



# Forests of Missouri, 2013

This science 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, for the measurement cycle 2013 (years 2009-2013) with comparisons made to cycle 2008 (years 2004-2008). The 2013 sample data consist of 3,185 field measured plots on forest land, with about 20 percent collected per year. Data used in this publication were accessed from the FIA Database in May 2014.

## Overview

The area of forest land in Missouri increased by 57 thousand acres (0.4 percent) from 15.4 million acres in 2008 to 15.5 million acres in 2013 (Table 1). The number of live trees on Missouri’s forest land in 2013 was estimated at 8.2 billion trees, a decrease of 3.9 percent from 2008. Live-tree aboveground biomass and net volume increased on both forest land and timberland. Average annual net growth, and average annual other removals (e.g., land use change) decreased, while average annual mortality and average annual harvest removals increased from 2008 (Table 1).

**Table 2.—Missouri forest statistics, change between 2008 and 2013 cycles**

	2008 Estimate	Sampling error (percent)	2013 Estimate	Sampling error (percent)	Change since 2008 (percent)
<b>Forest Land</b>					
Area (thousand acres)	15,395.5	0.8	15,452.4	0.7	0.4
Number of live trees ≥1 in diameter (million trees)	8,533.8	1.3	8,201.8	1.3	-3.9
Aboveground biomass of live trees ≥1 in (thousand oven-dry tons)	620,227.0	1.0	641,447.1	1.0	3.4
Net volume of live trees ≥ 5 in diameter (million cubic ft)	20,143.1	1.2	20,978.7	1.1	4.1
Annual net growth live trees ≥5 in (thousand ft <sup>3</sup> /yr)	546,563.6	3.6	402,506.9	3.9	-26.4
Annual mortality of live trees ≥5 in (thousand ft <sup>3</sup> /yr)	212,151.6	4.6	293,246.5	3.8	38.2
Annual harvest removals of live trees ≥5 in (thousand ft <sup>3</sup> /yr)	169,247.9	8.8	179,424.5	8.2	6.0
Annual other removals of live trees ≥5 in (thousand ft <sup>3</sup> /yr)	31,776.1	23.1	19,357.7	25.3	-39.1
<b>Timberland</b>					
Area (thousand acres)	14,921.8	0.8	14,912.7	0.8	-0.1
Number of live trees ≥1 in diameter (million trees)	8,251.3	1.4	7,911.4	1.3	-4.1
Aboveground biomass of live trees ≥1 in (thousand oven-dry tons)	600,961.2	1.1	620,212.5	1.1	3.2
Net volume of live trees ≥5 in diameter (million cubic ft)	19,511.6	1.2	20,280.1	1.2	3.9
Net volume of growing-stock trees (million cubic ft)	16,630.2	1.3	16,378.9	1.4	-1.5
Annual net growth of growing-stock trees (thousand ft <sup>3</sup> /yr)	493,503.6	3.2	327,977.1	3.4	-33.5
Annual mortality of growing-stock trees (thousand ft <sup>3</sup> /yr)	123,489.9	5.3	189,767.1	4.2	53.7
Annual harvest removals of growing-stock trees (thousand ft <sup>3</sup> /yr)	141,206.1	9.4	152,769.8	8.6	8.2
Annual other removals of growing-stock trees (thousand ft <sup>3</sup> /yr)	27,579.9	23.9	19,018.3	24.2	-31.0



# Forest Area



Autumn at Spring Creek Gap Conservation Area . Photo by Missouri Department of Conservation, used with permission.

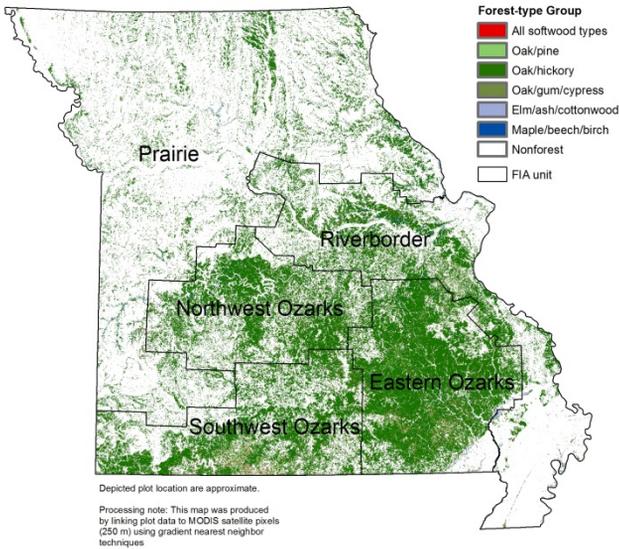


Figure 1.—Distribution of forest land by forest-type group, Missouri, 2013.

