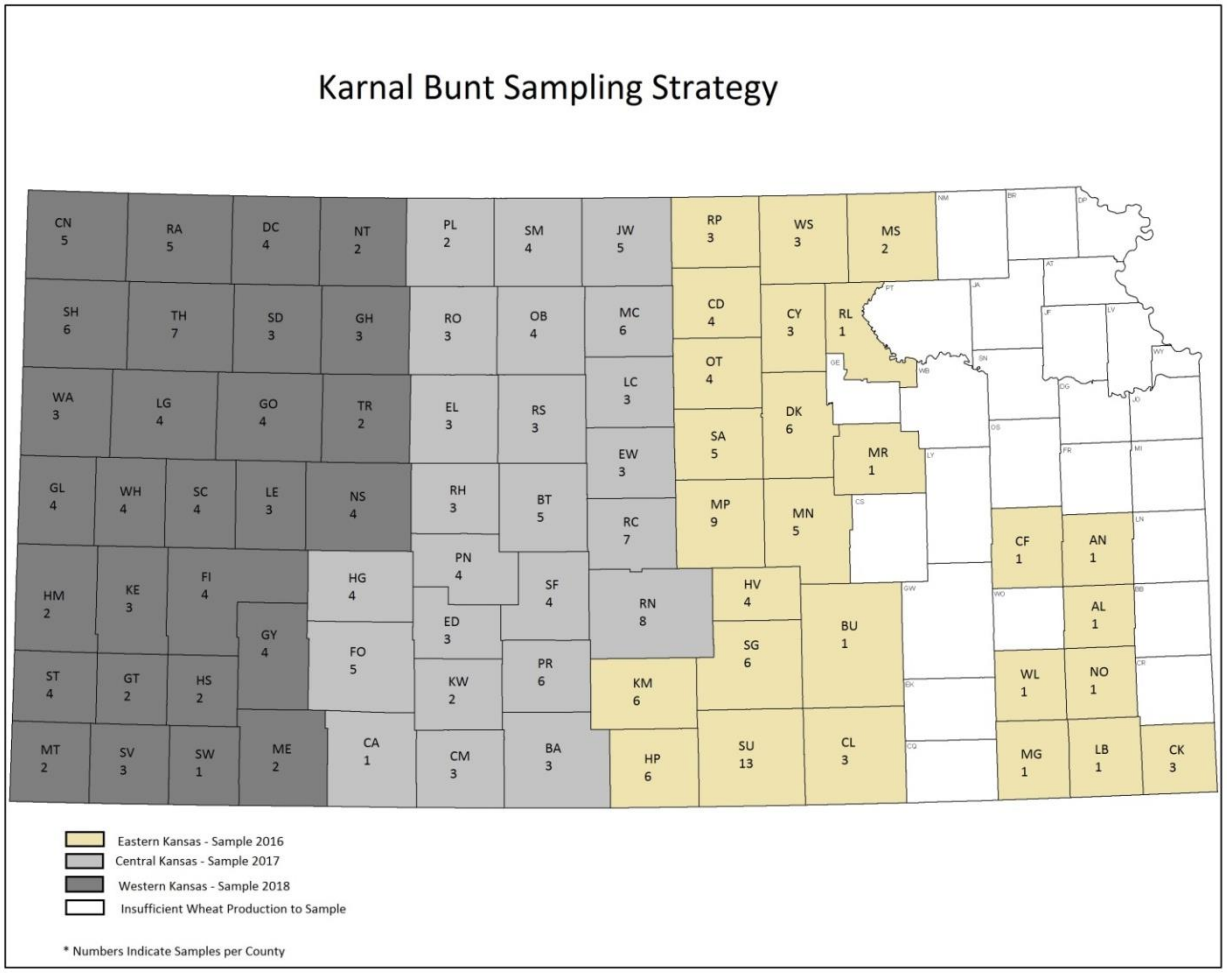
Minutes from CAPS Committee Meeting on May 23,2018

The state CAPS Committee met on May 18, 2017 at 9:00 am at the Kansas Department of Agriculture, 1320 Research Park Drive, Manhattan. In attendance were: Shayne Galford-USDA-APHIS-PPQ, Craig Webb-USDA-APHIS-PPQ, Doug Jardine-KSU, Chris Steffen-KDWPT, Ryan Armbrust-KFS, Tim Todd-KSU, Judy O'Mara-KSU, Megan Kennelly-KSU, Josh Roe-KDA, Jeff Vogel-KDA, Greg Chrislip-KDA, Scott Marsh-KDA and Laurinda Ramonda-KDA.

Introductions were made.

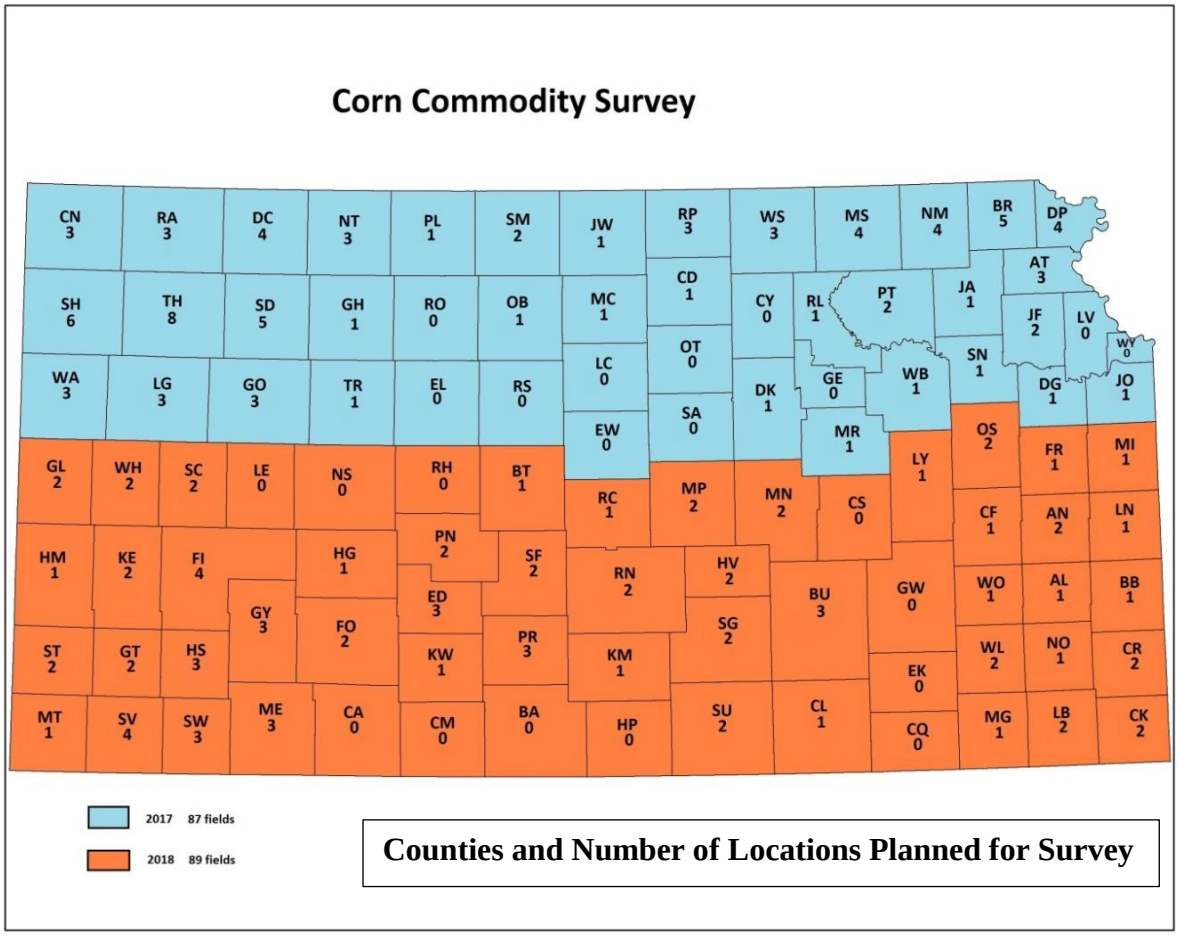
2017 CAPS, Farmbill and Line Items:

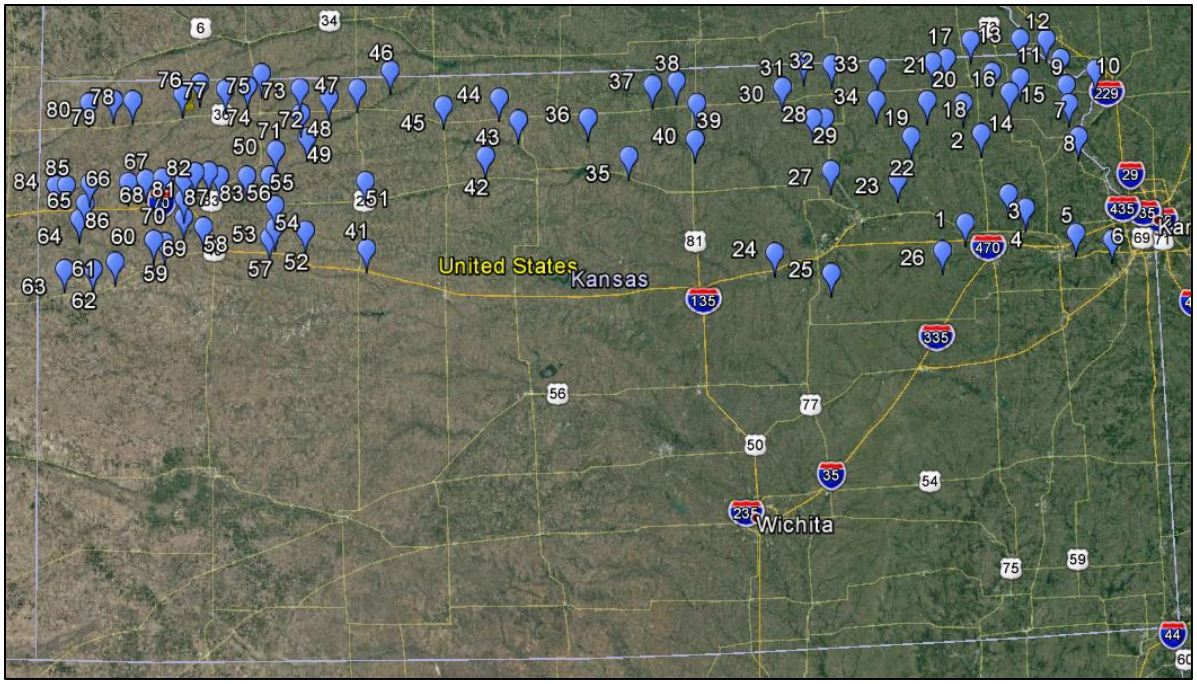
- **Karnal bunt**
  - 94 samples in 24 central part of the state – survey done by KDA staff – All negative



