

FROM THE  
MISSOURI DEPARTMENT  
OF CONSERVATION  
FOREST HEALTH  
PROGRAM

# MISSOURI Forest Health UPDATE



## Thousand Cankers Disease

Thousand cankers disease (TCD) represents a serious threat to eastern black walnut in Missouri. TCD is believed to occur primarily when the walnut twig beetle (WTB), *Pityophthorus juglandis*, attacks walnut trees, spreading the fungus *Geosmithia morbida* which causes small cankers in the phloem tissue under tree bark, eventually causing tree decline and mortality.

TCD has not been detected in Missouri; however, there is concern that undetected TCD infestations could be present, or that spread may occur from western states or Indiana, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee and Virginia where *G. morbida*, WTB or TCD has

been detected. Potential long-distance spread of TCD through movement of infected walnut materials enhances this threat. Existing survey technology is not very sensitive, and TCD is unlikely to be detected until several years after introduction. Detection of well-established infestations makes eradication efforts difficult. It is important to conduct detection surveys for TCD, as well as increase awareness of the risk of wood movement from areas with known infestations.

In 2015, both the Missouri Department of Conservation (MDC) and the Missouri Department of Agriculture (MDA) conducted surveys for TCD using

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Mary Ann Hansen, Virginia Polytechnic Institute & State University, Bugwood.org

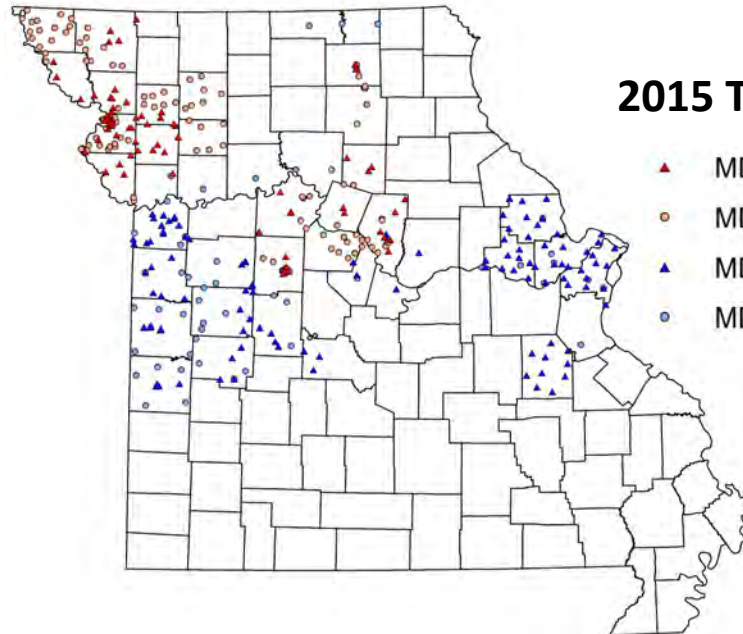
**The first symptom of TCD is usually upper crown dieback, and multiple trees may be affected.**

# Thousand Cankers Disease *continued*

USDA Forest Service and USDA Farm Bill funding, respectively. MDC placed 75 WTB pheromone-baited Lindgren funnel traps at high-risk locations with declining walnut trees (urban areas, campgrounds, sawmills) in central, northeast and northwest Missouri. MDA placed 110 WTB traps in central, east central, and west-central Missouri. Visual surveys were conducted by both agencies in high-risk areas to identify potentially infested trees. Branches were examined from suspect trees. When suspicious symptoms were observed under the bark, sample branch sections were triple-bagged, placed in a cooler with ice and transported to diagnostic facilities for evaluation and culturing as needed.

