



Forests of Missouri, 2016

This resource update provides an overview of forest resources in Missouri based on an inventory conducted by the U.S. Forest Service, Forest Inventory and Analysis (FIA) program at the Northern Research Station in cooperation with the Missouri Department of Conservation. Estimates are based on field data collected using the FIA annualized sample design and are updated yearly. Information about the national and regional FIA program is available online at <http://fia.fs.fed.us>. For the 2016 inventory, estimates for current variables such as area, volume, and biomass are based on 7,524 plot samples collected from 2011-2016. Change variables such as net growth, removals, and mortality are based on 7,343 samples collected in 2006-2011 and 2011-2016. Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005), O’Connell et al. (2013), and Gormanson et al. (2017) for definitions and technical details.

Overview

The forest land area of Missouri in 2016 is estimated at 15.3 million acres (Table 1). The small decrease in forest land area from 2011 to 2016 is within the margin of error, so it can be said that the area of forest land has remained unchanged. The number of live trees on Missouri’s forest land in 2016 was estimated at 8.0 billion trees, a decrease of 3.8 percent from 2011. From 2011 to 2016, live tree aboveground biomass increased by 2.1 percent on forest land and by 2.0 percent on timberland. Average annual net growth decreased by 25.8 percent on forest land and timberland, largely the result of increased mortality. Average annual mortality increased by 44.2 percent on forest land and by 39.0 percent on timberland. Average annual removals decreased by less than 1 percent on forest land and by 3 percent on timberland.

Table 1.—Missouri forest statistics, change between 2011 and 2016. 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.

	2016 Estimate	Sampling error (percent)	2011 Estimate	Sampling error (percent)	Change since 2011 (percent)
Forest Land					
Area (thousand acres)	15,332.2	0.7	15,472.0	0.7	-0.9
Number of live trees (million trees)	8,022.8	1.2	8,336.9	1.3	-3.8
Aboveground biomass of live trees (thousand oven-dry tons)	651,309.7	1.0	637,796.3	1.0	2.1
Net volume of live trees (million ft ³)	21,394.3	1.1	20,799.6	1.1	2.9
Annual net growth live trees (thousand ft ³ /yr)	355,718.5	4.4	479,173.8	3.7	-25.8
Annual mortality of live trees (thousand ft ³ /yr)	344,118.3	3.5	238,652.8	4.0	44.2
Annual harvest removals of live trees (thousand ft ³ /yr)	157,321.3	8.3	173,509.8	7.9	-9.3
Annual other removals of live trees (thousand ft ³ /yr)	20,114.9	23.4	23,889.4	25.4	-15.8
Timberland					
Area (thousand acres)	14,770.6	0.8	14,933.3	0.8	-1.1
Number of live trees (million trees)	7,732.0	1.3	8,031.7	1.4	-3.7
Aboveground biomass of live trees (thousand oven-dry tons)	628,498.3	1.0	616,467.7	1.1	2.0
Net volume of live trees (million ft ³)	20,637.1	1.2	20,099.2	1.2	2.7
Net volume of growing stock trees (million ft ³)	16,440.8	1.3	16,388.6	1.4	0.3
Annual net growth of growing stock trees (thousand ft ³ /yr)	298,630.8	3.9	389,483.1	3.3	-23.3
Annual mortality of growing stock trees (thousand ft ³ /yr)	215,918.3	4.0	155,313.7	4.2	39.0
Annual harvest removals of growing-stock trees (thousand ft ³ /yr)	131,590.2	8.9	149,530.4	8.3	-12.0
Annual other removals of growing stock trees (thousand ft ³ /yr)	16,486.3	25.3	29,754.0	22.2	-44.6



Forest Area

At the time of first settlement, it is estimated that 31 million acres in Missouri were forested (King et al. 1949). By the time of the first forest inventory in 1947, the area of forest land had declined to 15.2 million acres (Fig. 1). The 1972 forest inventory reported the lowest area of forest land in the State at 12.9 million acres (Spencer and Essex 1976). Since 1972, the area of forest land has increased, peaking at 15.5 million acres in 2010. Between 2010 and 2016, forest land area has decreased by 160,000 acres.

