Michigan Department of Natural Resources
Forest Resources Division

Forest Health Highlights

2025

2025: A year of progress, challenges

Resilience is a key concept in forest management – we are always looking to keep forests healthy to help them weather storms created by native and invasive diseases and insects, and invasive plants.

But in 2025 Michigan dealt with an actual storm, a disastrous ice storm leaving trees downed and broken and left Michigan Department of Natural Resources staff with a slew of new challenges, from timber salvage to reforestation. The DNR's forest health staff –expanded in 2024 and early 2025 – met this challenge and others with its own resilience.

The forest health response team now is comprised of six staff – three forest health foresters, one outreach forester and two invasive species wildlife biologists, stationed around the state from Marquette to Cadillac to Brighton. The addition of the response team has allowed the division to detect and address devastating forest health concerns earlier, mitigating future impacts to individual trees, stands and surrounding areas.

During 2025, the team surveyed for and addressed pest and disease issues including Heterobasidion root disease, oak wilt, hemlock woolly adelgid (HWA), balsam woolly adelgid (BWA) and more. The team also addressed invasive plants on Michigan's Watchlist, including stiltgrass, purple jewelweed, mile-a-minute weed, kudzu, lesser celandine, cinnamon vine, calligraphy sedge and chaff flower.

Progress includes:

- Surveyed 360 acres and treated 170 acres for HWA.
- Assisted with aerial survey where more than 18.2 million acres were surveyed and over 100,000 acres of damage was mapped.
- Treated 23 oak wilt sites.
- Surveyed a total of 2,094 acres for high priority species.
- Surveyed nearly 3,000 acres for invasive plants on the Watch list; detected cinnamon vine at Three Rivers State Game Area, lesser celandine at Grand River State Game Area, and stiltgrass in several southern Michigan locations. Treatment occurred at all sites with follow up needed at all sites in 2026.

DNR's forest health program continues to coordinate and collaborate with partners on issues plaguing forests and trees across jurisdictional boundaries. Efforts by program staff play critical roles supporting local, state, federal and international partners to diminish unwanted impacts and keep forests healthy.

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Key forest health highlights

Storm left 1-2" of ice on trees.

The ice storm that hit Michigan's northern Lower Peninsula March 28-31 was a once-a-century event, coating trees and branches with up to an inch of ice.

The beauty of the sparkling ice was breathtaking at first. So was the aftermath as trees bent and broke under its weight.

Entire red pine plantations stood like jagged toothpicks, their crowns lying below on the ground. Aspens jutted ragged branches to the sky. Forest roads and trails were impassible as whole trees lay across them and littered the forest floor.

The 2025 ice storm impacted approximately 3 million acres- including just under one million acres of state-managed land. Gov. Gretchen Whitmer declared a state of emergency in a 12-county area which included 3,400 miles of state forest roads, 19 state parks, 54 state forest campgrounds, 169 boating access sites and 3,290 miles of motorized and non-motorized trails.

Young aspen severely damaged in Atlanta, Mich.

Timber assessment in affected forests started almost immediately. The ice had a substantial impact on red pine, oak, aspen and hardwood trees. Initial ground-based assessment was largely impractical due to blocked roads, downed powerlines and inaccessible properties. Instead, the DNR's forest health program was able to use remote sensing and aerial survey to help identify stands hardest hit, helping staff better understand the situation and prioritize stands to get to first.

Red pine severely damaged from ice storm.

To provide guidance, a team of forest health, reforestation, silviculture, forest management and wildlife specialists convened early on to gather information from research and experience with similar ice storm events in eastern North America. For example, an abundance of fresh damaged red pine trees, logs, limbs and branches in early spring poses a serious risk for the buildup of native bark beetle populations that could expand to intact trees nearby. Bark beetles can produce three or more generations in a single year leading to a population explosion following disasters, making removal of damaged trees a priority. Over the next few years, additional bark beetle-induced mortality is possible in undamaged red pine. Health concerns also include the spread of diseases such as oak wilt and Heterobasidion root disease. Disturbed soil and open tree canopies can create ideal conditions for fast-growing invasive species to spread.

As access to the forest opened up, foresters began the challenging task of assessing and prioritizing stands for salvage efforts. Initial efforts focused heavily on pine stands and salvage started in late summer. Hardwood stands were assessed later. Salvage operations were delayed in hardwood stands to prevent damage to the bark of undamaged trees from logging equipment. Delaying entry into stands with oak trees also protects oak health. There is a high risk of oak wilt spread when beetles carry spores to fresh wounds between April 15-July 15. Wounds created during the ice storm itself are less of a concern than new wounds created after the storm and prior to July 15.

