



# Forests of Massachusetts, 2016

This report provides an overview of forest resources in Massachusetts based on an inventory 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. Results are for the measurement years 2011-2016 with comparisons made to 2007-2011<sup>1</sup> (see footnote on bottom of page 2). Forest resource measurements were taken on 535 plots with about 14 percent of the plots measured each year. Growth, mortality, and removals statistics are based on 505 remeasured plots. Estimates are updated and published annually.

For core tables and more information, including definitions and technical details, please refer to the

inventory citations on page 4 of this report or visit <https://fia.fs.fed.us>. A complete set of inventory tables is available at <https://doi.org/10.2737/FS-RU-138>.

## Overview

As of 2016, Massachusetts has an estimated 3.0 million acres of forest land (Table 1). The forest land area has not substantially changed since 2011. The estimated number of live trees on Massachusetts forest land in 2016 is 1.6 billion trees containing a total aboveground biomass of 220 million tons. The estimated volume of trees,  $\geq 5$  inches diameter at breast height, is 8.5 billion  $\text{ft}^3$ . The estimated annual net growth of these trees is 144 million  $\text{ft}^3/\text{yr}$  with annual mortality, harvest removals, and other removals, such as land clearing, of 51, 18, and 3 percent of net growth, respectively.

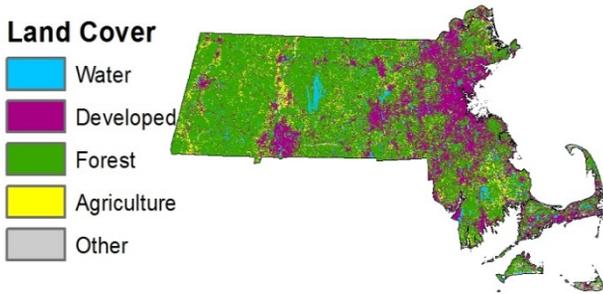
**Table 1.—Massachusetts forest statistics, change between 2007-2011 and 2011-2016. Sampling errors and error bars shown in the tables and figures in this report represent 68 percent confidence intervals for the estimated values.**

	2011 Estimate	Sampling error (percent)	2016 Estimate	Sampling error (percent)	Change since 2011 (percent)
<b>Forest Land</b>					
Area (thousand acres)	3,024.1	1.7	3,018.1	1.5	-0.2
Number of live trees $\geq 1$ in diameter (million trees)	1,567.6	3.1	1,561.5	3.2	-0.4
Live tree aboveground biomass (thousand oven-dry tons)	209,132.3	2.4	219,626.0	2.1	5.0
Net volume live trees $\geq 5$ in diameter (million $\text{ft}^3$ )	8,066.0	2.6	8,503.2	2.3	5.4
Net growth live trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	163,871.8	8.3	144,374.8	7.3	-11.9
Annual mortality of live trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	66,186.0	10.6	74,254.3	8.9	12.2
Annual harvest removals of live trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	34,065.4	28.4	25,892.9	23.4	-24.0
Annual other removals of live trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	10,932.3	35.2	4,158.6	41.2	-62.0
<b>Timberland</b>					
Area (thousand acres)	2,853.8	2.0	2,875.1	1.8	0.7
Number of live trees $\geq 1$ in diameter (million trees)	1,494.0	3.3	1,505.6	3.4	0.8
Live tree aboveground biomass (thousand oven-dry tons)	200,969.7	2.5	211,039.3	2.3	5.0
Net volume live trees $\geq 5$ in diameter (million $\text{ft}^3$ )	7,781.7	2.8	8,197.6	2.5	5.3
Net volume of growing stock trees (million $\text{ft}^3$ )	7,050.0	2.9	7,361.9	2.7	4.4
Net growth of growing stock trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	143,665.9	7.2	125,030.3	6.5	-13.0
Annual mortality of growing stock trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	43,279.9	11.3	51,155.5	9.7	18.2
Annual harvest removals of growing stock trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	28,313.3	28.4	21,309.8	24.7	-24.7
Annual other removals of growing stock trees $\geq 5$ in (thousand $\text{ft}^3/\text{yr}$ )	7,705.2	39.6	5,711.5	65.3	-25.9



