



Forests of Kansas, 2016

This resource update provides an overview of forest resources in Kansas based on inventories conducted by the U.S. Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station. For annual inventory years 2001-2013, the sample length was equal to 5 years. Beginning in 2014, the cycle length was changed to 7 years. For the 2016 inventory, estimates for current variables such as area, volume, and biomass are based on 8,719 field plot samples (594 forested) collected from 2011-2016. Change variables, such as net growth, removals, and mortality, are based on 8,667 samples (558 forested) collected in 2005-2011 and resampled in 2011-2016. Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005), O’Connell et al. (2014), and Gormanson et al. (2017) for definitions and technical details. Sampling errors and error bars shown in tables and figures in this report represent 68 percent confidence intervals. A complete set of inventory tables is available at [doi](#).

Overview

Kansas is home to 2.5 million acres of forest land, a slight loss of 0.8 percent since 2011 (Table 1). Timberland accounts for 95 percent of all forest land, while the remaining 5 percent of forest land is reserved or unproductive. On forest land, mortality and harvest removals have decreased since 2011 while number of trees, volume, biomass, net growth and other removals have all experienced gains. Mortality of growing-stock trees on timberland has increased while volume and net growth of growing stock trees have decreased. Overall, the growth rate of Kansas trees (≥ 5 inches d.b.h.) on forest land is positive but is a small increase ($< 3\%$) since the 2011 inventory and has decreased since 2015; the 2015 estimate was nearly 103 million cubic feet per year compared to the current estimate of approximately 94 million cubic feet per year.

Table 1.—Kansas forest statistics, 2011 and 2016.

	2011 Estimate	Sampling error (percent)	2016 estimate	Sampling error (percent)	Change since 2011 (percent)
Forest Land					
Area (thousand acres)	2,502.4	3.0	2,481.4	2.9	-0.8
Number of live trees ≥ 1 in diameter (million trees)	819.3	4.7	837.8	4.4	2.3
Net volume of live trees ≥ 5 in diameter (million ft ³)	3,145.6	4.6	3,286.5	4.1	4.5
Live-tree aboveground biomass (thousand oven-dry tons)	84,333.8	4.0	88,391.2	3.7	4.8
Net growth of live trees ≥ 5 in (thousand ft ³ /yr)	91,751.3	8.6	94,347.5	10.7	2.8
Annual harvest removals of live trees ≥ 5 in (thousand ft ³ /yr)	23,144.1	25.2	18,628.3	26.6	-19.5
Annual other removals of live trees ≥ 5 in (thousand ft ³ /yr)	4,079.4	39.0	8,405.7	30.4	106.1
Annual mortality of live trees ≥ 5 in (thousand ft ³ /yr)	45,458.9	10.1	43,335.8	10.2	-4.7
Timberland					
Area (thousand acres)	2,399.6	3.1	2,345.6	3.0	-2.3
Number of live trees ≥ 1 in diameter (million trees)	779.1	4.7	785.4	4.5	0.8
Net volume of live trees ≥ 5 in diameter (million ft ³)	3,056.1	4.8	3,193.2	4.3	4.5
Net volume of growing-stock trees ≥ 5 in diameter (million ft ³)	1,431.3	6.8	1,315.1	7.2	-8.1
Live-tree aboveground biomass (thousand oven-dry tons)	81,586.3	4.1	85,387.6	3.8	4.7
Net growth of growing-stock trees (thousand ft ³ /yr)	42,581.8	9.8	34,260.7	21.1	-19.5
Annual harvest removals of growing-stock trees (thousand ft ³ /yr)	10,226.5	33.1	5,617.8	34.9	-45.1
Annual other removals of growing-stock trees (thousand ft ³ /yr)	3,386.6	60.6	2,771.9	44.7	-18.2
Annual mortality of growing-stock trees (thousand ft ³ /yr)	13,990.5	16.4	15,784.6	20.1	12.8