The most heavily forested area in Missouri is in southeastern and south-central parts of the State (excluding the boot heel area) (Fig. 2). The northern and western areas of Missouri are primarily agriculture and prairie, with forest land found in wood lots and on the breaks and bottomlands along the streams.

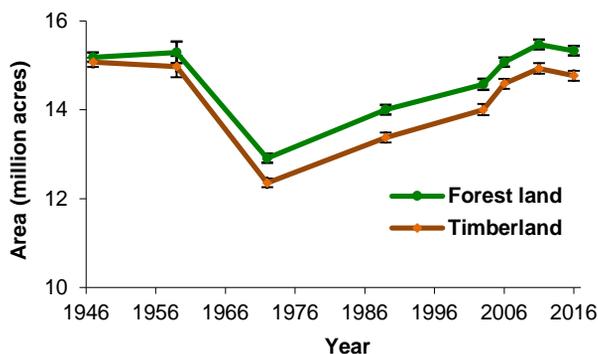


Figure 1.—Area of forest land and timberland in Missouri by year.

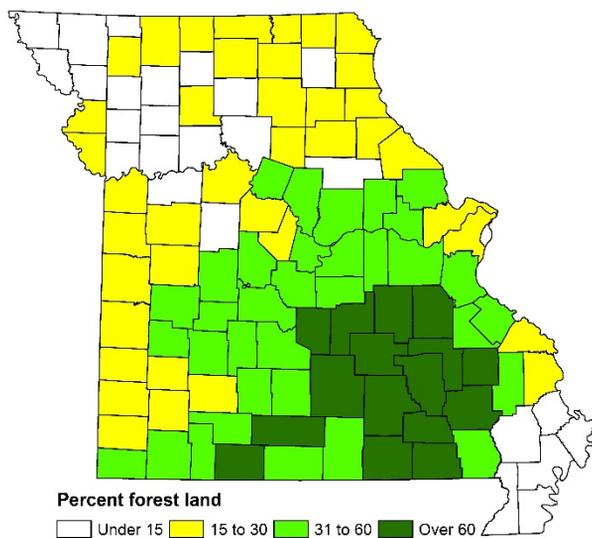


Figure 2.—Percent forest land by county, Missouri, 2016.

The oak/hickory forest-type group occupies 80 percent of the total area in the State (Fig. 3). The elm/ash/cottonwood forest-type group is the second largest forest-type group, but only makes of 7 percent of the total forest land area in the State.

Missouri’s timberland has been maturing as can be seen in the distribution of timberland by stand-size classes (Fig. 4). Between 2006 and 2016, the acreage of large-diameter stands increased by 19 percent while the acreage of medium diameter stands decreased by 14 percent and small diameter stands decreased by 33percent. Nearly 65 percent of the oak/hickory forest-type group is currently in the large diameter stand-size, while only 6 percent of is in the small diameter stand-size, raising concerns about the adequacy of oak regeneration.

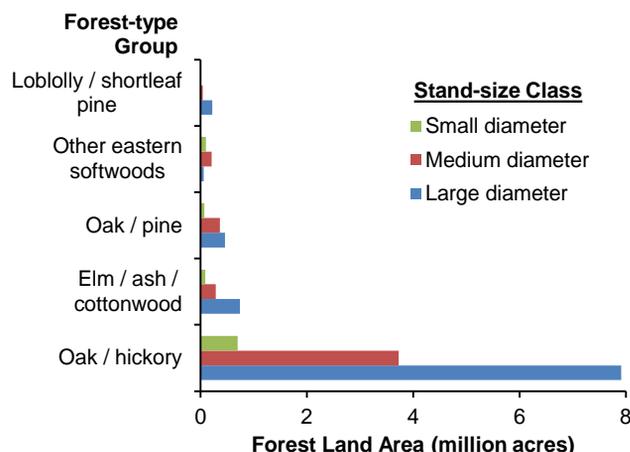


Figure 3.—Forest land area by stand-size class for top five forest-type groups, Missouri, 2016. Note: Large-diameter stands: a plurality of stocking is in softwoods 9 inches d.b.h. and larger and hardwoods 11 inches d.b.h. and larger. Medium-diameter stands: a plurality of stocking is in softwood trees from 5 to 9 inches and hardwood trees from 5 to 11 inches d.b.h. Seedling-sapling stands: a plurality of stocking is in trees less than 5 inches.