- **<u>Corn Commodity Survey</u>**

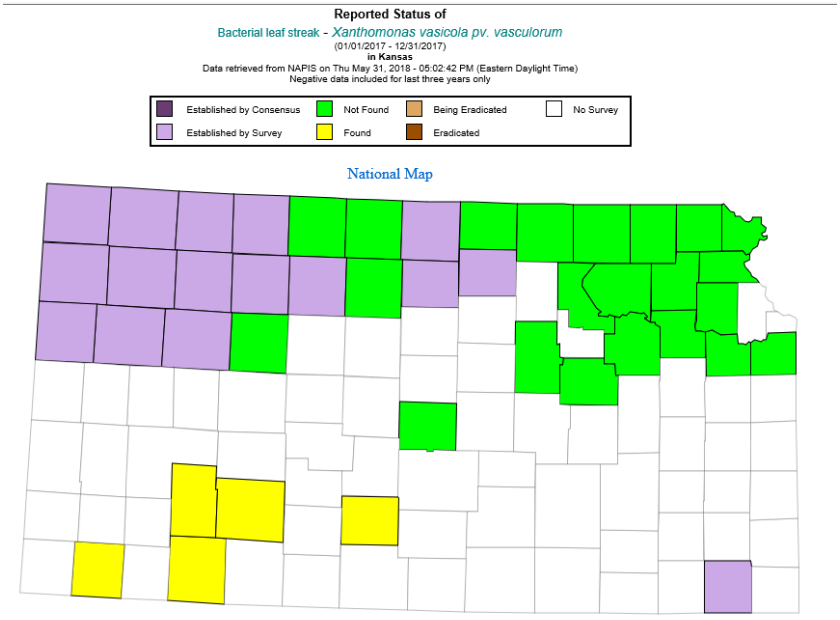
  - Two year survey. In 2017, 87 fields in 35 northern counties – survey done by seasonal staff, Brian Brunkow. One site for every 25,000 acres of corn. Soil sampling occurred once at each field and disease and trap activities will occurred monthly at each site during May to September. Survey began May 11 and completed on October 13. All targets were negative except bacterial leaf streak (*Xanthamonas vasicola* pv. *Vasculorum*). Map of counties below.
  - <u>Trapping</u> – Egyptian Cottonworm (*Spodoptera littoralis*) and cotton cutworm (*Spodoptera litura*) – 1 trap for each at each location
  - <u>Diseases</u> - late wilt (*Harpophora maydis*), Java downy mildew (*Peronosclerospora maydis*), Philippine downy mildew (*Peronosclerospora philippinensis*), Brown stripe downy mildew (*Sclerophthora rayssiae* var. *zeae*), bacterial leaf streak (*Xanthamonas vasicola* pv. *Vasculorum*), tar spot (*Phyllachora maydis* and *Monographella maydis*) and Goss' bacterial wilt.
  - <u>Nematode</u> - Mexican corn cyst nematode (*Punctodera chalcoensis*) – One sample consisting of 15-20 cores of soil from each field. Samples will be sent to Tim Todd at the KSU Nematology Lab.





Field Locations

Bacterial leaf streak/*Xanthomonas vasicola pv. Vasiculorum*

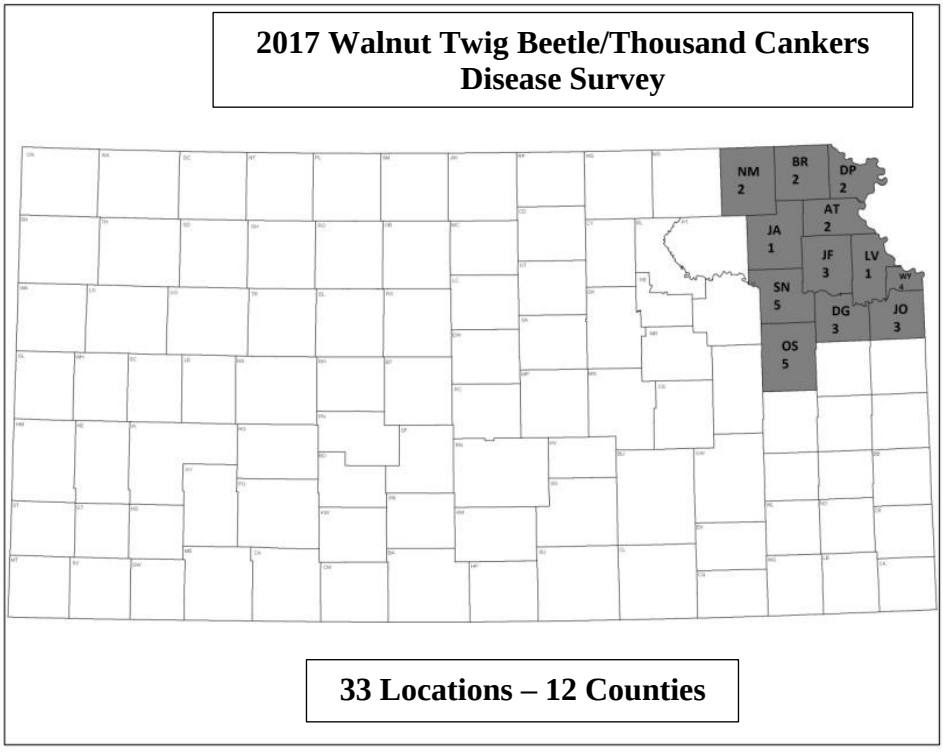


Includes surveys in southern counties by Doug Jardine (KSU)

2017 Farmbill:

- **Walnut Twig Beetle/Thousand Cankers Disease Survey**

  - 33 sites with 1 trap at each site in 12 northeastern counties by Brent Jones (seasonal employee).
  - Trapping will occurred from August 14-October 13, 2017.
  - All negative.



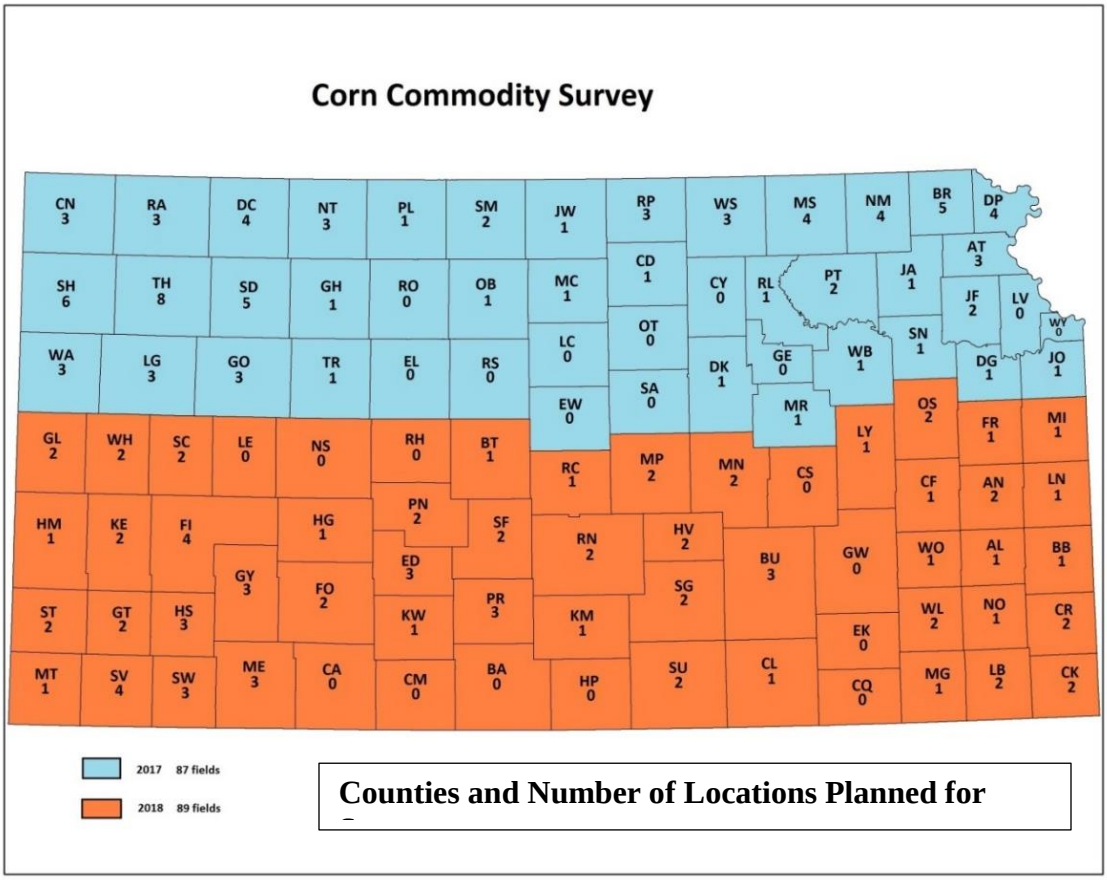
2018 Planned Surveys:

- **Corn Commodity Survey**

  - 89 fields in 48 southern counties – survey done by seasonal staff, Brian Brunkow.
  - One site for every 25,000 acres of corn. Soil sampling will occur once at each field and disease and trap activities will occurred monthly at each site during May to September.
  - Trapping – Egyptian Cottonworm (*Spodoptera littoralis*) and cotton cutworm (*Spodoptera litura*) – 1 trap for each at each location
  - Diseases - late wilt (*Harpophora maydis*), Java downy mildew (*Peronosclerospora maydis*), Philippine downy mildew (*Peronosclerospora philippinensis*), Brown stripe downy mildew (*Sclerophthora rayssiae* var. *zeae*), bacterial leaf streak (*Xanthamonas*