# Forest Area

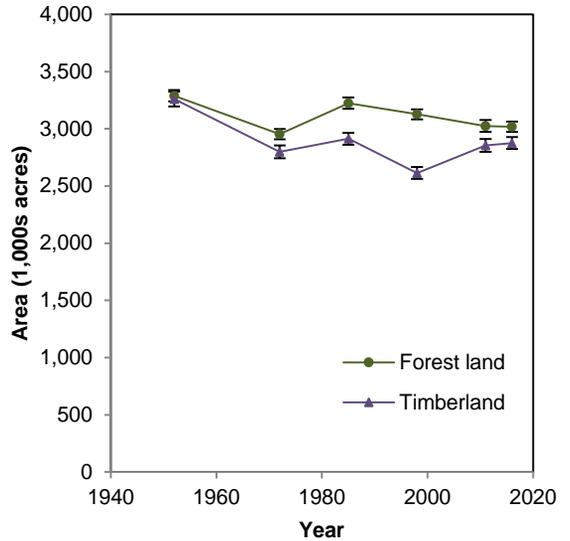
An estimated 60 percent of the land area of Massachusetts meets the FIA definition of forest land. This forest land is not evenly distributed across the Commonwealth (Fig. 1). The distribution is largely determined by development patterns and, to a lesser extent, arable lands—if left alone, most land in the Commonwealth would naturally revert to forest. Areas surrounding Boston, Springfield, and Worcester, along the coast and the major transportation corridors have the lowest occurrences of forest land.



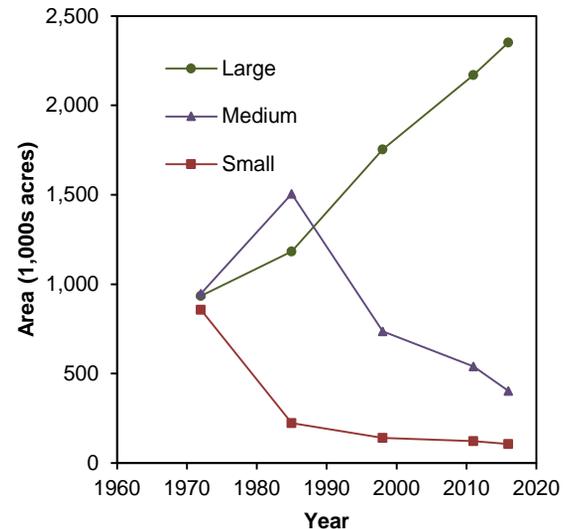
**Figure 1.—Forest and other land cover, Massachusetts, 2011.**  
Source: National Land Cover Database (Jin et al. 2013).

The area of forest land in Massachusetts has decreased from an estimated 3.3 million acres of in 1952, the first year FIA started collecting data in the Commonwealth, to an estimated 3.0 million acres in 2016, the nominal year of the most recent inventory results (Fig. 2). The general decrease from the earliest estimates is presumably due to increased development. The forest land estimates for 2011 and 2016 are not substantially different, but FIA will continue to monitor this.

There have been relatively few stand replacing events over the past few decades and this has resulted in the percentage of the forest land that is in the largest stand-size class<sup>2</sup> steadily increasing (Fig. 3). This has important implications for forest resilience (i.e., the ability of the forests to quickly recover following severe weather events or insect infestations), wildlife habitat, and other ecological functions.



**Figure 2.—Area of forest land and timberland, Massachusetts, 1952-2016.**



**Figure 3.—Area of timberland by stand-size class<sup>2</sup>, Massachusetts, 1972-2016.**

<sup>1</sup> One-fifth of the plots were measured annually from 1999 through 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 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.

<sup>2</sup> Small: dominated by trees less than 5.0 inches diameter at breast height (d.b.h.); Medium: dominated by trees 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods; Large: dominated by trees ≥9.0 inches for softwoods and 11.0 inches d.b.h. for hardwoods.

# Forest Composition

There are many different ways to characterize the composition of forests, three are presented here: forest-type groups, volume, and numbers of trees. Each provides a somewhat different view of the resource and there are many other potential metrics that can be examined.

Forest-type groups are amalgamations of forest types which are based on the plurality of trees within the plot/condition. In Massachusetts, oak/hickory and maple/beech/birch are the most common forest-type groups, representing 34 and 24 percent of the Commonwealth’s forest land, respectively (Fig. 4).