Forest Area

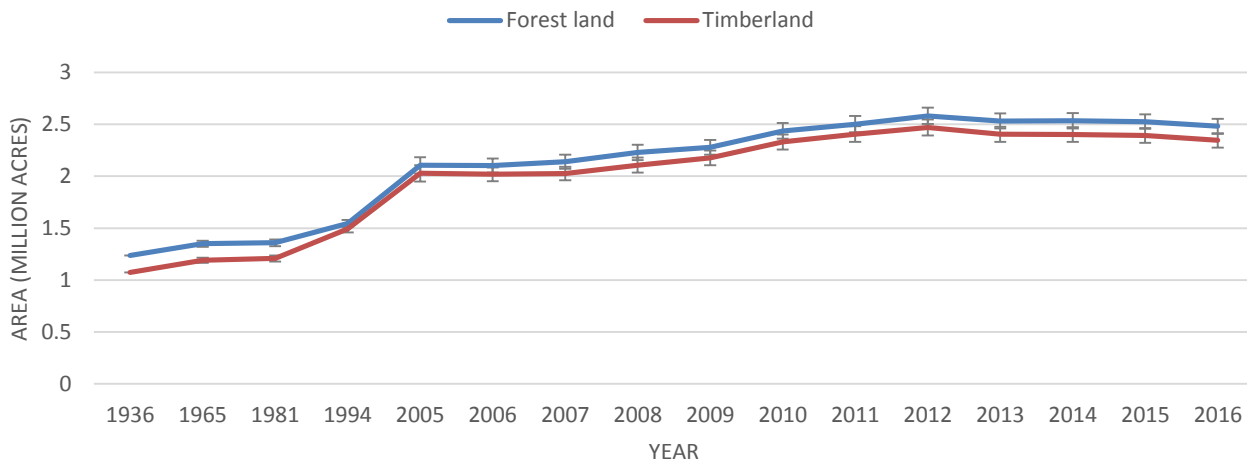


Figure 1.—Area of timberland and forest land by year, Kansas, 1936-2016.

Generally, forest land in Kansas has increased since the earliest inventory but has remained relatively steady since 2013 (Fig. 1) but now shows a slight decline. Ninety-three percent of forest land is privately owned. Forest land is dominated by hardwood forest types; only 3 percent of forested lands are nonstocked.

In terms of stand-size class, large diameter stands comprise half of all forest land area while medium and small stands occupy 27 and 20 percent of forest land area, respectively. The six most frequently occurring forest types (Fig. 2) occupy 74 percent of all forest land; 44 percent of the forest land is composed of the elm/ash/black locust and sugarberry/hackberry/elm/green ash forest types alone. The eastern redcedar/hardwood forest type is the only type with most of its area composed of small diameter trees.