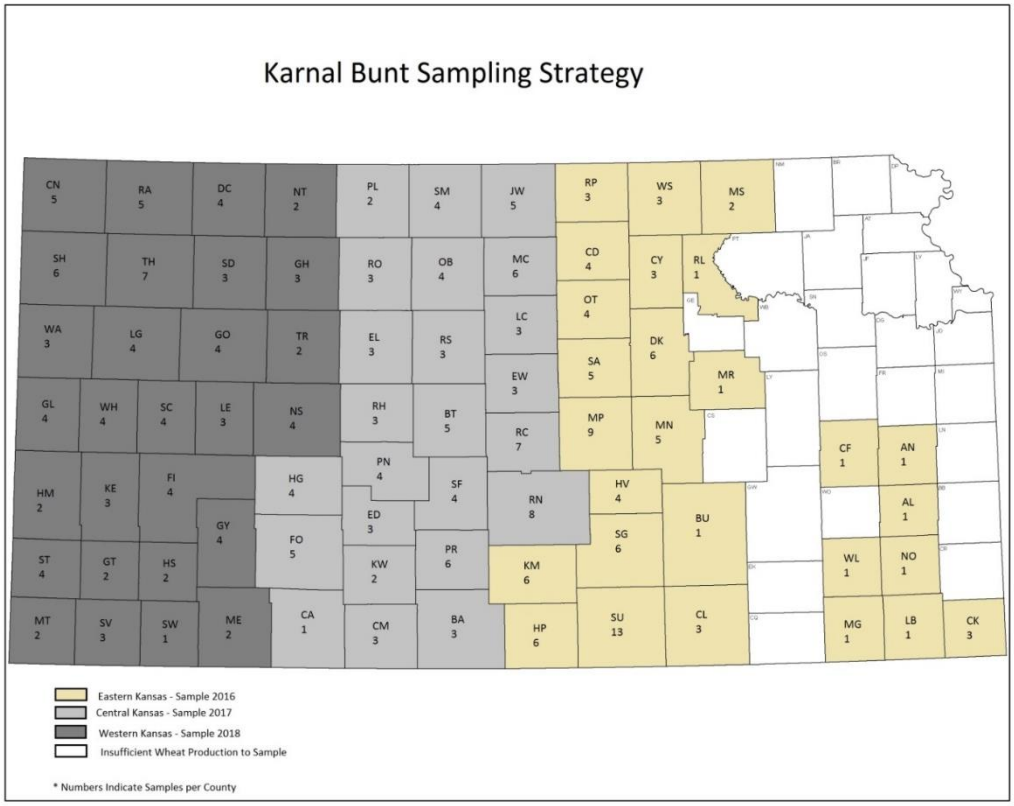
vasicola pv. *Vasculorum*), tar spot (*Phyllachora maydis* and *Monographella maydis*) and Goss' bacterial wilt.

- Nematode - Mexican corn cyst nematode (*Punctodera chalcoensis*) – One sample consisting of 15-20 cores of soil from each field. Samples will be sent to Tim Todd at the KSU Nematology Lab.



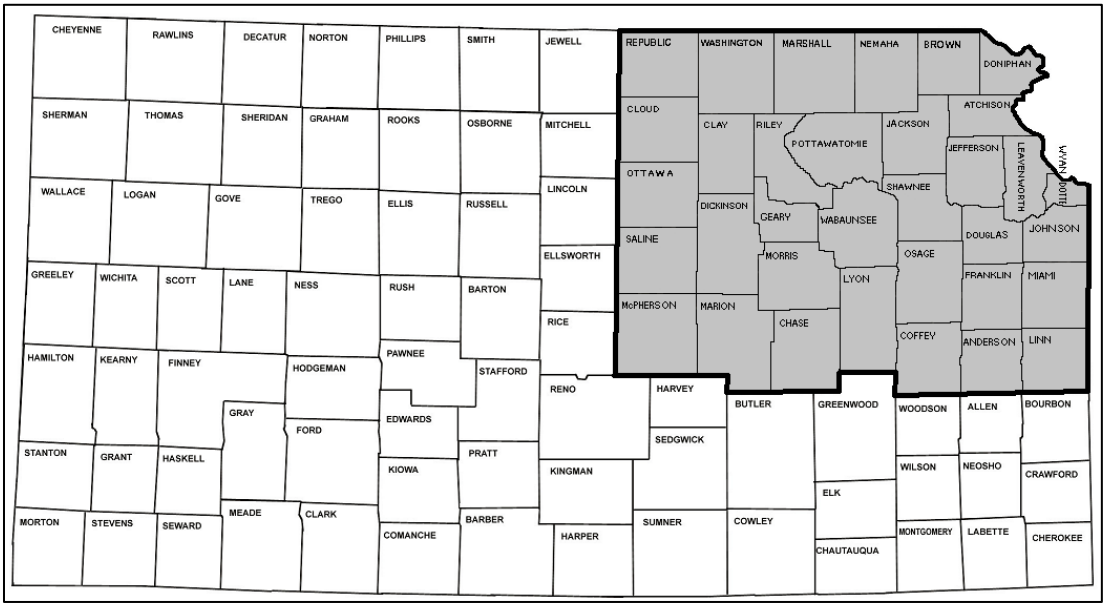
- **<u>Karnal bunt</u>**

  - 96 samples in 28 counties in the western part of the state – survey done by KDA staff



- **<u>Spotted Knapweed (*Centaurea stoebe* L.) Survey for Biological Control</u>**

  - 34 counties to be surveyed in the northeast part of Kansas
  - Surveyed by seasonal employee
  - June – July survey (when flowering)



Farmbill:

- **<u>Forest Pest Outreach</u>**

  - May - September

Objectives:

1. Obtain information on the movement of firewood by campers and outdoor enthusiasts into Kansas

2. Determine the knowledge level of campers and outdoor enthusiasts concerning firewood and invasive pest issues

3. Educate consumers, particularly hunters, fishers, outdoorsmen, and campers, about the risks of moving invasive pests via firewood. This group spends a great deal of time outdoors and is a potentially large source of unregulated firewood movement.

During this project, activities will be conducted to reach campers and other outdoor enthusiasts in Kansas:

1. One seasonal employee will visit campsites across the state to conduct camper surveys. Surveys will determine where the individuals are from, if they brought firewood with them, how much they know about firewood issues and invasive pests,

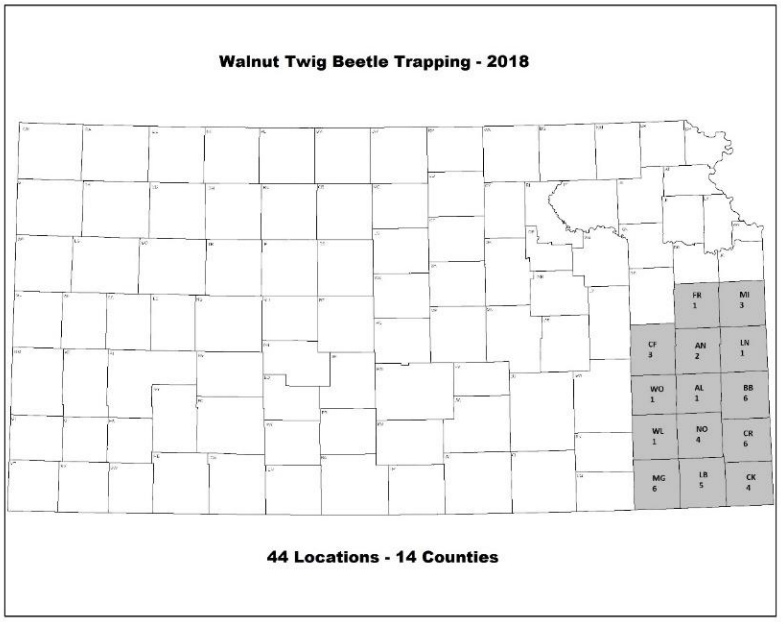
and if they are aware of any firewood quarantines in their state. After the questionnaire is completed, the campers will receive outreach materials on invasive pests and firewood movement. This will provide an educational experience about the prevention of spreading invasive pests.

2. The seasonal employee and a staff member would also conduct outreach events at 2-3 large hunting/camping stores (i.e. Cabela's, etc.) in the state. We will cooperate with each store to obtain space in their building or near their store entrance to display information about the different invasive species that are threatening our state and how to identify them. Visitors will be asked to complete a brief questionnaire, intended to determine their knowledge of pests of concern to the state and firewood as a pathway for invasive plant pests. We will also have specimens so that visitors can see what the pests and their damage look like. These events will provide the most accurate information to the public.

Data collected will be reviewed for patterns of movement of firewood into the state, and the awareness of campers and outdoor enthusiasts with regards to plant pests and firewood as a pathway. This data will be used to direct and improve future education and outreach efforts to campers and other members of the outdoor community, and target future regulatory efforts and pest surveys.

- **Walnut Twig Beetle**

  - June – August
  - 14 counties to be surveyed in the southeast part of Kansas
  - 44 sites
  - Surveyed by seasonal employee
  - Traps checked 1-2 weeks



USDA-APHIS-PPQ Updates:

Shayne Galford - State Plant Health Director (SPHD):

Surveys:

- Gypsy Moth – 300 traps in Kansas City Metro and 200 traps in northwest part of state
- 2017 – No gypsy moth found
- Bark Beetle/Wood Borer – 15 sites – in Kansas City, military bases and Emergency Action Notice EAN) areas
- Rosy Gypsy Moth traps will be set at same areas as bark beetles
- Emerald Ash Borer (EAB) – traps set at 100 miles of known infestations
- National contract group should be done setting traps in Kansas at end of May
- Federal Deregulation of EAB update – No survey planned for 2019, feds are currently working through the process
- Deregulation opposition – Forest Service and Native Americans, others will be able to make comments when the document is complete

Craig Webb – A few Phytophthora ramorum samples have been coming in

KDA Specialist Updates:

Jeff Vogel:

- Reorganized program -seed inspections added and Jeff oversees the Grain Warehouse program
- New field staff hired – Erin Smothers will be in the north central part of the state
- Area staff supervisor added – Jennifer Smith
- Legislature passed industrial hemp bill – PPWC will be administrating it. Working on regulations now. Need to be done by July 1 and adopted by end of year. License will be required to produce and this will only be for research.
- Disease update – wheat disease survey is in progress for producing the annual wheat disease report
- Nursery problems – Canna virus, Hosta Virus X and Rose Mosaic

Greg Chrislip:

- European Pepper Moth – 3 staff have taken samples and sent for confirmation. Came from southwest and southeast part of state
- KSU Diagnostic Lab Closing – Don't know what the effect of this will be. Happening June 16. Need to find out what the plan will be for samples.