In the most severely affected areas, the ice storm caused a "stand replacement event" where most existing trees succumb to injury and die. Natural regeneration may result in a new stand of young trees. In areas of more moderate impact, some trees may be more susceptible to stressors such as disease and insects, resulting in tree death. Others likely will grow at a slower rate for the foreseeable future. Experience from historical ice storm events suggests some affected hardwoods may recover or decline more slowly, providing an opportunity to monitor stands and delay management activities. In the least hard-hit areas, trees may experience lower levels of injury that cause stress and increase forest health risk, but will likely be able to heal wounds, recover and continue to grow at a normal rate.

Hardwoods damaged in Pigeon River Country.

Regenerating the forests in the most severely impacted areas will now be the focus of forest management staff across the northern Lower Peninsula. Some forested stands will need a hand from the DNR, and additional funding has been granted by the Michigan Legislature to accelerate reforestation efforts. Some damaged areas facing forest health implications may become a new cover type. For example, some planted red pine stands may be left alone to naturally regenerate to mixed tree species after harvest. Stands decimated by oak wilt after the ice storm may be transitioned to planted red pine.

Moving forward, the level of planned harvest under normal conditions in the impacted area will need to be adjusted to account for the loss due to mortality and additional salvage harvest.

Protecting Michigan's Natural Resources: National-Level Strategy, Delivered Locally

Every new invasive species that takes hold in Michigan threatens not only our lakes, forests and farms, but also our economy, recreation, and way of life.

Staff hand pulling Purple jewelweed.

With our world-class freshwater resources and natural resource-based economies, our state faces a constant threat from new invasive species. Success is not just about managing the invaders already here; it is about preventing introductions in the first place or about stopping the next major threat before it takes hold.

If prevention fails, our strategy known as Early Detection and Response (EDR) aims to detect it early and act quickly before it becomes established, spreads widely, and is far more expensive or impossible to control. EDR is a core pillar of the Michigan Invasive Species Program, a cooperative effort between the Departments of Natural Resources (DNR), Environment, Great Lakes, and Energy (EGLE), and Agriculture & Rural Development (MDARD).

Behind every rapid response is a careful process of scanning the horizon: our proactive effort to look ahead for potential threats. Each year, the Michigan Invasive Species Program evaluates many plant, animal, and pathogen species that could pose risks to the state's environment, economy, or public health. When a species raises concern, staff dig deeper, researching whether Michigan has habitats that could be affected, whether our climate is suitable now or projected to be in the near future, and whether the species may already be present in limited areas of the state. Representatives from all three departments evaluate those findings to determine if the species meets the criteria for inclusion on the Watch List.

When a Watchlist species is reported, we do not guess. We act. The Michigan Invasive Species Program operates under a formal, codified "Invasive Species Response Plan." It provides a clear flowchart for our DNR, EGLE, and MDARD

teams. This model is a textbook implementation of the national framework and ensures a prudent, efficient, and accountable use of state resources. The process generally follows three key steps:

1. **Receive report**: All reports from the public or agency staff are immediately sent to a designated Technical Lead.
2. **Verify species**: This is a critical step. The Technical Lead facilitates a prompt verification to confirm the species' identity. This prevents the costly mobilization of resources for a false alarm.
3. **Conduct status assessment**: Once a species is verified, a formal Invasive Species Response Status Assessment is conducted. This determines the extent of the invasion and whether a state-level response is the appropriate and effective course of action.

This process ensures that when Michigan decides to act, the response is rapid, coordinated, and justified.

The Mile-a-minute weed taking over forested land.

In recent years, this proactive approach has allowed Michigan to stay ahead of national trends. For example, species such as beech leaf disease, spotted lanternfly, hydrilla, and red swamp crayfish were identified and added to Michigan's Watch List well before or immediately upon regional detections, enabling rapid, coordinated responses.

Every dollar invested in early detection and response saves in long-term management costs. By maintaining a science-based watch list, Michigan ensures that we're preventing crises before they happen. Michigan's approach not only protects our own lands and waters but contributes to national resilience against invasive species. When Michigan acts early, the entire Great Lakes region benefits.

Expanded urban forestry team tackles forest health in communities

Urban Community Forestry team in 2025.

The Michigan Department of Natural Resources Urban and Community Forestry Program (UCF) has been expanding its forest health efforts in communities from metro Detroit to the Upper Peninsula.

UCF staff assist communities, nonprofit organizations and tribes across the state with trees and related issues. The program supports local tree planning and tree inventories to ensure a healthy and diverse tree canopy. This helps prevent major loss of trees in communities hit with a new invasive pest. Staff provide outreach to partners about relevant invasive threats such as spotted lanternfly, beech leaf disease and Asian longhorned beetle. These efforts will lead to greater awareness of these species, reduce opportunities for introduction and spread, and improve preparedness in communities to respond to these invasive pests. The UCF partnership has greatly expanded these educational efforts in high population areas where introductions of new invasive species are likely.