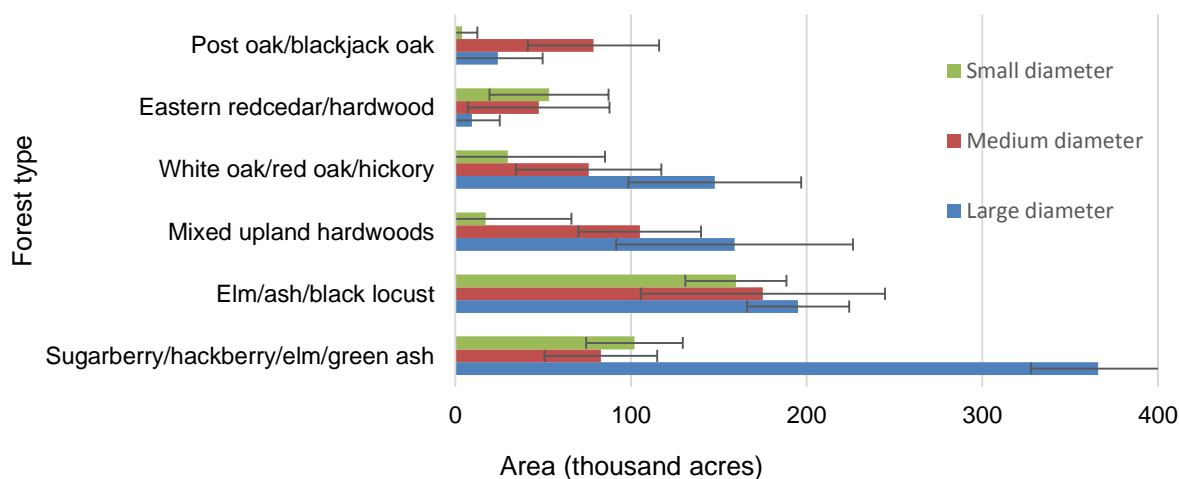


Figure 2.—Forest land by stand-size class for the top six forest types by acreage, Kansas, 2016.

Volume, Biomass, and Trends

Kansas forests contain approximately 838 million live trees (≥ 1 inch diameter) and nearly 3.3 billion cubic feet of net volume (live trees ≥ 5 inches diameter). Fifty-two percent of all trees are composed of five species: hackberry, American elm, Osage-orange, eastern redcedar and green ash (Table 2). The five most voluminous species (hackberry, cottonwood, American elm, green ash and Osage-orange) contain about 48 percent of total net volume. Historically, cottonwood had been the most voluminous species in the state but now ranks 2nd behind hackberry. In terms of biomass and number of live trees, cottonwood now ranks 5th compared to 3rd and 12th compared to 10th in the 2015 inventory, respectively. Green ash now ranks 4th in net volume compared to 3rd in 2015. Eastern redcedar has surpassed Osage-orange in number of trees and currently ranks 3rd but remains 10th in volume. The numbers of hackberry, chinkapin oak and northern red oak trees have also increased.

There are 88 million oven-dry tons of biomass in Kansas forests, most of which is contained in non-growing-stock trees (59%), followed by growing-stock trees (35%) and live trees 1 to 5 inches diameter (6%). Thirty-one percent of all biomass is found in three species: hackberry, Osage-orange, and green ash. Green ash and American elm have surpassed cottonwood in terms of biomass; however, number, net volume, biomass and net growth of green ash have decreased since 2015 while mortality and removals have increased. Comparing Table 2 to the 2015 inventory report shows increased mortality for hackberry, American elm, eastern redcedar, black walnut, chinkapin oak, northern red oak and cottonwood.

Table 2.—Number, volume, biomass, growth, mortality, and removals of live trees on forest land by species of the top 12 tree species by number, Kansas, 2016

Common name	Latin name	Number of trees ^a (millions)	Net volume ^b (million ft ³)	Aboveground biomass ^a (thousand dry tons)	Average net growth ^b (thousand ft ³ /yr)	Average mortality ^b (thousand ft ³ /yr)	Average harvest removals ^b (thousand ft ³ /yr)
Hackberry	<i>Celtis occidentalis</i>	116.6	447.6	11,091.3	13,262.3	4,044.6	1,645.4
American elm	<i>Ulmus americana</i>	106.7	264.3	6,680.0	8,522.5	6,399.3	1,788.0
Eastern redcedar	<i>Juniperus virginiana</i>	88.8	109.4	2,511.9	5,351.83	1,058.3	657.3
Osage-orange	<i>Maclura pomifera</i>	84.9	246.6	9,812.6	7,822.0	1,050.9	2,530.8
Green ash	<i>Fraxinus pennsylvanica</i>	40.4	252.6	6,808.5	5,595.2	4,421.8	600.5
Honeylocust	<i>Gleditsia triacanthos</i>	36.6	133.6	4,234.3	5,226.2	2,825.5	957.6
Red mulberry	<i>Morus rubra</i>	32.9	159.9	4,619.4	6,760.4	1,896.0	313.5
Black walnut	<i>Juglans nigra</i>	22.5	202.4	4,834.2	7,459.6	2,803.6	1,099.3
Chinkapin oak	<i>Quercus muehlenbergii</i>	21.7	97.0	2,962.2	726.6	751.1	--
Northern red oak	<i>Quercus rubra</i>	8.3	114.1	3,253.0	2,612.2	864.3	--
Bur oak	<i>Quercus macrocarpa</i>	8.1	152.5	4,113.6	3,042.9	935.7	1,311.1
Eastern cottonwood	<i>Populus deltoides</i>	8.1	355.7	6,404.6	10,932.5	3,310.5	--