Scott Marsh:

- New Noxious Weed Bill passed – Moved Law to Regulation – Makes it easier to add to list
- To add new weed to list the weed must will require scientific information and go through a 13-member advisory committee
- Spotted Knapweed – Top of list to add
- List will most likely change in 2020

- Leafy Spurge Flea Beetles – want to move some from North Dakota to Kansas because there are some small patches
- Bind Weed Mite and Moth – no success with in Kansas
- Colorado bio-control insects – there is a good resource here
- Grecian Foxglove – spraying continues and will be done last week in May

Specialist Updates:

Chris Steffen:

- Aquatic Nuisance Species (ANS) – Survey 14 lakes for plants. Getting an estimate on volume. Preparing to treat and monitor.
- Survey – 50 lakes will be surveyed in 2018 and have 100 to do
- Will be looking for a habitat specialist in the next 5 years
- Disease work – Large Mouth Bass Virus -10 lakes have it. 80%-90% kill rate. Takes about 10 years for population to get back to normal.
- Zebra Mussels – Monitor 100 lakes, 30 are positive. Also checked 200 bait shops.
- Don't Let It Loose Campaign – went to pet shops and gave signage to have a return policy so people don't release

Doug Jardine:

- Southern Rust – 3 years in a row has shown up earlier than average.
- Will be looking for Bacterial Rust in negative counties
- New App – IPIPE LITE – scouting tool – available on Google Play

Megan Kennelly:

- Gray Mold – A grad student is looking for it in greenhouses.
- New Staff – 2 new people have joined the department and are doing virus research

Ryan Armbrust:

- Attached is the Kansas Forest Service Report
- Abiotic Plant Pests – working on it for website
- EAB – conducting wind chill survey
- Doing invasive plant outreach
- Walnut Decline – report to Ryan if it is seen

Tim Todd:

- Nematode Survey – no exotics, first time done in corn fields
- Use data for loss estimates – 30% of corn fields are at risk for economic loss

Judy O'Mara:

- Samples are down – don't know if it is from the cold and dry weather or fee increase
- Wheat Streak – starting to pick up in last 2 weeks
- Winter Damage – seen on evergreens in west
- Herbicide Damage – still an issue

Thanks to all that attended and added information!

European Pepper Moth

ENTFACT-324: European Pepper Moth | Download PDF (//entomology.ca.uky.edu/files/efpdf2/ef324.pdf)

Duponchelia fovealis

Jen White, Extension Entomologist
University of Kentucky College of Agriculture

As its name suggests, the European Pepper Moth, *Duponchelia fovealis*, is a moth that is native to southern Europe and Northern Africa. It was first found in North America in 2004 in San Diego County, CA, and was subsequently eradicated. It was discovered again in 2010, and has since been found in 15 states. It has not been reported in Kentucky, but it has been found in neighboring states. It is not yet clear whether the moth is establishing in the landscape, or if it is restricted to greenhouses and containers.

European Pepper Moth

The adult moth has a wingspan of just under an inch, is brown and white, and relatively nondescript. However, one characteristic that is easily observed is that the hindmost white line on the wing has a distinctive backward-pointing bend (white arrow). The males have white bands that complete encircle the abdomen (red arrow), and have very long abdomens, which they hold curled up at the tip while at rest (yellow arrow).

Why is it a concern?

It is not known how much economic damage the European Pepper Moth might inflict in North America. Based on its broad host range and its status as a pest in European greenhouse agriculture, European Pepper Moth was initially categorized as a pest of quarantine significance, requiring regulatory action. However, now that it is clear that the pest is already widespread in the US, traditional containment and regulatory approaches have been discarded as impractical. Instead, a task force has been formed to develop appropriate pest management practices and disseminate this information to affected stakeholders.

What plants might be attacked?

Unfortunately, the list of species attacked by the European Pepper Moth is long: it has been recorded from more than 70 host species in a wide range of plant families. It is very likely that additional species are also affected. This table includes some of the most important greenhouse, nursery and field crops, but is not exhaustive.

African daisies (*Gerbera*)	*Kalanchoe*
Amaranthus	Lettuce (*Lactuca*)
Anthurium	Lisianthus (*Eustoma grandiflorum*)*
Azalea (*Rhododendron*)	Marjoram (*Origanum majorana*)*
Basil (*Ocimum basilicum*)*	Orchids (*Phalaenopsis*)
*Begonia**	Pepper (*Capsicum annuum*)*
Blackberry (*Rubus fruticosus*)*	Poinsettia (*Euphorbia pulcherrima*)*
Coleus	Pomegranate (*Punica granatum*)*
Corn (*Zea*)	Roses (*Rosa*)
Cucumbers (*Cucumis*)	Squash (*Cucurbita*)
Cyclamen	Strawberries (*Fragraria*)
English daisy (*Bellis perennis*)*	Thyme (*Thymus*)
Fig (*Ficus triangularis*)*	Tomato (*Solanum lycopersicum*)*
Geranium (*Pelargonium*)	A large variety of aquatic plants
Impatiens	

* Plant species for which European Pepper Moth is considered a pest

What is the life cycle?

The moth lays tiny whitish eggs (less that a millimeter) in small clusters on the undersides of leaves. As the eggs develop, they turn red before hatching. Larvae are tiny upon hatching, growing to a length of about 1 inch before pupation. The larvae have a dark head capsule, and their bodies vary in color from creamy white to brown (depending on what they've been feeding on) with dark spots.

The larvae prefer moist locations, and feed on detritus as well as live plant material. After about 4 weeks (depending on temperature), the moth constructs a messy cocoon of webbing and soil particles and pupates. The cocoons can sometimes be found on the undersides of leaves, or on the edges of pots. At 68°F, it takes about a month and a half for the moth to complete its lifecycle, meaning that 7-8 generations are possible per year at this temperature in year-round greenhouses. At higher temperatures, the moth will have shorter generation times.

What kind of damage is inflicted?

Larvae feed in a variety of locations, including leaves, roots, stems and fruit. While young, they mostly feed on leaves, where they make round or crescent-shape holes. Older larvae can consume whole leaves, or may feed below the soil surface, leaving little outward sign of damage. Other times, the larvae bore into stems and fruits, or may girdle stems as shown below, potentially killing whole plants.

How can I control infestations?

As with most greenhouse and nursery pests, the first line of defense against infestations is exclusion. Always examine new stock for signs of infestation, and maintain a period of isolation from established crops, if possible. Examine the pots (top and bottom) and soil surface for signs of webbing, and leaves and stems for chewing damage.

Cultural control – Removing debris and lower leaves, when possible, will both decrease habitat availability for the larvae, and decrease humidity at the soil surface. This process will also increase the effectiveness of any chemical controls applied (see below). Additionally, use of drier growth media should decrease the moist microclimate that is favorable to larval growth.

Chemical control – European Pepper Moth differs from many greenhouse pests in that it has not shown resistance to any major pesticides. Consequently, most chemicals labeled for lepidopterans (moths and caterpillars) will be effective against adults when applied as an aerosol, or when placed where adults will encounter them. However, the sheltered and secretive feeding locations of the larvae make effective application of larval pesticides difficult. Young larvae, which feed in more exposed locations, are more susceptible than older larvae.

At this writing, only limited pesticide efficacy trials are available, but a nice preliminary study by Bethke and Vander May (see references) found that acephate was most effective at controlling larval populations. However, it should be noted that the application procedures used (backback sprayer applied to pots turned on their sides or drench from above) were costly and efficacy might be considerably reduced using alternative (less expensive) application methods. Also, acephate is not labeled for many crops, so always be sure to check the label before use.

Biological control – Numerous biological control agents are commercially available for control of European Pepper Moth. In general, natural enemies that are labeled for attacking lepidopterans should be effective against European Pepper Moth. These include microbes (*Bacillus thuringiensis* - Bt), predatory nematodes that attack larvae (*Heterorhabditis bacteriophora*and *Steinernema* spp.), predatory beetles that attack eggs and larvae (*Dalotia* or *Atheta coriaria*), parasitoids that attack eggs (*Trichogramma* species), and predatory mites that attack eggs (*Hypoaspis aculeifer*, *Hypoaspis miles*). **Entfact 125 (//entomology.ca.uky.edu/ef125)** lists vendors that sell these organisms. Please consult with your distributor as to appropriate application rates, as well as conditions that best promote the efficacy of these living "good bugs."

How can I monitor for infestation?

Water traps baited with pheromone are considered to be the most effective for capturing adult moths (Van Deventer, 2009), but delta and funnel traps also work. European Pepper Moth baits and traps can be purchased from Koppert, Biobest and Syngenta. Please see Entfact 125 for contact information for these companies.

References

- NAPIS Pest Tracker. **http://pest.ceris.purdue.edu/map.php?code=ITBMGZA (http://pest.ceris.purdue.edu/map.php?code=ITBMGZA)**
- Bethke, J. and B. Vander Mey. Pest Alert: *Duponchelia fovealis*. **http://ucanr.org/sites/cetest/files/55177.pdf (http://ucanr.org/sites/cetest/files/55177.pdf)**
- Bethke, J. and B. Vander Mey. European Pepper Moth: a new invasive moth threatens California agriculture. **http://goo.gl/BsbbHS (http://goo.gl/BsbbHS)**
- Stocks, S. D. and A. Hodges. University of Florida Dept. of Entomology and Nematology: **http://entnemdept.ufl.edu/creatures/veg/leps/european_pepper_moth.htm**

(http://entnemdept.ufl.edu/creatures/veg/leps/european_pepper_moth.htm)
- Van Deventer, P. 2009. Water trap best for catching *Duponchelia*. Fruit & Veg Tech 9.1, 18-19. http://library.wur.nl/WebQuery/wurpubs/415552 (http://library.wur.nl/WebQuery/wurpubs/415552)
- White, J. and D. Johnson. 2011. Vendors of beneficial organisms in North America. University of Kentucky Cooperative Extension Service Entfact 125. http://www.ca.uky.edu/entomology/entfacts/ef125.asp (//entomology.ca.uky.edu/ef125)

Issued: 4/25/2012

Comments, corrections and updates are welcome. Please contact Jen White at the Entomology Dept., University of Kentucky.

CAUTION! Pesticide recommendations in this publication are registered for use in Kentucky, USA ONLY! The use of some products may not be legal in your state or country. Please check with your local county agent or regulatory official before using any pesticide mentioned in this publication.

Of course, **ALWAYS READ AND FOLLOW LABEL DIRECTIONS FOR SAFE USE OF ANY PESTICIDE!**

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Caterpillar Pests of Vegetables (/categories/caterpillar-pests-vegetables)
ENTfact (/categories/entfact)
Floral Pests (/categories/floral-pests)
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A native post oak savannah in rural Montgomery County.

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

Kansas Forest Service

Larry Biles, State Forester – lbiles@ksu.edu – (785) 532-3309

Ryan Armbrust, Forest Health Specialist – rarmbrust@ksu.edu – (785) 532-3276

http://www.kansasforests.org

USDA Forest Service – Rocky Mountain Region

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

J.L. Harris – jharris@fs.fed.us – (303) 275-5155

https://www.fs.usda.gov/main/r2/home

Forest Health Outreach

Don't Move Firewood

Continuing a long-standing outreach effort, educational material was distributed to high-risk sites that outlines the risks involved with moving firewood, and therefore potentially moving Emerald Ash Borer, Thousand Cankers Disease, and other forest pests.

