



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 (558 forested) samples 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 <https://doi.org/10.2737/FS-RU-142>.

Overview

Kansas is home to 2.5 million acres of forest land (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 diameter at breast height [d.b.h.]) on forest land is positive but is only a small increase (< 3 percent) since the 2011 inventory.

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 inch diameter (million trees)	819.3	4.7	837.8	4.4	2.3
Net volume of live trees ≥ 5 inches 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 inches (thousand ft ³ /yr)	91,751.3	8.6	94,347.5	10.7	2.8
Annual harvest removals of live trees ≥ 5 inches (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 inches (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 inch diameter (million trees)	779.1	4.7	785.4	4.5	0.8
Net volume of live trees ≥ 5 inches diameter (million ft ³)	3,056.1	4.8	3,193.2	4.3	4.5
Net volume of growing-stock trees ≥ 5 inches 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

Generally, forest land in Kansas has increased since the earliest inventory but has remained relatively steady since 2013 (Fig. 1). Forest land is dominated by hardwood forest types (93 percent); only 3 percent of forested lands are nonstocked. Ninety-three percent of forest land is privately owned. Private forest lands are dominated by hardwoods (94 percent), followed by softwoods (4 percent), and nonstocked areas (2 percent). Publicly owned forest land is also dominated by hardwoods (90 percent), followed by nonstocked areas (6 percent) while softwoods make up only 4 percent of public forests.

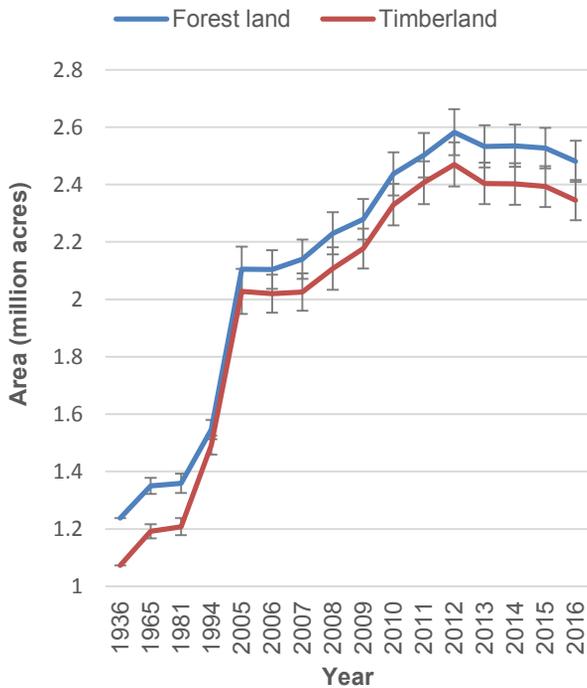


Figure 1.—Area of timberland and forest land by year, Kansas, 1936-2016.

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. Given the ability of eastern redcedar to outcompete most native tree species, this may impact future forest composition.

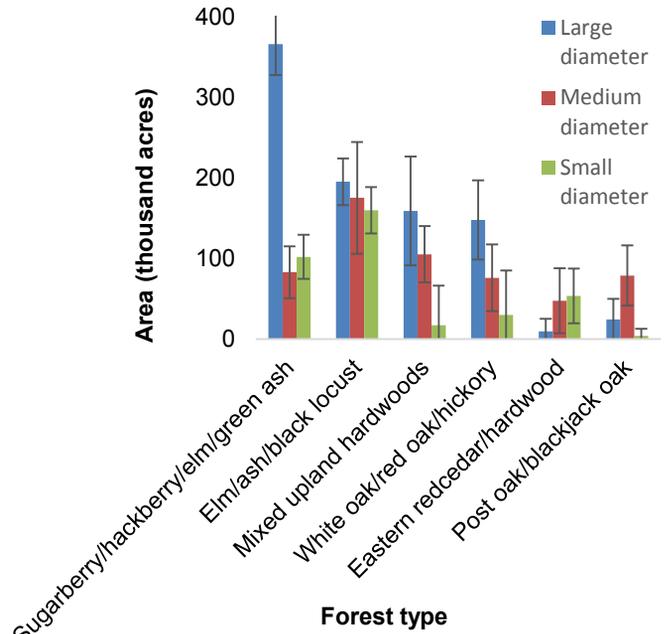


Figure 2.—Forest land by stand-size class for the top six forest types by acreage, Kansas, 2016.

Disturbances can also affect forest composition and structure so field crews use codes to record the kinds of disturbances that have occurred on forest lands since the previous inventory. The frequency and types of disturbances that occur on publicly versus privately owned lands can vary. The 2016 inventory for Kansas revealed that 22 percent of public forest lands incurred some type of disturbance since the 2011 inventory compared to 42 percent of private forest lands (Fig. 3). Fire and weather are the most common disturbances on public forest land while domestic animals and livestock are by far the leading cause of disturbance on private forest lands. More than one-third (36 percent) of private forest lands have animal-caused disturbance.