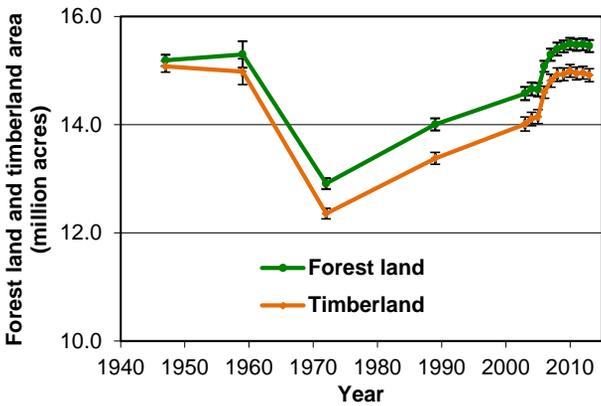


Figure 2.—Area of forest land and timberland in Missouri, by year. Note: Sampling errors and error bars shown in the tables and figures in this report represent 68 percent confidence intervals for the estimated values.

Missouri is divided into 5 survey units (Fig. 1). Statewide forest land area is 15.5 million acres  $\pm$  12,000 acres, almost 35 percent of total land area in the State. The oak/hickory forest-type group accounts for 80 percent of the forest land area in the State.

The Eastern Ozarks Forest Survey Unit, at 70 percent forested, is the most forested Unit in the State, followed by the Northwest Ozarks and Southwest Ozarks Units, which are both 50 percent forested. In the Southwest Ozarks Unit, oak/hickory, oak/pine, and oak/gum/cypress combined account for more than 90 percent of the forest land area. The elm/ash/cottonwood forest-type group, at 7 percent, is the State’s second most common forest type group.

Forested area plummeting after the 1959 inventory, but since 1972 both forest land and timberland area has been increasing (Fig. 2). There are now more acres of forest land than there was during the first inventory of Missouri’s forests in 1947.

More than 80 percent of the forest land in the State is owned by private individuals or groups (Fig. 3). More than 90 percent of the forest land in the Prairie and Riverborder Units are privately owned. The Eastern Ozarks Unit has the largest percent of forest land area in public ownership at 32 percent.

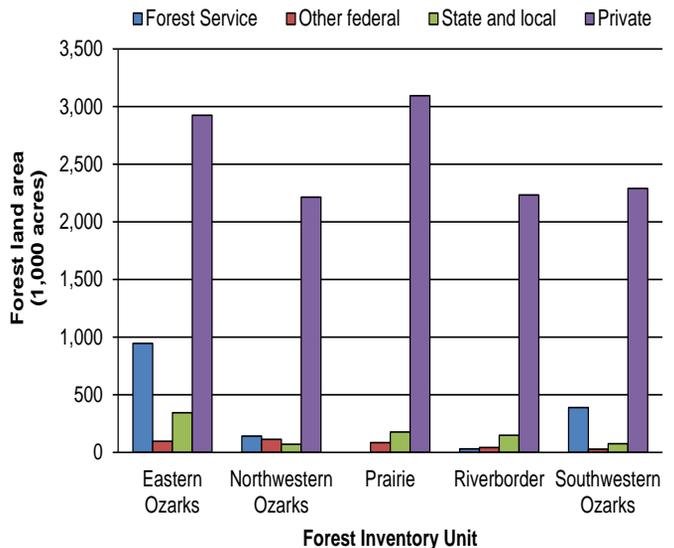


Figure 3.—Area of forest land by Forest Inventory Unit and ownership group, Missouri, 2013.

# Volume, Biomass, and Trends

FIA field crews recorded 88 tree species on Missouri forest land during the 2013 inventory cycle. Two-thirds of Missouri’s 21.0 billion cubic feet of live tree volume on forest land is represented by just 10 species (Table 2). Oak species make up 58 percent of the live tree volume on forest land, with white oak alone accounting for 20 percent of the total. Eighty percent of the volume comes from growing stock trees.