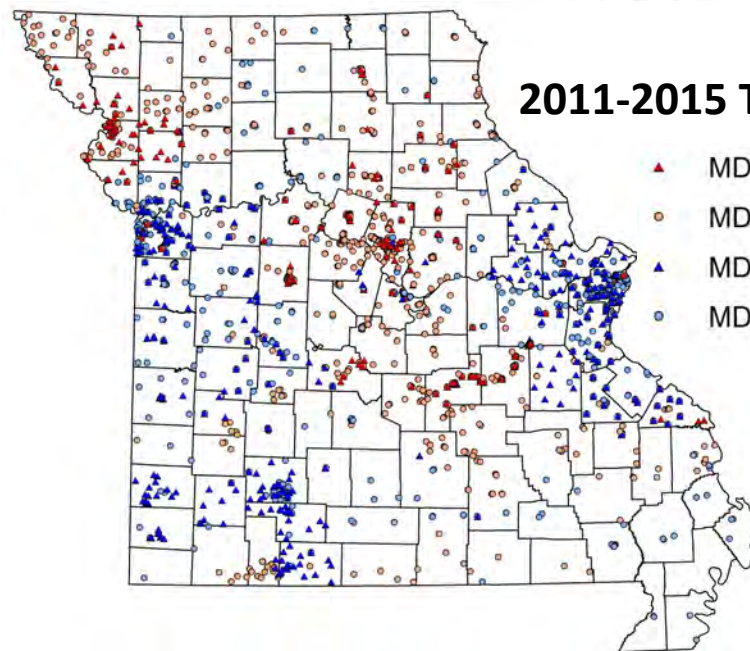
Survey efforts are rotated to different regions each year; 44 counties were surveyed in 2015. Since 2010, 1,566 locations have been surveyed visually and 618 WTB traps deployed. No evidence of WTB or TCD has been detected in Missouri. During the surveys, we continue to find other walnut problems, particularly dieback and associated infestation by several wood-boring insects that commonly attack stressed walnut trees (primarily roundheaded and flatheaded borer larvae and ambrosia beetles). This damage is consistent with drought stress and site-related tree stress.

Outreach efforts by MDC, MDA, other state agencies and stakeholder groups were continued to raise public awareness about TCD. Messages included the potential



## 2015 TCD Survey

- ▲ MDC Trap
- MDC Visual Survey
- ▲ MDA Trap
- MDA Visual Survey



## 2011-2015 TCD Survey

- ▲ MDC Trap
- MDC Visual Survey
- ▲ MDA Trap
- MDA Visual Survey

impact of TCD, the threat posed by movement of infected walnut materials, and identification of suspect trees.

See the Missouri Invasive Forest Pest Council website, [treepests.missouri.edu](http://treepests.missouri.edu) for more information on what to look for and how to report a suspect tree. MDC also maintains a website for more information on TCD,

[mdc.mo.gov/thousand-cankers](http://mdc.mo.gov/thousand-cankers).

Missourians are encouraged to report suspect trees via the online reporting form which can be found linked to the TCD websites. Photos of suspect trees can also be emailed to [forest.health@mdc.mo.gov](mailto:forest.health@mdc.mo.gov) as a first step in determining what trees should be visited by trained personnel.

# Emerald Ash Borer

The emerald ash borer (EAB), *Agrilus planipennis*, is a non-native forest pest causing widespread mortality of ash trees in North America. By November 2015, it had been detected in 25 US states and two Canadian provinces stretching from Colorado to Massachusetts and from Quebec to Georgia.

EAB was detected in several new Missouri locations in 2015. The first EAB detection in northeast Missouri occurred in Hannibal (Marion County). Detections in St. Louis County and City of St. Louis added to the previous St. Louis area discovery in St. Charles County (2014). All of these newest detections were made by alert green industry or municipal professionals who reported suspect trees. Additional detections in 2015 were made with EAB traps and included an Oregon County site in southeast Missouri and locations in and near St. Joseph (Buchanan County), adjacent to several positive counties in the Kansas City area. A total of 207 EAB traps were monitored in 2015

in 29 counties by MDA, MDC, and US Dept. of Agriculture. The 2015 detections bring the total of EAB positive counties in Missouri to 15, plus the City of St. Louis. See [eab.missouri.edu](http://eab.missouri.edu) for more information about EAB in Missouri.