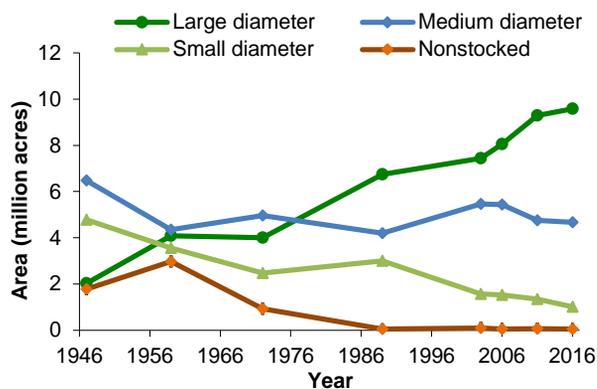


Figure 4.—Timberland area by stand-size class and year, Missouri.

Volume, Biomass, and Trends

FIA field crews recorded 86 species of trees on Missouri's forest land during the 2016 inventory. More than half of Missouri's 21.4 billion cubic feet of live tree volume on forest land is represented by just 5 species (Table 2): white oak (*Quercus alba*), black oak (*Quercus velutina*), post oak (*Quercus stellata*), shortleaf pine (*Pinus echinata*), and northern red oak (*Quercus rubra*). Between 2011 and 2016, eastern redcedar (*Juniperus virginiana*) had a 13.0 percent increase in volume of live trees on forest land, followed by shortleaf pine. The volume of scarlet oak (*Quercus coccinea*) decreased by 20.6 percent and northern red oak decreased by 7.5 percent over the same period. The large increase in live tree volume for eastern redcedar is due, in large part, to there being a prolific seed source as redcedar is the most numerous tree species in the State with a wide distribution and a relatively low rate of mortality. Scarlet oak is experiencing large decreases in volume because of the large amount of trees that are becoming overmature, and insect and weather related mortality.

The aboveground live tree biomass on forest land increased from 637.6 million short tons in 2011 to 651.3 million short tons in 2016. Most aboveground tree biomass is in the bole (70 percent), followed by tops and limbs (18 percent), saplings (8 percent), and stumps (4 percent).

Average annual net growth of live trees on forest land (equivalent to annual gross growth less annual mortality) slowed from 479.2 million cubic feet per acre per year in 2011 to 355.7 million cubic feet per acer per year in 2016. The major reason for this decrease is the high rate of mortality in the other red oak and other eastern soft hardwoods species groups. Drought, insects, disease, and stand age are some of the factors that have lead to the high mortality rate in Missouri.

Table 3.— Average annual net growth, annual mortality, and annual removals of growing-stock on timberland as a percent of current growing-stock volume on timberland, Missouri, 2016

Major species group	Average annual net growth	Average annual mortality	Average annual harvest removals	Average annual other removals
Pine	1.9	0.8	0.7	--
Other softwoods	3.2	0.4	1.4	0.3
Oak	1.5	1.4	0.8	0.1
Other hard hardwoods	2.3	1	0.8	0.1
Soft hardwoods	2.6	1.8	0.6	0.1
Total	1.8	1.3	0.8	0.1

Annual net growth of growing-stock on timberland exceeds removals of growing-stock on timberland for all of the major species groups in Missouri. Growth, removals, and mortality are often expressed as a percent of current volume to facilitate comparisons (Table 3). Higher mortality rates in the soft hardwoods major species group are mostly due to mortality of American elm (*Ulmus americana*), white ash (*Fraxinus americana*), and eastern cottonwood (*Populus deltoides*).

Mortality rates as a percent of growing-stock volume on timberland, are highest for soft hardwoods at 1.8 percent, followed by oaks at 1.4 percent. Harvest removal rates, as a percent of growing-stock volume on timberland, are highest for other softwoods at 1.4 percent, and nearly the same for the other major species groups.