The Kansas Department of Agriculture inspected firewood retail locations throughout the state to ensure compliance with applicable Emerald Ash Borer and Thousand Cankers Disease quarantine law.

Several radio features were also produced to explain why moving firewood or other untreated wood can threaten our forest resources in both rural and urban settings.

Moving firewood is a significant risk for spreading forest pests and diseases, especially when unused wood is left behind at camp sites.

Diversity

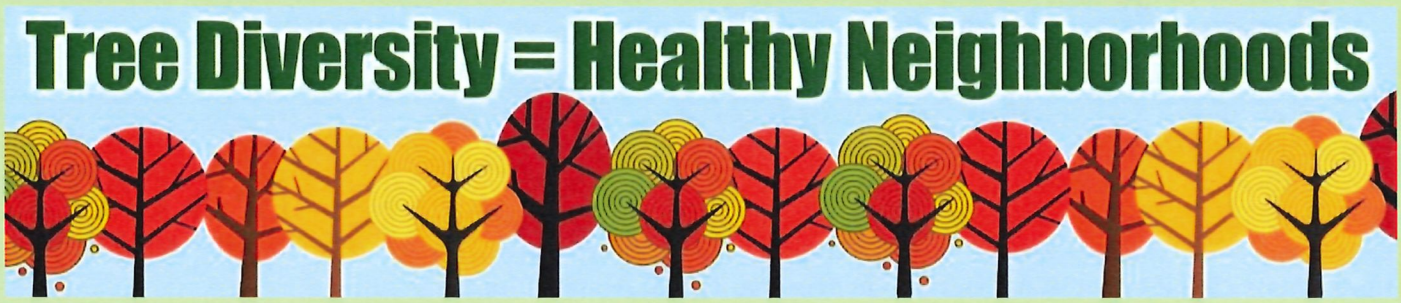
A guiding principle of the Kansas Forest Service Forest Health program is that a diverse urban and rural forest is the best way to ensure a resilient, healthy forest for future generations.

Giant "Tree Tags" were placed on trees in several cities in the Kansas City metro area, and also in Manhattan. These tags focused on bringing the benefits of a diverse urban forest into focus for people who may otherwise have passed by these trees without a second glance.

Continued emphasis on diversity of species, age, growth form, and niche will allow the Kansas Forest Service to be proactive in mitigating threats to the many kinds of forests throughout Kansas.

To this end, recommended tree lists were updated by district and community foresters for several regions, native seed sources were explored for better-adapted Kansas trees, and trials were conducted for alternatives to various conifers that are disappearing from the landscape due to pine wilt or abiotic weather stresses.

Large "Tree Tags" were placed on trees in several cities, highlighting the value in a diverse urban forest made up of many species, in many age classes, on many sites.



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. USDA-APHIS and KDA **had no positive finds in traps set in 2016 or 2017**.

The Wichita metro area had 163 traps set using a one/square mile grid. Traps were also placed in SW Kansas as part of the regular trapping where USDA-APHIS traps 1/4 of the state yearly. KDA set 9 traps as part of the live plant dealer inspection process. It is planned to expand KDA gypsy moth trapping in 2018.

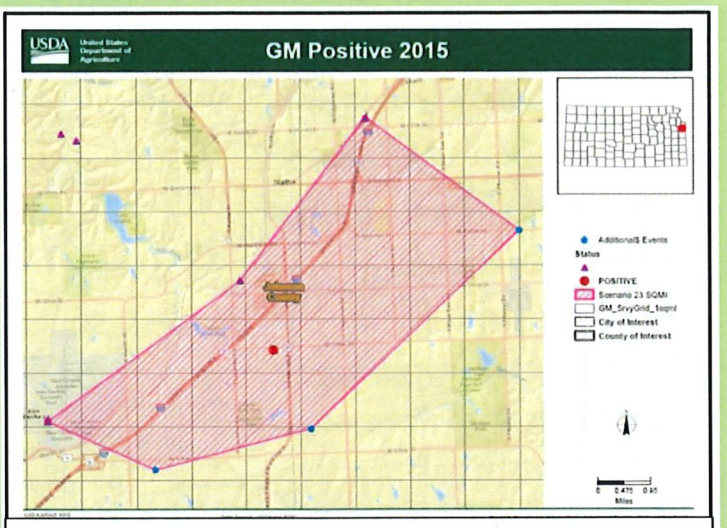
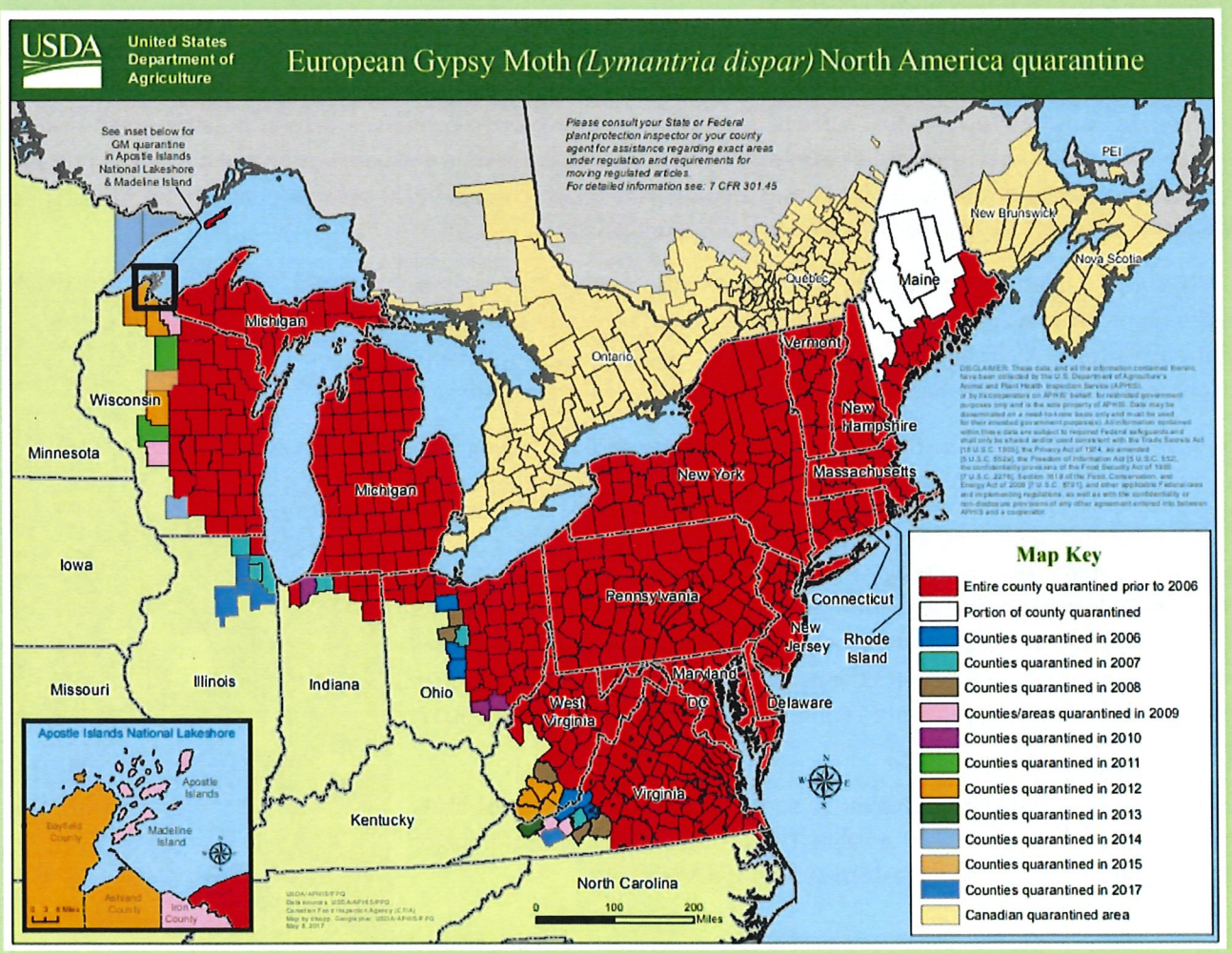
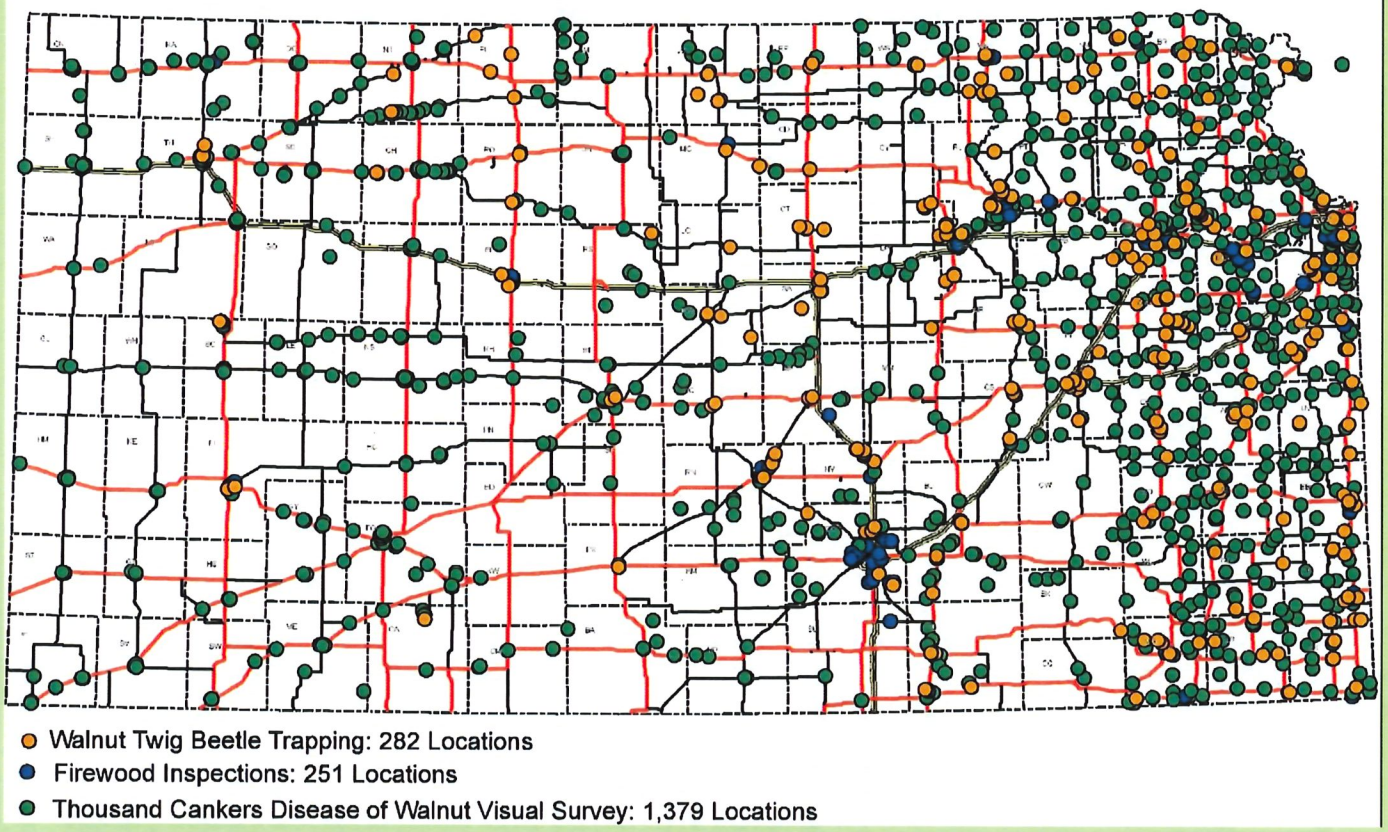


Figure 1. Gypsy Moth delimit area in the Kansas City Metro Area.