Effective EAB management strategies have evolved in recent years. The first step for both communities and homeowners is to inventory and assess the condition of their ash trees. Those trees that are in poor health or on poor sites (e.g., under utility lines or in crowded locations) could be removed now prior to EAB's arrival in an area. High-value ash trees may be protected with systemic insecticide treatments applied as trunk injections or soil applications. However, insecticides should not be applied until after EAB has been detected within 15 miles or in the same county as the trees to be protected. More details are provided in a new "Emerald Ash Borer Management Guide for Missouri Homeowners" at [eab.missouri.edu](http://eab.missouri.edu).



David Cappaert, Michigan State University, Bugwood.org

## Emerald ash borer adult.

Communities need to prepare an EAB response plan now, even if EAB is not in their county. By the time EAB is detected in a new location, the number of dead ash trees can be expected to explode in just a few years. Financial impacts can be a huge burden over a short time span, if a community does not plan ahead. Where large numbers of ash trees exist, strategic use of insecticide treatments and a multi-year program of incremental ash tree removal can be used to spread out EAB management costs. Ash trees should be replaced with a diversity of tree species to limit impacts of future invasive pests.

Efforts continue to establish biological controls for long-term EAB management. Three species of stingless parasitic wasps that specifically attack EAB have been released in at least 21 states since 2007. The Missouri Dept. of Agriculture, in cooperation with the U.S. Dept. of Agriculture, has released these wasp species in several EAB-infested locations within Missouri since 2012 (Clay, Platte, Pulaski, St. Charles and Wayne Counties). An FAQ document about EAB biological control in Missouri is available at: [extension.missouri.edu/treepests/documents/FAQbiocontrol.pdf](http://extension.missouri.edu/treepests/documents/FAQbiocontrol.pdf)



**Known EAB-infested counties in Missouri as of November 2015.**

■ Counties with positive detections

# Rapid White Oak Mortality

White oak is important in Missouri due to its longevity, mast production for wildlife and saw timber value (2 billion dollars). However, significant white oak mortality has been reported in central, east central and southeast Missouri since 2011. Unlike other common and well-studied patterns of oak decline and mortality in Missouri, this mortality disproportionately affects white oak, tree crowns die rapidly, and mortality is greatest on better quality sites for tree growth. Consequently, this phenomenon has been described as rapid white oak mortality (RWOM) to separate it from other oak decline patterns.

As of summer 2015, RWOM reports were received from 45 Missouri counties on federal, state and private lands. While mortality appears to have peaked in 2012, some new mortality was reported in 2015 on sites where RWOM symptoms were not present previously. When feasible, affected timber has been salvaged from lands managed by the Missouri Department of Conservation and the privately held Pioneer Forest in southeast Missouri.

Depending on the location, white oak has been subjected to many stressors in recent years. Several extreme weather events include a severe freeze in early April 2007, the wettest back-to-back years in state history during 2008-2009, and drought in 2010, 2011, and 2012. Extensive defoliation has not been reported in RWOM affected areas for more than a decade, however a jumping oak gall infestation turned many white oak canopies brown in 2010. Limited tree ring analysis suggests some trees may have been affected by various stressors over several decades.

Research by a team of University of Missouri researchers, including Dr. Sharon Reed, Dr. Jim English, Dr. Rose-Marie Muzika, Dr. Patrick Guinan, and Dr. John Kabrick (USDA-Forest Service) with USDA-Forest Service Forest Health Protection Evaluation Monitoring, MDC, and L-A-D Foundation funding is ongoing. Initial surveys indicate mortality occurs most frequently on lower slopes of all aspects and next to ephemeral or seasonal drainages. Large overstory white oak trees are affected most often, but other sizes, crown positions, and species including post oak are also affected. Some healthy white oak trees remain in most affected stands, especially on mid- and upper slopes.

