Missouri Forest Health Highlights 2022

Forest Health Program | Annual Report

Missouri Department of Conservation | mdc.mo.gov

Serving nature and you

IN THIS ISSUE

EMERALD ASH BORER IN 102 COUNTIES

The emerald ash borer (EAB), *Agrilus planipennis*, is an invasive beetle that has killed millions of ash trees in North America. It was initially discovered in the Detroit, Michigan area in 2002, but EAB likely entered that region at least a decade earlier via wood pallets and crating from China. EAB has now been detected in 35 US states and five Canadian provinces, stretching its range from Manitoba to Texas and Colorado to Maine.

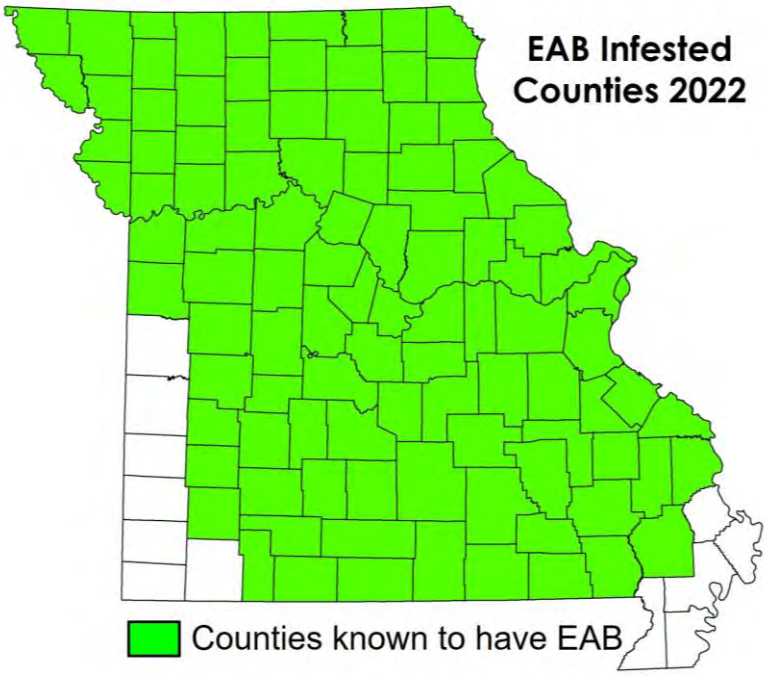

Figure 1: Missouri counties with EAB detections as of Dec. 2022.

Missouri's first detection of EAB came in 2008 in Wayne County, near Lake Wappapello. As of December 2022, 102 Missouri counties and the city of St. Louis are known to have EAB infestations. The Missouri Department of Agriculture monitored 72 purple prism traps in eight counties throughout the state in 2022. Trap locations included high-risk areas like campgrounds and municipal yard waste facilities. EAB was captured on traps in only two new counties this year: Dade and Henry.

Reports of EAB continue to increase across the state from MDC staff and private landowners observing bark blonding on ash trees. This bark damage is caused when woodpeckers search for insect larvae in ash trees and pop off the trees' outer bark to reveal highly noticeable, light-colored inner bark. To find new areas of EAB infestation, look for ash trees with bark blonding in late winter or early spring. Please report suspected EAB infestations, especially if the location is in a new county where EAB has not yet been found.

EAB populations can take a long time to build in an area. A county is often confirmed to have the pest several years before residents start noticing dying ash trees in forests and urban areas. Unfortunately, by the time trees are showing signs of bark blonding, it is usually too late to save

them using an insecticide treatment. Affordable options are available to protect healthy, high-value ash trees from EAB. Please see details in the Emerald Ash Borer Management Guide for Missouri Homeowners.

EAB populations can expand slowly on their own to new areas, but EAB can move long distances in a short amount of time by hitchhiking in ash firewood. To slow the spread of EAB and other invasive forest pests, don't move firewood. Buy it as close as possible to the location you plan to burn it, or harvest firewood on site, if permitted.

For more information or to report possible EAB, send an email to Forest.Health@mdc.mo.gov.

Figure 2: During the winter, look for damaged bark on ash trees, known as blonding, as an indication of EAB in an area. Lightly blonded ash (left side of photo) typically die within a season or two of the damage being noticed; heavily blonded trees (right side of photo) rarely leaf out the following spring. Image: MDC

LAUREL WILT OF SASSAFRAS

In recent years, laurel wilt was detected killing sassafras trees in several counties in western Tennessee, just a few miles from Missouri's southeastern border. Since then, MDC Forest Health staff have visited several sites across the state but have been unable to confirm the presence of laurel wilt in Missouri. For the most recent map of laurel wilt locations, visit the Laurel Wilt Public Dashboard.

Laurel wilt is a tree-killing insect and disease complex, which consists of the invasive redbay ambrosia beetle (*Xyleborus glabratus*) carrying a fungal counterpart, *Raffaelea lauricola*. When the redbay ambrosia beetle bores into trees, the fungus causes a lethal vascular wilt disease of sassafras and other plants in the Lauraceae family. In addition to killing sassafras, both spicebush and pondberry (a shrub already endangered by wetland habitat loss) are susceptible to laurel wilt.