After two years of collaboration and development, the UCF program is releasing the Michigan Community Tree Species Selection Guide to help communities and residents choose appropriate trees.

This guide will act as a menu of viable tree species in Michigan placing importance on Michigan and U.S. native trees, climate adaptability, and urban site tolerance while discouraging planting of invasive and potentially invasive species. The guide is not meant to be directive but to give partners and the public information about what considerations should be factored into making that decision.

The Unique, Odd, and Amazing Things in Nature

Our forest health staffers receive a lot of questions from the public, which usually start out with "What in the world is this?" Here are several interesting inquiries from this year.

Monkey Slug/Hag moth caterpillar: This is a unique looking caterpillar. Its two sets of front legs have adaptations that make their movements appear like they're gliding across surfaces rather than walking. This movement, coupled with their hairy, furry "legs," can give them a monkey-like appearance. Taking a photo is encouraged but hold off on touching them as those hairs have toxins which can irritate sensitive skin. For more information, visit Monkey Slug, Vol. 10, No. 13 | Mississippi State University Extension Service.

Lichens: This question came from a concerned Michigander that the presence of lichens was killing trees. However, seeing something on a plant doesn't always mean it causes decline or death. In this case, we love to see lichens growing on trees and other items in nature since they are an indicator of clean air. Lichens are another unique form of life, created by a fungus and either a green or blue-green algae (blue-green algae are technically bacteria, also known as cyanobacteria) growing together. Lichens absorb nutrients and water through the air and rain, and are negatively impacted by toxins, making them perfect indicators of air quality. For more information, visit About Lichens.

Witches' Broom: This isn't the kind of broom that witches fly on, but rather a disease that can cause plant tissue to take on a distinctive bristle shape. The disease can be from insect feeding, parasitic plants, fungi, phytoplasmas, mite infestations, genetic mutations, herbicide injury, or even environmental issues such as frost damage killing terminal buds of shoots, leading to abnormal tissue growth.

This bristle shape is a dense cluster of stunted shoots, branches, and foliage. These unusual growths were observed on serviceberry in portions of the Upper Peninsula in 2025. On serviceberry, infection begins when fungal spores develop and grow into weakened areas along the twigs and leaf axils affecting the buds, flowers, and foliage. Fruiting bodies develop on the underside of the leaves and appear black, mirroring the much more common black sooty mold fungus. However, unlike sooty mold, the leaf veins will remain bright green. There is no cure for serviceberry witches' broom and little you can do to prevent its introduction. You can prune affected branches or remove infected plants. Sanitize tools between cuts and discard infected material. For more information, please visit Which Witches' Broom Is It?

Invasive-Free Products – Soon Available in Michigan!

A new project is underway to create invasive-free certification programs for firewood and a variety of landscaping, gardening and construction materials: gravel, fill, mulch and compost. All these products are known vectors of invasive species that introduce pests and diseases into new areas.

Landscape Material & Firewood Survey Banner: ~80% want certified products.

In the wake of the emerald ash borer's sweep across the state, devastating Michigan's ash resource, the connection between moving firewood and spreading forest invaders is fairly well-recognized. More challenging is spreading the word about products like gravel, fill, mulch and compost, as some people are unaware of the potential for landscaping, gardening, and construction products to harbor and spread invasive species.

Boat launches and roads are often repaired with gravel sourced off-site, which may contain invasive plant material leading to some severe impacts. Additionally, the disjointed nature of both federal and state-managed land in Michigan puts more public land at risk from invasive species. These introductions have devastating impacts on native plants and wildlife.

To gauge existing knowledge and opinions, this project began with two social surveys, one for producers of firewood, gravel, fill, mulch and compost, and a second for consumers. The surveys span from May to September of 2025. The survey results were encouraging, with over 75% of respondents from both survey groups claiming knowledge and concern regarding invasive species.

A good number of the producers saw the potential for invasive species to be inadvertently spread by their products, with only 13% of surveyed producers being completely unconcerned with such a possibility. Regardless, producers expressed skepticism that consumers would be willing to pay higher prices that would be required if they participated in these programs.

However, the consumer survey responses indicated that producers are underestimating their customers' desire for and willingness to pay for certified

products in order to protect their favorite campgrounds, as well as their own property and surrounding areas, from invasive species. About 80% of consumers surveyed are likely to purchase certified invasive-free products if given the choice, and 89% of those respondents also reported a willingness to pay a premium of 5-10% more for certified invasive-free products.

Participation in the certification programs by producers of firewood, gravel, fill, mulch and compost will be entirely voluntary, making an important aspect of this project to garner input from producers as these programs are developed. Upcoming stakeholder meetings in 2026 will provide a forum for producers to ask questions and express concerns about the certification programs. A main goal of these meetings is to identify and address possible barriers to participation in the certification programs by producers.