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.



Thousand Cankers Disease of Walnut Survey, 2009 - 2016



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. Lindgren traps, with lure, were set and monitored by Kansas Department of Agriculture (KDA) personnel at key locations statewide. **No walnut twig beetle (WTB) specimens have been found to date**.

The WTB survey began on June 14 and concluded on October 13. Thirty-three Lindgren funnel traps were deployed in 12 northeast Kansas counties, with one trap at each site, in Atchison, Brown, Doniphan, Douglas, Jackson, Jefferson, Johnson, Leavenworth, Nemaha, Osage, Shawnee, and Wyandotte counties.

Traps were checked weekly, so the samples were cleaner and processing took a much shorter time. All samples are completed and no suspect specimens were detected.

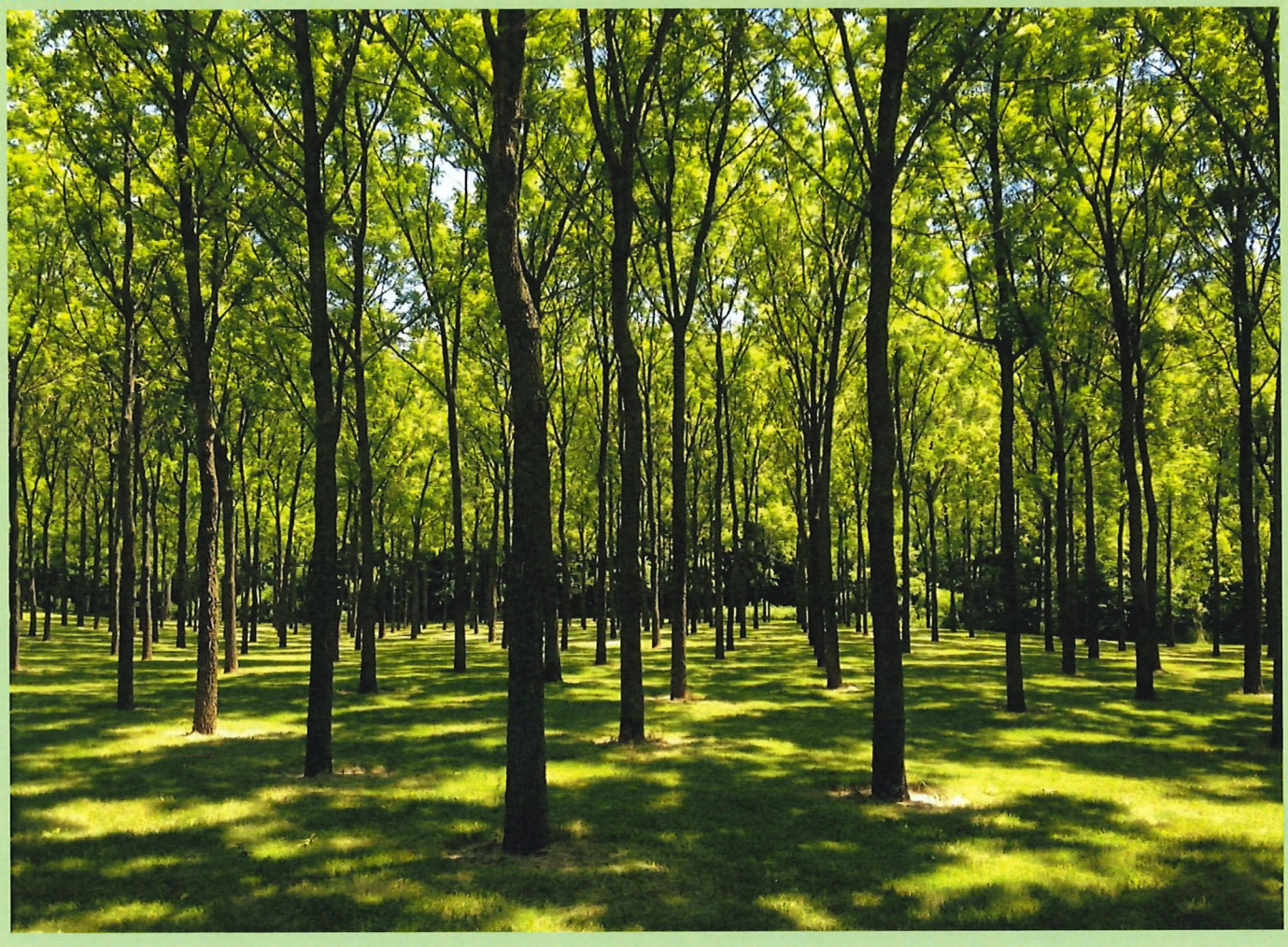
A dedicated sentinel site trap program was maintained in western Kansas of known walnut locations. This was prompted by the discovery of walnut twig beetle in Eads, Colorado, about 40 miles directly west of the Colorado-Kansas border. The Eads infestation remains the nearest known TCD positive, although a new infestation in along Interstate 76 in Brush, Colorado was found in 2017, 85 miles from northwestern Kansas.

The Interstate 70 corridor from Denver to Kansas City remains the most likely pathway for TCD, linking the TCD-positive Denver metro area with the major black walnut production area of eastern Kansas and Missouri.

A Lindgren funnel trap, used to monitor for WTB.

Forest Health Threats

Thousand Cankers Disease



A 20-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.

Small exit holes and galleries from the walnut twig beetle are visible on this TCD-infested tree in Colorado. Pocket knife is for scale.

Invasive Plants

Invasive callery pear seedlings mingled with bush honeysuckle on a vacant lot bordering woodlands near Lenexa, KS.

Invasive plants threaten several Kansas ecosystems, from saltcedar along the Arkansas River watershed, to sericea lespedeza in native prairies, to callery pear and bush honeysuckle in urban wildland interfaces, and many more such as Russian-olive, tree-of-heaven, old world bluestem, Japanese honeysuckle, and more.

These invasive plants suppress native plant and forest regeneration, deplete available water resources, fail to support native wildlife and pollinators, and generally disrupt ecosystem function wherever they become entrenched.

The Kansas Forest Service has secured grant funding to address these issues in a broad, cooperative, and sustainable manner. A series of Plant Pest Detector trainings are being held, and a comprehensive Invasive Plant Management and Restoration Guide for the region is being developed with a diverse array of partners and stakeholders.

Bumper magnets were developed and distributed throughout the state to help raise awareness of the impact of invasive species on our resources.

While it's important to note that eastern redcedar is not considered an invasive species, the aggressive expansion of this native tree into rangelands over recent years is an issue that must be addressed.

This management problem is being met with an emphasis on land management practices, such as prescribed burning, that keep this native species within its historic niches, while preserving the highly important redcedars that are critical conservation tools in windbreaks and shelterbelts throughout the state.

Prescribed fires can be a valuable management tool for preserving high-quality ecosystems.

A dry streambed, typical of saltcedar infestation in western Kansas along the Arkansas River. (Photo by Eric Coombs, Bugwood.org)

Herbicide Injury

While woody plants in Kansas have experienced varying levels of impact from herbicides for decades, a noticeable increase has taken place in recent years.

The application of herbicides that readily volatilize, such as ester formulation of 2,4-D, has long been known to cause leaf deformation in sensitive species such as oak, redbud, sycamore, and others.

Symptoms consistent with 2,4-D exposure have been documented on woody species across the state. While a one-time exposure to low levels of herbicide may cause deformation of new growth without having a significant impact on long-term tree health and vigor, repeated exposure and injury will contribute to decline, especially when complexed with the existing abiotic and biotic stressors that already impact trees in Kansas.

In 2017, the controversial topic of dicamba injury came to a national forefront, focusing mainly on injury to non-tolerant crops adjacent to dicamba-tolerant fields.

However, Kansas (like many other states in the region) also witnessed injury to many trees within forested land both adjacent to, and some distance from, agricultural land where dicamba may have been applied.

These symptoms manifested especially strongly on black walnut adjacent to agricultural fields where dicamba was applied as an early spring "burn down" herbicide to control glyphosate-resistant weeds before planting soybeans or corn. Even if the applicator has taken steps to limit risk for wind-aided drift, dicamba could move off-target due to volatilization or movement through the soil water.

A clear causal relationship between herbicide application and tree injury has not yet been established, but based on the widespread symptoms observed in 2017, further study will be undertaken in 2018 to document and investigate the source of these symptoms. A focus will be on testing of symptomatic trees to determine herbicide residues, if any.

Deformation and cupping of new growth and chlorosis, symptoms consistent with herbicide injury on redbud (top photo), sycamore (middle photo), and northern red oak

Invasive Bush Honeysuckle

Invasive bush honeysuckle that has been treated and removed (on the left) next to untreated plants in the understory, in Hutchinson, KS.

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.

Additionally, a spectral remote-sensing protocol has been developed to detect and delimit infestations, and mapping of this newly-acquired data will aid in strategically treating populations and limiting the spread of this invasive plant.

Leaves and fruit of bush honeysuckle in late fall, still green well after leaf drop of native woodland trees and shrubs.