Researchers have established 28 research sites on MDC and Mark Twain National Forest lands in east central and southeast Missouri where they are collecting data on site and stand characteristics, measuring tree age and growth rates, and identifying associated insects and diseases. Hypoxylon canker was documented at most sites. Three species of *Armillaria* (Armillaria root rot) were detected. Several insect borer species were identified, including 3 species of cerambycid (longhorn) beetles, buprestid (jewel) beetles and an ambrosia beetle, *Xyleborinus gracilis*, native to the southeastern US and first documented in Missouri in 2008. Soil samples are being tested for various root disease pathogens. *Phytophthora cinnamomi*, an exotic root rotting pathogen, has been identified at 5 sites. Work is ongoing to identify *P. cinnamomi* and other pathogens in soil samples at other sites as well as additional fungi and insects from affected trees.



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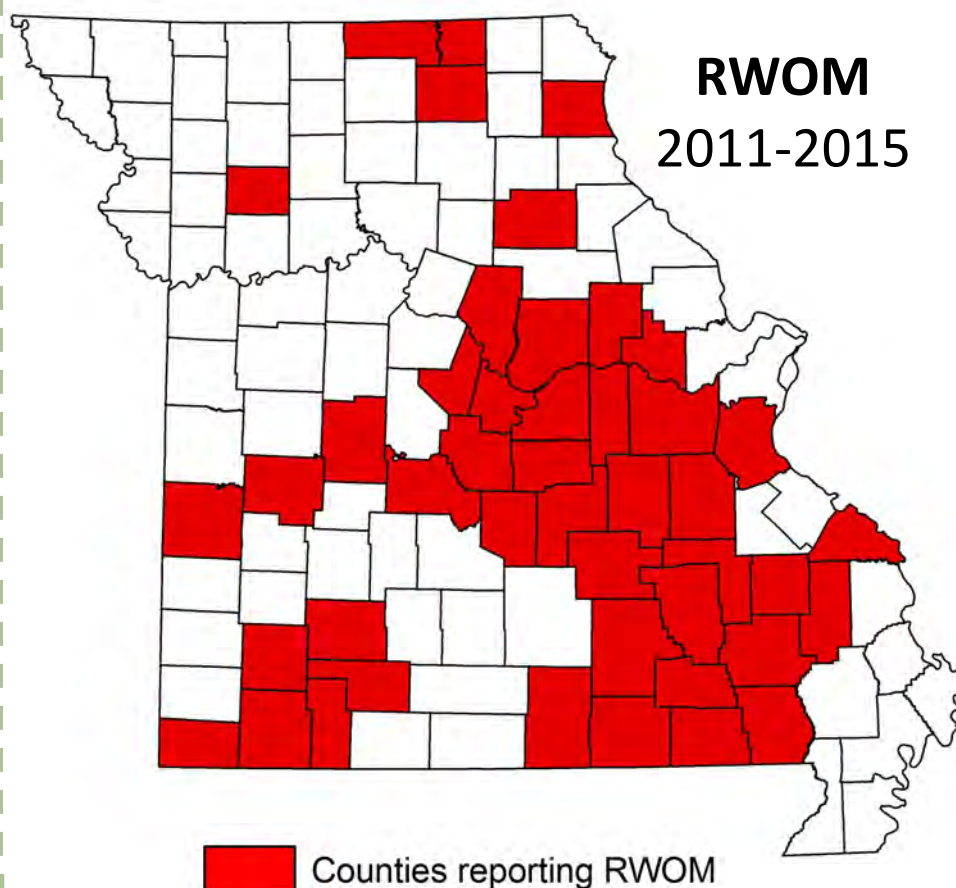
**RWOM pocket at Pea Ridge Conservation Area in east central Missouri.**

# RWOM *continued*



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**RWOM pocket at Huzzah Conservation Area, Crawford County, Missouri.**



Although data collection is far from complete, accumulated tree stress is thought to play an important role in the mortality. Most of the insects and diseases detected primarily affect stressed trees. Although *P. cinnamomi* has not been detected at all RWOM-affected sites tested, it has been associated with similar white oak mortality patterns in Ohio (Nagle *et al.*, 2010), oak decline in Europe, and causes plant diseases worldwide. It was introduced into the southeastern US in the late 1700's or early 1800's and disproportionately affects susceptible species on lower slopes and along drainages.

