USDA
United States Department of Agriculture

RESOURCE UPDATE FS-35

Forests of Michigan, 2014

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 2014 inventory, estimates for current variables such as area, volume, and biomass are based on 6,635 plot samples collected from 2009-2014. Change variables such as net growth, removals, and mortality are based on 6,116 samples collected in 2004-2009 and 2009-2014. 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.

*(See footnote on page 4.)

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 13.2-percent increase in average annual mortality of trees on forest land (Table 1).

Table 1.—Michigan forest statistics, 2014 and 2009. 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.

	2014 Estimate	Sampling error (percent)	2009 Estimate	Sampling error (percent)	Change since 2009 (percent)
Forest Land					
Area (thousand acres)	20,297	0.6	19,903	0.4	2.0
Number of live trees (million trees)	14,107	1.4	13,899	0.9	1.5
Aboveground biomass of live trees (thousand oven-dry tons)	867,107	1.0	805,589	0.7	7.6
Net volume of live trees (million ft^3)	34,802	1.1	31,976	0.8	8.8
Annual net growth live trees (thousand ft^3/yr)	759,198	2.6	755,823	1.9	0.4
Annual mortality of live trees (thousand ft^3/yr)	390,801	3.5	345,201	2.2	13.2
Annual harvest removals of live trees (thousand ft^3/yr)	355,204	6.6	351,743	4.6	1.0
Annual other removals of live trees (thousand ft^3/yr)	9,550	27.7	14,848	19.6	-35.7
Timberland					
Area (thousand acres)	19,322	0.7	18,889	0.5	2.3
Number of live trees (million trees)	13,415	1.5	13,208	1.0	1.6
Aboveground biomass of live trees (thousand oven-dry tons)	822,239	1.0	762,900	0.8	7.8
Net volume of live trees (million ft^3)	32,969	1.1	30,216	0.8	9.1
Net volume of growing stock trees (million ft^3)	30,248	1.2	27,972	0.9	8.1
Annual net growth of growing stock trees (thousand ft^3/yr)	674,327	2.6	687,016	1.9	-1.8
Annual mortality of growing stock trees (thousand ft^3/yr)	303,286	4.0	263,745	2.4	15.0
Annual harvest removals of growing stock trees (thousand ft^3/yr)	313,107	6.8	310,395	4.7	0.9
Annual other removals of growing stock trees (thousand ft^3/yr)	9,982	25.5	22,957	17.1	-56.5

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 being unable 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 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 (54 percent).

Families and individuals, corporations, and other private entities own the majority of forest land (45.0, 13.9, 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, 13.5, 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 2009 and 2014 inventories. The acreage of medium-diameter stands has been declining since the 1966 inventory.

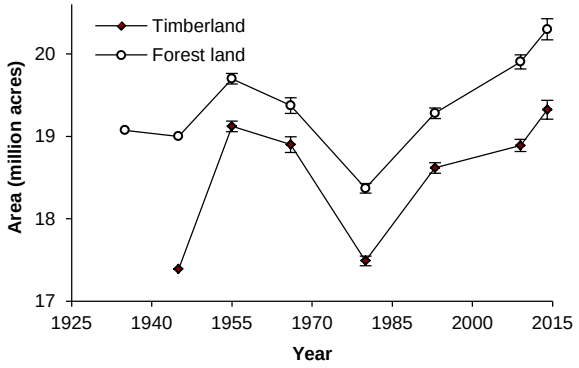

Figure 1.—Forest land and timberland by year, Michigan.

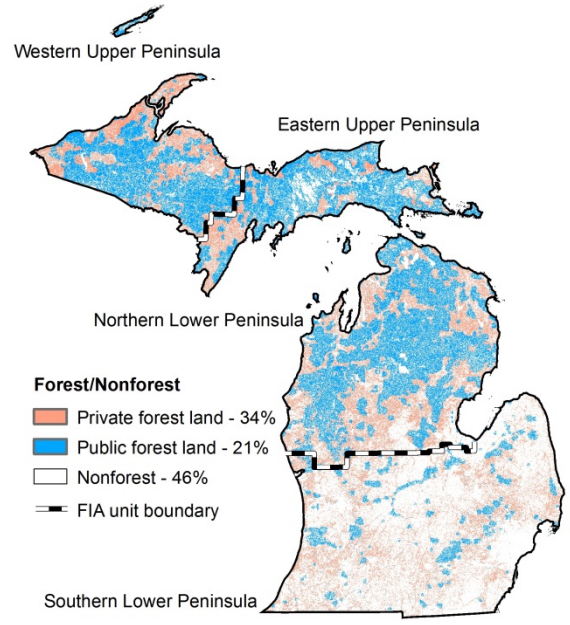

Figure 2.—FIA unit boundaries and area of forest/nonforest with forest identified by major ownership group, Michigan 2014.

