

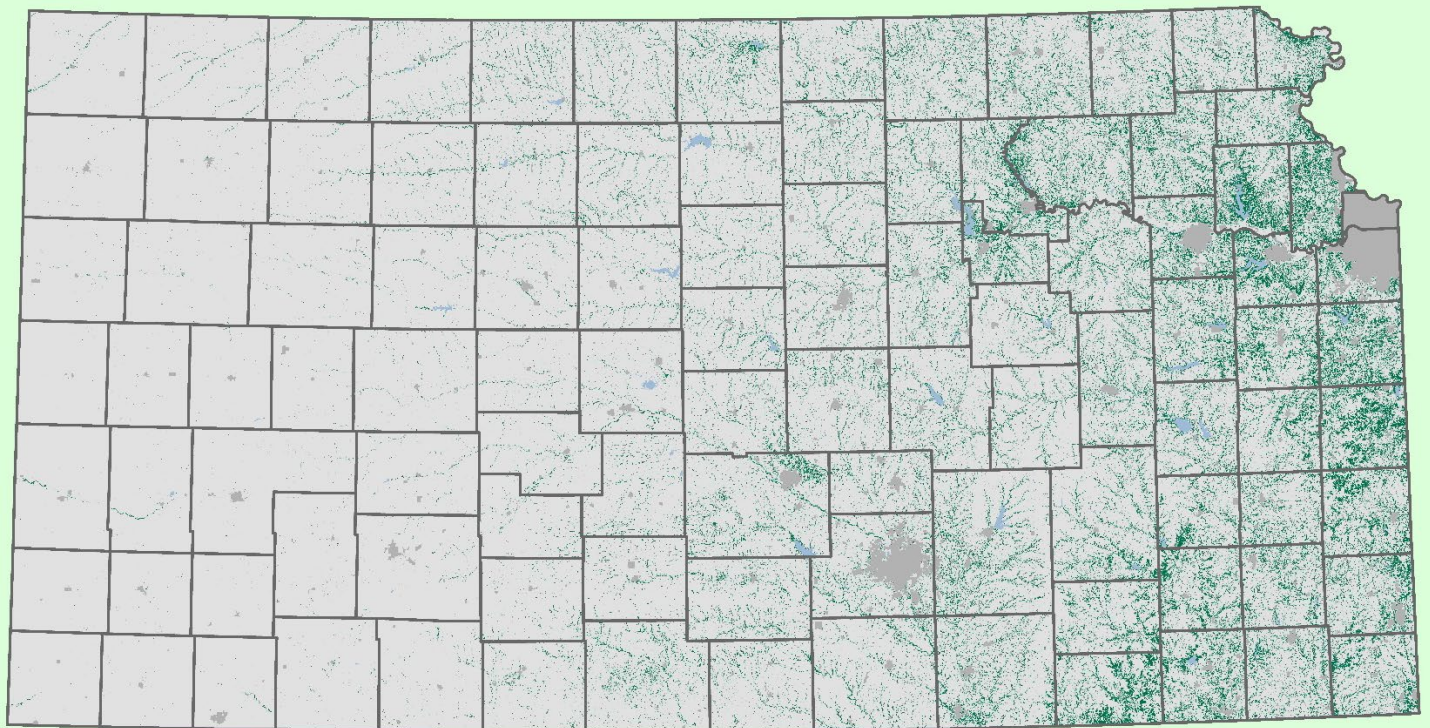
Kansas Forest Health Highlights 2019



A well-established forest buffer on a streambank stabilization project in rural Atchison County, Kansas.

Forest Resources of Kansas

In Kansas, the central hardwood forests transition into the Great Plains, with more than **4.5 million acres of trees**; 2.4 million acres of forest land and an additional 2.1 million acres of trees outside forest land. These forests, which are 92% privately owned, are productive; **7,456** local forest products jobs (**\$330 million** in wages) contribute approximately **\$2.1 billion annually** to the Kansas economy. Much of the landscape is devoted to agriculture, but forests and trees are prominent components. The majority of these woodlands are linear in nature and follow water features along the terrain, although contiguous forestland can be found in far eastern Kansas.



-  Tree Canopy
-  Bodies of Water
-  Incorporated Areas
-  County

0 15 30 60
Miles

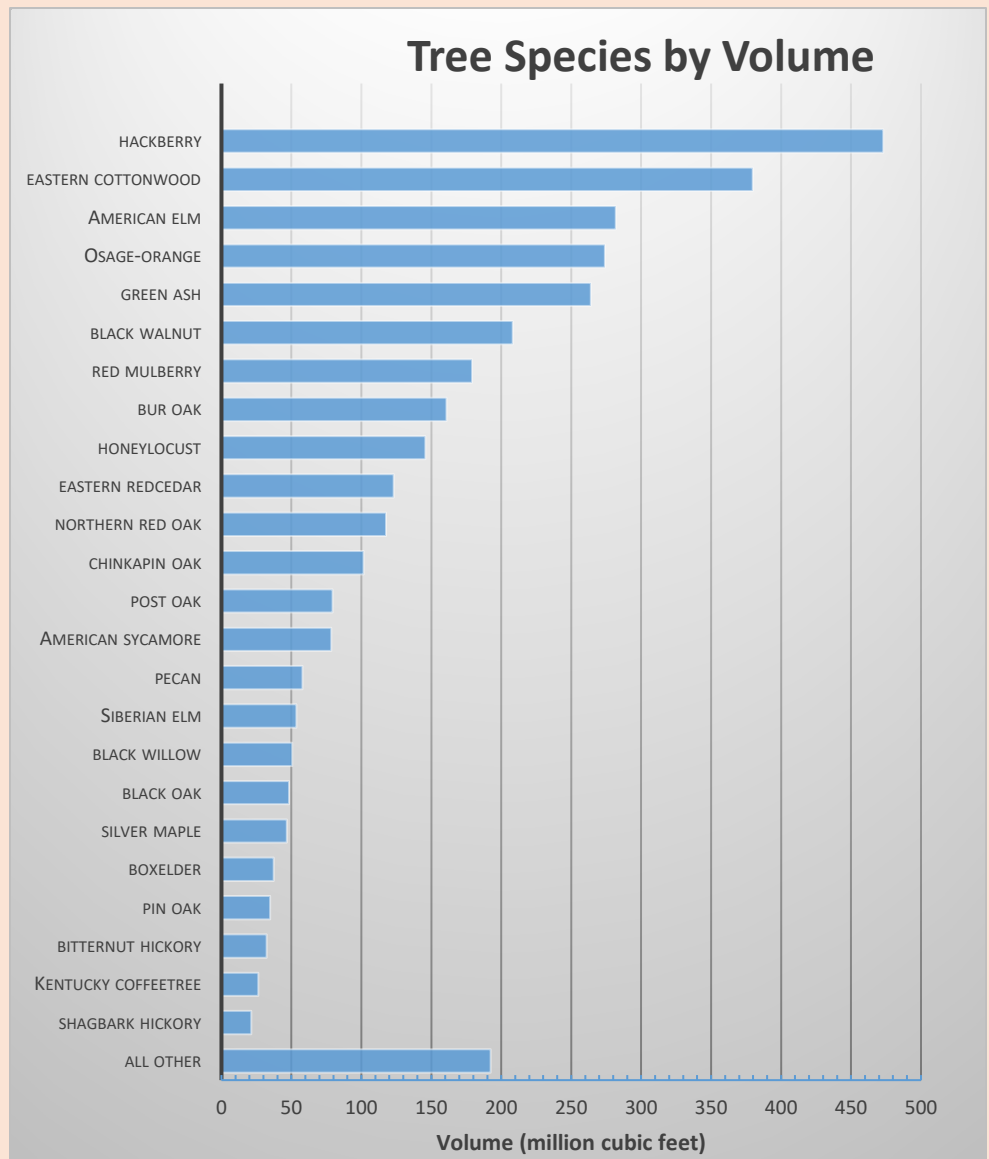


The top tree species, by statewide volume, are hackberry, eastern cottonwood, American elm, osage-orange, green ash, black walnut, red mulberry, bur oak, honeylocust, and eastern redcedar.

The two dominant forest type groups in Kansas are Elm/ash/cottonwood and Oak/Hickory.

Over the past 60 years or so, cottonwood regeneration levels have been low. Re-engineering of riparian environments due to the expansion of agriculture, construction of dams, and stream channelization have altered the landscape where cottonwood previously flourished. Unlike cottonwoods, eastern red-cedar trees have been very successful as early invaders on grasslands and abandoned range and farmlands.

Kansas's forests increased in acreage between 1939 and 2012, with a slight decrease since 2012. The oak component is decreasing in some areas as forest succession favors shade-tolerant species, such as hackberry and American elm.



According to Forest Inventory and Analysis (FIA) data, forest land in Kansas has increased since the earliest inventory and currently is showing signs of plateauing. In terms of stand-size class, sawtimber stands comprise half of all timberland area while poletimber and sapling/seedling stands occupy 29 and 19 percent of timberland area, respectively.

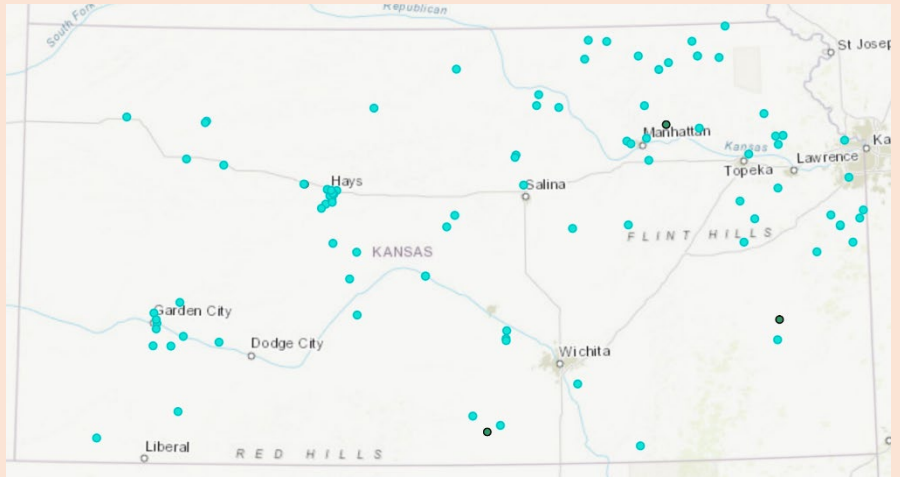
The forests of Kansas contain approximately **820 million live trees** (≥ 1 -inch diameter) and nearly **3.5 billion cubic feet of net volume** (live trees ≥ 5 -inches diameter). The most numerous species are hackberry, American elm, eastern redcedar, Osage-orange, and green ash; they make up 52 percent of all trees. The five most voluminous species contain nearly half (48%) of total net volume, and of the five species previously listed, four are in the top five for volume as well: hackberry, green ash, American elm, and Osage-orange. Eastern cottonwood is the second-most voluminous species in the state but ranks 25th in terms of number of trees. While eastern redcedar is 3rd in terms of number of trees, it ranks 11th in volume.

There are more than **89 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%). Nearly one-third of all biomass is found in three species: hackberry, Osage-orange, and American elm. Osage-orange now ranks second in biomass, surpassing eastern cottonwood and American elm.

Overall, hackberry, eastern cottonwood, and American elm have the highest growth rates, followed closely by black walnut and Osage-orange. However, mortality has increased while the area of forest land, number of live trees, and net growth of live trees has decreased since 2012. This could be a concern if this trend continues.

Summary of Rural Forester Reporting

Kansas Forest Service receives funding from the USDA Forest Service that is used to support field foresters responding to and diagnosing insects and disease problems and other forest health issues. Historically, a major hurdle to accurate and complete reporting of these insect and disease issues has been that there isn't a simple, streamlined way for field foresters to report on those technical assistance visits with landowners.