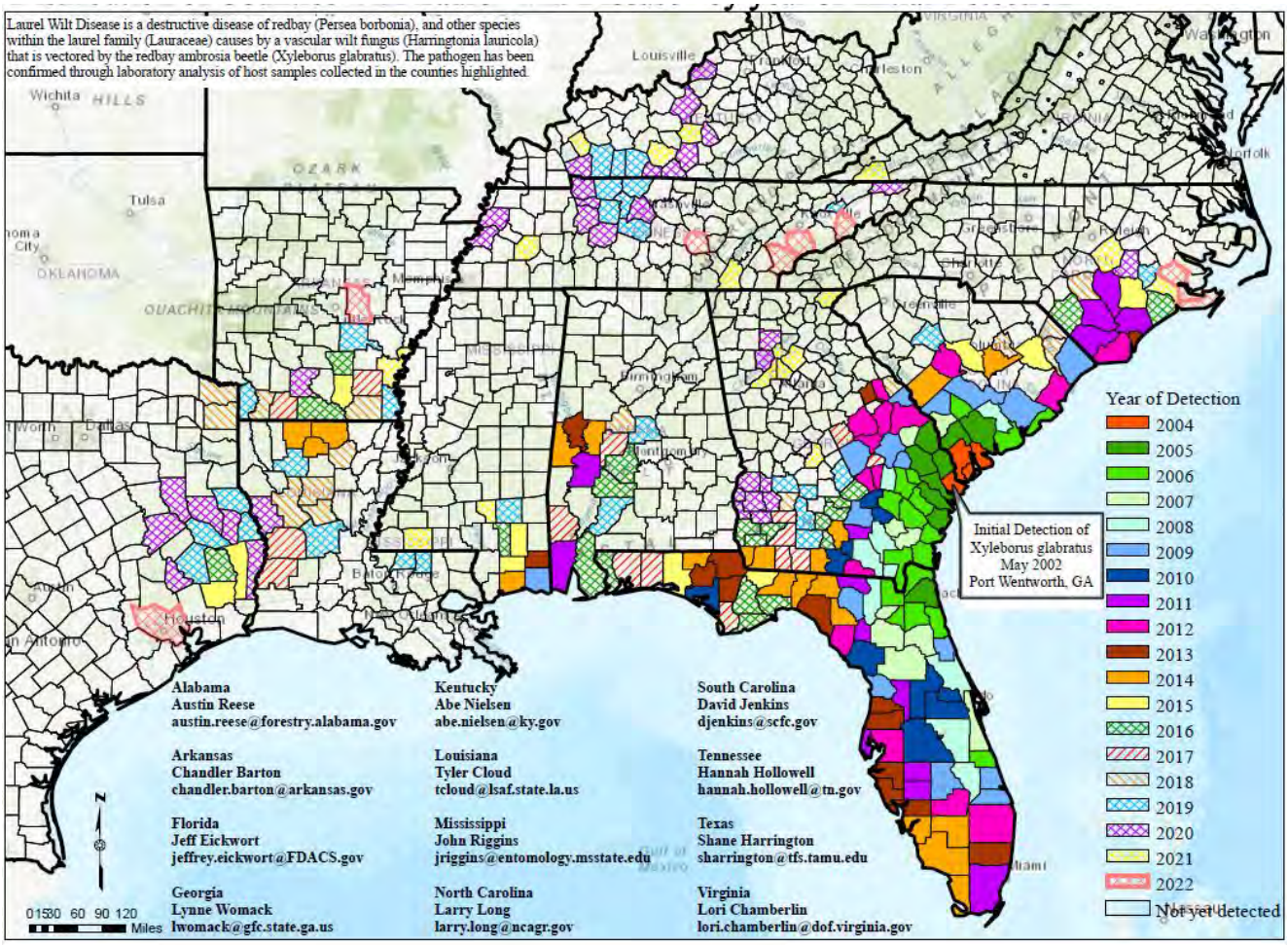

Figure 3: Current distribution of laurel wilt disease-positive counties by year of initial detection. Map created by Lynne Womack using the Laurel Wilt Public Dashboard.

Figure 4: Streaking in the sapwood is a sign of laurel wilt in sassafras. Image: Ellen Crocker, University of Kentucky.

Symptoms of laurel wilt on sassafras include rapidly wilting leaves that turn reddish-brown, dark staining in the sapwood, and small ambrosia beetle exit holes in the bark. Fragile frass 'toothpicks' can be found coming out of beetle exit holes. Entire clumps of sassafras may wilt, as the disease can quickly spread through lateral roots to nearby trees.

Although laurel wilt has not yet been identified in Missouri, expanding infestations in neighboring states and the 2020 find near the Tennessee-Missouri border mean that this tree-killing pest could arrive at any time. MDC's Forest Health staff ask Missourians to report dying sassafras by sending an email to Forest.Health@mdc.mo.gov.