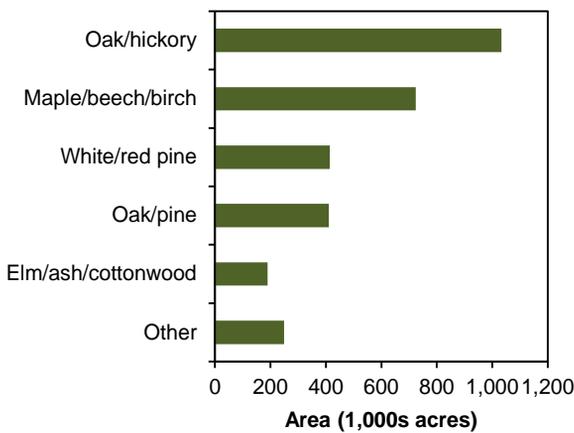


Figure 4.—Area of forest land by forest-type group, Massachusetts, 2011-2016.

The forests of Massachusetts contain a wide variety of tree species, with 68 species observed on the FIA plots inventoried between 2011 and 2016. In terms of total volume (Table 2), eastern white pine is the most common tree in the Commonwealth, but in terms of number of stems (Fig. 5), red maple is the most common. Rankings of the next most common species vary depending on whether volume or number of trees are examined, but in addition to these two species there are a number of oak species, eastern hemlock, sugar maple, white ash, and sweet birch among the group. Collectively, the 10 most common tree species account for 85 percent of the volume of the live trees and 78 percent of the number of trees in the Commonwealth.

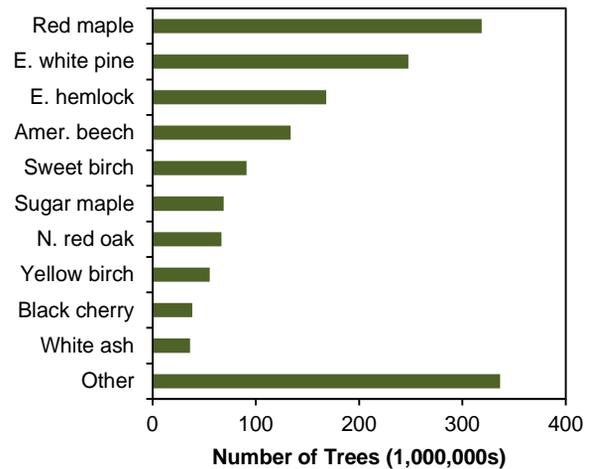


Figure 5.—Number of trees ≥1 inch diameter by species, Massachusetts, 2011-2016.

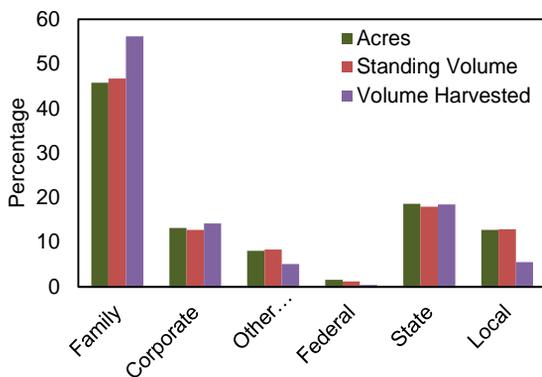
Table 2.—Top 10 trees species by volume estimates, Massachusetts, 2011-2016

Rank	Species	Volume of live trees on forest land (million ft <sup>3</sup> )	Sampling error (%)	Change since 2011 (%)	Volume of sawtimber trees on timberland (million board ft)	Sampling error (%)	Change since 2011 (%)
1	Eastern white pine	2,123.5	7.6	8.1	9,415.4	8.3	11.2
2	Red maple	1,431.3	5.9	2.4	2,992.9	8.9	3.0
3	Northern red oak	1,008.8	8.2	10.2	3,726.6	9.2	12.7
4	Eastern hemlock	869.5	10.3	3.3	2,313.5	12.1	0.1
5	Black oak	355.1	10.6	5.5	1,134.1	13.6	7.5
6	Sugar maple	335.5	13.3	-0.3	834.1	15.6	-2.4
7	White ash	303.8	14.5	0.2	997.2	18.3	4.8
8	Sweet birch	278.5	11.6	13.4	593.9	17.3	12.6
9	White oak	247.8	10.5	11.5	812.2	14.6	23.9
10	Scarlet oak	232.9	13.3	9.1	681.3	15.8	8.6
	All species	8,503.2	2.3	5.4	26,944.0	3.5	8.3

## A Closer Look at Timber Supply: Who Owns the Wood and Who is Harvesting?

Knowing who owns the timber resource, and who is and who is not harvesting, is important for making informed business and policy decisions. Due to small sample size issues, results are presented for Southern New England (i.e., Connecticut, Massachusetts, and Rhode Island). The many commonalities across the ownerships and forests of the region help justify this combination.