Demand by consumers is likely the most important component leading to producer participation. Promotion of a preference by consumers for certified products will be taking place simultaneously with enrolling interested producers in the programs. The launch of the certification programs during the spring and summer of 2026 will coincide with marketing campaigns promoting consumer preference for certified products.

A kiln designed to kill invasive species in firewood.

For firewood messaging, billboards will be installed on highways leading to popular camping destinations, and posters will be hung at Michigan Department of Transportation welcome centers and distributed by partnering Cooperative Invasive Species Management Areas (CISMAs) and conservation districts. In addition, during the spring and summer months of 2026 and 2027, all of the products will be promoted through booths at camping, home and garden shows, and through social media campaigns.

The Michigan departments of Natural Resources and Agriculture and Rural Development have been working collaboratively on this project using Great Lakes Restoration Initiative funded provided through the Environmental Protection Agency.

Take advantage of forest health learning opportunities

Keeping informed on the many issues affecting forest health can be difficult, but technology has made access to learning much easier. Here's a list of resources for people who are interested in learning more about forest health issues that affect or have the potential to affect Michigan.

The NotMISpecies webinar series discusses the impact of invasive species, management techniques and current research and programs. To sign up for future webinars and find recordings of earlier presentations, go to EGLE - NotMISpecies Webinar Series (michigan.gov). Past recordings of particular forest health interest include:

- "**They'll need that hug: How climate change is increasing native and invasive threats to Michigan's trees**," offers info about invasive insects and diseases that affect Michigan's forests such as the hemlock woolly adelgid, beech bark disease and beech leaf disease. Ir explains how a changing climate is further stressing our trees.
- During the height of the most recent spongy moth outbreak, a NotMISpecies webinar titled New name, familiar pest: Preparing for Lymantria dispar formerly known as Gypsy moth - YouTube, covers the insect's history in the United States and Michigan and offers solutions when dealing with the distasteful impacts of an outbreak. Tips include how to help your stressed trees recover from defoliation and options to help reduce the nuisance around your home.
- **"Hold the invasives, please!" Certified Invasive-free Products are Coming to Michigan** webinar dives into Michigan's new voluntary, invasive-free certification program meant to provide consumers with clean options for gravel, fill, mulch, compost and firewood.

The DNR's Forest Health website will keep you up to date on insect and disease threats to Michigan's forests. It includes online interactive maps, the current annual Forest Health Highlights report and a wealth of other information. Get access to previous Forest Health Highlights by scrolling down to Michigan and choosing the year in the drop-down menu. At the bottom of the webpage, you can sign up to receive DNR forest health email alerts. They include reminders of when and when not to prune oak trees to help prevent the spread of oak wilt and how to protect your trees from other pests.

Surveys and observations

Forest health from a bird's eye view

Have you ever wondered how a program like the Michigan DNR's Forest Health Program can keep an eye on issues across a state where roughly half of its 37.5 million acres are forested in addition to fragmented forested areas and trees in urban settings?

Aerial view of Michigan forests.

The answer may surprise you. It is true that on-the-ground efforts play a critical role in detecting and verifying new and ongoing issues. These reports from professionals and outdoor enthusiasts can lead to real impacts mitigating damage caused by forest health concerns across the state. But it is difficult to keep an eye on roughly 20 million acres of forest.

To increase efficiencies, the Forest Health Program takes a look at tree health from a broader perspective. Aerial surveillance and remote sensing can pick up changes during the growing season that can help target areas to survey. This last year, over 18.2 million acres were flown with a fixed-winged aircraft occupied by a pilot and two forest health surveyors. This equates to roughly 70 hours of flight time to cover a vast majority of Michigan's forests.

While in the air, surveyors note visible damage to tree canopies that can be a result of insect feeding, disease, tree decline or other non-biological factors such as the ice storm damage that the northeastern Lower Peninsula experienced this year. Over 100,000 acres of damage were mapped during the 2025 aerial survey, most of which was from defoliators.

Defoliators are not always visible every year and it is important to know their outbreak cycles and where defoliation occurs, as it may cause stress to trees that are fed on in consecutive years. Native insects and those naturalized into Michigan forests have outbreak cycles where they will build in

numbers, resulting in heavy defoliation for a few years before predators, parasitoids and/or other factors cause a collapse to endemic levels or levels that are not noticeable.

Aerial view of spongy moth defoliation.

Recently, Michigan just had the largest documented outbreak by spongy moth that peaked in 2021 and defoliated more than 1.35 million acres of forest. By 2025, less than a thousand acres were observed defoliated after the population collapsed naturally. Spongy moth outbreaks typically occur every seven to 10 years. Another pest that periodically outbreaks in Michigan is the native forest tent caterpillar. Its last major outbreak was in 2018, with 266,206 acres mapped but surveyors have seen some localized defoliation in the Upper Peninsula since then. This pest typically outbreaks every 10 to 16 years. These pests often do not overstrain healthy forests as they are controlled naturally.