Figure 5: Laurel wilt is a vascular disease that can easily spread through lateral roots, causing entire clumps of sassafras to wilt. Image: Ellen Crocker, University of Kentucky.

THOUSAND CANKERS DISEASE UPDATE

Identified in 2008, thousand cankers disease (TCD) is a disease complex consisting of the tiny walnut twig beetle (*Pityophthorus juglandis*) and a fungus (*Geosmithia morbida*) it carries to walnut trees. In Missouri, black walnut is the primary species susceptible to TCD.

TCD is the result of walnut twig beetles tunneling into the bark of walnut branches where they feed on the phloem and introduce *Geosmithia morbida*. As the fungus grows, it creates areas of infected tissue called cankers. Thousands of small cankers, along with walnut twig beetle tunnels, can coalesce to girdle branches, resulting in a decline in tree health and ultimately, tree death. Research has suggested that the severity of TCD in eastern states (the native range of black walnut) is related to site and environmental conditions, including drought.

Survey and detection work for TCD is ongoing in Missouri. To date, the walnut twig beetle has not yet been detected, and Missouri is not known to have TCD.

Figure 4: Walnut twig beetle tunnel and cankering under the bark of a small walnut branch (left). Walnut twig beetle trap in a walnut tree (right). Images: MDC.

TCD Survey

In 2022, MDC and the Missouri Department of Agriculture surveyed for TCD using USDA Forest Service and USDA Farm Bill funding, respectively. Trapping and visual surveys were conducted at high-risk locations within 41 counties in central, northeast, southeast, and southwest Missouri.

Survey activities this year included 190 walnut twig beetle traps in walnut trees or at sawmill log piles, as well as 236 visual surveys to identify potentially infested trees. Analysis of 2022 trap catches resulted in no walnut twig beetles found at any surveyed location. Since 2010, there have been 3,382 locations visually surveyed and 2,149 WTB traps deployed.