Affected trees decay rapidly and should be harvested as soon as possible to avoid loss from decay or to prevent trees from becoming a hazard. Oak regeneration has been observed but competition with shade tolerant species is common. Management of undesirable species may be necessary to maintain an oak component on affected sites. Managers should consider increasing stand diversity, especially on lower slopes and in drainages. Good stand management practices are recommended, although it may not prevent RWOM. Preemptive harvesting is not suggested in stands with no signs of decline. Spread within a stand beyond the trees initially observed to have RWOM symptoms has been limited. RWOM may not be present in stands with only a few declining or dead white oak and these stands should be watched carefully prior to planning a harvest in response to RWOM. New information over the next few years may help us better predict and manage locations with RWOM.

Nagle, A. M., Long, R. P., Madden, L. V., and Bonello, P. 2010. Association of *Phytophthora cinnamomi* with white oak decline in southern Ohio. *Plant Dis.* 94:1026-1034.

# Foliar Diseases of Trees

Foliar diseases were prevalent in 2015. Missouri experienced the second wettest May-July on record which likely favored foliar disease development. Of particular note were the cedar rusts, ash leaf spot and brown spot needle blight of Scotch pine.

In addition to cedar apple rust, there are several other related “cedar rust” diseases that alternate between junipers (eastern red-cedar, etc.) and certain varieties of apple, hawthorn, serviceberry and related trees. This year we also had reports of significant rust infection on some cultivars of ornamental pear, causing yellow to orange lesions on the leaves. Leaves with lots of lesions turned black and began falling from trees midseason leading to confusion with fire blight and other diseases. Ornamental pear rust reports came from Boone, Cole, Jefferson and Warren counties. While we are still working to get this rust identified to species, management should be similar to other cedar rust diseases. See more information on cedar rust diseases in this guide: [ohioline.osu.edu/hyg-fact/3000/pdf/3055.pdf](http://ohioline.osu.edu/hyg-fact/3000/pdf/3055.pdf).

Ash leaf spot (*Mycosphaerella* leaf spot) caused early leaf drop on ash trees in several areas of the state this year. This disease becomes apparent in late summer and is favored by wet spring and summer weather. Affected leaves have brown lesions that may coalesce to form large brown blotches. Insecticide treatments for emerald ash borer have no effect on this disease. Defoliation usually occurs late enough in the growing season that the impact on tree health is minimal. Visit this webpage for more information: [Ohio State University Ash Leaf Spot Guide](#).

Brown spot needle blight caused extensive needle browning and needle drop on Scotch pine this year. Christmas tree growers who were unable to treat with fungicides during the critical early summer period experienced significant tree damage. Scotch pine frequently requires treatment for other tree health issues and is not recommended for forest or landscape planting in Missouri. More information on brown spot needle blight is available at: [www.extension.umn.edu/garden/yard-garden/trees-shrubs/brown-spot-needle-blight/index.html](http://www.extension.umn.edu/garden/yard-garden/trees-shrubs/brown-spot-needle-blight/index.html)



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**Cedar rust lesions on ornamental pear leaf.**



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⇐ **Early defoliation caused by ash leaf spot.**