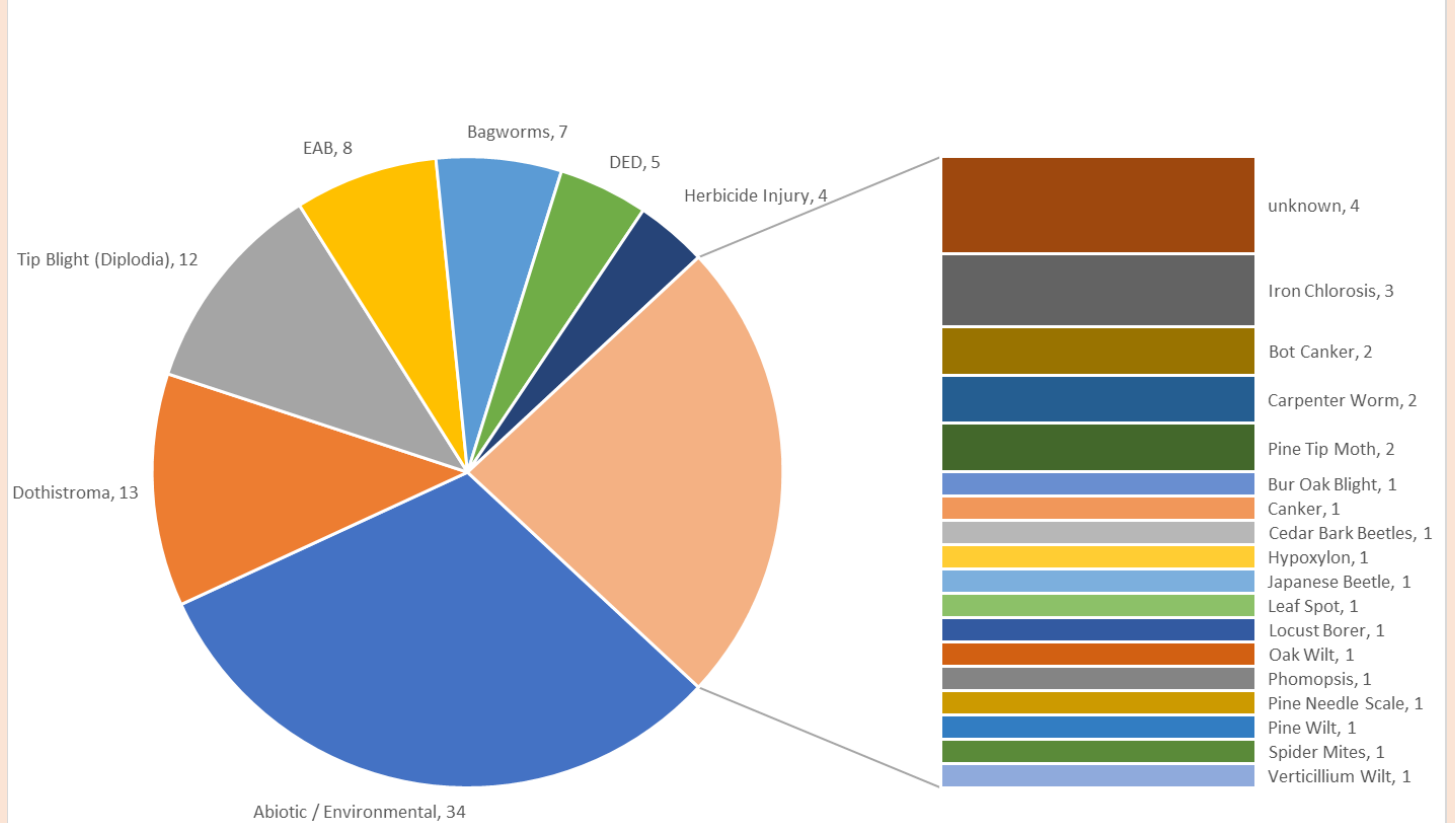
Working with the KFS GIS Specialist and Rural Forestry staff, field foresters are now able to effectively use a Rural Reporting map and the ESRI Collector app, to have the option of reporting I&D diagnosis and/or comments as point data. Most field foresters have taken advantage of this, while some have not yet fully embraced it.

In 2019, more than 110 points were entered into the Rural Reporting map on Collector with I&D data, representing a significant increase in objective forest health condition data over previous years.

This data is summarized in the chart below, but in general, this data supports the anecdotal evidence KFS has relied on for years to guide forest health priorities. As usual, **abiotic and environmental stress** represents a major share of the problems Kansas forests face. Following closely behind abiotic stress are the “usual suspects” of **dothistroma**, **diploia**, **EAB**, **bagworms**, **Dutch Elm Disease (DED)** and **herbicide injury**.

This data is fairly well distributed across the districts, but it may be skewed slightly by the amount of points (or landowner visits) that any particular district forester made.

Summary of Rural Reporting I&D Diagnosis, Oct 1 2018 - Sep 30 2019



Emerald Ash Borer

Emerald ash borer (EAB), an exotic wood-boring beetle, was first detected in 2012 in Wyandotte County, Kansas. Since that time, EAB has also been found in Johnson, Leavenworth, Douglas, Jefferson, Atchison, Doniphan, Shawnee, Miami, and Jackson counties.

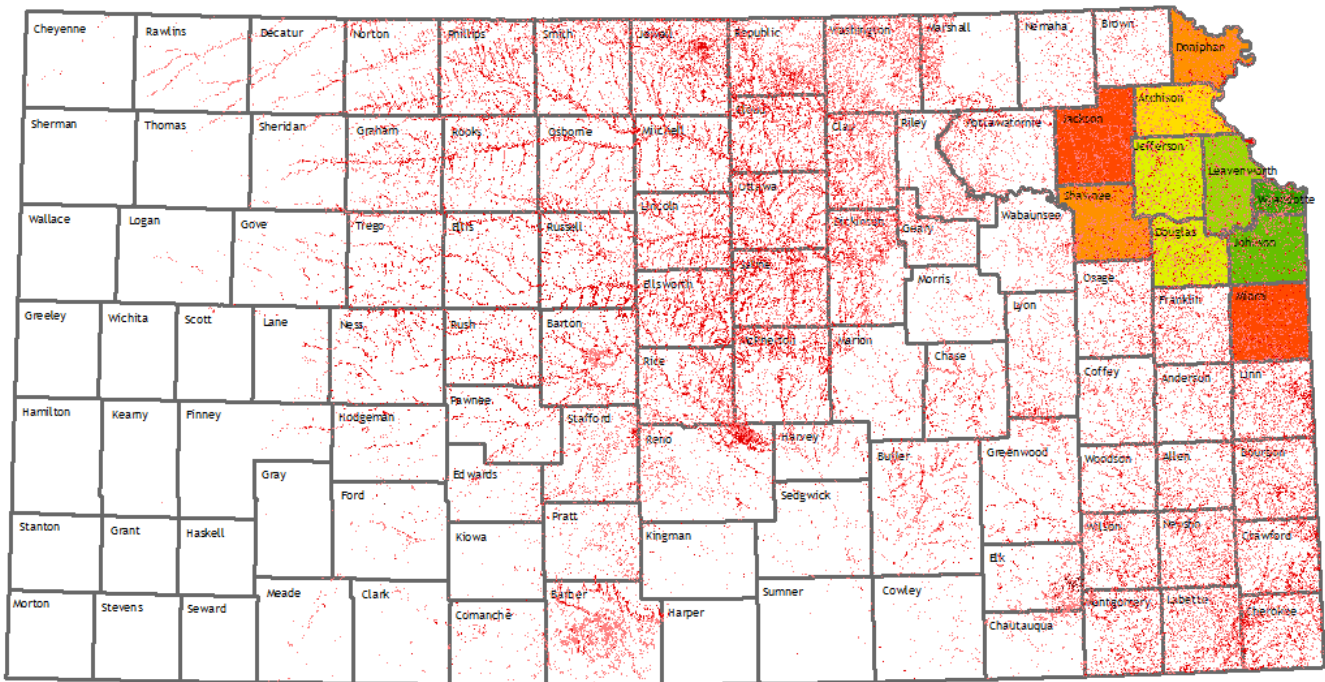
EAB is a pest of all North American ash (*Fraxinus* spp.). Kansas' forest land contains **51.1 million ash trees**, or an average of about 20 trees per acre of forest land. Ash trees account for nearly **275 million ft³** of volume, or **8 percent** of total net volume of live trees on forest land. Most of the ash resource (93%) is located on privately owned forest lands and is distributed primarily in the central and eastern parts of the state; the heaviest concentrations of ash are in the northeastern corner and along the eastern boundary.

In 2019, **two new counties** (Jackson and Miami) were added to the existing Emerald Ash Borer Quarantine in Kansas, bringing the total number of counties with confirmed EAB presence to ten; all contiguous in the Kansas City-Topeka area. In previously quarantined counties, ash tree mortality was observed to increase over previous years.

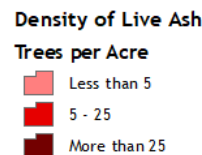
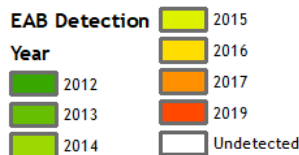
All trap trees placed in non-quarantined Kansas counties (Brown, Riley, Osage, Wabaunsee, Ellis, Russell, Sedgwick, Labette, Crawford, Cherokee) were negative for EAB presence. Emphasis on trapping in southeast Kansas was based on the detection of EAB in northeast Oklahoma (Delaware County) in late 2016, less than 25 miles from the Kansas-Oklahoma border.



A green ash is proactively removed by a homeowner in Wabaunsee County. This tree is not a good candidate for EAB treatment due to poor structure and presence of decay.



0 10 20 40 Miles



As of: 11/21/2019



KFS and KDA staff inspect and peel girdled EAB trap trees in Labette (left) and Cherokee (right) counties in October 2019. No EAB larvae were found at either site.

Releases of three biocontrol species (*Tetrastichus*, *Spathius*, *Oobius*) were done by the USDA APHIS contractors throughout the season at infested sites in northeast Kansas. This is the fourth year for biocontrol releases in Kansas.

In response to EAB, a message of forest health resilience through diversity has been promoted statewide, in addition to the presentation of EAB and invasive pest information at forestry field days and workshops.



Significant crown dieback and watersprouts are obvious on these green ash, typical of parking lot and urban ash in much of Kansas. EAB was not found in these trees, located in Salina. Decline is likely due to environmental factors. Symptoms such as these make EAB visual survey challenging.

Bagworms

While bagworms are a cyclical native pest in Kansas, 2019 saw severe bagworm infestations across the state. The caterpillars cause damage by feeding on foliage of a wide variety of plant hosts, with most significant damage occurring on coniferous species that are unable to replace lost foliage at a rate sufficient to retain vigorous growth.

Christmas tree farms, eastern redcedar windbreaks, and juniper landscaping were hardest hit in 2019, with widespread damage reports across Kansas.

As is typical for this pest, most damage becomes highly visible when the late spring (May-June) window for effective control has passed. Chemical control measures applied when the bagworms are mature in late summer are often ineffective.



A large bagworm larva is obvious on this Scotch pine in a Douglas County Christmas tree farm (right). Nearly complete foliage removal has resulted in the likely dearth of this large Pfitzer juniper in Ellis County (below).



Pine Wilt

Pine wilt is caused by a plant parasitic nematode called the pine wood nematode, *Bursaphelenchus xylophilus*. The nematode is vectored by the pine-sawyer beetle, a long-horned borer in the genus *Monochamus*. They kill pine trees by feeding and reproducing in the resin canals of the branch and trunk.

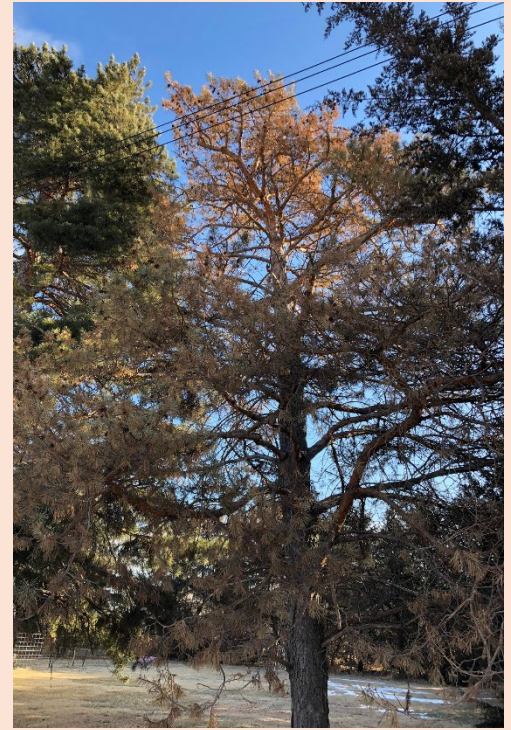
This disease is continuing to spread westward, frequently damaging and causing high mortality in windbreaks and conservation plantings containing Austrian pine (*Pinus nigra*) and Scotch pine (*P. sylvestris*).

In 2015, several pine wilt positive trees were found in a Scotch pine windbreak, several miles north of Goodland (**Sherman County**). These trees were removed and destroyed. In October 2016, four pine wilt positive Scotch pine trees were found in Goodland. In March 2018, eight Scotch pine trees were removed after two positives. In September 2019, one sample from Goodland was negative.

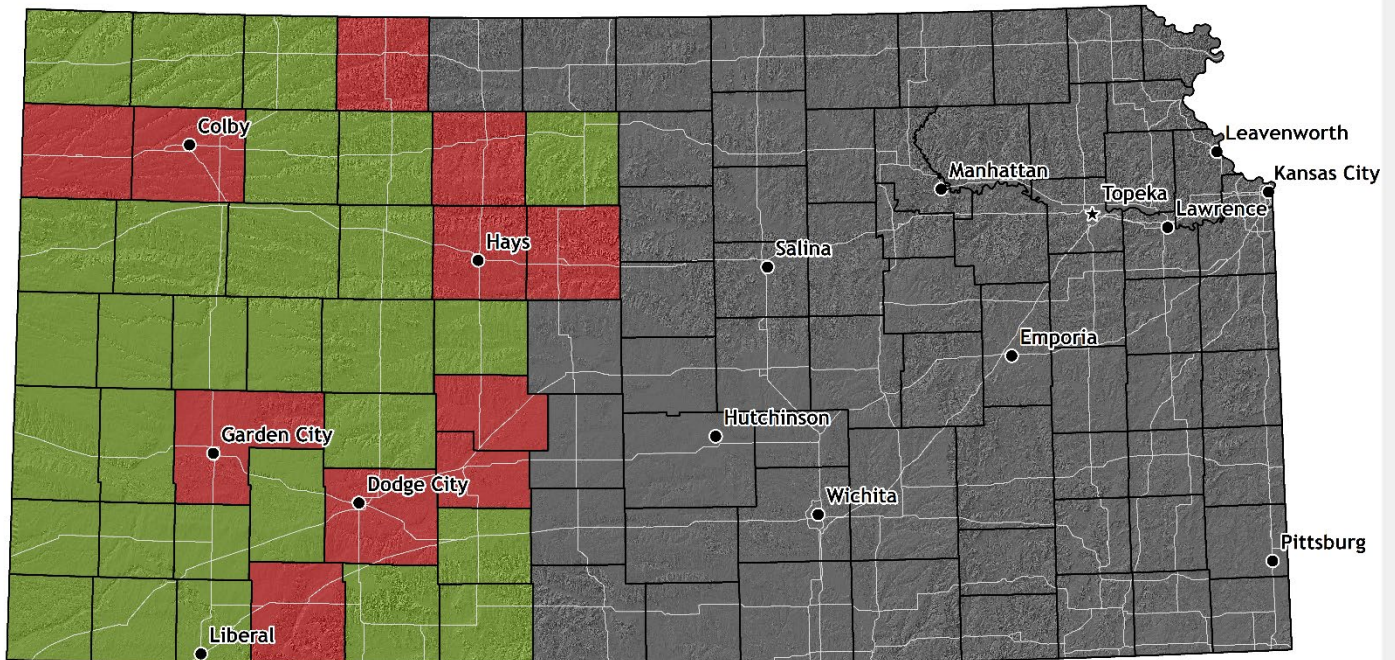
Five pine wilt positive Scotch pine trees were found and destroyed in the town of Alma (**Norton County**) in March and April 2017. A homeowner subsequently removed 10 positive trees in rural Norton County in 2019.