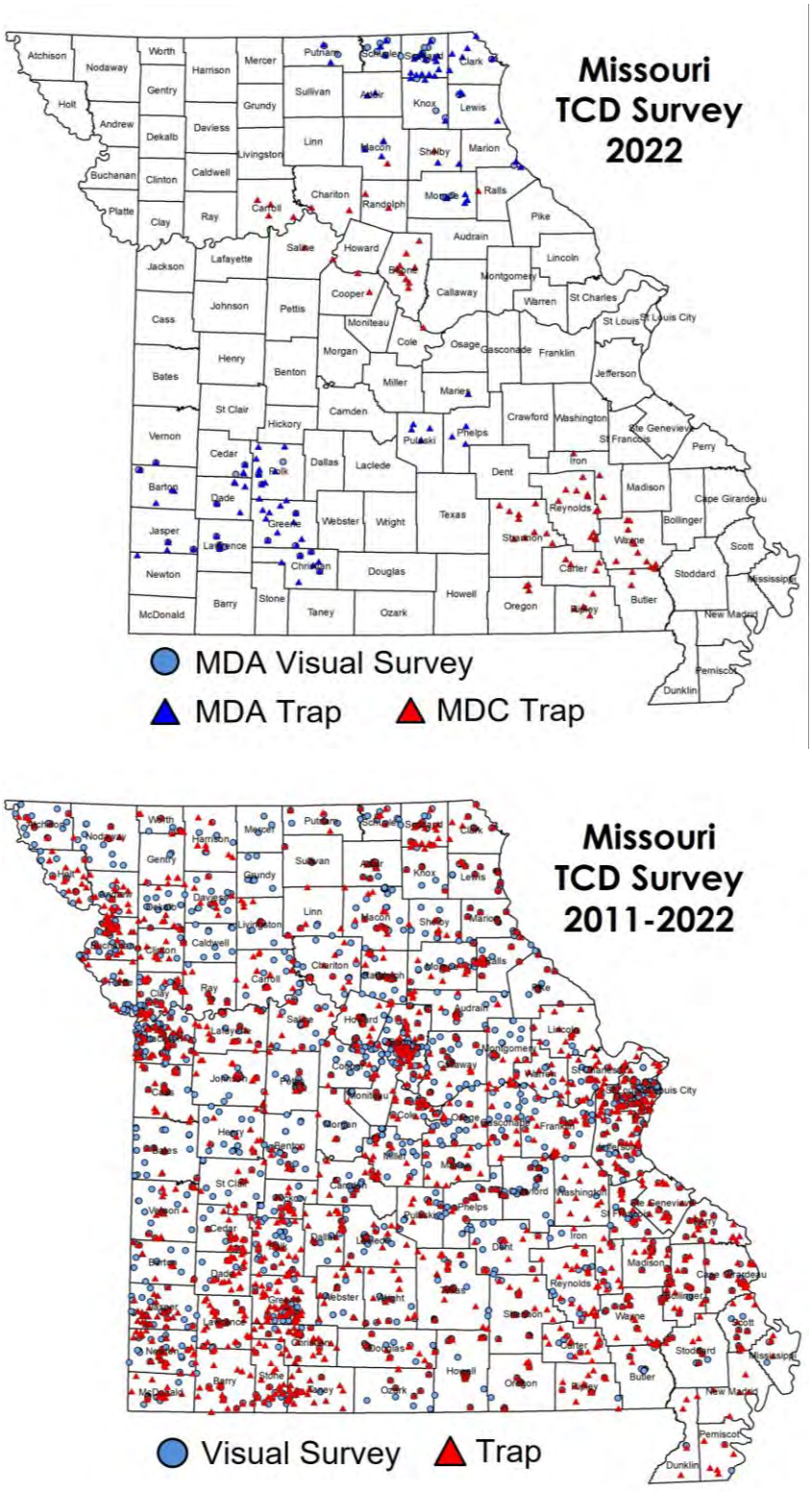

Figure 5: Locations of TCD traps and visual survey in 2022 (top), and all trap and visual survey locations since 2011 (bottom).

Because early detection of TCD is difficult, reports of walnut tree dieback and decline are very important. Visit the MDC Learn how to Identify TCD webpage to learn more about the symptoms of TCD. Please report symptomatic walnut trees: Forest.Health@mdc.mo.gov.

SPONGY MOTH SURVEY RESULTS

The multi-agency Missouri Cooperative Spongy Moth Program conducted its annual survey to detect the presence of spongy moth (*Lymantria dispar*; formerly known as gypsy moth) by placing and monitoring 6,156 traps in 46 counties. Three male moths of European/North American genetic origin were captured statewide in 2022. Two of these moths were captured in St. Louis County while the third showed up in a remote area of nearby Jefferson County. Spongy moth males are frequently found in this area of the state, most likely because of the number of people (and hitchhiking pests!) moving to and through the greater St. Louis area. Next summer, the locations where moths were captured will be intensively surveyed to confirm no breeding populations of spongy moth are present.

Missouri is not known to have any established populations of spongy moth. It is very easy, however, to accidentally transport this pest's egg masses to our state. People moving to Missouri from infested states are legally required to examine all outdoor articles for tan, fuzzy egg masses. Please remove these masses before moving items to Missouri.

Figure 6: Sticky traps containing spongy moth pheromone are used to survey for the foliage-feeding pest (left). Three male spongy moths, including the one pictured, were captured in sticky traps in Missouri in 2022 (right). Images: MDC.

2022 WEATHER UPDATES

Spring Frost

A mild freeze in mid-April caused damage to trees, particularly in the valleys and low-lying areas along the southern border of the state. For some locations, this marked the third growing season in a row with a spring freeze that damaged leaves. Trees that experienced this early spring defoliation are likely stressed, making them more susceptible to pests and pathogens, especially when drought follows like it did in 2022.

Figure 9: Sycamore with frost damage to the first set of leaves. Image: MDC.

Persistent Drought in 2022

The last several years have been anything but normal regarding weather patterns across the state. Most notably, trees have experienced several drastic shifts from wet-to-dry and dry-to-wet conditions. It's no longer a rare event for Missouri trees to receive more than three inches of rain in 24 hours (sometimes in less than an hour!), then not get another drop for three to six months. This type of water stress—both super wet and very dry—has the potential to stress tree roots and leave them more susceptible to pests and pathogens.

In 2022, most counties spent several months in drought conditions. Rains in May pulled counties from the winter and early spring drought, but by mid-June, abnormally dry conditions were starting to return according to the U.S. Drought Monitor. Throughout July, the drought intensified in the southern half of the state, with the southwest region experiencing extreme drought by early August. Six counties along the Kansas/Oklahoma border also hit exceptional drought levels by mid-fall. By the end of December, drought still persisted at abnormally dry to severe levels across 64% of the state's acres.

Despite the drought, many areas of the state recorded rainfall totals for 2022 within the normal annual range, with some counties even showing a surplus of rainfall for the year (according to Missouri Mesonet). So how can we have both a surplus of rainfall and a drought in the same place? It's complicated! What is happening in some places is that a lot of rainfall is occurring in

a short period of time–bumping up that annual rainfall total–but it ends up as run-off (the soil can only hold so much water). For example, in the St. Louis area in late July, nearly 11 inches of rain fell in just three days (20% of the annual total!), including over seven inches in just 12 hours. In other areas of the state, data shows that most of the annual rainfall fell in a few months, rather than just a few days. However, concentrating rainfall into a couple of months still results in drought later on if precipitation slows through the summer and fall. As we enter 2023, over half of the state needs precipitation to recharge subsoil moisture.