**Needle browning caused by brown spot needle blight.** ⇒



MN Dept. of Natural Resources Archive, Bugwood.org

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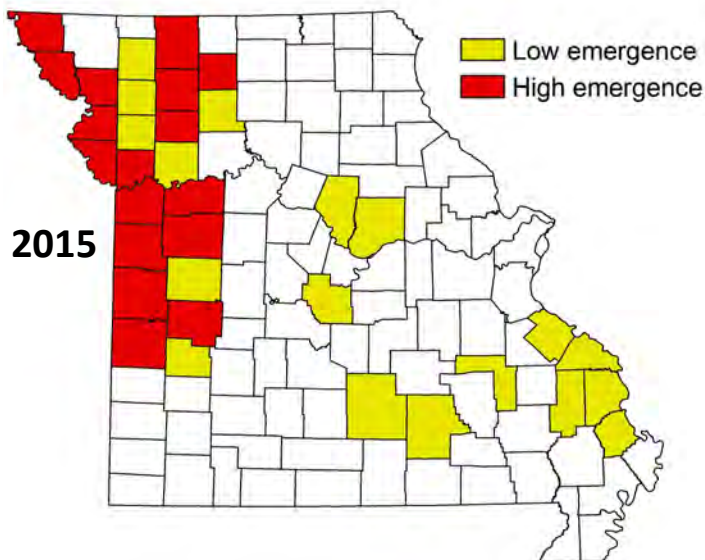
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## Periodical Cicadas

Two broods of periodical cicadas (*Magicicada* spp.) emerged in parts of Missouri in 2015. Adults were present in May and June. Females cut slits in the undersides of small branches in which to deposit their eggs (oviposition). The damage can cause flagging (clusters of brown leaves) across a tree crown. Small, damaged branches may eventually break and fall, but impacts are minor on large trees.

Brood IV, a brood of 17-year cicadas, emerged in northwestern and central western Missouri. The full range of this brood extends from southwestern Iowa to northern Texas and is sometimes referred to as the Kansan Brood. Brood XXIII, a brood of 13-year cicadas, emerged in southeastern Missouri in counties near the Mississippi River. That brood extends from southern Illinois to Louisiana and is known as the Lower Mississippi Valley Brood. Very small numbers of periodical cicadas were also observed in scattered locations in central and central southern Missouri. These may be remnants of a broader distribution of Brood XXIII which was observed in the early 1900s extending over much of Missouri. Higher population levels were reported among counties where Brood IV emerged.

### Periodical cicada adult and oviposition scars on a branch.



2015

A complex of several species of loopers and other hardwood defoliators was active in early spring, particularly in northeastern Missouri. Defoliation occurred on oaks, ash, pecan and other hardwoods, but hackberry trees were particularly hard hit. Several landowners reported in mid-May that their hackberry trees appeared as if they had not leafed out this year. Presumably large numbers of defoliating caterpillars fed on foliage early in leaf phenology, perhaps during budbreak and early leaf expansion. Scattered pockets of hackberry defoliation were reported in counties bordering the Mississippi River from the northeast corner of the state south to St. Louis.

Trees that are severely defoliated in early spring typically leaf out with a second flush of leaves in June. That increased foliage production puts a drain on a tree's stored energy reserves causing stress on tree health. Missouri received above average precipitation from May to July, which may have benefited reflushing trees.

At the other end of the growing season, in September, fall webworm (*Hyphantria cunea*) populations were high in southwest Missouri and northwest Arkansas. Some trees were heavily covered in webbing, not only on branches, but also extending down trunks to the ground. Defoliation was common on typical fall webworm hosts such as black walnut, hickories, pecan and persimmon, and also present on less common host species (e.g., oaks, sweetgum and redbud). Defoliation late in the growing season causes much less stress on tree health than similar damage occurring in spring.

## Hardwood Defoliators



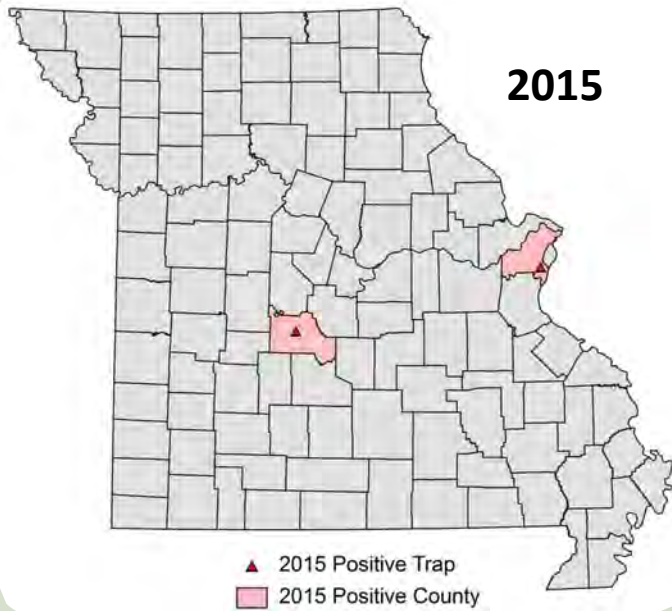
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### Heavy webbing by fall webworm on a pecan tree in southwest Missouri.