In terms of sawtimber volume on timberland, eastern redcedar is not in the list of top 10 species, falling to number 24. Eastern redcedar is the most numerous tree species on forest land in Missouri, but only 5 percent of the species is sawtimber size.

The majority of aboveground tree biomass is in the bole (70 percent), followed by tops and limbs (17 percent), saplings (9 percent), and stumps (4 percent). The aboveground live tree biomass on forest land increased from 620.2 million short tons in 2008 to 641.1 million short tons in 2013 (Fig. 4).

Every year between 2009 and 2013, there was an average of 517.7 million cubic feet of growing-stock volume added to the timberland of Missouri through growth (average annual gross growth). From this average annual gross growth, an average of 189.8 million cubic feet of growing stock died each year (average annual mortality). This resulted in an average annual net growth of growing stock of 328.0 million cubic feet per year (Fig. 5). The average annual removals of growing stock during the same period was 171.8 million cubic feet. Subtracting mortality and removals from growth resulted in a net gain of 156.2 million cubic feet of growing stock per year between 2009 and 2013 on timberland.

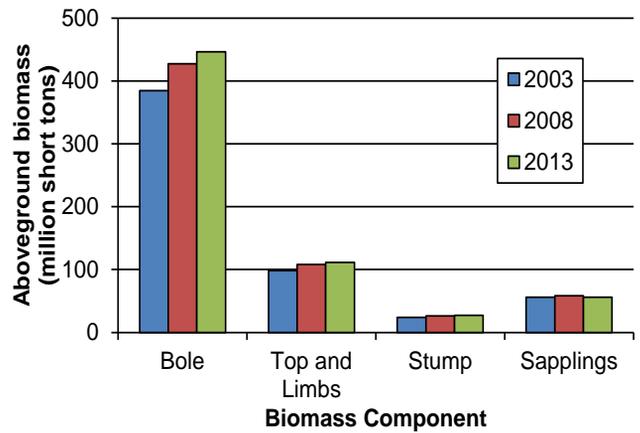


Figure 4.—Aboveground dry weight of live trees (at least 1 inch d.b.h./d.r.c.), in million dry short tons, on forest land by tree component, Missouri, 2003, 2008, and 2013.

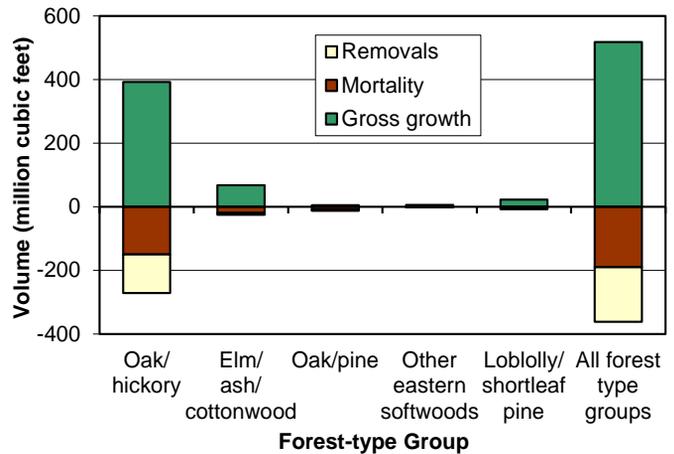


Figure 5.—Average annual gross growth, mortality, and removals of growing-stock on timberland for the top five forest-type groups, Missouri, 2013.

Table 2.—Top 10 tree species by statewide volume estimates on forest land and timberland, Missouri, 2009-2013

Rank	Species	Volume of live trees on forest land (1,000,000 ft <sup>3</sup> )	Sampling error (%)	Change since 2008 (%)	Volume of sawtimber trees on timberland (1,000,000 board feet)	Sampling error (%)	Change since 2008 (%)
1	White oak	4,125.2	2.8	2.6	12,591.0	3.5	2.9
2	Black oak	2,870.3	3.2	-2.4	9,164.8	3.9	-3.3
3	Post oak	2,107.4	3.6	0.5	4,362.1	4.8	-4.6
4	Northern red oak	988.7	5.7	-2.9	3,495.1	6.8	-1.5
5	Shortleaf pine	952.9	6.8	5.8	4,015.3	7.1	8.9
6	Eastern redcedar	747.1	5	11.1	439.5	11.2	-55.6
7	Black walnut	699.6	6.2	13.3	1,895.2	8	8.2
8	Shagbark hickory	581.4	6.1	3.7	1,441.9	8.4	1.9
9	Scarlet oak	547.1	6.3	-16.4	1,812	7.8	-10.9
10	American sycamore	453.8	12.3	13.3	1,749.4	13.9	13.9
	Other softwood species	11.2	75.1	-27.3	47.4	83.8	-31
	Other hardwood species	6,893.9	2.4	10.4	14,533.1	3.8	10
	All species	20,978.7	1.1	4.1	55,546.8	1.7	1.9