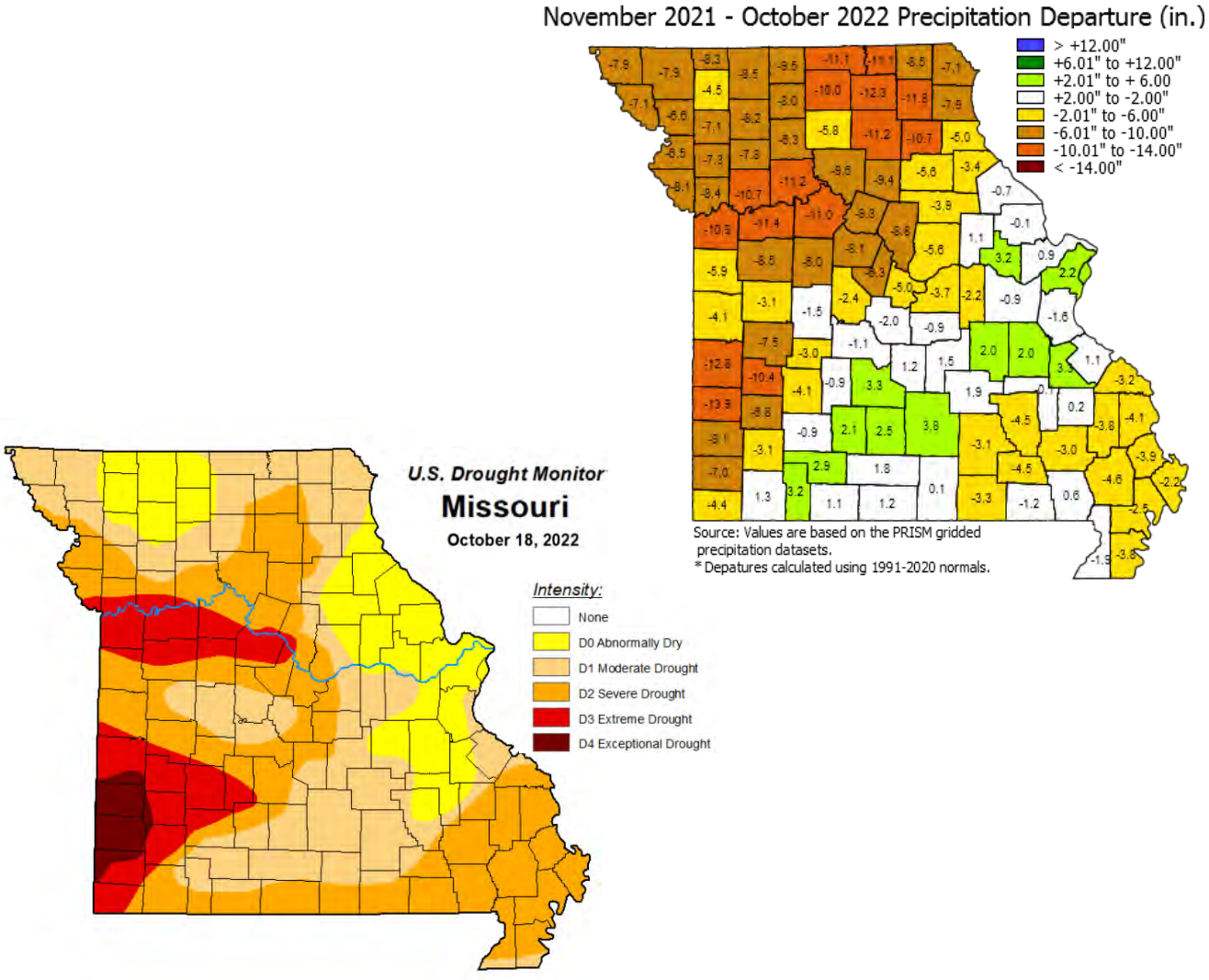

Figure 10: Map of precipitation departure from normal (November 2021-October 2022) by Dr. Pat Guinan, University of Missouri Extension Associate Professor in Climatology on Missouri Mesonet (upper, right) compared to the October 18, 2022 drought map by Adam Hartman (NOAA/NWS/NCEP/CPC) on U.S. Drought Monitor (lower, left).

ARMILLARIA ROOT ROT

Throughout 2022, MDC Forest Health staff searched for Armillaria root rot in numerous urban and forest trees. Armillaria root rot is a common root disease of trees caused by several closely related species of Armillaria fungi. This native disease can affect many tree species but is most commonly observed on oak, maple, and elm in Missouri.

Armillaria infections often go unnoticed as the fungi parasitize the root systems of living trees. Armillaria is frequently identified late in the infection, and only then by removing the bark on major roots or the root collar to expose white mycelial tissue. In some species, such as sassafras, Armillaria infection can result in dark sap weeping through the bark.

Symptoms of Armillaria root rot initially include stunted leaves, reduced tree vigor, and canopy thinning. As the disease progresses, significant branch dieback becomes noticeable, and root and heart rot weaken the structural integrity of trees. In some cases, the disease progresses quickly, resulting in trees that wilt suddenly in late summer. These symptoms can be similar to those of other diseases, making it easy to misdiagnose Armillaria.

Figure 11: Trees suffering from Armillaria root rot often display symptoms of decline, including branch dieback, thin canopy, and discolored leaves. This tree had multiple clumps of Armillaria mushrooms growing around the trunk in 2020 (left), and it finally died in 2022 during a summer drought (right). Image: MDC.

When weather conditions are favorable in early fall, Armillaria can produce masses of light-brown honey mushrooms at the bases of trees or from roots near the soil surface. This year, Armillaria mushrooms were not noticed in much of the state, likely due to the extended drought across Missouri. While the mushrooms can be helpful in identifying Armillaria, tree health professionals should not rely on the presence of mushrooms for diagnosis.