A Kansas Department of Agriculture (KDA) survey of Edwards, Ellis, Ford, Ness, Pawnee, and Russell counties resulted in all negative samples for pine wilt.

The city of Hays (**Ellis County**) has more than 7500 susceptible pines, and is surveyed annually as part of the pine wilt initiative project by KDA, Kansas Forest Service, and Ellis county extension. The disease has been eliminated at several sites throughout the community and outlying developments. Trees found positive for pine wilt disease have been removed and destroyed, and the site continues to be monitored and controlled with City of Hays and county extension help. The City of Hays offers rebates for removal of infested pines, incentivizing removal for private landowners.



A Scotch pine showing typical pine wilt symptoms, in Norton County. Nearby healthy pines can remain in the landscape longer with timely removal of symptomatic dead trees.



- Pine Wilt established in both communities and rural settings.
- Pine Wilt not yet discovered.
- Pine Wilt present, but limited to one or a few locations. Eradication ongoing.



0 10 20 40
Miles

Diplodia Tip Blight and Dothistroma Needle Blight

Often mistaken for pine wilt symptoms, two common foliar diseases of pines saw increased impact in Kansas in 2019.

Diplodia Tip Blight, caused by the fungus *Diplodia pini*, is a disease that affects Austrian, ponderosa, Scotch, and mugo pines. This disease is most severe on mature trees, often 20 years or older. While a single infection will not cause mortality, the stress of repeated annual infection over several years can cause decline and death on susceptible trees. Wet spring weather creates an environment conducive to severe infection, and 2019 saw ideal conditions for this disease across the state.

In addition, mechanical injury such as that caused by hail storms can cause latent infections of Tip Blight to flare up. Hail storms in western Kansas caused damage and subsequent Tip Blight outbreaks to occur on many susceptible pine plantings.

Dothistroma Needle Blight, caused by the fungus *Dothistroma septospora*, is a serious foliar disease of Austrian and ponderosa pines, especially in high-density plantings like windbreaks. This disease causes premature needle drop the year after infection, leading to thin, sparse canopies on impacted trees. These sparse branches are less able to maintain tree vigor, and can lead to tree death over several years.

Needle Blight tends to be fairly common in eastern Kansas where sustained wet weather is more common, which facilitates this disease persisting in the landscape, but in 2019 wet conditions across the state led to widespread impact from Needle Blight even in western Kansas pine windbreaks.



Typical symptoms of Diplodia Needle Blight on this ponderosa pine in Hays, pictured above. These pines in Quinter, pictured below, were hit hard by a spring hail storm, and the decline is associated with Dothistroma Needle Blight and Diplodia Tip Blight. Samples were negative for Pine Wilt.

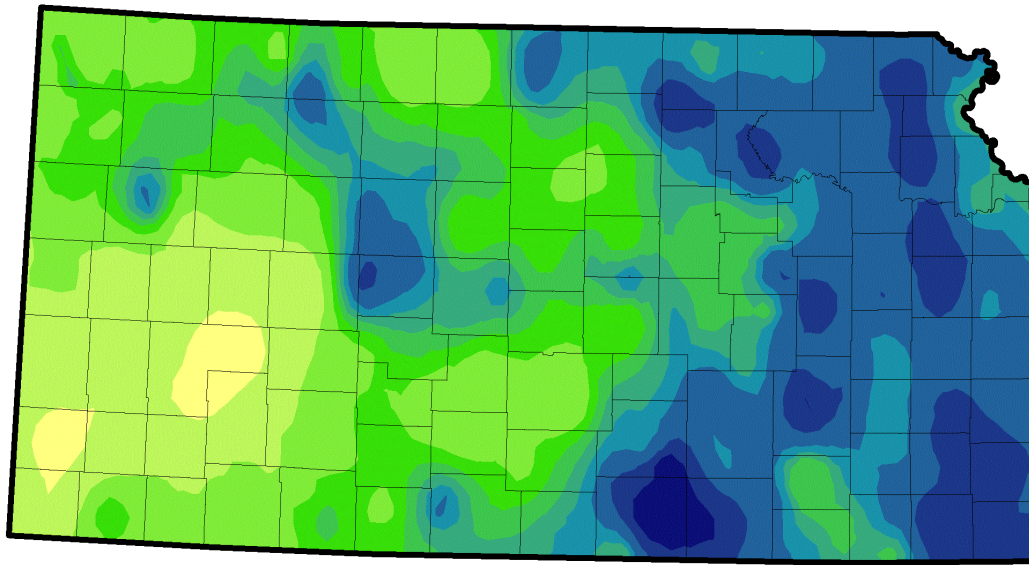


Abiotic and Environmental Stress

Continuing a pattern of extreme wet-dry seasonality throughout the decade, the winter of 2017-2018 was one of the driest on record for Kansas, leaving little soil moisture for trees to draw on as the growing season approached. Statewide, it was the second-driest November-to-April period since records began in 1895, and the driest on record for the north-central region of the state.

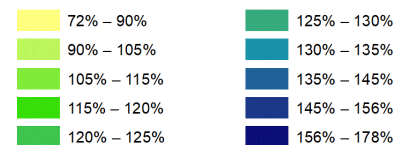
The statewide water year of October 2018-October 2019, in contrast, was one of the wettest on record. Most of Kansas received nearly 150-200% of its annual average precipitation, equating to 12-20" more than normal. In parts of southeastern Kansas, more than 60" and even 70"+ inches of rain were recorded. May and August 2019 were, respectively, the wettest May and August on record, especially in the eastern 2/3 of the state.

Percent of Normal Annual Precipitation
January 1 - December 31, 2019



0 20 40 80 Miles

Percent of Normal Precipitation (100=Normal)



Produced by Weather Data Library
Department of Agronomy
Kansas State University

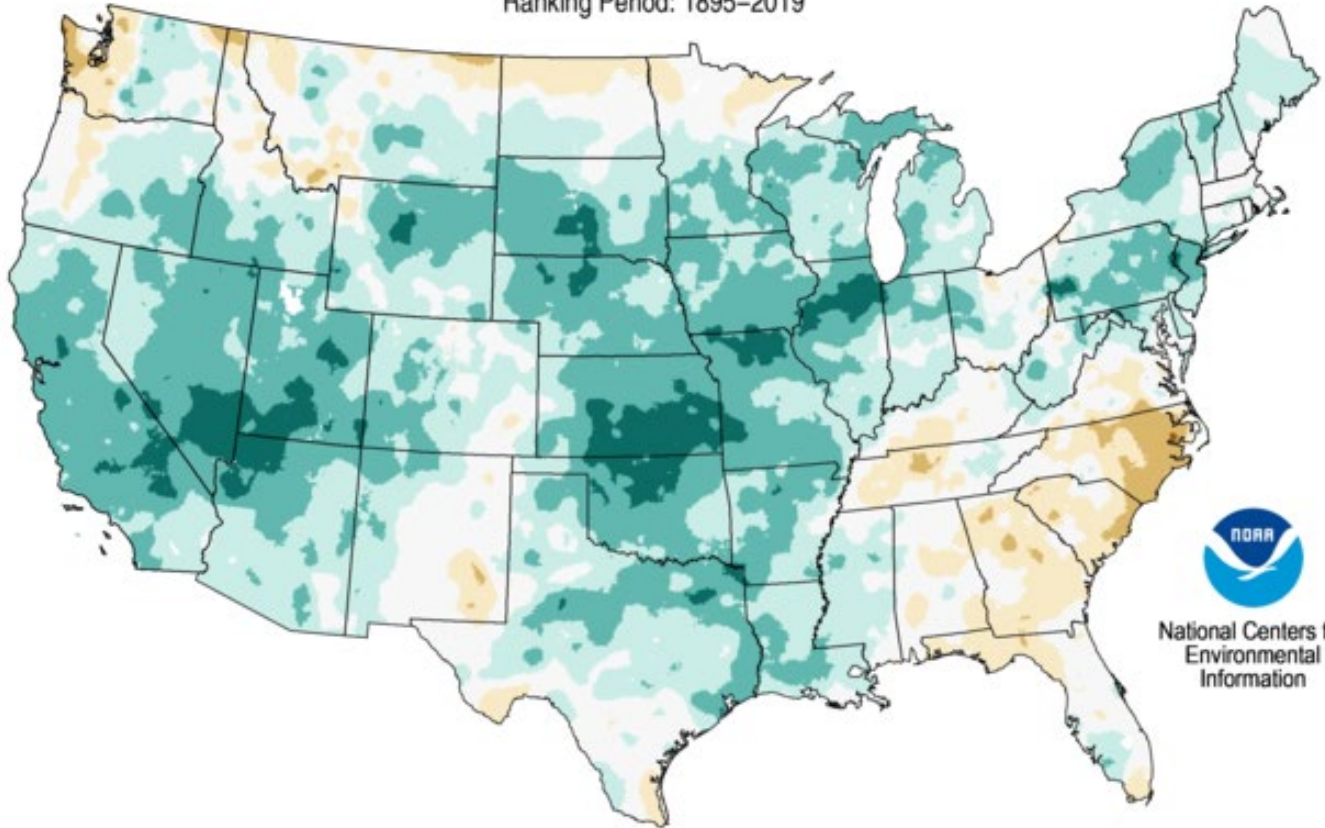


Flooding from heavy rains in May in Leavenworth County (left) resulting in short-term inundation of lowland forestland and trees. Heavy spring rains contributed to high flows in rural streams and bank erosion on many sites, such as this stream in rural Morris County (right).

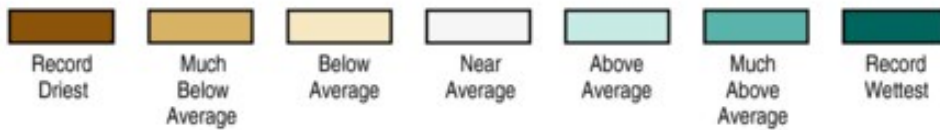
Total Precipitation Percentiles

May 2019

Ranking Period: 1895–2019

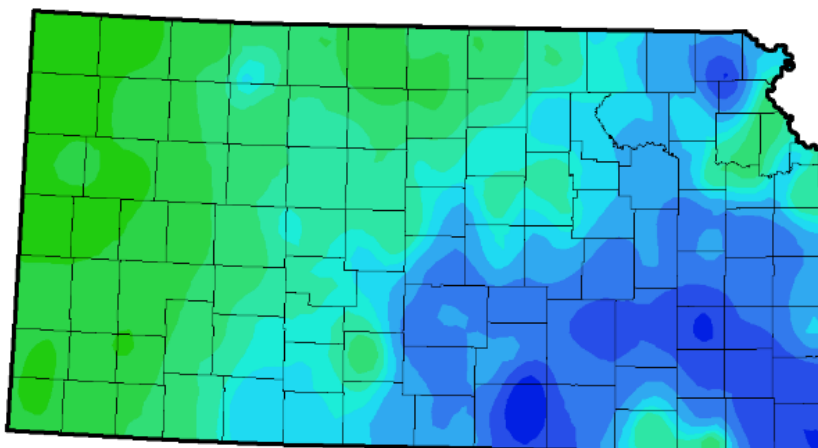


National Centers for Environmental Information



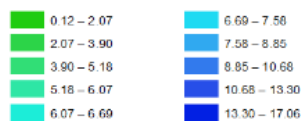
Departure from Normal Monthly Precipitation

May 1 - May 31, 2019



0 20 40 80 Miles

Departure from Normal Precipitation (Inches)



Produced by Weather Data Library
Department of Agronomy
Kansas State University

According to a report from the Kansas State Weather Data Laboratory, May was a distinctively wet month with heavy rainfall events leading to high flows on many streams:

“The National Weather Service at Wichita at one time had river flood warnings for 43 river points!