Abiotic Stress

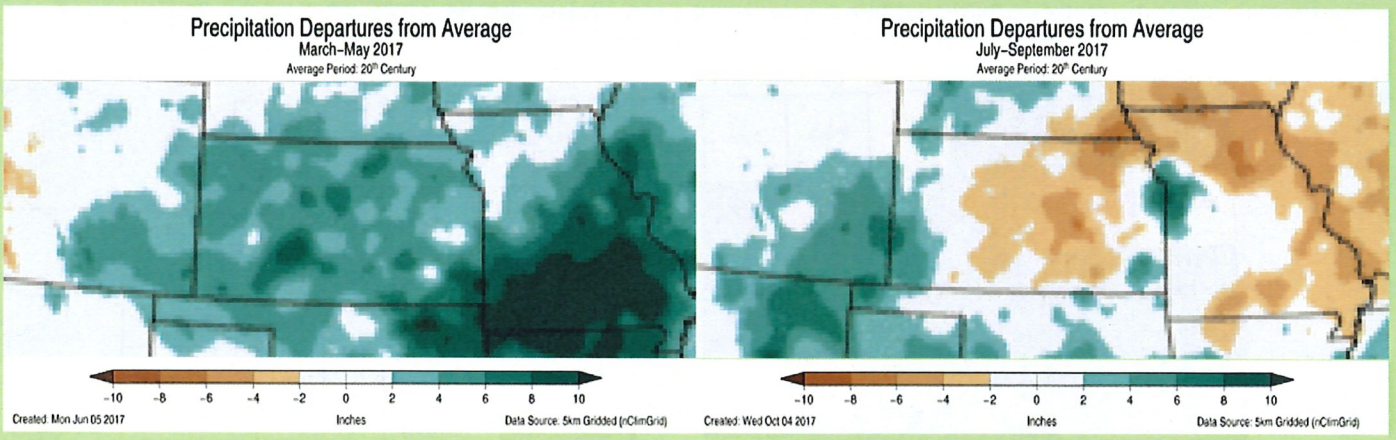
While the state received total precipitation that was near average for the year, the temporal distribution of that precipitation was abnormal. Heavy spring rains were followed by a drier-than-normal summer in most of the state, leading to localized stress where root systems of low-lying trees experienced saturated soils for weeks early in the growing season, only to receive less than normal rainfall for the hottest part of the season.

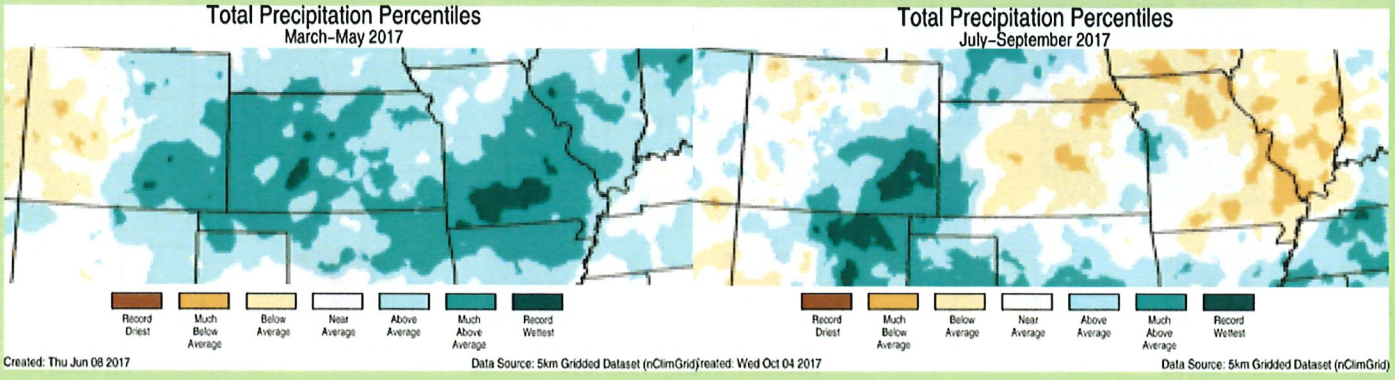
In April, much of southeast and southwest Kansas received 5-8" more rain than normal, a significant departure from normal. In parts of southwest Kansas, it was the wettest spring on record. Northeast Kansas set a new record for consecutive days with precipitation, with 14 days in a row.

Tree damage in Dodge City, caused by one inch of ice accumulation during Winter Storm Jupiter on January 15, 2017. (Image courtesy of Akeam Ashford)

By mid-summer, most of Kansas was already experiencing short-term drought, and ended 2017 with 100% of the state in in drought. Parts of southern Kansas ended 2017 with 95-100 consecutive days with less than 0.10" of precipitation.

A heavy ice storm ("Winter Storm Jupiter") in January, with nearly 1-inch of ice accumulation, caused limbs to fail on thousands of trees across the western half of Kansas, with significant damage in Pratt, Garden City, Hays and Dodge City. Additionally, several hail storms, including one in WaKeeney with tennis-ball size hail, caused damage to urban and rural forests across the state, stressing trees and causing wounds. This has the potential to hasten canopy decline in communities that may not be well-positioned to respond aggressively with corrective pruning and replanting efforts.





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*).

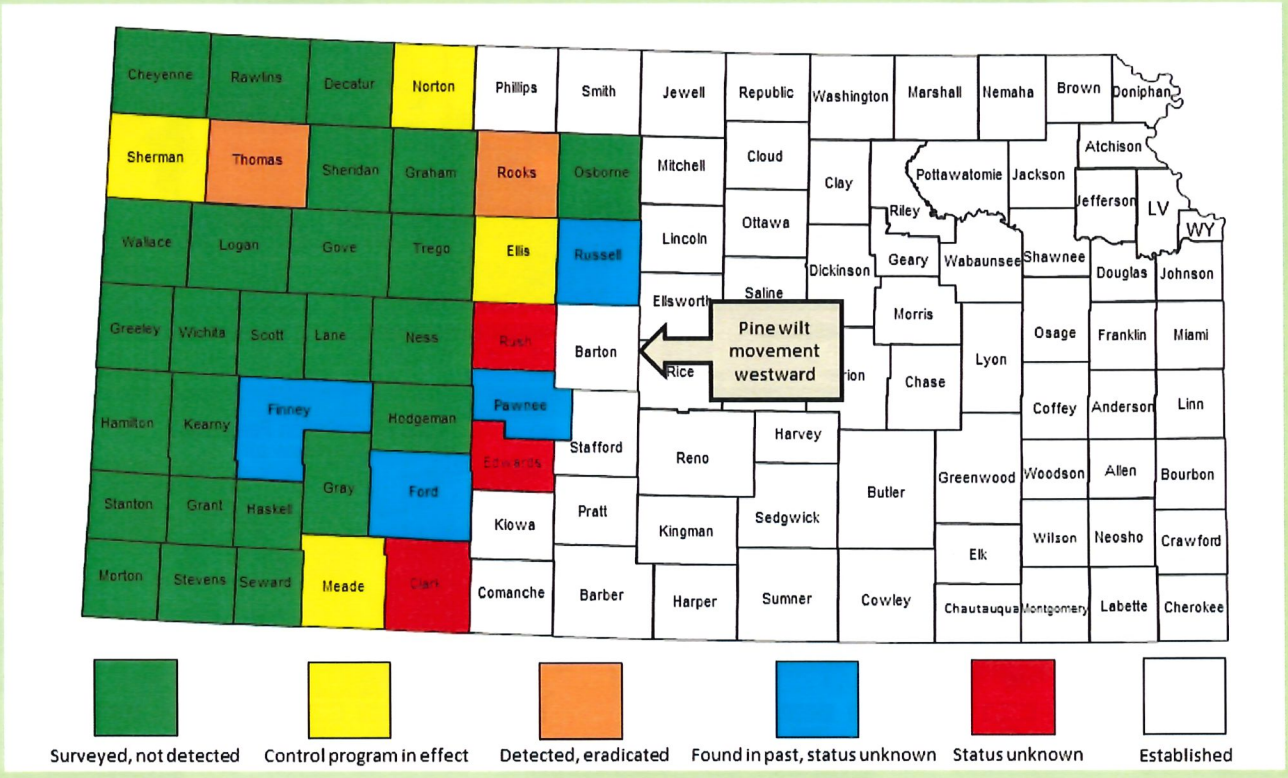
In 2015, several pine wilt positive trees were found in a Scotch pine windbreak, several miles north of Goodland (**Sherman County**). These trees were removed and destroyed. In October 2016, four pine wilt positive Scotch pine trees were found in Goodland. A delimiting survey was done and no additional suspicious trees were found. This site will be checked again for additional dead trees.

Five pine wilt positive Scotch pine trees were found and destroyed in the town of Almena (**Norton County**) in March and April 2017. This represented a new county record for Norton County. A delimiting survey was performed and no additional suspicious trees were found.

A Kansas Department of Agriculture (KDA) survey of the previously non-infested Hamilton, Greeley, Wichita, Scott and Lane counties was negative for pine wilt.

An Austrian pine showing signs of decline due to pine wilt in late summer, in Manhattan, KS. Healthy ponderosa pine is nearby.

The city of Hays (**Ellis County**) has thousands of susceptible pines, and was surveyed as part of the pine wilt initiative project by KDA, Kansas Forest Service, and Ellis county extension. Two mugo pine trees at a residence and one Scotch pine tree at a country club were found positive for pine wilt and removed. 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.



KFS and KDA staff and volunteers peel EAB trap trees in Ottawa (right) and Topeka (left) in October 2017. No EAB larvae were found at either site..

Additional trap trees placed in non-quarantined northeast Kansas counties (Brown, Osage, Franklin, Miami) and southeast Kansas counties (Labette, Crawford, Cherokee) were negative for EAB presence. Emphasis on trapping in southeast Kansas was justified by the detection of EAB in northeast Oklahoma (Delaware County) in late 2016, less than 25 miles from the Kansas-Oklahoma border.

Weekly releases of three biocontrol species (*Tetrastichus, Spathius, Oobius*) were done by the Kansas Department of Agriculture throughout the season at five sites around Wyandotte County Lake. This is the second year for biocontrol releases in Kansas. Additional releases of biocontrol agents are planned for 2018, along with follow-up survey to assess if the biocontrol species are established.

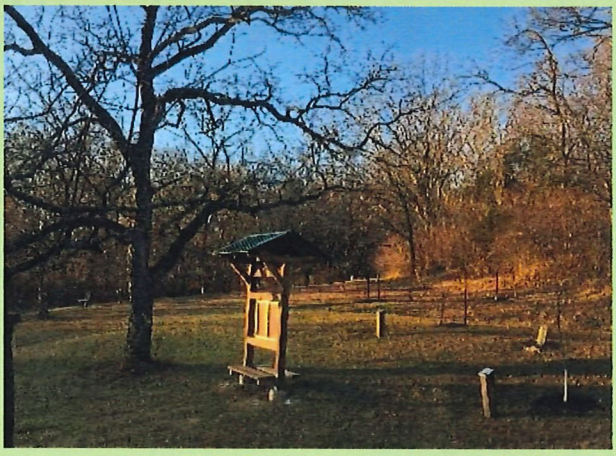
In response to EAB, a message of forest health resilience through diversity has been promoted statewide. As part of this diversity outreach, several tree plantings have been coordinated by KFS in public parks in the Kansas City metro area. 120 trees of more than 40 species were planted at six sites, with an additional 30+ species planted to enhance the diversity at the KFS office arboretum in Manhattan.