^a Trees ≥ 1 inch diameter ^b Trees ≥ 5 inches diameter Note: Table cells without data are indicated by --

Mapping all tree cover in Kansas

Areas of tree cover must be at least 1 acre in size and 120 feet wide to meet FIA’s definition of forest land. Much of the tree cover in the Great Plains, however, is configured in a way (e.g., narrow linear strips) that does not meet these requirements. Despite their small size, these groupings of trees are a critical resource and offer a wide range of benefits, such as preventing erosion, serving as riparian buffers, providing wildlife habitat, and protecting structures and livestock from harsh weather. Recently, natural resource agencies have recognized the lack of available information on this important resource, referred to as ‘trees outside forests’ (TOF).

A partnership between the U.S. Forest Service’s Northern Research Station-FIA and the Kansas Forest Service has resulted in the development of the first ever statewide 1-meter map of tree cover (Fig. 3). The tree cover was mapped from aerial photography (NAIP) with 1-meter spatial resolution. Such high-resolution images allow the mapping of narrow windbreaks and even individual tree crowns. This detailed geospatial data layer provides new insights about all tree resources in Kansas and not only forests. The new data revealed that there are about 1.3 million acres of TOF in Kansas in addition to an estimated 2.5 million acres of forest land. TOF are a significant resource in Kansas that can now be better monitored via the new information acquired through this mapping effort; the GIS data are available here:

<https://www.fs.usda.gov/rds/archive/Product/RDS-2017-0025/>

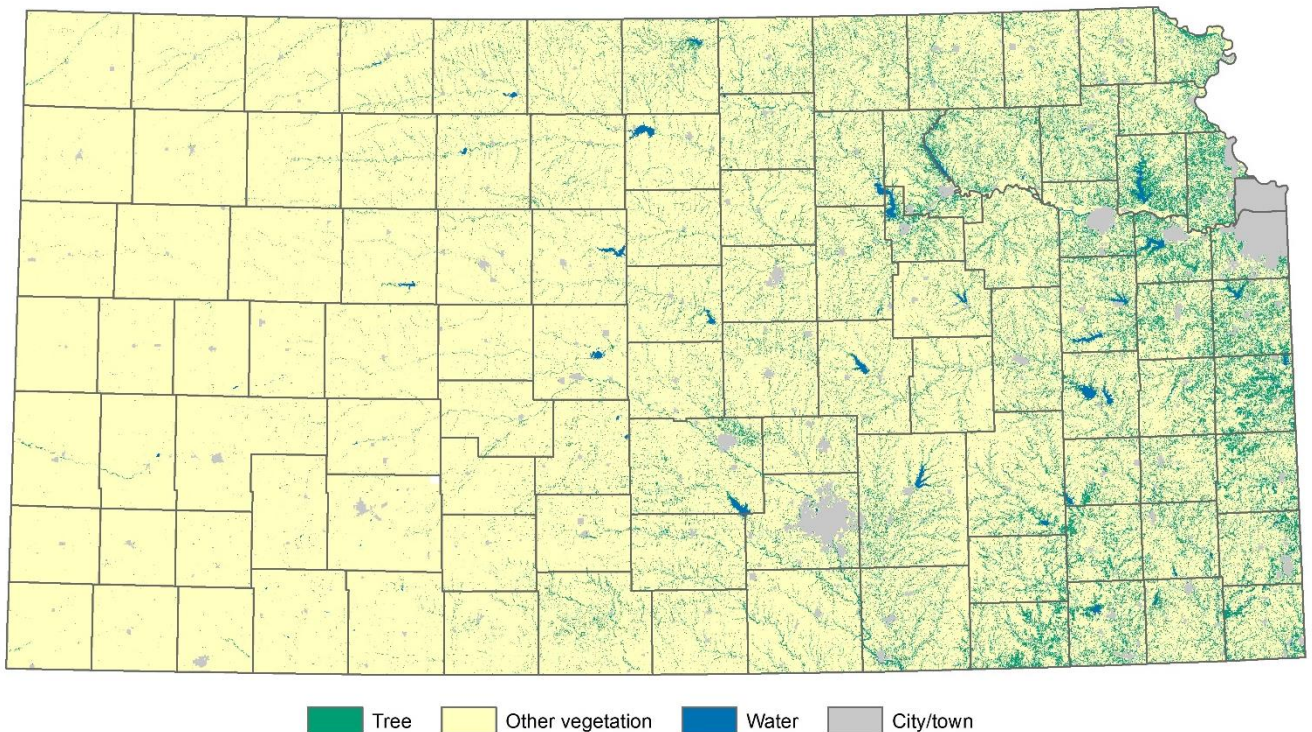


Figure 3.—1-meter statewide land cover map of Kansas, 2015.

Definitions

Average annual mortality— The average cubic foot volume of sound wood in growing-stock trees that died in 1 year.

Average annual removals— The average net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues and the volume of other removals.

Biomass— The aboveground weight of wood and bark in live trees 1.0 inch (2.5 cm) d.b.h. and larger from the ground to the tip of the tree, excluding all foliage. The weight of wood and bark in lateral limbs, secondary limbs, and twigs under 0.5 inch (1.3 cm) in diameter at the point of occurrence on sampling-size trees is included but is excluded on poletimber and sawtimber-size trees. Biomass is typically expressed as green or oven-dry weight and the units are tons.

Forest land— Land that has at least 10 percent canopy cover of live trees of any size or formerly having had such tree cover and is not currently developed for nonforest uses. The area with trees must be at least 1 acre and at least 120 feet wide.

Forest type— A classification of forest land based upon and named for the tree species that forms the plurality of live-tree stocking. A forest type classification for a field location indicates the predominant live-tree species cover for the field location; hardwoods and softwoods are the first group to be determine predominant group, and forest type is selected from the predominant group.

Net annual growth— The average annual net increase in the volume of trees during the period between inventories. Components include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that died during the year, and minus the net volume of trees that became cull trees during the year.

Net volume in cubic feet— The gross volume in cubic feet less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

Nonstocked—Land that currently has less than 10 percent stocking but formerly met the definition of forest land. Forest conditions meeting this definition have few, if any, trees sampled.

Reserved forest land— Land permanently reserved from wood products utilization through statute or administrative designation. Examples include national forest wilderness areas and national parks and monuments.

Timberland— Forest land that is producing or is capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands and is not withdrawn from timber utilization by statute or administrative regulation.

Additional Inventory Sources

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.

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: U.S. Department of Agriculture, Forest Service, Northern Research Station. 23 p. <https://doi.org/10.2737/NRS-GTR-166>.

Moser, W.K.; Hansen, M.H.; Atchison, R.L.; Butler, B.J.; Crocker, S.J. [et al.]. 2013. **Kansas' Forests 2010**. Resour. Bull. NRS-85. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 63 p.

O'Connell, B.M.; LaPoint, E.B.; Turner, J.A. [et al.]. 2014. **The Forest Inventory and Analysis database: database description and user guide version 6.0.1 for Phase 2**. Washington, DC: U.S. Department of Agriculture, Forest Service. 748 p. <http://www.fia.fs.fed.us/library/databasedocumentation/>.

How to Cite This Publication

Meneguzzo, D.M. 2017. **Forests of Kansas, 2016**. Resource Update FS-84. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p.

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

Contact Information

Dacia Meneguzzo, Research Forester
USDA Forest Service, Northern Research Station
1992 Folwell Ave.
St. Paul, MN 55108
Ph: 651-649-5129 / Fax: 651-649-5140
dmeneguzzo@fs.fed.us

USDA is an equal opportunity provider and employer

The published report is available online at <http://treearch.fs.fed.us>