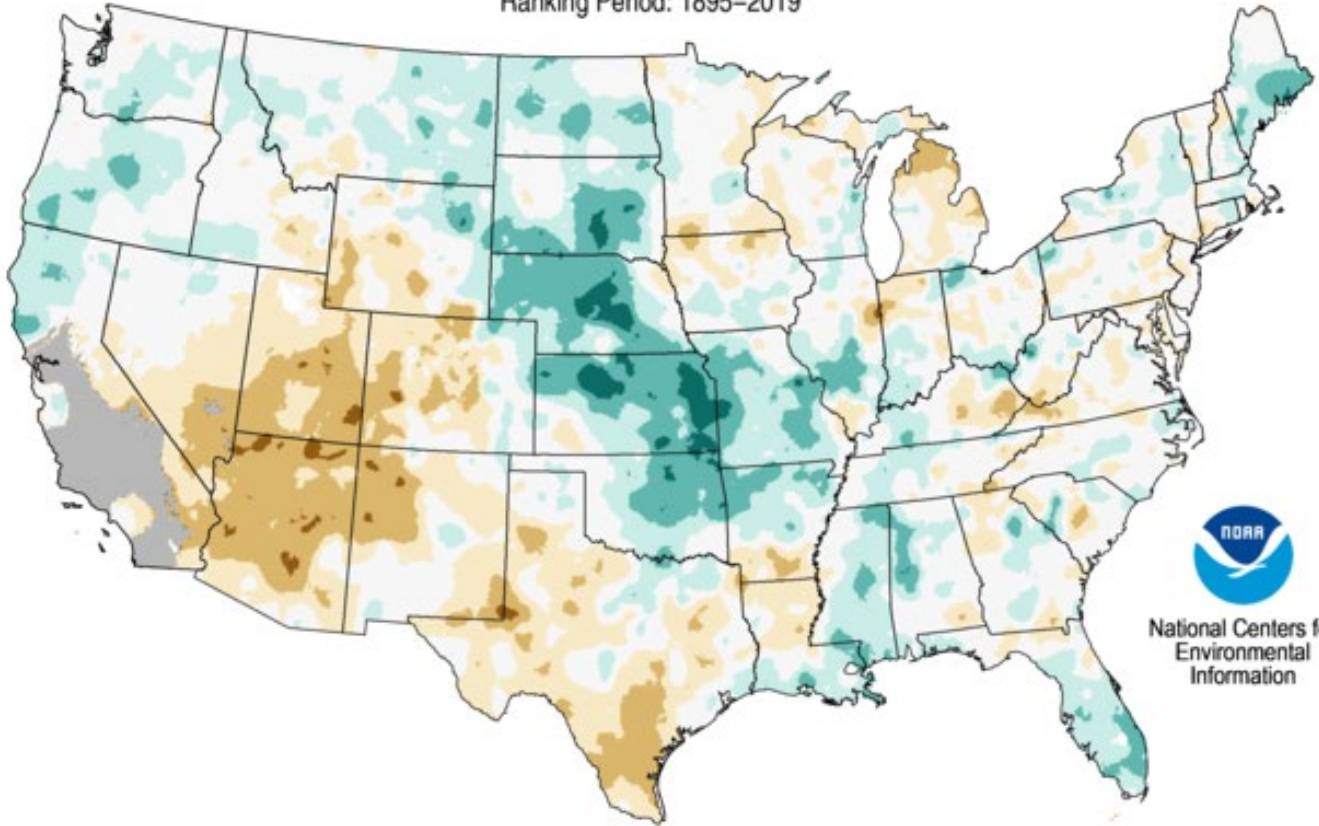
Some rivers reached levels not seen in over a decade or even longer. Major flood category was reached along the Neosho, Arkansas, Verdigris and Walnut rivers with numerous other rivers reaching moderate flood stage.

Flooding was also reported on the Smokey Hill, Republican, Kansas, and Blue Rivers. Multiple Corps of Engineer flood control reservoirs reached over 90 percent of flood pool capacity.”

Total Precipitation Percentiles

August 2019

Ranking Period: 1895–2019

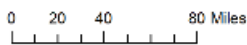
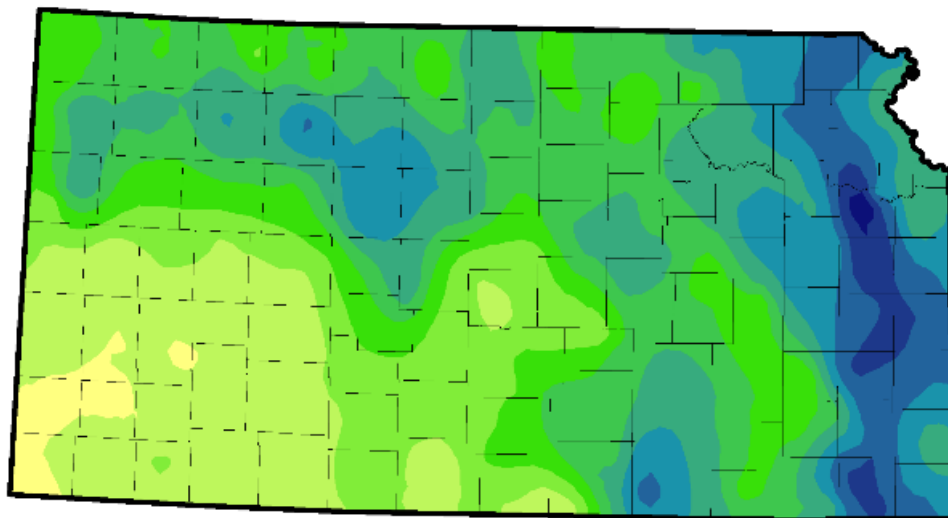


National Centers for Environmental Information



Departure from Normal Monthly Precipitation

August 1 - August 31, 2019



Departure from Normal Precipitation (Inches)

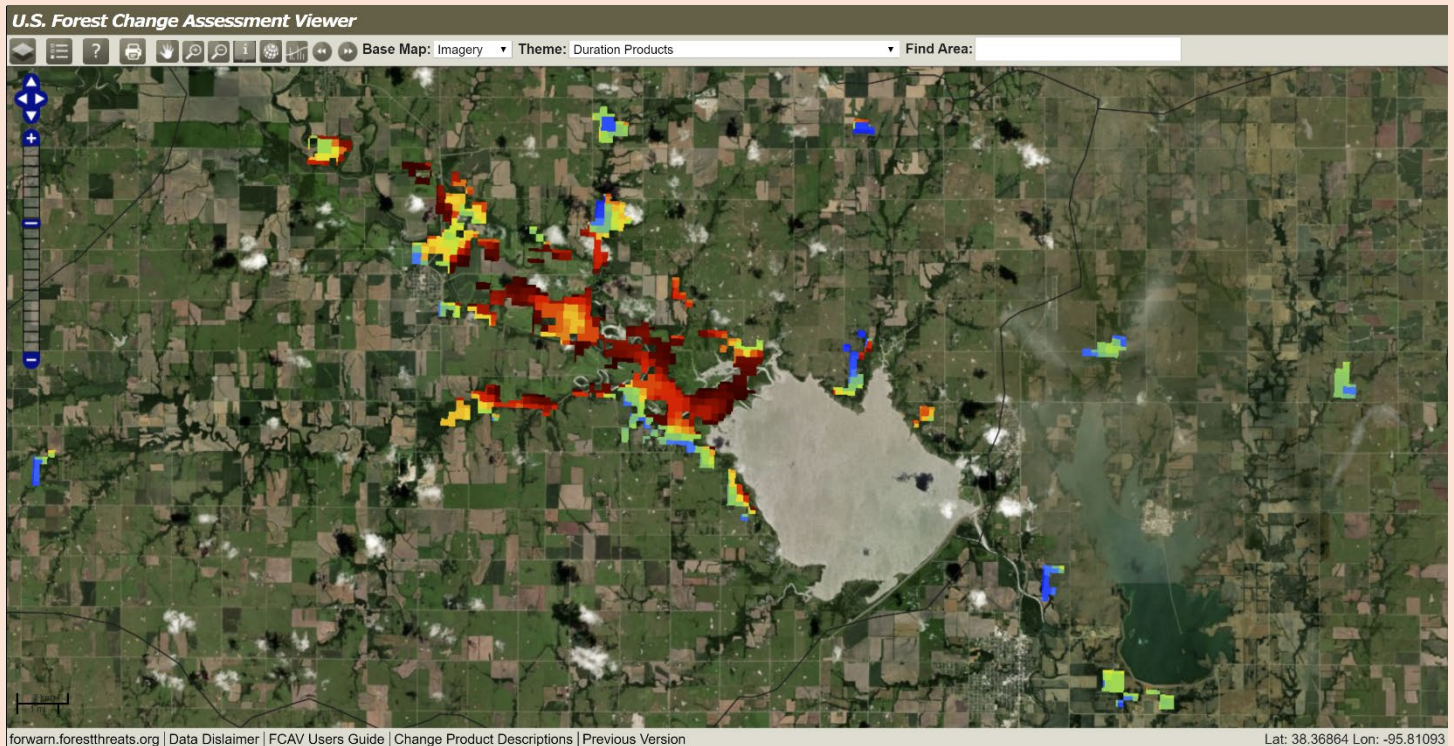


Produced by Weather Data Library
Department of Agronomy
Kansas State University



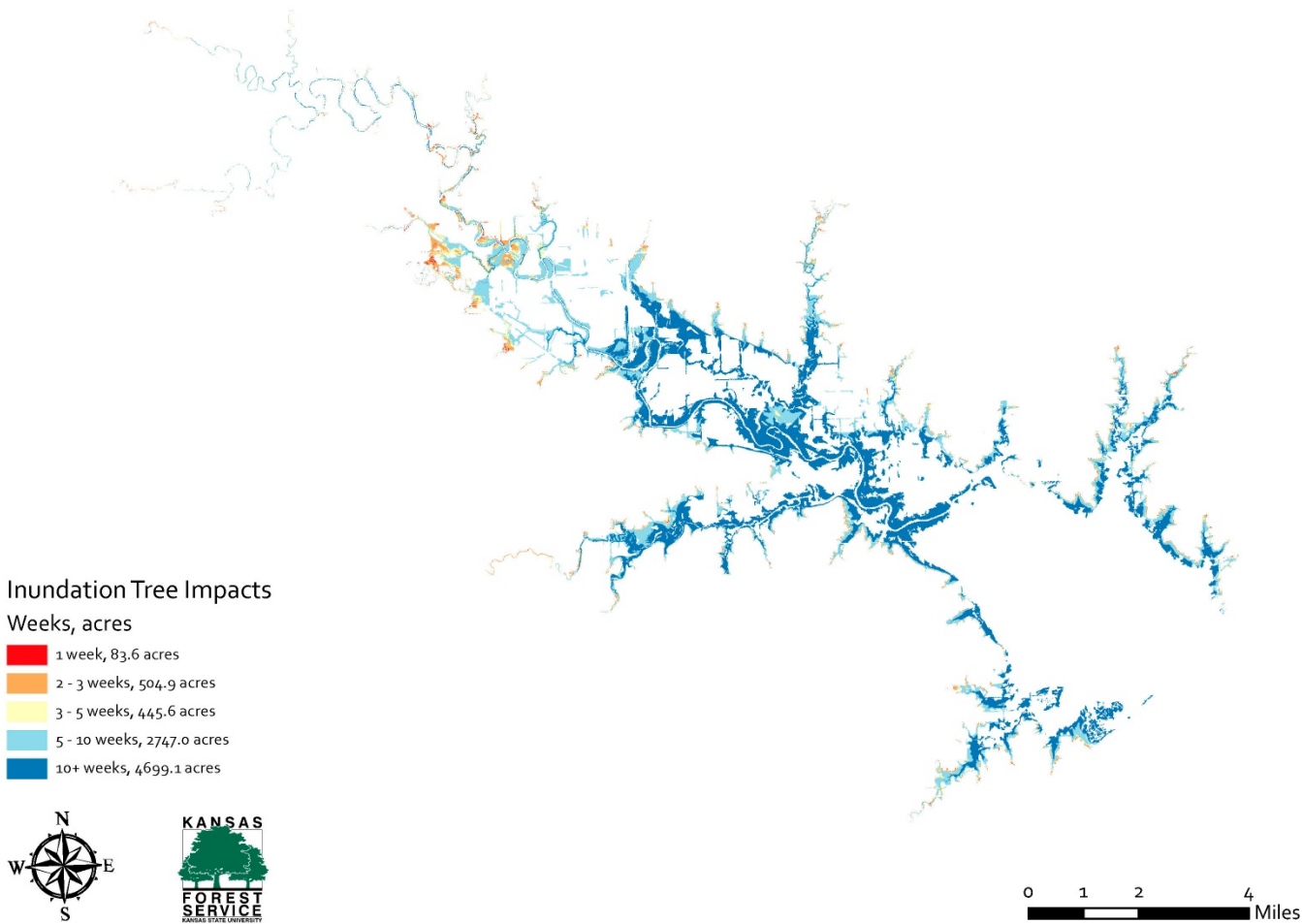
Long duration flooding impact can be clearly seen from this aerial photo of forest land adjacent to Perry Lake in Jefferson County, Kansas.

Starting in the fall of 2018 and continuing through the spring of 2019, much of Kansas saw above-average or even record precipitation. In an effort to mitigate downstream flooding in the Missouri/Mississippi watershed, the Army Corps of Engineers enacted flood control measures that kept many Kansas reservoirs at high water levels for much of the 2019 growing season. These high water levels may have impacted tens of thousands of acres of forest lands.



Reports were received of mortality/decline on forest stands associated with high pools on federal reservoirs. A decline in vegetation NDVI was clear through satellite tools (such as the US Forest Change Assessment Viewer, above, on John Redmond Reservoir), indicating likely negative impact on associated forest land. The Kansas Biological Survey and Kansas Forest Service collaborated to create spatial data that represent the forested area that was not only impacted by the flooding, but also by the length of time. These data will be shared with partners to better manage the area around reservoirs in preparation for other flooding events. Preliminary assessment of forestland acres for Redmond, Tuttle, Perry, Milford, and Clinton follows, below.