Larch casebearer damage turning canopies reddish brown and/or yellow.

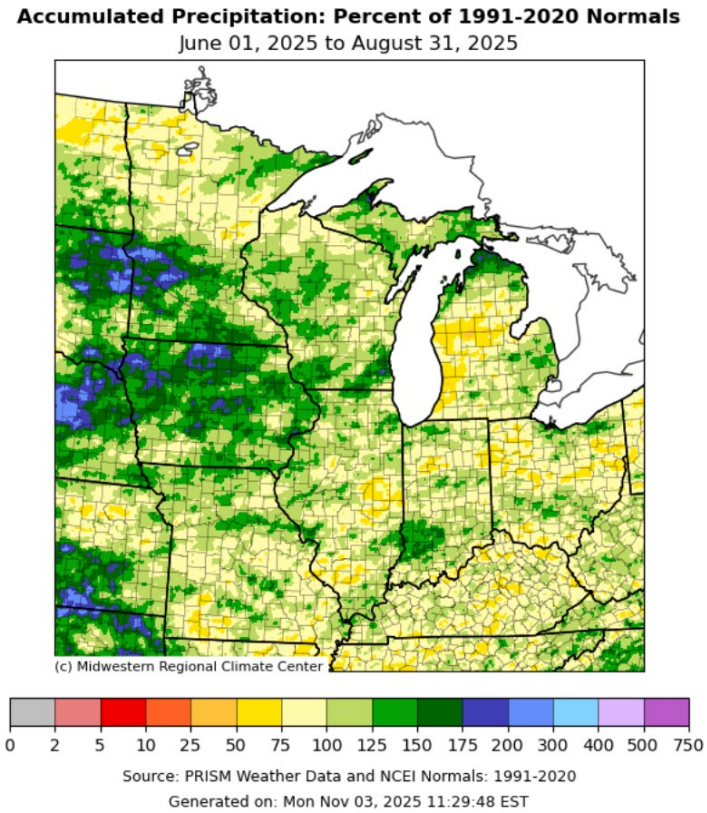
However, they can act as a catalyst to already stressed trees that may lead to decline or even mortality. Surveys such as these help keep an eye on Michigan's vast forest resources and are critical to monitor forest health concerns across the state. They also pick up on new issues early to give land stewards the best chance to mitigate impacts in their forests.

Divergent weather patterns created tree stress challenges in 2025

Michigan's climate extremes and resulting weather have always driven tree and forest health issues. However, we anticipate more frequent impacts from droughts, wildfires, floods, pest outbreaks, and other events in the future.

In 2025, rainfall was remarkably erratic during the growing season. In extreme cases, adjacent counties were vastly different where one county may have been abnormally wet next door to a county that was abnormally dry. A swath of very dry conditions occurred from the southwest Lower Peninsula across the state to just above the Thumb (*Fig. 1*). In this area, drought-related tree stress was reported. By early August some areas of southwest Michigan were reporting premature leaf drop or early fall color change.

Some counties at the tip of the Lower Peninsula and the Upper Peninsula had unusually wet conditions, which can favor the development of fungal diseases. The City of Petoskey had its wettest summer on record, according to the Great Lakes Region Quarterly Climate Impacts and Outlook.



Midwest states' accumulated precipitation.

Over the long-term, moisture fluctuations in the soil can be a major tree stressor, with both dry and excessively wet conditions damaging root systems. Trees then have to use energy reserves to regenerate roots. This becomes a factor in tree decline syndromes, where weakened trees become vulnerable to attack by insects and diseases, leading to dieback and mortality.

The DNR is identifying stands at greatest risk of decline and working to minimize impacts by increasing stand vigor through management activities, promoting adaptable native species and species diversity.