# Gypsy Moth

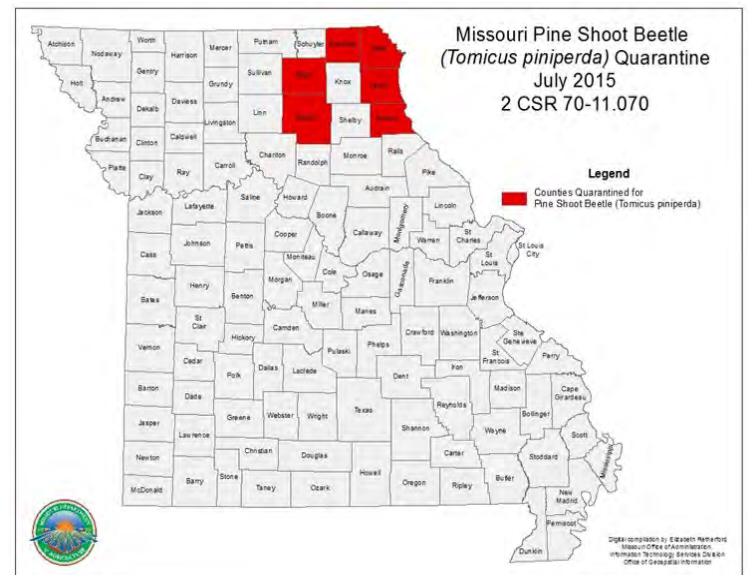
The multi-agency Missouri Cooperative Gypsy Moth Program conducted its annual survey to detect the presence of gypsy moths (*Lymantria dispar*) by placing and monitoring over 6,100 traps in 51 counties during 2015. Delimit areas of intensive trapping were established around four sites where gypsy moths were captured in 2014 (one moth in Camden County and three moths in St. Louis County).

Only two male moths were captured statewide in 2015: one in Camden County and one in St. Louis County. Both were confirmed to be European gypsy moths. Neither moth was captured in a delimit area (4 square miles each), although they were captured within the same counties as the 2014 captures. No reproducing populations of gypsy moths have yet been detected in Missouri, but gypsy moths can easily hitchhike to new locations during their egg mass stage. Travelers returning from northeastern states should examine vehicles and outdoor gear that were present in gypsy moth-infested states during July and August. Detected gypsy moth egg masses should be removed before returning to Missouri.



# Pine Shoot Beetle

The pine shoot beetle, *Tomicus piniperda*, a bark beetle pest of pines in Europe and Asia, was discovered in the US in Ohio in 1992, and was first confirmed in Missouri in Macon County in April 2012. Additional populations were detected in four other northeastern counties (Adair, Clark, Lewis and Marion) by the end of 2014. In 2015, the Missouri Dept. of Agriculture surveyed counties adjacent to known positive counties, using Lindgren funnel traps and host volatile lures, and detected pine shoot beetles for the first time in Scotland County. A state interior quarantine regulates the movement of pine trees, logs, lumber with bark attached, and other raw pine materials in all positive counties. Concerns exist about possible impacts of the pine shoot beetle, when it eventually extends its range to shortleaf pine stands in southern Missouri.



**Questions?** Contact your local Resource Forester or Community Forester with the Missouri Department of Conservation.

**Find contact information for your county at:**

[mdc.mo.gov](http://mdc.mo.gov)

An electronic copy of this document can be found at:

[mdc.mo.gov/node/12746](http://mdc.mo.gov/node/12746)

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