JOHN REDMOND RESERVOIR



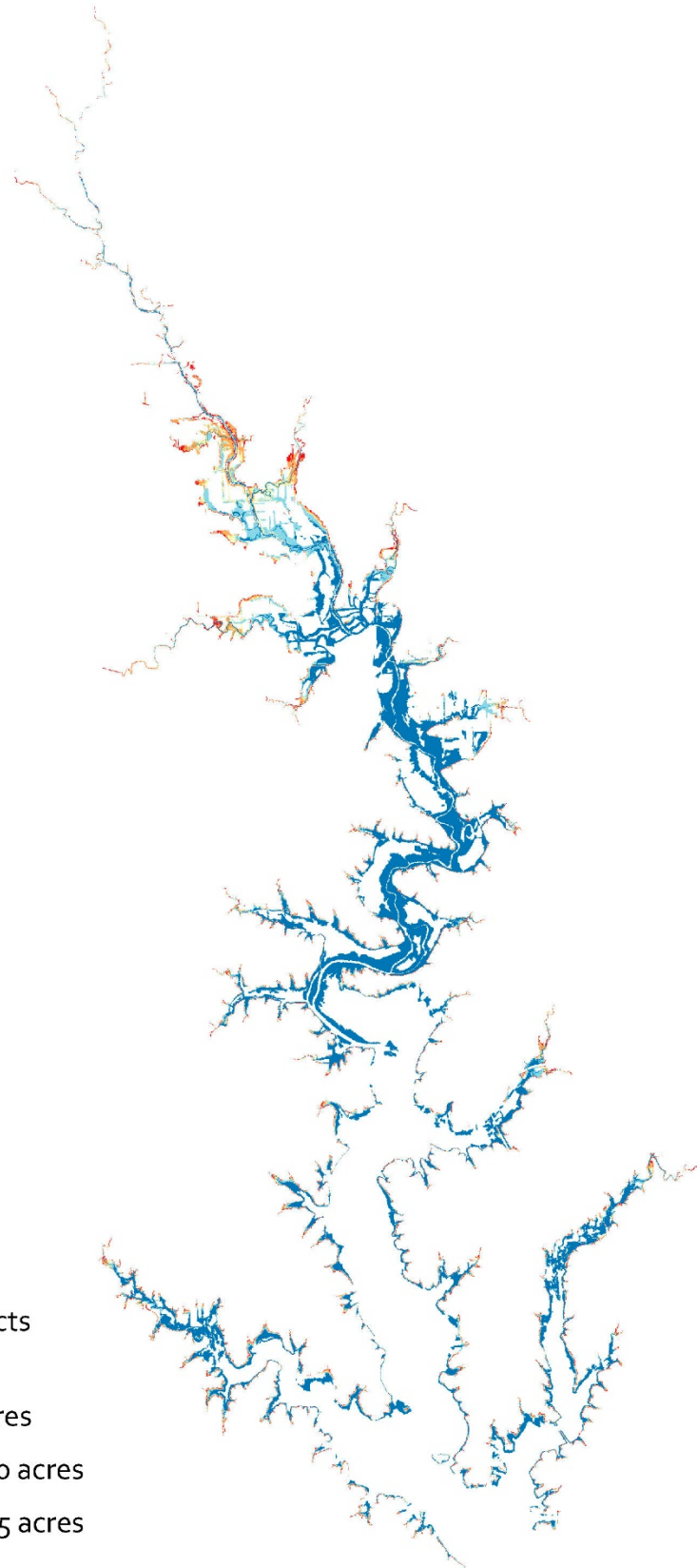
Based on initial assessment work, it's likely that many thousands of acres of forest will see decline and/or conversion in vegetation type in the near future, but this assessment is still preliminary.

To create these maps, a complete rural tree canopy layer was cross-referenced with inundation duration data, to give an idea of how long each of these forested pixels was underwater in 2019. It's difficult to assess the tolerance of flooding by trees, and it comes down to a great number of factors beyond simple "days with saturated soil." In an attempt to create reasonable thresholds for assessing potential impact, research from Dey, Koslowski and De Jager was referenced to come up with the following classes:

- 0-7 days (assumed to be negligible impact)
- 8-21 days (assumed to have some impact, varying based on timing of growing season or dormant)
- 22-35 days (small impact on mature trees, reduced vigor on seedlings/regen of tolerant species, mortality for intolerant species i.e. black walnut)
- 26-70 days (significant seedling/regen mortality, significantly reduced vigor on mature trees)
- 70+ days (significant decline and mortality on all trees, which may not manifest for 1-3 years)

This isn't designed to fully assess current and future impact, but instead to help focus future monitoring, restoration and management work. For many areas, this might mean that no management is needed in frequently flooded bottomland willow areas, but at some lakes it is known that more upland sites were impacted, including some recreation areas. In some areas, it's likely that invasive plants and/or low-quality regeneration could replace the higher-quality forest that was impacted, and active management may need to be planned.

PERRY RESERVOIR

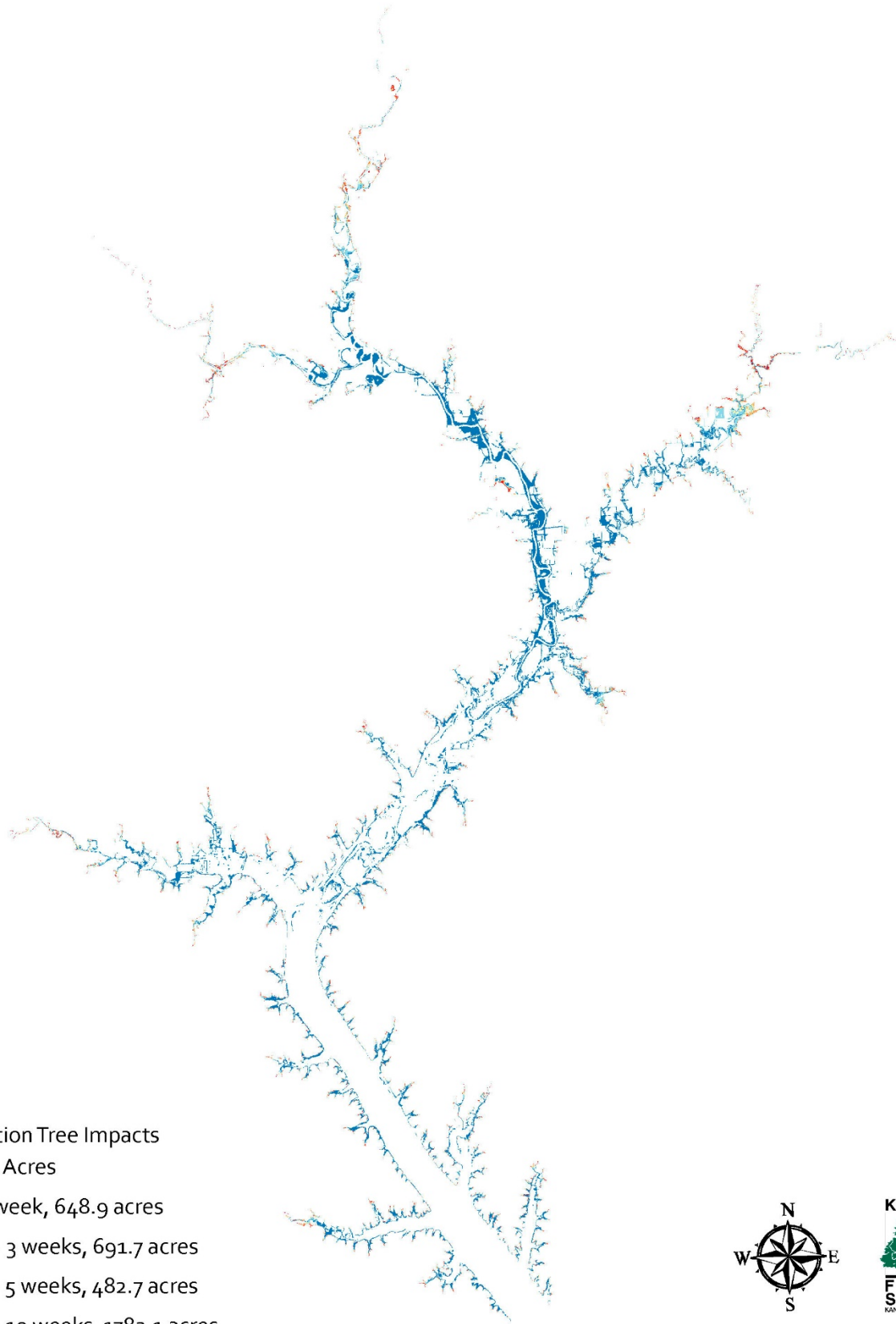


Inundation Tree Impacts Weeks, Acres

-  1 week, 270.6 acres
-  2 - 3 weeks, 706.0 acres
-  3 - 5 weeks, 424.5 acres
-  5 - 10 weeks, 1107.5 acres
-  10+ weeks, 5066.8 acres



TUTTLE CREEK RESERVOIR

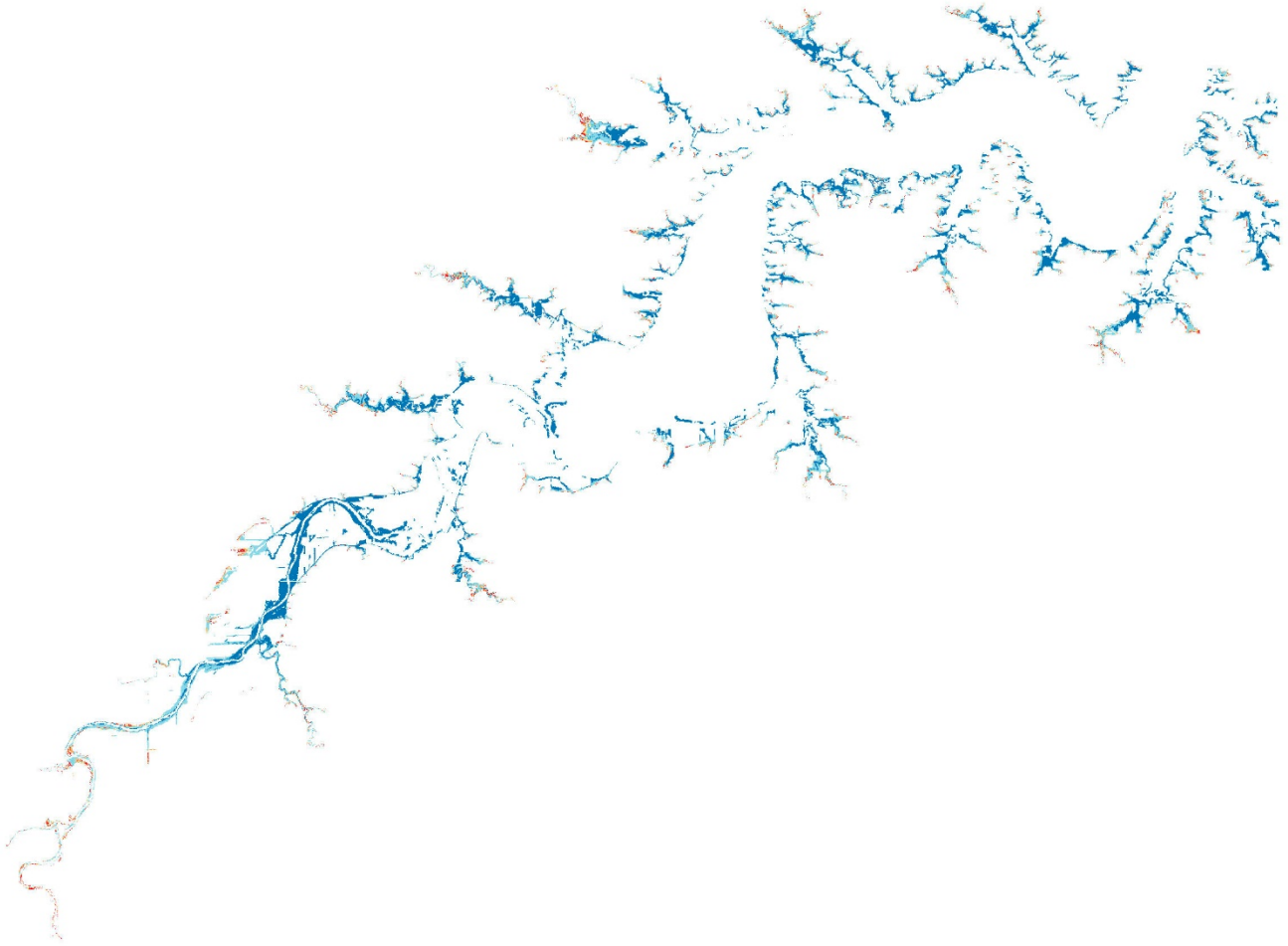


Inundation Tree Impacts Weeks, Acres

- 1 week, 648.9 acres
- 2 - 3 weeks, 691.7 acres
- 3 - 5 weeks, 482.7 acres
- 5 - 10 weeks, 1782.1 acres
- 10+ weeks, 7357.0 acres