In urban or yard settings, Armillaria root rot can result in hazardous trees and difficulty establishing new trees. Read more about this disease in the Armillaria Forest Health Alert, available on the MDC Missouri Forest Health news webpage. The Forest Health Program also has a fact sheet available with photos and tips for identifying Armillaria in the field. Please email Forest.Health@mdc.mo.gov for a copy of this fact sheet.

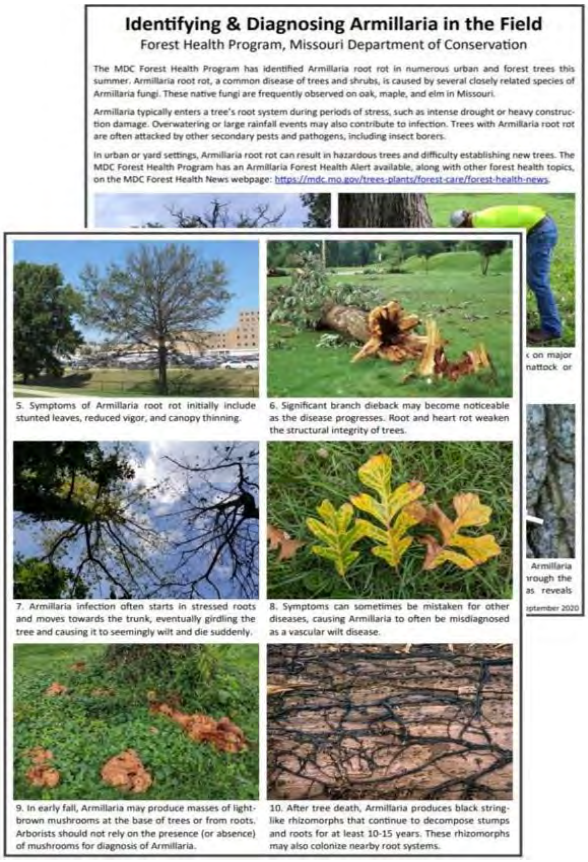

Figure 12: The MDC Forest Health Program has a fact sheet titled "Identifying and Diagnosing Armillaria in the Field" available upon request. Images: MDC.

Figure 7: Mycelial fans of Armillaria occur right under the bark, making bark loose and easy to remove. Image: MDC.

Figure 14: When conditions are favorable in the fall, clusters of brown Armillaria mushrooms may form on the trunk or roots of infected trees. Image: MDC.

SKELETONIZED PIN OAKS SCARCE IN 2022, AND SO WERE PINE NEEDLES

In 2021, an unknown leaf-skeletonizing insect was reported on pin oaks throughout northeast Missouri. By the time MDC Forest Health staff could investigate, the culprits were long gone. In mid-June of 2022, reports started rolling in about more skeletonizing on pin oaks. At one location, MDC Forest Health staff identified adults of the scarlet oak sawfly (*Caliroa quercuscoccinae*). By July, no other reports were received about this pest, and the skeletonizing didn't progress on oaks with damage in June. For reasons unknown, the second generation of scarlet oak sawflies saw a population crash in 2022.

Figure 15: Scarlet oak sawflies congregating on a partially skeletonized pin oak in mid-June. Image: MDC via Jeff Vogel.

European pine sawflies (*Neodiprion sertifer*), on the other hand, had a banner year in Missouri. We received dozens of reports from across the state of outbreak levels of this species. Some pines were totally stripped of their needles by late May. Fortunately for the trees, European pine sawfly only has one generation per year in Missouri, so new growth on pines was not in danger of being eaten. With persistent drought conditions across the state, homeowners are advised to water their pines to help alleviate environmental stress. A good rule of thumb for pines and other evergreens is five gallons of water per inch of trunk diameter every 2-3 weeks. Double that amount when watering deciduous trees.

Figure 16: European pine sawfly was present in phenomenal numbers during late spring in 2022. Image: MDC via Nikki Rucker.

HERBICIDE INJURY ON TREES

If you follow agricultural news, you have likely heard about some of the herbicide concerns in Missouri and surrounding states. Since the 2017 growing season, millions of acres of crops—from soybeans to peaches, grapes, and watermelons—have been injured by new over-the-top formulations of dicamba and 2,4-D used on soy and cotton fields. Injury has also been reported on many different tree species in both yard and forest settings. For more in-depth information on the history of this issue, view MDC Forest Entomologist Robbie Doerhoff's 2020 EAB University Webinar on YouTube: https://youtu.be/ZdxeoX2QobY.

The appearance of herbicide injury symptoms on an individual tree varies based on the tree's species and its relative health, the time of year, and the herbicide used. Herbicide injury symptoms caused by dicamba or 2,4-D generally include curled, cupped, pale, twisted, and/or strap-like leaves. In some cases, the tips of twigs can be twisted and deformed or even killed. Large trees severely injured by these herbicides typically have thin crowns and few normal leaves. Oaks (especially white oak), sycamore, redbud, and bald cypress are particularly sensitive.