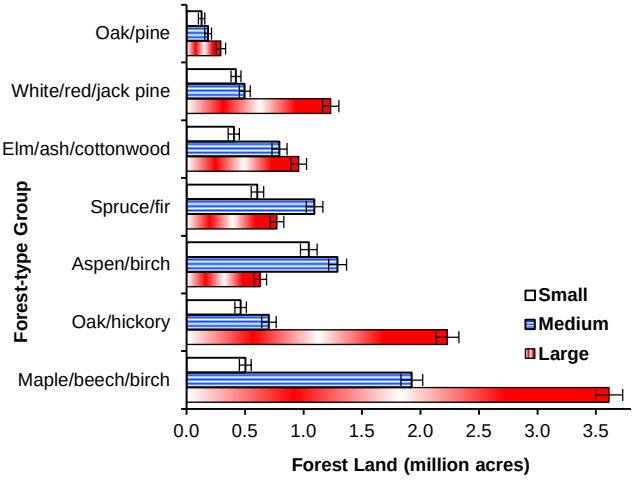

Figure 3.—Forest land by stand-size class (based on small, medium, and large trees) for top seven forest-type groups, Michigan 2014.

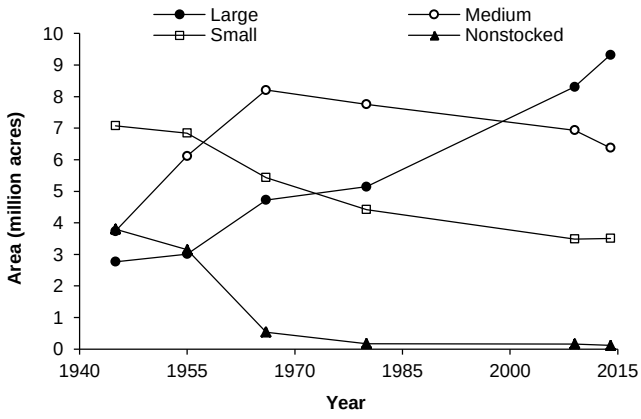

Figure 4.—Timberland by stand-size class and year, Michigan.

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 about 3,514 million live trees (at least 5-inch diameter) on forest land accounting for approximately 34,802 million ft^3 of volume and 784.1 million oven-dry tons of aboveground biomass. Estimates for volume and biomass each increased by 8.8 and 8.5 percent, respectively, since the 2009 inventory.

Contributing to this increase, notable gains in volume were observed for sugar maple (8 %; *Acer saccharum*), northern white-cedar (11%; *Thuja occidentallis*), white spruce (12%; *Picea glauca*), red maple (15%; *A. rubrum*), white oak (15%; *Quercus alba*), eastern hemlock *(*17%; *Tsuga canadensis*), eastern white pine (22%; *Pinus strobus*), black oak (28%; *Q. velutina*), silver maple (31%; *A. saccharinum*), and black cherry (36%; *Prunus serotina*).

Total net growth has not varied much since the 2009 inventory (Table 1). Disregarding net growth attributed to reversions (change from nonforest to forest), net growth for live trees on forest land rose 12 percent from the 2009 to 2014 inventory (623.9 to 696.8 million ft^3). In contrast, reversion growth declined by 53 percent due to overestimation in the 2009 inventory. Some reversions in the 1990s to early 2000s were not identified until the 2009 inventory (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 (*Fraxinus americana*, *pennsylvanica*, and *nigra*), American beech (*Fagus grandifolia*), and yellow birch (*Betula alleghaniensis*) have experienced large increases in mortality at 200, 124, and 71 percent, respectively. Mortality for paper birch (*B. papyrifera*) has declined slightly since the 2009 inventory but still exceeds growth. The emerald ash borer (*Agrilius planipennis*) and beech bark disease (*Cryptococcus fagisuga* and *Neonectria*) are the primary agents affecting ash and American beech, respectively. Succession and management challenges are contributing to negative net growth in birch.

Eastern white pine, eastern hemlock, and balsam fir (*Abies balsamea*), each shade-tolerant species, experienced gains in net growth since the 2009 inventory (40, 57, and 85 percent, respectively). Silver maple and paper birch each experienced gains in net growth of approximately 40 percent since the 2009 inventory.

Northern red oak and black oak (*Q. rubra* and *velutina*) had noticeably lower mortality since the 2009 inventory (50- and 62-percent reductions, respectively).

Given the variability in estimates of removals it is difficult to determine if total average annual removals actually differed from the 2009 to 2014 inventory. However, the red pine (*P. resinosa*) annual harvest removal estimate increased by 124 percent, while estimates decreased for jack pine (*P. banksiana*) and paper birch by 38 and 36 percent, respectively.

