forest land by stand-size class (based on small, medium, and large trees) for top seven forest-type groups by acres, Michigan 2013.

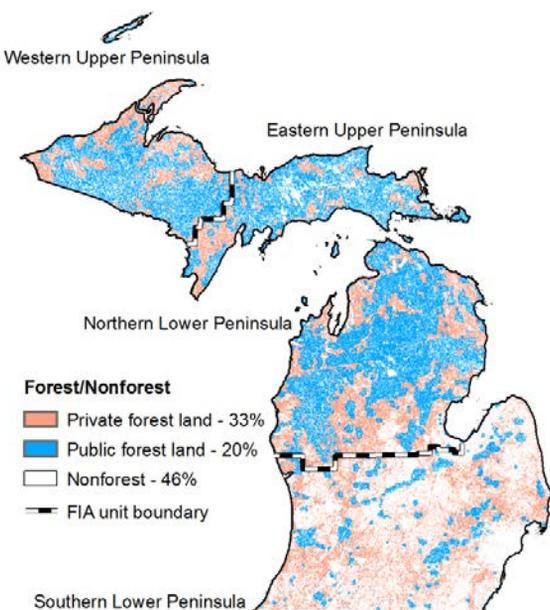


Figure 2.—FIA unit boundaries and area of forest/nonforest with forest identified by major ownership group, Michigan 2013.

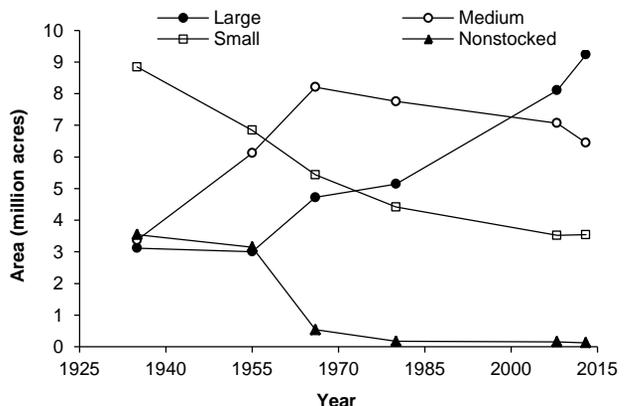


Figure 4.—Timberland by stand-size class and year, Michigan.

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 34,654 million ft³ of volume and 782, 119 thousand oven-dry tons of aboveground biomass. Volume and biomass each increased by 9.8 percent since the 2008 inventory.

Contributing to this increase, notable gains in volume were observed for sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), eastern white pine (*Pinus strobus*), black cherry (*Prunus serotina*), white oak (*Quercus alba*), white spruce (*Picea glauca*), and silver maple (*Acer saccharinum*) at 11, 18, 21, 27, 16, 19, and 35 percent, respectively.

Due to an artificially high estimate of annual net growth for the 2008 inventory, the current estimate is comparably 2.3 percent less (Table 1). An overestimation of reversion (change from nonforest to forest) growth caused the high estimate for the 2008 inventory. Some reversions that occurred in the 1990s to early 2000s were not identified until the 2008 inventory (see Pugh 2013). Disregarding net growth attributed by reversions, net growth for live trees on forest land rose 7.2 percent from the 2008 to 2013 inventory (627,780 to 673,272 thousand ft³). Mortality has reduced net growth for some species.

White (*Fraxinus americana*), green (*Fraxinus pennsylvanica*), and black ash (*Fraxinus nigra*) each experienced dramatic increases in mortality since the 2008 inventory (total increase of 57,188 thousand ft³ or 260 percent). The emerald ash borer (*Agrilus planipennis* Fairmaire) was the probable cause for most of this mortality.

Negative net growth estimates for white and green ash indicate that mortality was greater than growth for these species (Table 2). American beech (*Fagus grandifolia*) also experienced a large increase in mortality (93 percent) and negative net growth. American beech has been suffering from the adverse effects of beech bark disease (*Cryptococcus fagisuga* and *Neonectria*).

Eastern white pine and eastern hemlock (*Tsuga canadensis*), each shade tolerant species, experienced gains in net growth since the 2008 inventory (27 and 51 percent, respectively).

Northern red oak and black oak (*Quercus rubra* and *velutina*) had noticeably lower mortality since the 2008 inventory (54 and 48 percent reductions, respectively).