MILFORD RESERVOIR

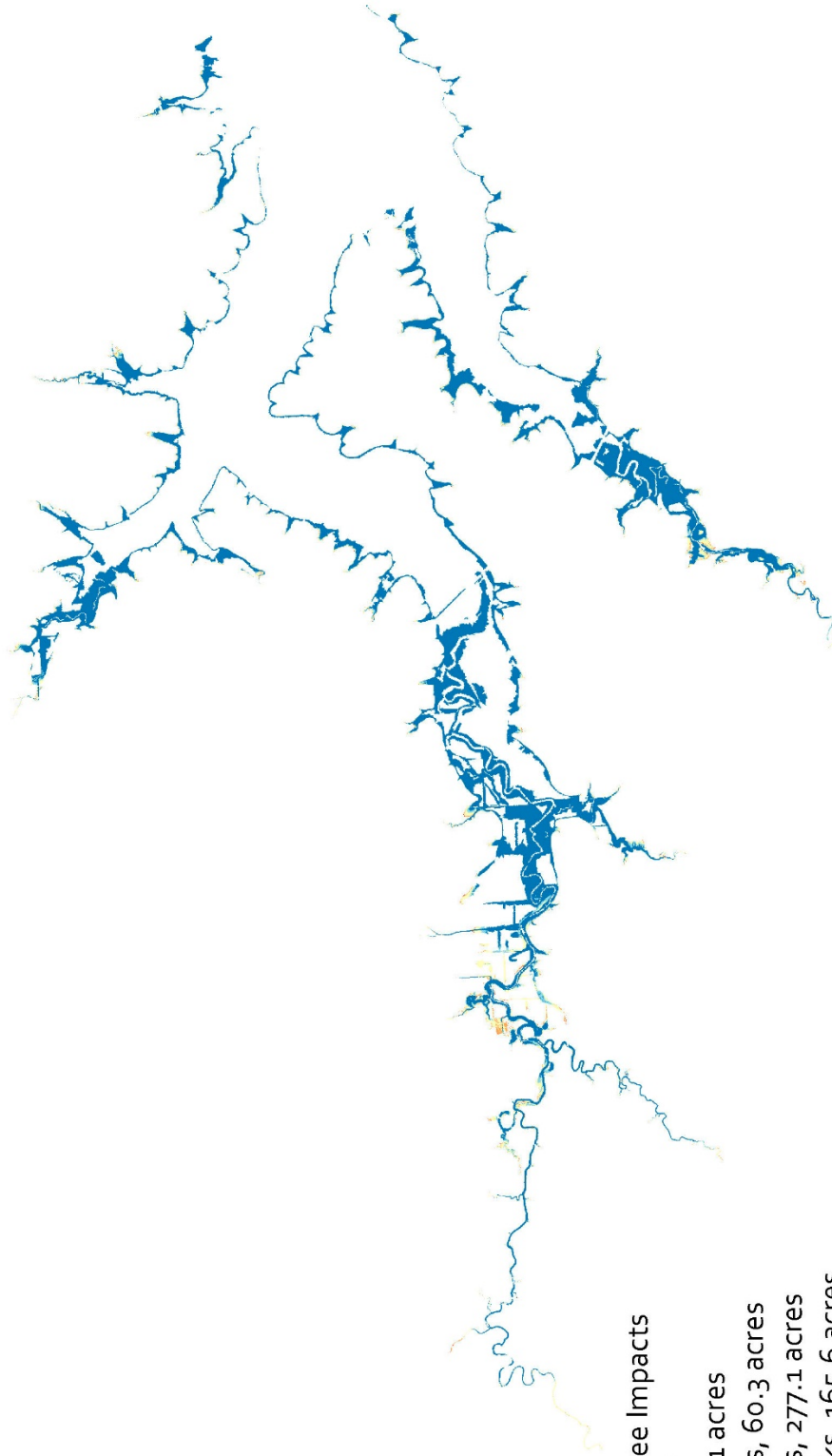


Inundation Tree Impacts

- | Weeks, acres |
|-----------------------------|
| 1 week, 239.3 acres |
| 2 - 3 weeks, 381.1 acres |
| 3 - 5 weeks, 170 acres |
| 5 - 10 weeks, 1,699.8 acres |
| 10+ weeks, 2,738.6 acres |



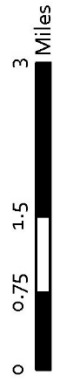
CLINTON RESERVOIR



Inundation Tree Impacts

Weeks, acres

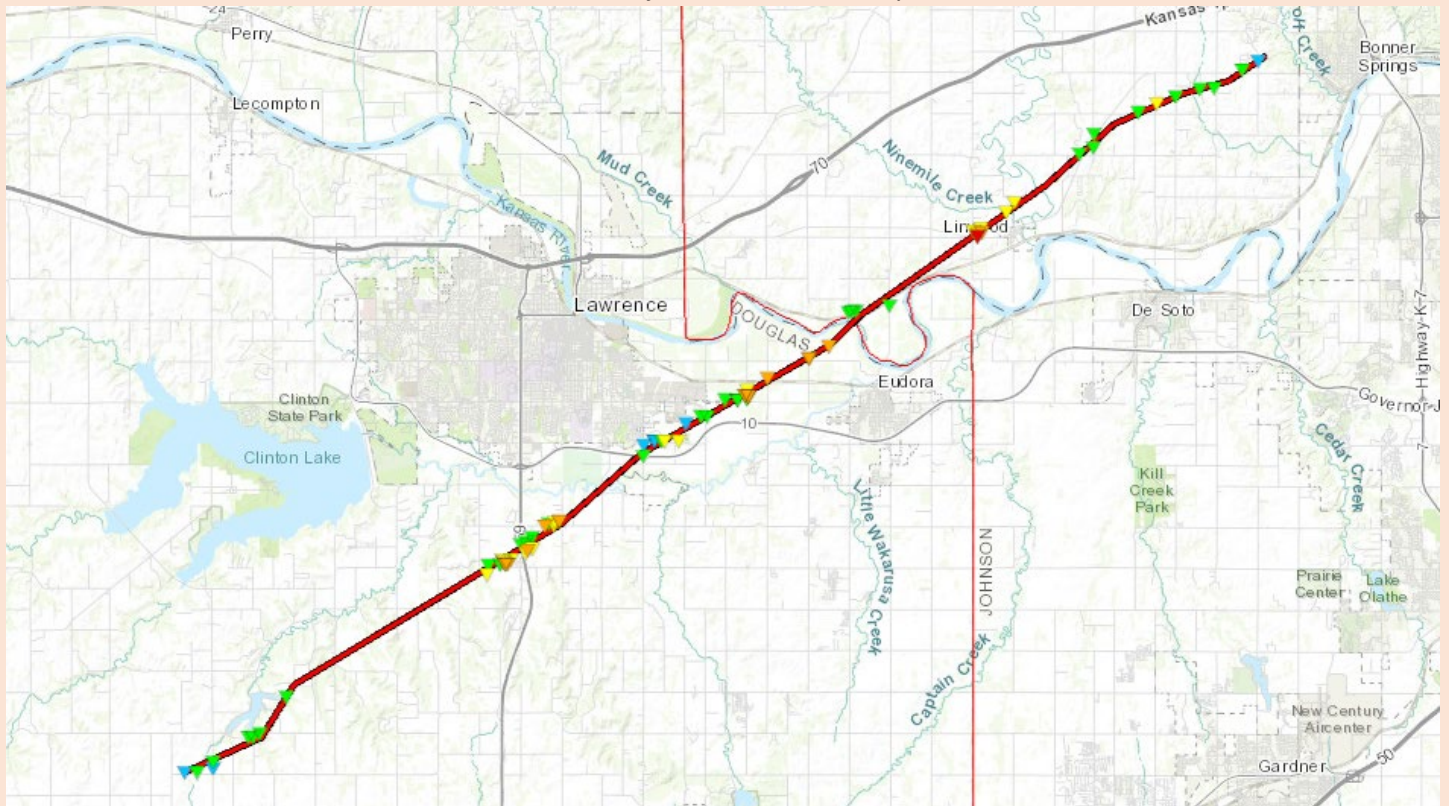
- 1 week, 4.1 acres
- 2 - 3 weeks, 60.3 acres
- 3 - 5 weeks, 277.1 acres
- 5 - 10 weeks, 165.6 acres
- 10 + weeks, 2,237.9 acres



Severe Weather

Kansas experienced its usual share of severe weather in 2019, including several large hail storms and several significant tornadoes. These had an acute local impact on rural forests, community trees, windbreaks, and riparian forests.

According to the National Weather Service, Kansas had 89 recorded tornadoes in 2019 (twice as many as the quiet 2018 season), including 8 rated at EF2 or above; classified as Strong or Violent. The strongest of these was the EF4 tornado on May 28 that cut a nearly 32-mile swath from southwest of Lawrence to Bonner Springs. This tornado, the strongest in the area since 2003, caused \$26 million in property damage, impacted heavily forested areas along the Clinton Lake, the Wakarusa River, and the Kansas River, and led to 18 injuries – but thankfully zero deaths.



Significant damage to forestland and trees is apparent in this NWS photo from Lawrence on May 28, below.



Invasive Bush Honeysuckle



Bush honeysuckle (green) creating a dense monoculture in the understory of native forestland at Mined Land Wildlife Area near Pittsburg, Kansas.

The non-native bush honeysuckles (*Lonicera maackii*, *L. tatarica*, and *L. x bella*) and their vine counterpart, Japanese honeysuckle (*L. japonica*) have invaded many woodlands, forests, and nature preserves causing declines in species diversity and richness of native ground cover and mid-story vegetation.

Honeysuckle infestation can be ascribed, in part, to their adaptability to a wide variety of habitats and spread as a result of being a prolific producer of seeds (bush honeysuckles primarily) that are easily dispersed by birds.

Asian bush honeysuckle possesses rapid aboveground and belowground growth, is adapted to low-light environments, begins growth earlier and can continue growing later in the growing season than most other woodland species.

Urban woodlands around **Wichita, Topeka**, and the **Kansas City** metro area continue to implement management efforts to combat these invasive shrubs and vine. Some land managers have been utilizing backpack mistblowers for control, which show promise in economical, effective control of this forestland invader.

The Kansas Forest Service provides backpack mistblowers on loan to landowners for no charge, in order to facilitate treatment of infestations in late fall, when off-target impact is minimized and control of bush honeysuckle has been shown to be highly effective.



A large mistblower was acquired in 2019, available to landowners and agency partners for treating bush honeysuckle infestations.

Invasive Callery Pear



Invasive callery pear seedlings proliferate in grasslands in rural Geary County. Untreated seedlings on the left, treated seedlings on the right.



A seedling of callery pear in forestland in rural Labette County.

Callery pear (*Pyrus calleryana*) was introduced to the United States from China in 1917 as an ornamental tree. Starting in the 1950s with the introduction of the popular cultivar 'Bradford', these small trees have been widely planted in landscapes across the country. Efforts to address poor branching structure and subsequent storm damage led to the introduction of improved cultivars, but these new trees with better branch angles were also genetically distinct from the clonally propagated and identical 'Bradford' that existed in the landscape. With these new cultivars came cross-pollination of previously sterile 'Bradford' flowers, and birds widely distributed the now-viable seeds where they became established in undermanaged margins and interfaces between forestland, urban areas, grasslands and "waste" areas.

Callery pear's prolific ability to resprout, tolerance of a wide range of environmental conditions, and dense shade cast by its canopy, has led to a rapid infestation and conversion of previously diverse ecosystems into a virtually impenetrable monoculture of callery pear seedlings and trees in a short time. In many cases, this invasion and conversion happens without land managers being aware of the process, and it is only noticed when it's too late and management has become a challenge.



A large callery pear exhibits strong pyramidal form, in a waste area in rural Cherokee County.

Evidence shows that callery pear seedlings are becoming established in important ecosystems such as the tallgrass prairies and gallery forests of the Flint Hills and the remnant post oak savannah forestland of the Cross Timbers. Unlike states to the east of Kansas, from Missouri to Indiana, where infestations are widespread and well-established, Kansas is early in the callery pear infestation stage. There are a few well-established populations of callery pear near urban areas of Wichita and Kansas City, but many smaller infestations are still becoming established in other areas such as Hutchinson, Manhattan, Topeka, and towns in southeast Kansas.



A callery pear seedling produces a proliferation of fruit, with seeds that are likely viable, at an infestation in Riley County.

Report from the Kansas State University Plant Pathology Diagnostic Lab – by Judy O’Mara



A declining red oak at Fort Scott National Historic Park in Bourbon County. Samples submitted from this tree were negative for known pathogens.

Declining Oaks... are not that easy to sort out. There is an assumption that if an oak tree is dying it must be due to a disease. That is usually NOT the case. Most of the poor growth that we see on oak trees in Kansas is generally due to a combination of site factors and environmental extremes. 2018 and 2019 provide back to back examples of weather extremes. Add in site factors like tree planting depth (too deep), construction damage, heavy soils or compacted soils that drain poorly, sandy soils that don’t hold on to water very well, and trees can develop root systems that are not as vigorous as they should be. The result is a situation where trees are prone to declining under weather extremes - and Kansas is all about extreme weather.

A look at some weather data for Johnson County (Olathe, KS) provided by the K-State Weather Mesonet shows that the 20yr average annual precipitation is 40.04” for that location. At a glance it is easy to see that some years run wetter than average and some years are drier than average. I picked the Johnson County, KS location to highlight because we frequently get oak tree samples in the K-State Plant Disease Diagnostic Lab from the Kansas City area with questions about disease.

2018 was a dry year due to a winter drought and we saw trees decline across the state, including quite a few oaks from the Kansas City area.

There was below average precipitation between November 2017 and September 2018. This weather snapshot also shows extreme weather during 2019, particularly during April and May. Saturated soils resulting in root damage and tree decline has been a common problem this year. Young trees and shrubs are particularly at risk due to smaller root systems. In many cases, damage wasn’t immediately apparent until June or July when higher temperatures put a greater demand on the root system. So bottom line, extreme weather patterns frequently play a role in the health of our landscapes.