## Harvest levels: Timber Products Output Survey versus FIA field plots

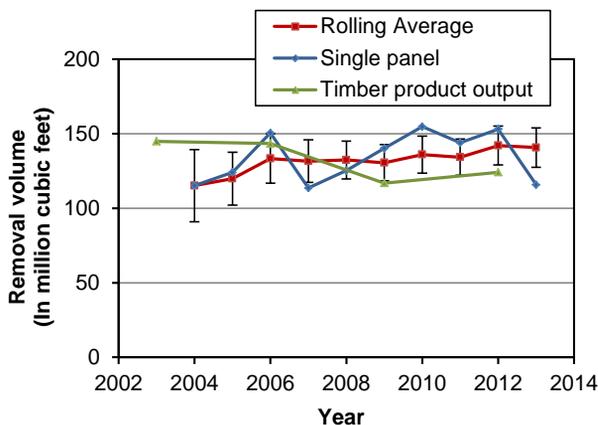
Harvest levels are currently reported using two methods:

1) Timber Product Output (TPO) reports from mill canvasses and fuelwood surveys, and 2) statistical estimates based on remeasured FIA field plots.

The TPO data are based on a canvas of the primary wood-using mills using a questionnaire designed to determine the size and composition of the State's primary wood-using industry, its use of roundwood, and its generation and disposition of wood residues. The TPO data used in figure 6 is the volume of timber products reported from the TPO canvass with an estimate of logging residues generated based on harvest utilization studies. At the time of this writing, the most recent TPO estimate is for 2009. The TPO estimate for 2012 is being processed.

The statistical estimate is based on FIA field plots and is reported as average annual removals. Average annual removals are the average volume removed annually from the harvest of forest products and associated logging residues, and the volume of other removals each year between survey periods. The rolling average in figure 6 is calculated each year from the current 5 years of FIA plot data and the previous 5 years (e.g., 2004-2008 compared to 2009-2013). The confidence intervals around these estimates can be rather large as only about 1 in 33,000 trees 5" dbh or larger is remeasured in Missouri. Still, since approximately 1 percent of the trees in Missouri are harvested each year and approximately 12,000 trees 5" dbh and larger are remeasured every year, it should not be surprising that the statistical estimates track well with the TPO numbers. The rolling average has the effect of dampening fluctuations in harvest levels from year to year, but does present the general trend.

Removals were also estimated using single panels of FIA plot data. This method only looked at the removals from FIA plots that were remeasured during a single year. The estimates from the single panel approach, while more timely than those from the rolling average approach, magnify the fluctuations in removals over time. Since the single panel approach is based on only 1/5<sup>th</sup> of the inventory plots, it would have a wider confidence interval.



**Figure 6.—Missouri harvest estimates obtained using Timber product output survey data and FIA field data (5-year rolling average and single panel).**

The TPO reports, which are conducted jointly by the Missouri Department of Conservation and the FIA program, provide the best estimate of current harvest removals. The rolling average of annual removals is useful for verifying these numbers and for providing additional plot and tree-level information about removals that is not available from the TPO study, such as detailed species and ownership removals.

## Additional Inventory Resources

Moser, W.K.; Hansen, M.H.; Pugh, S.A.; Treiman, T.B. 2013. **Missouri's forest resources, 2012**. Res. Note NRS-184. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p.

Piva, R.J.; Treiman, T.B. 2012. **Missouri timber industry: an assessment of timber product output and use, 2009**. Resour. Bull. NRS-74. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 88 p.

### Metadata

Information published in this report and in related tables is based on Forest Inventory and Analysis Database (FIADB), collected under field guides 3.0 to 6.0 and compiled in National Information Management System (NIMS) version 6.0, installed on November 15, 2012. Due to occasional changes to NIMS and FIADB, trend analyses should be made using FIA's online estimation tools, not by comparing published reports or tables. FIA estimates, tabular data, and maps may be generated at <http://fiatools.fs.fed.us>

### How to Cite This Publication

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