Noteworthy 2025 pest activity

Name	Hosts	Status	Impact	Signs	Symptoms	Management
Armillaria root rot	Deciduous and evergreen trees/shrubs	Common statewide	Mortality of stressed trees	Mycelial fan, rhizomorphs under bark	Decline, death	Reduce tree stress
Beech bark disease	Beech	Common east, central UP, northern LP	Decline and mortality	White scale on trunk	Oozing tarry spots; rough, cankered bark; thin, ragged crowns	Remove heavily infested/dying trees
Diplodia shoot blight	Red, jack and ornamental pines	Common statewide	Seedling/sapling mortality, defects	Microscopic fungal structures, shoots, cones	Stunted straw-colored needles on shoots, sticky resin, dead branches and seedlings	Avoid susceptible pine overstory, reduce tree stress
Dwarf mistletoe	Primarily black spruce	Range of black spruce	Mortality	Yellow/orange aerial mistletoe shoots	Witches brooms, decline	Eliminate infected trees
Eastern larch beetle	Tamarack	Limited activity	Mortality	Small holes, reddish boring dust, tunnels under bark	Resinous sap ooze, tree death	Sanitation, stand health
Elongate hemlock scale	Hemlock, fir	Limited to areas near planted hemlock	Tree stress	White needle underside due to scale insects	Reduced needle growth	Insecticides for high-value trees
Emerald ash borer	Ash species	Detected statewide	Mortality	1/8 inch D-shaped holes, S-shaped tunnels under bark, cream-colored larvae with bell-shaped segments	Decline, mortality	Canopy thinning and dieback, trunk sprouts
Larch casebearer	Tamarack	Limited activity	Tamarack decline	Camouflaged cases protecting larvae	Bleached/straw-colored needles	Promote tree health
Redheaded pine sawfly	Primarily jack and red pine	Low activity	Threat to pine seedlings	Groups of larvae on branch tips	Defoliation, mortality	Minimize plantation edges and competition
White pine weevil	Pine, spruce	Common statewide	Poor tree form	Feeding punctures, oviposition punctures in leaders	Crooked, wilted leaders oozing resin, leader mortality	Pruning, dense plantings

Disclaimer: We receive frequent reports of these pests not covered in other articles. This is not a comprehensive list of the pests in Michigan's forests.

Insects

Spotted Lanternfly

Adult spotted lanternfly on tree of heaven branch.

Since the first detection in Pennsylvania in 2014, spotted lanternfly has spread to 19 states throughout the eastern and central United States. Although adults are not strong flyers, the insect is a notorious hitchhiker, with new detections occurring along railways, on shipped nursery stock and on private and commercially transported materials.

In areas where spotted lanternfly has been introduced, large numbers of feeding adults can be seen excreting sugary honeydew onto surfaces below, which leads to the growth of sooty mold. Sooty mold is mainly a nuisance for homeowners, attracting flies and wasps and coating surfaces below where lanternflies feed. But Michigan's grape growers are on high alert, as other states have reported damage to their vines.

Spotted lanternfly was first detected in Michigan in August 2022 in Pontiac, introduced through nursery stock from the eastern United States. This site remained the only known infestation until 2024, when detections were made in Monroe, Wayne, Macomb, and Lenawee counties.

New County Detection

Public reports of spotted lanternfly are submitted to the state via the Eyes in the Field application, which collects observations and provides a method to investigate and respond. In 2025, MDARD received almost 700 reports of the insect, over half of which included an image captured at the report location.

In September 2025, an Eyes in the Field report with a photo of an adult lanternfly was received from downtown Jackson, which led to the discovery of an infestation. Additional verified reports were received throughout the year in other counties, but subsequent survey efforts did not detect additional populations. This highlights the hitchhiker quality of spotted lanternfly. Finding a single adult or nymph may not indicate an infestation nearby. Perhaps the individual hitched a ride on a car, trailer, train, bus, or even a boat. In Jackson however, adult insects were found on trees of heaven throughout the area indicating a more widespread population.

A spotted lanternfly sitting on a pumpkin.

In early October 2025, adult lanternflies were detected on a commercial ship located at a port in Alpena. The vessel had travelled from Detroit and Toledo, both areas with known infestations. A search of the area surrounding the port in Alpena did not detect additional individuals on land. In an effort to prevent spread of spotted lanternfly via this mode of transportation, MDARD collaborated with US Customs and Border Protection to send a notice to vessel agents throughout the Great Lakes region informing them about the spotted lanternfly. Additionally, MDARD Plant Health inspectors conducted a survey of the areas surrounding active ports in Muskegon, Ludington, Manistee, Escanaba, Alpena, Saginaw, and St. Clair. No insects were detected during this port survey.

What's next?

Outreach efforts including press releases, news segments, social media campaigns, webinars, and articles have been ongoing to educate the public and assist in early detection of new populations across the state. With each outreach effort, an increase in Eyes in the Field submissions is noted. This highlights the importance of spreading the word.

In November 2025, MDARD began accepting public comments regarding a proposed interior quarantine for spotted lanternfly. The quarantine proposes to regulate the movement of nursery stock to reduce the risk of spreading spotted lanternfly. Movement of nursery stock from locations within known infested counties is allowed with written approval from MDARD, provided that all stipulations of the compliance agreement are met. The stipulations include having trained personnel inspect all stock prior to shipment, suggests monitoring and pesticide treatment if lanternfly life stages are observed, and requires recordkeeping for all shipping documents. The public comment period closed on December 5, 2025 and a decision about signing the quarantine is expected in 2026.

Fall Webworms: Have you seen us?

You may notice fall webworm by the "bags" it makes on branches.

Have you ever wondered what those white-looking bags are that pop up every fall on the end of branches?

In many cases, if they are on trees like cottonwood, walnut or cherry, they may be webbing created by fall webworm. These native caterpillars will consume the encased foliage in late summer into fall but rarely cause long-term effects to the tree. They are kept in check naturally by many parasites and predators.