Most of the forest land across Southern New England is privately owned with 46 percent of all forest land classified as family forest land (Fig. 6). The distribution of the standing timber volume is similar to the acreage distribution. The relative distribution of timber harvesting reflects differences in ownership objectives and management practices; 56 percent of the removals are from family forest lands.



**Figure 6.—Percentage of forest land, standing timber volume and annual timber harvest volume by ownership class, Southern New England, 2016.**

## Literature Cited

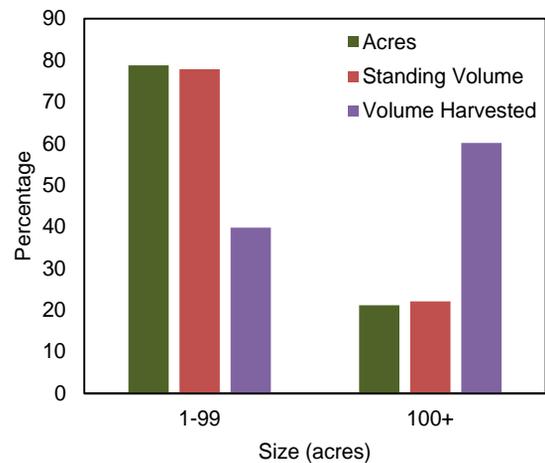
- Bechtold, W.A.; Patterson, P.L., eds. 2005. **The enhanced forest inventory and analysis program: national sampling design and estimation procedures**. Gen. Tech. Rep. SRS-80. Asheville, NC: USDA Forest Service, Southern Research Station. 85 p. <https://doi.org/10.2737/SRS-GTR-80>.
- Butler, B.J.; Hewes, J.H.; Dickinson, B. [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: USDA Forest Service, Northern Research Station. 39 p. <https://doi.org/10.2737/NRS-RB-99>.
- Gormanson, D.D.; Pugh, S.A.; Barnett, C.J. [et al.]. 2017. **Statistics and quality assurance for the Northern Research Station Forest Inventory and Analysis Program, 2016**. Gen. Tech. Rep. NRS-166. Newtown Square, PA: USDA Forest Service, Northern Research Station. 39 p. <https://doi.org/10.2737/NRS-GTR-166>.

### How to Cite This Publication

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Northern FIA: <https://nrs.fs.fed.us/fia/>  
National FIA: <https://fia.fs.fed.us>

Using data from the National Woodland Owner Survey (Butler et al. 2016), the 387,000 family forest ownerships (50,000 family forest ownerships with 10+ acres) across the region can be examined in greater detail. Family forest ownerships have a range of size of holdings with 79 percent of the family forest land in holdings less than 100 acres (Fig. 7). But the larger ownerships, those with 100+ acres, contribute a disproportionate 60 percent of the annual timber harvest from family forest lands. Looking at other attributes of family forest ownerships, such as reasons for owning, absentee ownership, owner age, and interactions with forestry professionals (Silver et al. 2015), are also important and should be considered in future examinations of timber harvesters.



**Figure 7.—Percentage of forest land, standing timber volume and annual timber harvest volume by family forest ownership size class, Southern New England. Plot data: 2012-2016 (remeasured from 2007-2011). NWOS data: 2011-2103.**

- Jin, S.; Yang, L.; Danielson, P. [et al.]. 2013. **A comprehensive change detection method for updating the National Land Cover Database to circa 2011**. Remote Sensing of Environment. 132: 159–175. <https://doi.org/10.1016/j.rse.2013.01.012>.
- O'Connell, B.M.; Conkling, B.L.; Wilson, A.M. [et al.]. 2017. **The Forest Inventory and Analysis database: Database description and user guide for Phase 2 (version 7.0)**. Newtown Square, PA: USDA Forest Service, Northern Research Station. 830 p. <https://www.fia.fs.fed.us/library/database-documentation> (accessed May 26, 2017).
- Silver, E.J.; Leahy, J.E.; Weiskittel, A.R. [et al.]. 2015. **An evidence-based review of timber harvesting behavior among private woodland owners**. Journal of Forestry. 113(5): 490–499. <https://doi.org/10.5849/jof.14-089>.

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