Figure 17: Southern red oak with severe herbicide injury. This tree tested positive for dicamba (85 ppb) and 2,4-D (50 ppb) in August. Image: MDC.

MDC Forest Health staff have been tracking herbicide injury on trees since 2018. We are currently installing long-term monitoring plots to gain a better understanding of how agricultural herbicides affect off-target trees and plants. In addition to monitoring herbicide residues and growth rates on plot trees, we will be collecting data on seed production and viability, insect feeding and presence, leaf decomposition, and native plant flowering within each plot.

Trees appear to recover from light to moderate herbicide injury, but severe or repeated damage may ultimately lead to tree decline and death. It's best to take a wait-and-see approach; some trees may make a full recovery within a couple of growing seasons. To help trees recover in a yard setting, provide supplemental water 2-3 times per month during dry periods (aim for 10 gallons of water per diameter inch). Encourage the growth of fine feeder roots by installing a 3-inch-deep organic mulch ring. Avoid fertilizing injured trees for at least a year so as not to encourage excess growth and stress.

If you notice herbicide injury on your trees or garden plants in 2023, report the damage to the Missouri Department of Agriculture's Bureau of Pesticide Control. You can fill out an online form at http://agriculture.mo.gov/plants/pesticides/incidentreport.php.

Figure 18: White oak showing severe herbicide injury surrounded by relatively normal leaves (likely a result of the tree putting on new leaves when herbicides were not in the air). The symptomatic leaves tested positive for dicamba (11 ppb) in August. Image: MDC.

ASIAN LONGHORNED BEETLE SURVEY

MDC Forest Health staff have been traveling around the state the last two years conducting dozens of surveys for the Asian longhorned beetle (ALB), *Anoplophora glabripennis*. Because ALB can easily hitchhike in firewood, both public and private campgrounds have been the targets for these surveys. At each location, staff conduct a thorough check of hundreds of trees for possible signs of ALB and look around dusk to dawn lights for dead beetles. Staff also provide forest pest outreach materials to campers and campground hosts. So far, no ALB sightings have been recorded, but this pest could show up in Missouri at any time. Keep an eye out for these signs of ALB next time you take a walk or visit your favorite forest!