Johnson County (Olathe, KS). K-State Weather Mesonet

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	0.04	0.80	0.79	4.93	1.37	8.19	1.41	4.77	2.70	5.07	0.48	2.11	32.66
2015	0.77	0.82	0.86	3.17	10.60	6.19	7.07	3.91	2.67	1.47	5.82	3.80	47.15
2016	0.78	0.47	2.09	4.50	7.56	1.61	4.39	8.48	3.37	1.92	1.67	0.90	37.74
2017	0.89	0.03	2.31	5.80	4.33	5.79	9.88	9.57	2.21	3.80	0.10	0.37	45.08
2018	0.70	0.71	3.23	0.92	3.88	1.18	3.27	2.93	3.17	9.98	0.88	2.59	33.44
2019	0.99	1.09	2.42	6.42	9.24	6.29	4.36	10.44	4.53	1.16	0.67	1.47	49.08
Normal (1981-2010)	1.12	1.57	2.63	3.99	5.43	5.78	3.72	3.72	4.51	3.44	2.49	1.64	40.04

That said (most oak problems are not due to disease), we have picked up two different oak diseases in the Kansas City area this summer that have the potential to cause tree decline, **Hypoxylon canker** and **oak wilt**.

Hypoxylon Canker

Hypoxylon canker, also known as *Biscogniauxia* canker (*Biscogniauxia atropunctata*; *B. mediterranea*) is a disease common on oak trees throughout Kansas. It is considered to be a stress disease, usually associated with drought stress. Trees showing symptoms in 2019 were likely triggered by the dry growing conditions of 2018.

The initial symptoms of Hypoxylon canker are a tan or silver fungal mat on the trunk of the tree. This light colored surface layer quickly wears off and exposes a black crusty mass that looks like asphalt. Leaves turn yellow and shed and infected trees generally die within the first year. By the second year the dead oaks slough off the remainder of their bark.

The best protection against Hypoxylon canker is to avoid stress. This starts with planting into well-drained sites and providing deep, regular watering during prolonged periods of dry weather. Also take care to avoid damage due to construction activities.



A fungal mat (black) and bark sloughing on the trunk of a parking lot oak tree, typical of hypoxylon canker symptoms.



Oak Wilt

Oak wilt (*Bretziella fagacearum*) has been picked up in a couple of red oak trees in the Kansas city area (Johnson County, KS) this summer. It is an occasional problem on red oaks and pin oaks in northeast Kansas and in counties along the Missouri state line.

Oak wilt causes a partial leaf scorch (brown at the leaf tip and green at the base). Beneath the bark tissue, the disease produces dark brown streaks in the sapwood (see photos). Oak wilt on red oaks tends to start on a major limb or in a section of a tree and then progress until the tree dies, usually within a season.

The disease can be spread by sap feeding insects so it is important to avoid pruning oaks between April-June. Oak wilt can also spread to nearby red oak trees through roots that have fused.

There is no cure for the disease. Infected trees should be removed and destroyed. The wood should not be kept for firewood. If there are red oaks nearby, the root grafts between the trees should be severed. Healthy red oaks nearby may benefit from a fungicide injection.

The best time to test for oak wilt is when trees are freshly wilted, generally in the spring.

Red oaks declining near Oskaloosa (Jefferson County) that were lab-confirmed positive for oak wilt., at top left and center. Root grafting likely increased the rate of spread and number of trees impacted in this stand.

Pictured at right, typical leaf symptoms of oak wilt on a red oak. Striking under the bark is clear on this twig sample, at bottom left.



Forest Health Threats

Thousand Cankers Disease



A 25-year-old black walnut plantation in northeast Kansas, which is threatened by the potential for TCD to enter Kansas.

This disease complex has **not yet been detected** in Kansas. However, Kansas shares a 200-mile border with Colorado, an infested state, increasing the risk of TCD introduction. With TCD existing as close as Colorado, Kansas is a potential “doorway” to the entry of thousand cankers disease into the native range of black walnut, which would have disastrous consequences both economically and environmentally.

Doniphan, Bourbon, Franklin, Osage, Linn, Leavenworth and Pottawatomie counties contain the largest number of black walnut trees in Kansas.

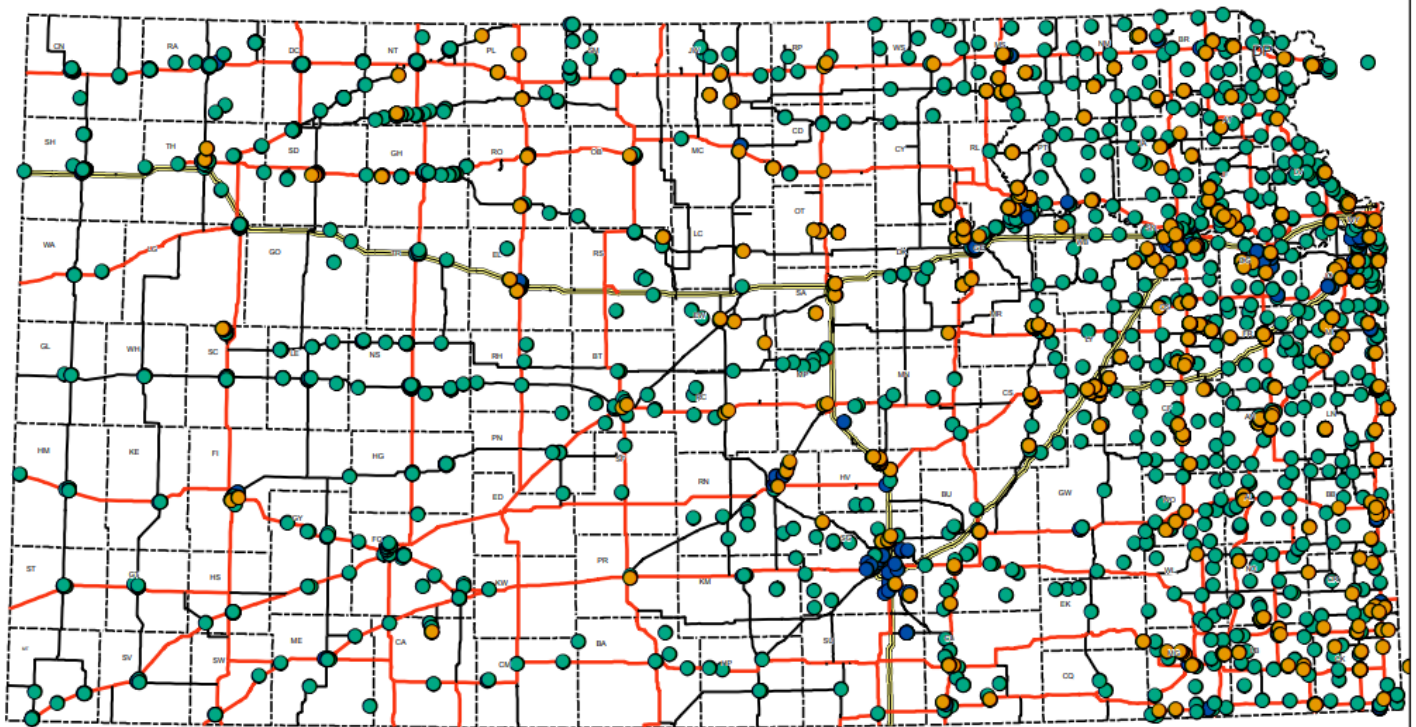
A recent estimate of economic loss associated with the introduction of thousand cankers disease to Kansas suggests at least **\$160 million** over the next 20 years.

TCD trainings occurred throughout the year to arborists, municipalities, and landowners, greatly increasing the detection network and providing further outreach efforts. Walnut Twig Beetle pocket ID cards were distributed to interested parties, including arborists and extension agents.



Walnut twig beetles are visible on this black walnut twig in Loveland, Colorado. Walnut twig beetles have not yet been detected in Kansas

Thousand Cankers Disease of Walnut Survey, 2009 - 2018



● Walnut Twig Beetle Trapping: 367 Locations
● Firewood Inspections: 251 Locations
● Thousand Cankers Disease of Walnut Visual Survey: 1,379 Locations
 Not Displayed: 21 Firewood Inspections and 46 Visual Survey Locations prior to 2011

0 5 10 20 30 40 Miles

March 20, 2019
kda/ppwc/jvogel

Street-side and on-the-ground visual surveys of black walnut have been conducted across the state. High risk areas of central and eastern Kansas were visually surveyed, where walnut is common and pathways are of concern.

In 2019, 44 Lindgren funnel traps, with lure, were deployed by Kansas Department of Agriculture (KDA) personnel in 15 south-central Kansas counties, in Butler, Chase, Chautauqua, Cowley, Elk, Greenwood, Harvey, Lyon, Marion, McPherson, Morris, Reno, Rice, Sedgwick, and Sumner counties.

This was the second year of dry cup trapping, providing easier collection and sorting, but some predation and rain washing was observed. In addition, 22 walnut bolts were deployed alongside the funnel traps as an alternative method for detecting WTB and *Geosmithia* fungus presence.

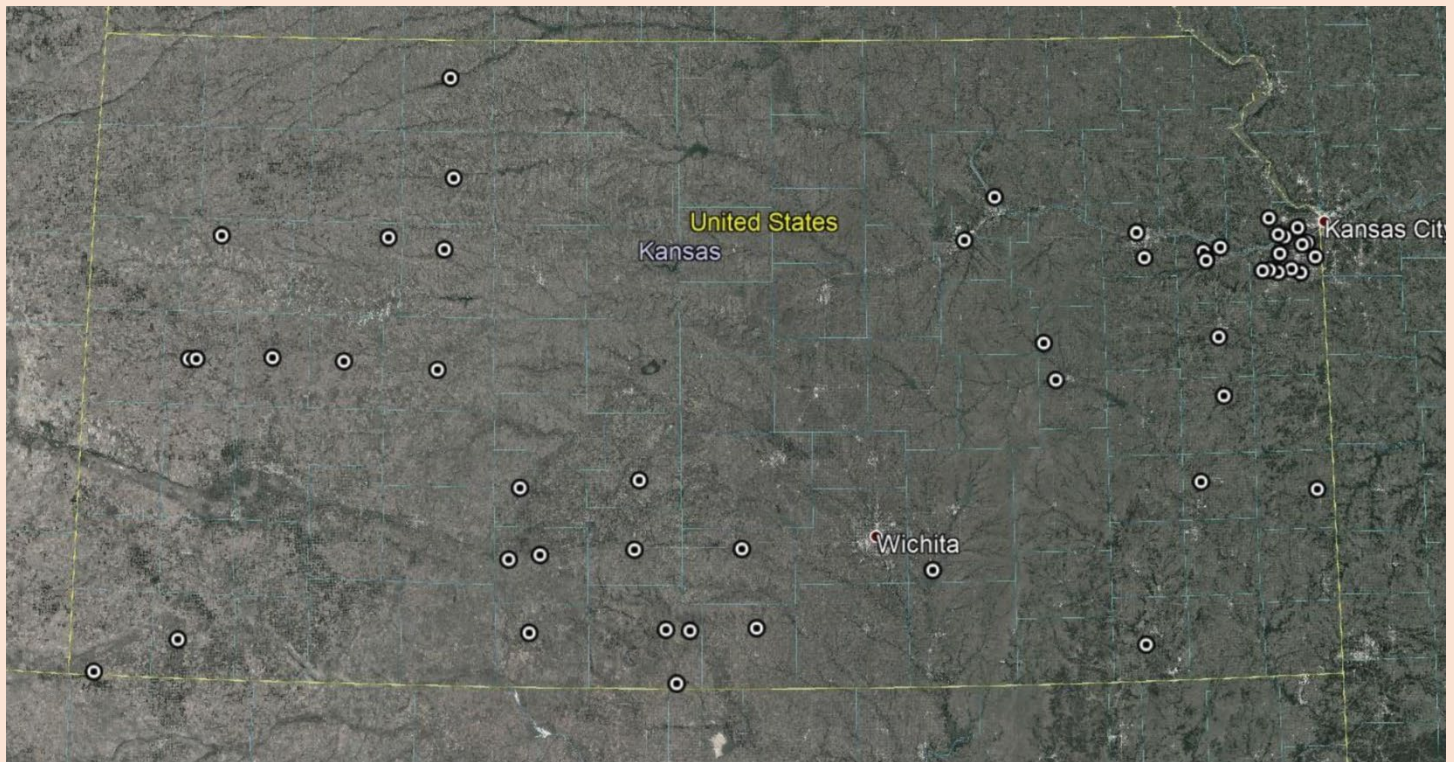


A Lindgren funnel trap and baited walnut bolt, used to monitor for walnut twig beetles and Geosmithia morbidia fungus..

No walnut twig beetle (WTB) specimens have been found to date.

A dedicated sentinel site trap program was maintained in western Kansas of known walnut locations. The nearest known walnut twig beetle population is in Eads, Colorado, about 40 miles directly west of the Colorado-Kansas border.