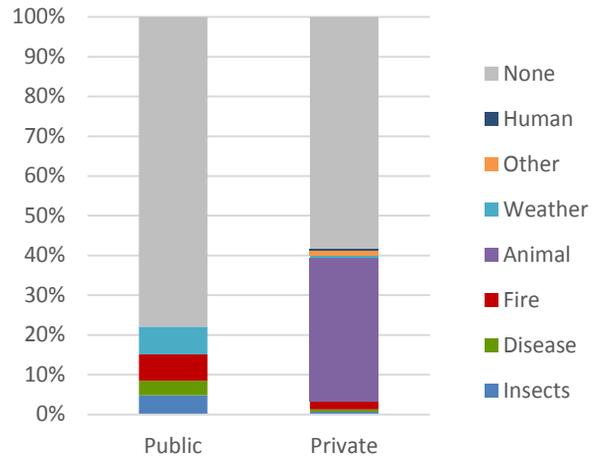


Figure 3.—Forest land by ownership class and disturbance, Kansas 2016.

Volume, Biomass, and Trends

Kansas forests currently contain approximately 838 million live trees (≥ 1 inch diameter), or about 338 trees per acre of forest land compared to a density of 327 trees per acre in the 2011 inventory. 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 second behind hackberry and is fifth in terms of biomass and its number of trees continues to decrease. Insects and weather are the leading causes of cottonwood mortality.

There are 88 million oven-dry tons of biomass in Kansas forests, most of which is contained in non-growing-stock trees (59 percent), followed by growing-stock trees (35 percent) and live trees 1 to 5 inches diameter (6 percent). Thirty-one percent of all biomass is found in three species: hackberry, Osage-orange, and green ash. Green ash and American elm have recently surpassed cottonwood in terms of biomass; however, number, net volume, biomass, and net growth of green ash have decreased since the previous inventory while mortality and removals have increased. Green ash mortality is nearing average annual net growth. The causes of its mortality are associated with insects, disease and weather events (e.g., flooding). These things may continue to negatively impact the green ash resource.

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 --

Comprehensive Assessment of 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. 4). 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, 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 at <https://www.fs.usda.gov/rds/archive/Product/RDS-2017-0025/>.

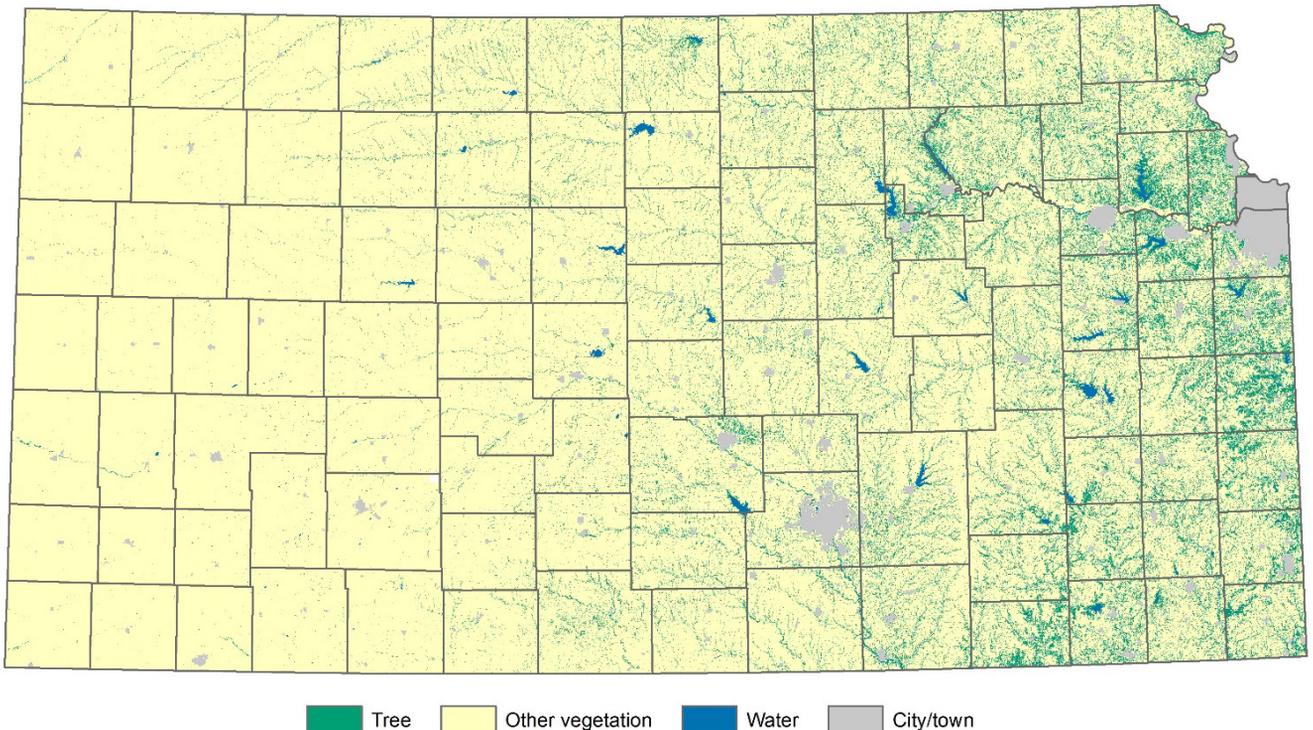


Figure 4.—Statewide map of Kansas land cover derived from 2015 aerial photography with 1-meter spatial resolution.

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.

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