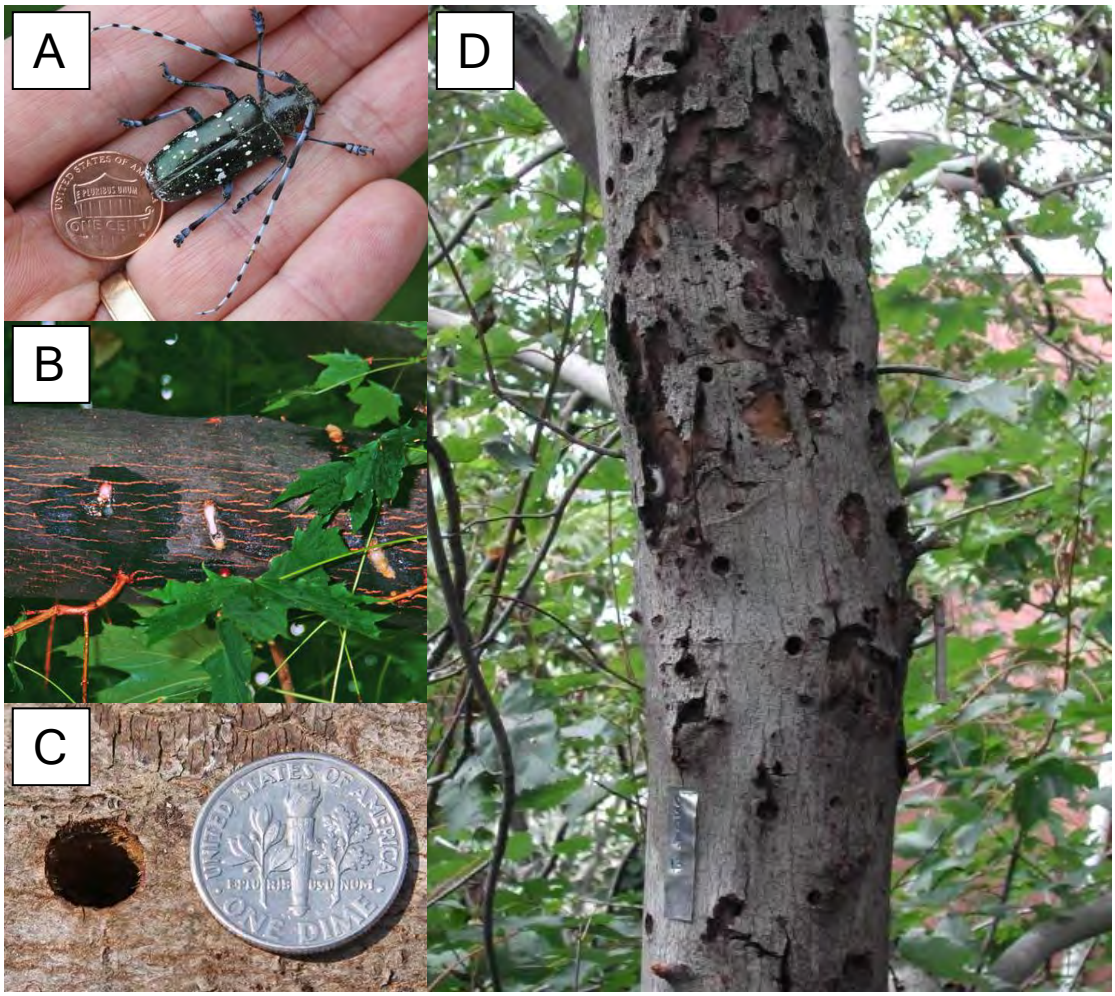

Figure 19: A. Adult Asian longhorned beetles have black bodies with white spots and mottled antennae. Image: Joe Boggs, Ohio State University. B. Female beetles chew pits for egg-laying into bark, causing sap to weep from the wounds. Image: Dennis Haugen, USDA Forest Service. C. Exit holes chewed by adult beetles leaving the tree are large and round. Image: Joe Boggs, Ohio State University. D. Multiple years of ALB infestation caused visible damage to the trunk of this maple. Image: PA Dept. of Conservation & Natural Resources.

INVASIVE SPECIES SPOTLIGHT

Spotted Lanternfly

MDC Forest Health staff as well as our partners at both the Missouri and US departments of Agriculture have been busy looking for spotted lanternfly (*Lycorma delicatula*) and its favorite host, Tree of Heaven. This large planthopper is native to Asia but has been detected in 14 states east of Missouri since 2014. The spotted lanternfly has earned its bad reputation by sucking sap from over 100 different tree and plant species, including grape, apple, oak, black walnut, maple, and tree of heaven. While no live spotted lanternflies have been found in Missouri yet, some sharp-eyed citizens did report a few dead specimens in 2022. Be on the lookout for this pest in 2023 and send photos of any potential spotted lanternflies to Forest.Health@mdc.mo.gov.

Figure 20: Spotted lanternflies are often mistaken for a common native Missouri tiger moth species. Image: MDC.

Royal Paulownia (aka Empress Tree)

Meet Royal Paulownia—a fast-growing tree that is becoming increasingly common in the southern part of Missouri. This invader is strikingly beautiful in early spring with big clusters of purple flowers, making it a popular ornamental tree in urban areas and yards. Unfortunately, those big clusters of flowers lead to thousands of seeds ready to catch a ride on the wind and start a new tree elsewhere. If you see this tree growing in a natural setting, such as a forest or woodlot, please report the location by sending an email to Forest.Health@mdc.mo.gov.


Figure 21: An empress tree, *Paulownia tomentosa*, showing its beautiful purple blooms in spring. Image: Jim Robbins, Creative Commons.

EARLY DETECTION, RAPID RESPONSE SURVEY

"What is *that*?" was a common question received this past spring in reference to the long, black insect traps placed at 10 locations across the state. These traps were part of the Early Detection, Rapid Response (EDRR) Survey conducted by the Missouri Department of Conservation and funded by the USDA Forest Service. This survey aims to detect and monitor populations of non-native bark and ambrosia beetle species, especially those with the potential to harm Missouri's trees and forests. Trap catches are still being processed for the 2022 survey.

The EDRR survey was last conducted in Missouri in 2014. That year, MDC Forest Health staff collected 2,559 bark and ambrosia beetle specimens representing over 50 species, including several known invasive species. The most frequently captured exotic species was the Fruit-tree Pinhole Borer (*Xyleborinus saxesenii*) with 1,159 individuals, and the most frequently captured native species was the Yellow-banded Ambrosia Beetle (*Monarthrum fasciatum*) at 150 specimens. The most interesting find was a single specimen of a *Coccotrypes* species, a palm seed borer, collected from a yard waste site in Columbia.

Figure 22: EDRR traps were placed near this mountain of pallets at a landfill site in Boone County. Locations like this are high-risk for invasive forest pest introductions thanks to the ability of some pests to hitchhike in wood. Image: MDC.

FIREWOOD: CAMPGROUND OUTREACH

The MDC Forest Health Program is working with campground and RV park owners to help spread the message of safe firewood usage and the importance of not moving firewood. There is a variety of free outreach items available for campground and RV park offices, including a new "What's in Your Firewood Brochure", brochure holders, magnet notepads, pens, kid activity sheets, and crayons.

Figure 23: A variety of outreach items are available to campgrounds and RV park offices. Image: MDC.

If you know of a campground or RV park office interested in obtaining any of these free items, please send an email to Forest.Health@mdc.mo.gov.

Questions?

Contact your local Forester with the Missouri Department of Conservation.

Find contact information for your county at:

mdc.mo.gov

Missouri Department of Conservation | mdc.mo.gov

Serving nature and you

This project was funded in whole or in part through a grant awarded by the USDA, Forest Service, Northeastern Area State and Private Forestry. The USDA is an equal opportunity provider and employer.