Gypsy Moth

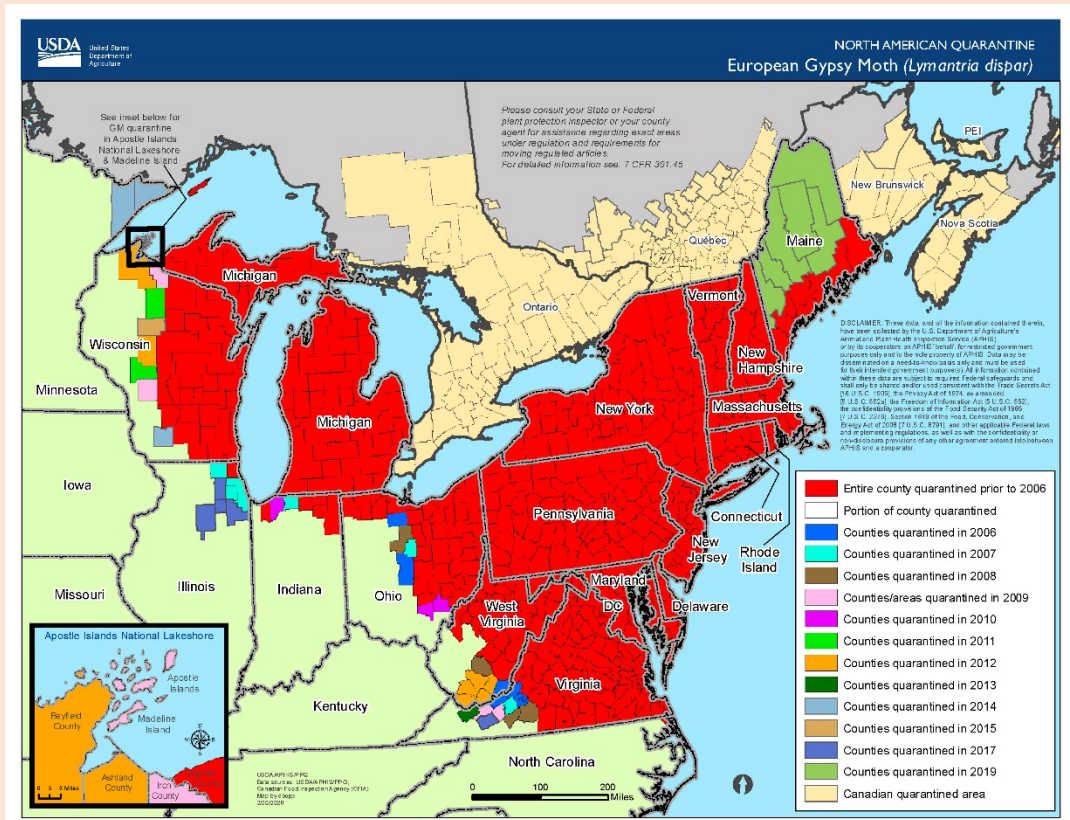


According to a report by the Kansas Dept. of Agriculture, during checks of the gypsy moth traps deployed as a part of the pathway survey, one male gypsy moth was collected in 2015. The trap was located at a distribution location located in Johnson County. The moth was sent to an Aphis PPQ, where it was identified as the European gypsy moth *Lymantra dispar dispar*. This find triggered a follow-up delimiting survey.

In 2019, KDA set 52 traps across 33 counties throughout the state: Allen, Anderson, Barber, Bourbon, Butler, Comanche, Douglas, Edwards, Franklin, Geary, Gove, Graham, Harper, Johnson, Kingman, Kiowa, Lane, Leavenworth, Logan, Lyon, Montgomery, Morton, Ness, Norton, Pratt, Riley, Scott, Shawnee, Stafford, Stevens, Trego, Wichita, and Wyandotte counties.

USDA-APHIS and KDA have had **no positive finds** in traps set every year since 2015.

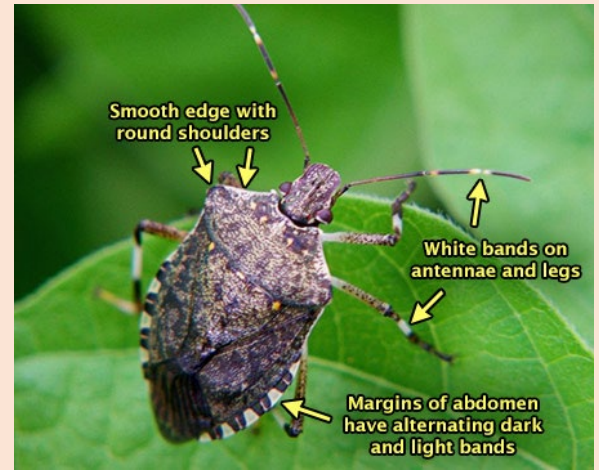
The nearest established population of gypsy moth to Kansas is in southern Wisconsin and northeastern Illinois, more than 400 miles from Kansas. Based on the current annual spread of gypsy moth, abated by the “Slow the Spread” program, gypsy moth is not expected to become established in Kansas for at least 30 years.



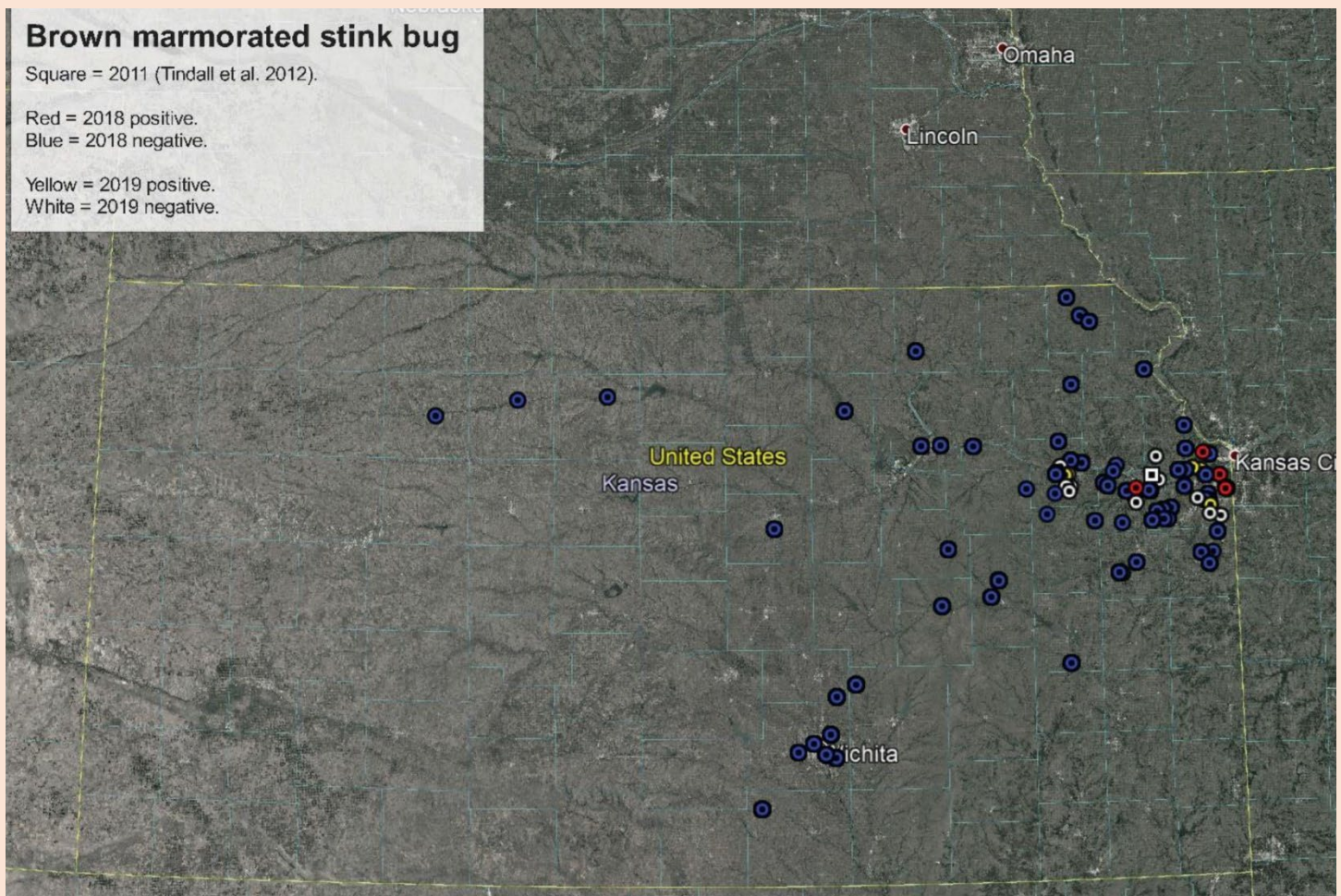
Brown Marmorated Stink Bug

Brown marmorated stink bug (BMSB) is a non-native invasive pest that damages a wide variety of fruit, vegetable, and ornamental crops. In Kansas, trees potentially impacted would include apple, pear, hazelnut, nectarine, peach, apricot, cherry, serviceberry, redbud, Japanese pagoda tree, Korean evodia, Peking tree lilac, dogwood, and linden.

According to a report from the Kansas Department of Agriculture, BMSB was first detected in Douglas Co. in 2011 and later reported in the Journal of the Kansas Entomological Society. Subsequently, BMSB came to the attention of KDA through reported sightings in Johnson Co., follow-up trapping efforts by KDA and a sighting in Douglas Co.



Brown marmorated stink bug (Halyomorpha halys).
Photo by Steve Schoof.



In 2019, KDA surveyed for BMSB with 18 pheromone baited traps, placed across four counties (Douglas, Leavenworth, Johnson, and Shawnee). Three traps from **Johnson County** and one trap from **Shawnee County** recovered BMSB, the latter representing a new county record for Kansas. Although specimens were not abundant in Johnson Co. traps, due to specimens being recovered consecutively over the years, BMSB is likely widespread and well established in the area.

Six specimens were recovered from a trap in at Washburn University in Shawnee Co. The high abundance may illustrate that BMSB is already established in parts of Shawnee Co., and presence on a university campus may be due to unintended movement by students.

Although not yet known to cause noticeable damage, due to their highly polyphagous nature and economic importance, KDA will continue to monitor and survey for BMSB in 2020.

Sudden Oak Death / *Phytophthora ramorum*

Sudden Oak Death (SOD) is caused by *Phytophthora ramorum*, a water mold pathogen. The pathogen is also the cause of the Ramorum Leaf Blight, Ramorum Dieback and Phytophthora Canker Diseases.

SOD was first detected in the San Francisco Bay Area in the mid-1990s. It was first recognized as killing trees in Oregon forests in 2001. The SOD pathogen is considered especially dangerous because it affects a wide variety of trees, shrubs and plants and there is no known cure. The pathogen has killed millions of tanoak and coast live oak trees along the central CA coast into Southern OR and is a concern because it also infects rhododendron, camellia and other common horticultural nursery plants.



Coast live oak dying from P. ramorum infection, China Camp State Park, CA. Sudden Oak Death has NOT yet been associated with any tree mortality in Kansas.

The oak forests of Kansas are predominately in the eastern third of the state, and while most native oaks like bur oak are of the potentially less-susceptible white oak group, there are millions of red, black, pin, shumard, blackjack, shingle, and other oaks that could be impacted should this disease gain a foothold in the state.

Unfortunately, few details are certain about how this pathogen might affect the species that are native to the central hardwood forests present in Kansas, so KFS encourages the public to be proactive in taking steps to ensure this disease does not spread from rhododendrons or other infested plant material into our community forests and rural woodlands.

In May 2019, KDA received a list of 60 Walmarts and one Home Depot in the state which had received rhododendron stock from a nursery in Oklahoma infected with *Phytophthora ramorum*, the causal agent of Sudden Oak Death.

These stores were part of a multi-state trace forward of rhododendron plants from this nursery. Seven varieties were confirmed positive in this trace forward. In May and June, all 61 stores were visited. Samples were taken from 19 of the Walmarts and the Home Depot, for a total of 20 samples from the trace forward. Of these, all but one sample from one of the Walmarts were positive for *P. ramorum* when tested in the USDA laboratory. KDA staff also carried in-field test strips for *Phytophthora* species and ordered destruction of plants if they were positive for any *Phytophthora* spp.

Although Sutherlands stores were not included on the trace forward list, KDA staff also visited two Sutherlands stores and collected 7 additional samples. All these samples were positive for *Phytophthora* spp. but negative for *P. ramorum*. A trace forward list was also provided containing plants shipped to Lowes stores, but no samples were collected at these stores.

In total, **34 Kansas counties** received shipments that included the seven confirmed positive varieties of rhododendron. Of these 34 counties, KDA intercepted and ordered destruction of plants at stores in 17 counties. There were 1220 rhododendrons shipped to stores in Kansas from the Oklahoma nursery, and KDA ordered destruction of 222 (18.2%). The remainder of those 1220 plants had already been sold by the time KDA was notified of the trace forward so were unable to be inspected prior to their sale. There are plans for a follow-up survey in the spring of 2020.

At this time, there are no reports of *Phytophthora ramorum* becoming established in the landscape in Kansas, causing symptoms on oaks, or causing mortality on oaks. Therefore, **Sudden Oak Death is not known to be present in Kansas**, although the pathogen that causes it has been introduced through infected nursery stock.



A well-managed multispecies home windbreak provides protection for this rural McPherson County farmstead near Inman, in central Kansas. There are more than 22,000 miles of windbreaks in Kansas, providing wind protection to more than 1.2 million acres of land. At least 65,000 Kansas farmsteads are protected by windbreaks. Field and home windbreaks contribute \$50 to 60 million in value to Kansans annually.

For Forest Health assistance and further information on Forest Health in Kansas, please refer to the following.



[Kansas Forest Service](#)

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[USDA Forest Service – Rocky Mountain Region](#)

Forest Health Protection (FHP) – Forest Health Monitoring (FHM)

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