Table 2.—Number, net volume, aboveground biomass (oven-dry), net growth, mortality, and harvest removals of live trees on forest land, Michigan 2014 (for 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	443	5,043	156,596	102,660	17,730	57,883
Red maple	475	4,739	127,968	124,206	19,517	48,045
Northern white-cedar	459	2,899	46,465	43,981	11,360	10,226
Red pine	222	2,402	43,356	77,723	6,460	41,020
Eastern white pine	103	1,744	29,838	64,362	6,149	4,056
Northern red oak	95	1,729	52,845	53,589	2,793	12,453
Quaking aspen	183	1,625	36,414	33,354	44,262	32,830
Bigtooth aspen	118	1,275	27,728	33,088	23,352	18,517
Black cherry	93	1,098	28,132	32,120	10,612	11,215
Eastern hemlock	74	1,080	20,823	19,383	4,791	4,842
Yellow birch	56	633	18,754	-1,080	12,153	7,614
Green ash	64	565	17,124	-19,665	45,609	4,533
American beech	38	558	16,614	-3,316	14,065	10,230
White ash	31	432	12,759	-7,607	25,051	3,326
Black ash	61	323	10,892	-2,800	13,808	1,334

[a]At least 5-inch diameter trees. [b]At least 1-inch diameter trees.

Ash Mortality Increases — Valued in Millions of Dollars Annually

In the previous section, emerald ash borer was identified as the primary agent for the increase in mortality of ash from the 2009 to 2014 inventory. On timberland, pulpwood losses (mortality increase of nearly 350 percent) were estimated in cords for trees at least 5 inches in diameter and sawtimber losses (mortality increase over 400 percent) were estimated in board feet (International 1/4-inch rule) for the saw log portion of growing-stock trees. Notably, the distribution of the increase in pulpwood mortality varies from the distribution of live pulpwood volume by ownership group. The distribution of mortality increase is 0.6, 4.3, and 95.1 percent for U.S. Forest Service, State and local government, and private ownership, respectively; while, the corresponding distribution of live pulpwood volume is 8.0, 13.0, and 79.0 percent. Most ash volume (62 percent) and mortality (87 percent) is on private land in the Lower Peninsula where EAB has been established the longest. The Upper Peninsula has a higher proportion of publicly owned ash (36 and 15 percent for Upper and Lower Peninsula, respectively) and EAB is not or more recently established in much of the area.

Annual value losses of pulpwood and sawtimber by ownership group (Fig. 5) were calculated using the difference in average annual mortality between the 2009 and 2014 inventory and stumpage prices of $20 per cord and $100 per 1,000 board feet (see Michigan Department of Natural Resources Stumpage Price Reports at http://www.michigan.gov/dnr/0,1607,7-153-10368_22594-81536--,00.html). These estimates do not consider many of the caveats involved such as market dynamics, availability, loss of future growth, and the adverse effects imposed on Michigan's other natural resources. Nonetheless, results highlight that the loss is serious.

Statewide annual losses for pulpwood and sawtimber are each in the $14 to 15 million range, but current values of live ash on timberland are $322 and $297 million for pulpwood and sawtimber, respectively. Ash is a valuable resource in Michigan and rising mortality will cause greater future losses.

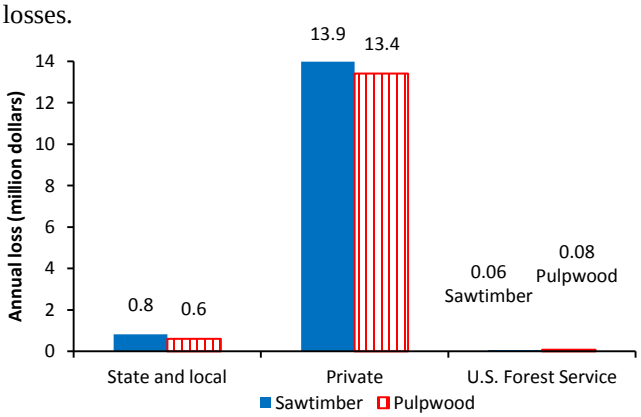

Figure 5.—Annual loss represented by increase in average annual mortality of ash by ownership group between the 2009 and 2014 inventory, Michigan.

Footnote—*One-fifth of the plots were measured annually from 1999 thru 2013 resulting in a complete set of samples for every 5 years of data collection. In 2014, this 5-year cycle was changed to 7 years, wherein 1/7th (14.3 percent) of the plots are measured annually. The complete set of plots will be retained. All inventory estimates (both current and change) will continue to be based on the most recent measurements and remeasurements taken on these plots. As the 7-year cycle is phased in, the difference between the report year and average date of the recent data will increase from 2 to 3 years. The difference between the report year and the average midpoint year for change will increase from 4.5 to 6.5 years. For the 2014 report, these differences are 2.3 and 4.8 years, respectively.

References

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How to Cite This Publication
Pugh, Scott A. 2015.
Forests of Michigan, 2014.
Resource Update FS-35. Newtown Square, PA:
U.S. Department of Agriculture, Forest Service,
Northern Research Station. 4 p.
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