You can identify fall webworms by the white webbing covering branches.

Healthy deciduous trees recover with no additional aid. However, concerned individuals can prune out webs and safely burn them to help reduce populations in the area. Or you can simply tear open the webs and drop caterpillars into a bucket of soapy water for 48 hours before disposing of them.

Tiny bug, huge threat: Michigan's fight to save hemlocks

How can something smaller than a grain of rice kill a towering forest tree? Meet the hemlock woolly adelgid (HWA). It's a tiny, invasive insect with a big appetite for destruction. By sucking sap from hemlock trees, this pest can quietly kill even the healthiest trees. The adelgid is easy to spot because it creates little, cottony white ovisacs at the base of the tree's needles.

Hemlock woolly adelgid infesting trees.

Michigan is home to about 176 million hemlock trees and losing them would mean far more than having fewer trees in the woods. Hemlocks stabilize sand dunes, provide shelter and food for wildlife, and shade cold water streams that trout and other fish depend on. When hemlocks disappear, entire ecosystems feel the impact.

Identify HWA by the small white dots at the base of the needles.

A spreading problem

First found in Virginia in 1951, HWA has wiped out millions of hemlocks across the eastern U.S. It reached Michigan in 2006 and is currently confirmed in 11 counties, mostly along the Lake Michigan shoreline. Surveys in 2025 found HWA populations in Manistee and Van Buren counties. Infestations now affect federal forests and several state parks, threatening unique ecosystems, migratory bird habitat, and critical dune systems. The pest spreads easily by wind, birds, animals, and even people.

Efforts to slow the spread of the adelgid in Michigan have been under way for many years. In 2001, an exterior quarantine was established to prevent infested plants from entering the state. Current populations in Michigan were likely initially introduced through infested nursery stock planted before the quarantine or in violation of the quarantine. An internal quarantine was implemented in 2017. Since then, new measures have been put in place as HWA is detected in new areas, including further restrictions on the movement of hemlock trees in 2020 and 2023.

Holding the Line

The Michigan Hemlock Woolly Adelgid Coordinating Committee's statewide strategy focuses on prevention, early detection, research and outreach. This strategy was written in 2017, updated in 2021, and again in 2025.

HWA has wiped out millions of hemlocks across the eastern U.S.

The coordinating committee is composed of representatives from state and federal agencies as well as institutions involved with regulation, land management, or research to address Michigan's unique situation. In 2025, several Michigan representatives attended the 11th annual Hemlock Woolly Adelgid Program Managers' Meeting held virtually and hosted by the Ohio Department of Agriculture. This meeting brings together researchers and land managers from Canada and the eastern United States to facilitate networking and information exchange.

The recent update of the statewide strategy now includes guidance for long-term management of HWA using multiple integrated pest management tools. It continues to emphasize the importance of slowing the spread

into uninfested regions of the state. Quarantines, tighter movement restrictions on hemlock trees and a statewide response plan guide the effort. Teams from state, federal, local, and university partners continue to work together to detect new outbreaks and respond quickly.

Hemlock woolly adelgid collaborators

- **Federal:** U.S. Department of Agriculture Forest Service Forest Health Protection, Animal and Plant Health Inspection Service, Huron-Manistee National Forest and Northern Research Station, and the Pictured Rocks and Sleeping Bear Dunes National Lakeshores.
- **State:** Michigan departments of Agriculture and Rural Development; Environment, Great Lakes, and Energy; and Natural Resources.
- **Local Cooperative Invasive Species Management Areas and affiliated organizations:** Many partners work together in a coordinated effort to address HWA. Those most involved in 2025 include CAKE (Charlevoix, Antrim, Kalkaska and Emmet counties) Lake to Lake, North Country, Three Shores and West Michigan CISMAs, Northwest Michigan Invasive Species Network, and Wild Rivers Invasive Species Coalition. Tribes also play a critical role participating and advising in HWA management often in direct collaboration with their local CISMA.
- **University partners:** Grand Valley State University, Michigan State University, Michigan Technological University, and University of Michigan.

Fighting Back

Michigan puts on an extensive HWA awareness campaign. Since it started in 2018, the campaign has reached an estimated 4.7 million people. In 2025, all partners reported 1,432,096 impressions with 268,429 coming from the DNR Forest Resource Division. This campaign has led to early detections of HWA in new areas, allowing staff to rapidly respond.

In addition to reports coming in, partners gain valuable tips from professionals and staff on the ground. Partners collectively traverse thousands of acres every year in high-value hemlock stands and in areas surrounding known infestations. Knowing where the pest is and isn't helps to develop successful management plans.

The most lethal weapon against HWA is targeted insecticide treatment. In 2025 alone, 4,630 acres and 80,806 trees (638,085 total diameter-at-breast-height in inches) were treated across public and private lands. These

insecticide treatments are carefully planned using survey data to protect the most valuable hemlock.