Table 2.—Top 10 tree species by statewide volume estimates on forest land and timberland, Missouri, 2016

Rank	Species	Number of live trees on forest land (million)	Change since 2011 (%)	Volume of live trees on forest land (million ft ³)	Change since 2011 (%)	Volume of sawtimber trees on timberland (million board feet)	Change since 2011 (%)
1	White oak	715.7	-1.1	4,214.7	2.7	13,047.4	5.1
2	Black oak	425.5	-14.7	2,926.7	1.5	9,472.5	3.5
3	Post oak	429.3	-10.4	2,130.9	1.8	4,397.0	0.7
4	Shortleaf pine	139.3	-2.5	1,000.6	8.6	4,255.4	11.6
5	Northern red oak	110.5	-18.1	955.2	-7.5	3,481.0	-2.9
6	Eastern redcedar	796.4	4.0	802.2	13.0	503.9	14.2
7	Black walnut	110.6	-2.4	725.2	7.5	1,984.5	9.4
8	Shagbark hickory	194.8	-1.7	603.2	5.4	1,539.7	7.4
9	Scarlet oak	71.0	-21.2	495.9	-20.6	1,693.6	-16.3
10	American sycamore	25.2	8.8	442.2	0.6	1,631.2	-4.7
	Other softwoods	1.0	-33.8	18.9	35.3	76.1	27.9
	Other hardwoods	5,003.6	-3.1	7,078.5	5.2	14,565.6	1.7
	Total	8,022.8	-3.8	21,394.3	2.9	56,647.9	2.7

Missouri's Timber Product Output, 2015

In 2016, the primary wood-using mills in Missouri were surveyed to determine the size and composition of the State's primary wood-using industry, its use of roundwood, and the generation and disposition of wood residues for 2015. Below are some preliminary findings from that survey. A full report will follow as the information is analyzed.

In 2015, there were 381 primary processors of roundwood in Missouri, of which 351 were saw mills, 6 were cooperage mills, 6 were post and pole mill, and the rest processed other miscellaneous products. Saw mills processed 87 percent of the total industrial roundwood processed in the State.

There were 132.1 million cubic feet of industrial roundwood harvested from Missouri's forests in 2015, an 8 percent increase from 2012. Saw logs accounted for nearly 85 percent of industrial roundwood harvested in 2015. Industrial roundwood harvested for pulp and composite panels was the second most harvested product, accounting for less than 5 percent of the total harvest. Red oaks and white oaks remained the most harvested species group, combined, accounting for 70 percent of the State's total harvest (Fig. 5). Other important species harvested were shortleaf pine, black walnut, and hickory.

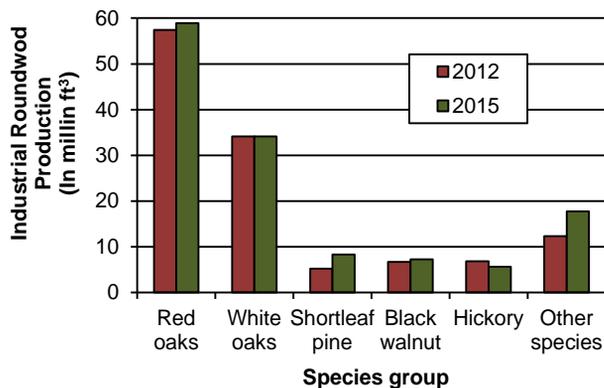


Figure 5.—Industrial roundwood production by species group, Missouri, 2012 and 2015.

One-third of the mill residues generated during the processing of industrial roundwood was used for charcoal (Fig. 6). Nearly another third of the mill residues were used for mulch, animal bedding, and other miscellaneous uses. Only 4 percent of the mill residues went unused.

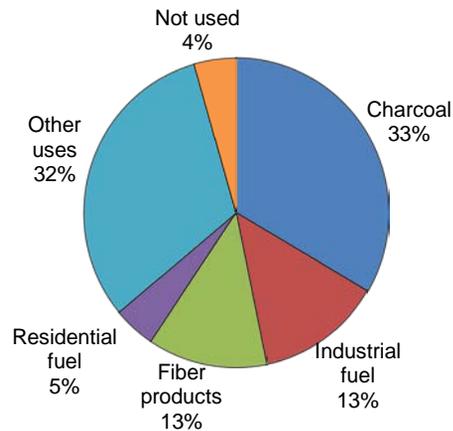


Figure 6.—Distribution of residues generated by primary wood-using mills by method of disposal, Missouri, 2015.

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