Given the variability in estimates of removals, it is difficult to determine if total average annual removals actually differed from the 2008 to 2013 inventory. However, red pine (*Pinus resinosa*) and American basswood (*Tilia americana*) annual harvest removal estimates increased by 82 and 108 percent, respectively.

Table 2.—Number, net volume, oven-dry biomass, net growth, mortality, and harvest removals of live trees on forest land, Michigan 2013 (selected prominent species).

Species	Trees ^a (million trees)	Net volume ^a (million ft ³)	Aboveground biomass ^b (thousand tons)	Net growth ^a (thousand ft ³ /yr)	Mortality ^a (thousand ft ³ /yr)	Harvest removals ^a (thousand ft ³ /yr)
Sugar maple	447	5,079	157,747	105,077	18,103	49,088
Red maple	476	4,706	127,232	124,075	19,197	43,900
Northern white-cedar	463	2,898	46,551	41,654	11,271	7,467
Red pine	218	2,384	43,094	77,664	5,744	38,257
Northern red oak	97	1,742	53,154	54,487	2,995	11,841
Eastern white pine	101	1,673	28,649	60,522	6,685	3,467
Quaking aspen	182	1,627	36,622	28,433	50,387	31,551
Bigtooth aspen	116	1,271	27,637	29,641	24,919	20,906
Eastern hemlock	74	1,076	20,771	18,635	4,797	3,432
Black cherry	89	1,042	26,859	30,361	10,673	9,595
Green ash	66	587	17,823	-19,966	46,443	4,896
American beech	39	569	16,921	-210	10,904	11,175
White ash	32	452	13,241	-6,529	24,125	3,985
Black ash	64	332	11,433	2,411	8,570	1,434

^aAt least 5-inch diameter trees. ^bAt least 1-inch diameter trees.

Reserve Status — Improved Implementation

FIA defines reserved forest land as forest land withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood-harvesting methods). All private forest land, regardless of conservation easements that may restrict harvesting, is not reserved. Timberland does not include reserved forest land.

In an effort to increase consistency among states and across inventory years, a refined set of procedures determining reserve status have been implemented with version 6.0 of the FIA field manual which took effect with the 2013 inventory year (began October 2012). Furthermore, all previously collected annual inventory data (1999 to present) have been updated using the new standardized interpretation.

Starting now, timberland estimates generated for earlier annual inventories can differ from previously published estimates. The 2012 inventory was the last inventory in which all data were available under the previous and improved implementations (Table 3). Small but significant changes are associated with timberland acreage, number of trees, volume, and biomass. The changes associated with the remaining timberland estimates are minor given the inherent variability in the associated estimates.

The improved implementation of the reserve status definition increases the spatial and temporal precision of timberland estimates allowing for higher quality trend analyses and potentially better forest management decisions.

Table 3.—Comparison of timberland estimates calculated using previous and improved reserve status implementations, Michigan 2012. Volumes are for 5-inch and larger diameter trees.

	2012 Estimate improved	2012 Estimate previous	Difference	Difference (percent)
Timberland				
Area (thousand acres)	19,298	19,685	-388	-2.0
Number of live trees ≥1 in diameter (million trees)	13,366	13,641	-275	-2.0
Aboveground biomass of live trees ≥1 in (thousand oven-dry tons)	809,601	829,103	-19,502	-2.4
Net volume of live trees (million ft ³)	32,305	33,106	-801	-2.4
Net volume of growing stock trees (million ft ³)	29,748	30,482	-735	-2.4
Annual net growth of growing stock trees (thousand ft ³ /yr)	667,881	677,832	-9,951	-1.5
Annual mortality of growing stock trees (thousand ft ³ /yr)	284,522	293,369	-8,847	-3.0
Annual harvest removals of growing stock trees (thousand ft ³ /yr)	309,034	309,034	0	0.0
Annual other removals of growing stock trees (thousand ft ³ /yr)	15,861	13,626	2,235	16.4

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.

O'Connell, B.M.; LaPoint, E.B.; Turner, J.A.; et al. 2013. **The Forest Inventory and Analysis database: database description and users manual version 5.16 for Phase 2**. Washington, DC: U.S. Department of Agriculture, Forest Service. (<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.; et al. 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].

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