One of the tree planting sites at Wyandotte County Park, with informational signage and deer-protective cages (above).

A timber-frame kiosk, installed at the tree-planting diversity demonstration site at Porter Park in Prairie Village.

Educational kiosks were constructed by a timber-framing class at KU, with materials sourced from urban lumber in the City of Lawrence, further demonstrating the "full circle" benefits of managing urban forests.

These kiosks were installed at tree-planting demonstration sites at parks in the Kansas City metro area; Wyandotte County Park in Bonner Springs, Stony Point Park in Kansas City, the Schlagle Environmental Library at Wyandotte County Lake, and Windsor Park and Porter Park in Prairie Village.



A timber-frame kiosk at a tree-planting demonstration site at the Schlagle Environmental Library in Kansas City (above).

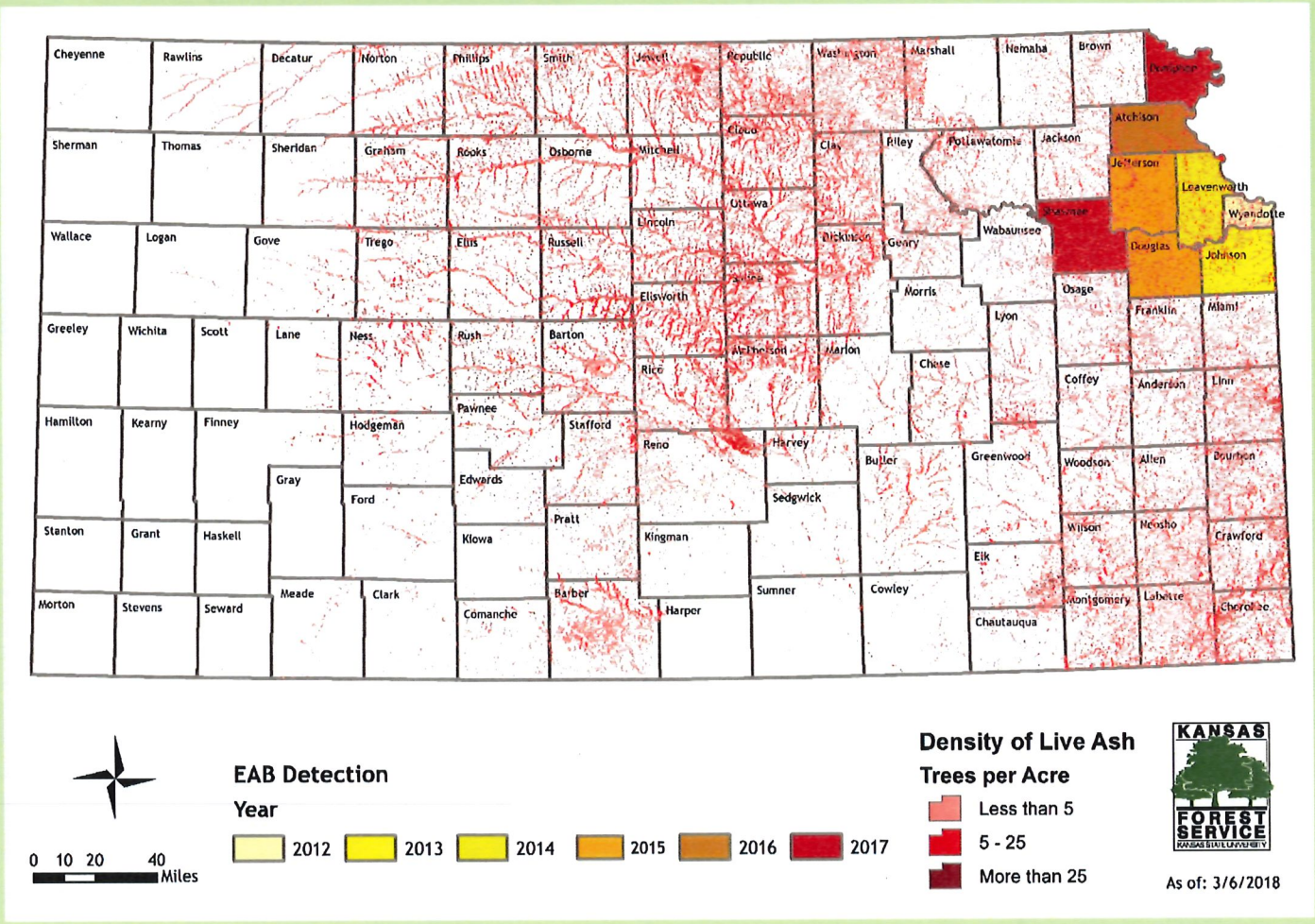
Emerald Ash Borer

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, and Shawnee counties.

Ash trees in Roeland Park marked for removal due to the presence of EAB.

EAB is a pest of all North American ash (*Fraxinus* spp.). Kansas' forest land contains **52.5 million ash trees**, or an average of almost 21 trees per acre of forest land. Ash trees account for nearly **275 million ft^3** 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 2017, Kansas expanded the Emerald Ash Borer Quarantine to include **Doniphan** and **Shawnee** counties, bringing the total number of counties with confirmed EAB presence to eight; all contiguous in the Kansas City area. In Doniphan County, several larvae were removed from a native stand of ash by a KFS forester, and were later confirmed to be EAB. In Shawnee County, several galleries were observed and a live adult was taken from an urban Topeka tree after KDA was notified by a local arborist. In previously quarantined counties, ash tree mortality was observed to increase over previous years.

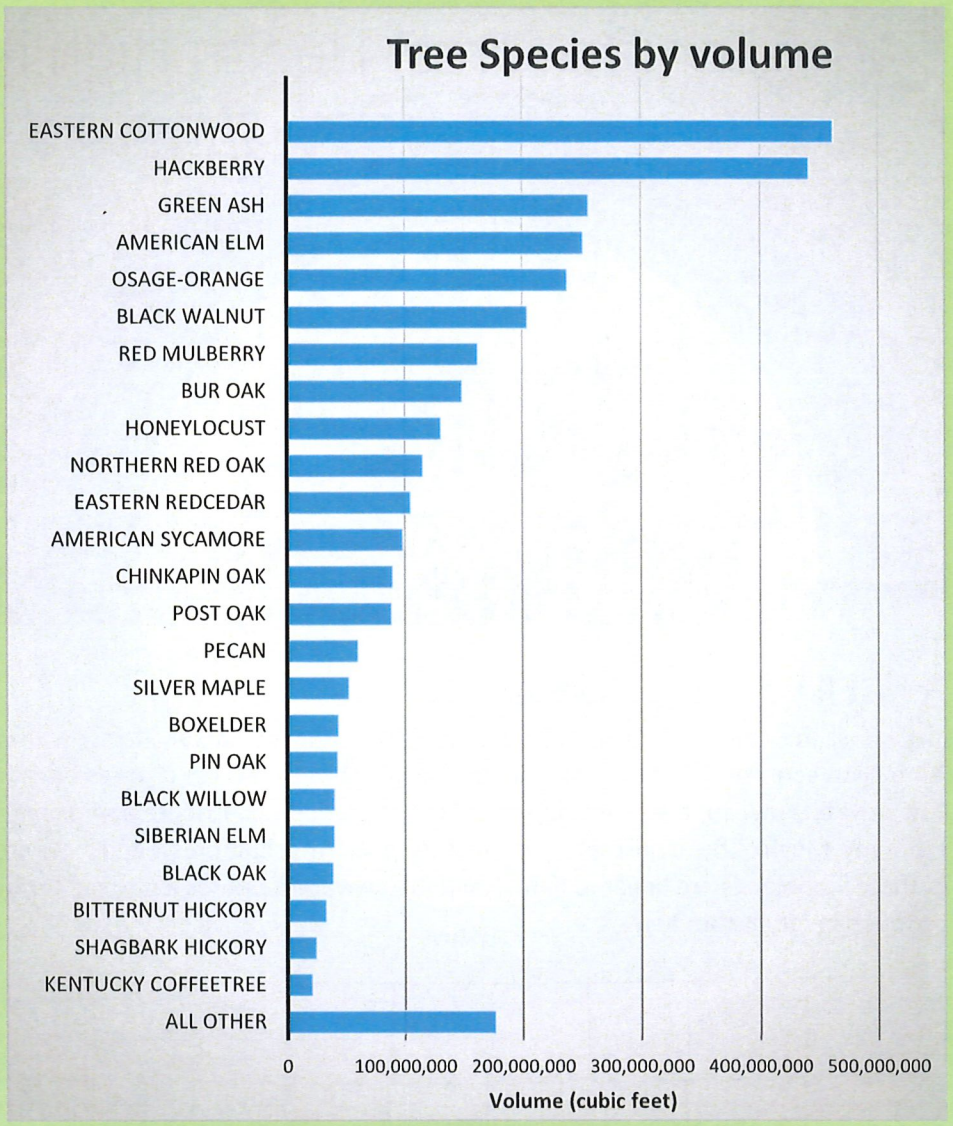


The top tree species, by statewide volume, are cottonwood, hackberry, green ash, American elm, osage-orange, black walnut, red mulberry, bur oak, honeylocust, and northern red oak.

The two dominant forest types 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.

Even though Kansas's forests are increasing in acreage, 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 **838 million live trees** (≥1-inch diameter) and nearly **3.3 billion cubic feet of net volume** (live trees ≥5-inches diameter). The five most numerous species are hackberry, American elm, eastern redcedar, Osage-orange, and green ash; together, 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 most voluminous species in the state but ranks 9th in terms of number of trees, and while eastern redcedar is 3rd in terms of number of trees, it ranks 11th in volume.

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

Overall, the growth rate of Kansas' trees remains positive, with eastern cottonwood, hackberry, and American elm having the highest growth rates, followed closely by Osage-orange and black walnut.

Kansas Forest Health Highlights 2017

Fall foliage on display at Kelley Park, in Burlington (Coffey County) Kansas.

Forest Resources of Kansas

In Kansas, the central hardwood forests transition into the Great Plains, with more than **4.6 million acres of trees**; 2.5 million acres of forest land and an additional 2.1 million acres of trees outside forest land. These forests, which are 95% privately owned, are productive; local forest products 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.