The table below has a breakdown of treatments by year in Michigan and a total summary of all work completed since 2017 when treatments began.

Year	2017-2019	2020-2022	2023-2025	Total
Trees Treated	48,502	120,730	231,910	401,142
Tree Diameter Inches Treated	314,360	807,044	1,799,233	2,920,637
Acres Treated	2,445	6,874	11,170	20,488

What's next?

More than $10 million has already gone into managing HWA — and the work isn't done. The good news: Less than 1% of Michigan's hemlocks are currently known to be infested, and many forests remain far from known outbreaks. Recent studies also suggest that cold temperatures could play a role in the adelgid's spread and establishment. However, a changing climate and warmer winters may enhance HWA survival in colder areas of the state.

Looking ahead, Michigan is shifting toward long-term solutions where eradication is not an option, combining chemical treatments with biological controls, forest management, and research into tree resistance. Funding from the Michigan Invasive Species Grant Program, Great Lakes Restoration Initiative, U.S Environmental Protection Agency, Recreation Passport (state park user fees), fundraising efforts supported by Bob Ross International and other internal state funds continue to support these response efforts.

Thanks to the hard work of state agencies, local organizations, researchers, and volunteers, Michigan is doing its best to protect these important trees for years to come.

How You Can Help

Report suspected hemlock woolly adelgid infestations through the Midwest Invasive Species Information Network, available online at MISIN.MSU.edu. If an infestation is confirmed, landowners can take action to treat trees. It is important to know which insecticides and application methods work best.

Balsam Woolly Adelgid

Balsam woolly adelgid (BWA) remains one of Michigan's forest health priorities due to the significant ecological and economic risks it poses to true fir species.

Surveying for BWA in Missaukee County.

Since the first detection in 2021 in Kent County (treated), state and federal partners have continued to track, contain, and plan for remediation of this invasive pest. Several major developments occurred in 2025, including expanded delimitation surveys, new quarantine actions, and preparation for remediation of infested fir in Missaukee County.

There are currently three known BWA infestations in Michigan, all discovered in 2023. These are in Clare, Oceana, and Missaukee counties, and each has unique circumstances. In Clare County, BWA was found in an isolated pocket of fir on a small rise within a wetland, and an extensive delimitation survey revealed no additional signs of infestation. This site is on state land and will be managed by the Michigan Department of Natural Resources. BWA was detected on a Christmas tree farm in Oceana County. Because the county lies south of Michigan's native fir range, remediation is limited to removal of infested and adjacent Christmas tree stock. MDARD conducts annual inspections of the farm and flags infested trees. The Missaukee County infestation spans a 2.6- by 1.1-mile area that includes 21 privately owned forested parcels and one state-managed parcel. The majority of the Michigan Department

Winter survey for BWA in Missaukee County.

of Agriculture and Rural Development's remediation work is focused on this infestation.

In the early winter of 2025, MDARD used grant funds provided by the USDA Forest Service to lead a multi-agency delimitation survey in Missaukee County that expanded upon survey conducted in previous years. MDARD and partner organizations surveyed approximately 1,400 acres. During the two weeks of survey, 49 new BWA infestation points were detected, resulting in a total of 150 acres of infested fir across a 2.9 square mile area. Efforts to find additional infestation beyond the known edge of the infestation found no evidence of further spread.

Using grant funds provided by the Environmental Protection Agency's Great Lakes Restoration Initiative, MDARD is working with the Mason Lake Conservation District to remediate infested fir trees and uninfested fir trees within 200 feet in Missaukee County. The remediation program allows landowners to voluntarily register to have fir within the remediation area felled or treated with herbicide. At present, over 75 percent of private landowners have agreed to remediation efforts and MDARD continues to reach out to impacted landowners.

BWA in Missaukee County in 2025.

In September 2024, MDARD implemented an interior quarantine in portions of Missaukee County following confirmation of a local infestation. The quarantine restricts the movement of true fir nursery stock, logs, firewood, boughs, and other regulated materials outside the quarantine area unless moved under a compliance agreement. This regulatory action was designed to prevent the spread of the pest while surveys and treatment approaches could be refined.

In May 2025, MDARD revised the state's exterior BWA quarantine to strengthen oversight of out-of-state shipments of fir material into Michigan. Although the revision did

not add new restricted areas, it clarified responsibilities for shippers, improved traceability procedures, and reinforced measures intended to prevent new introductions of the pest.

Michigan's multi-year response demonstrates the importance of early detection, strong interagency collaboration, and public engagement in protecting forest resources. Continued monitoring, outreach, and remediation efforts will remain critical priorities as the state works to protect native fir, mitigate economic impacts, and prevent the broader establishment of BWA within Michigan's forested landscapes.

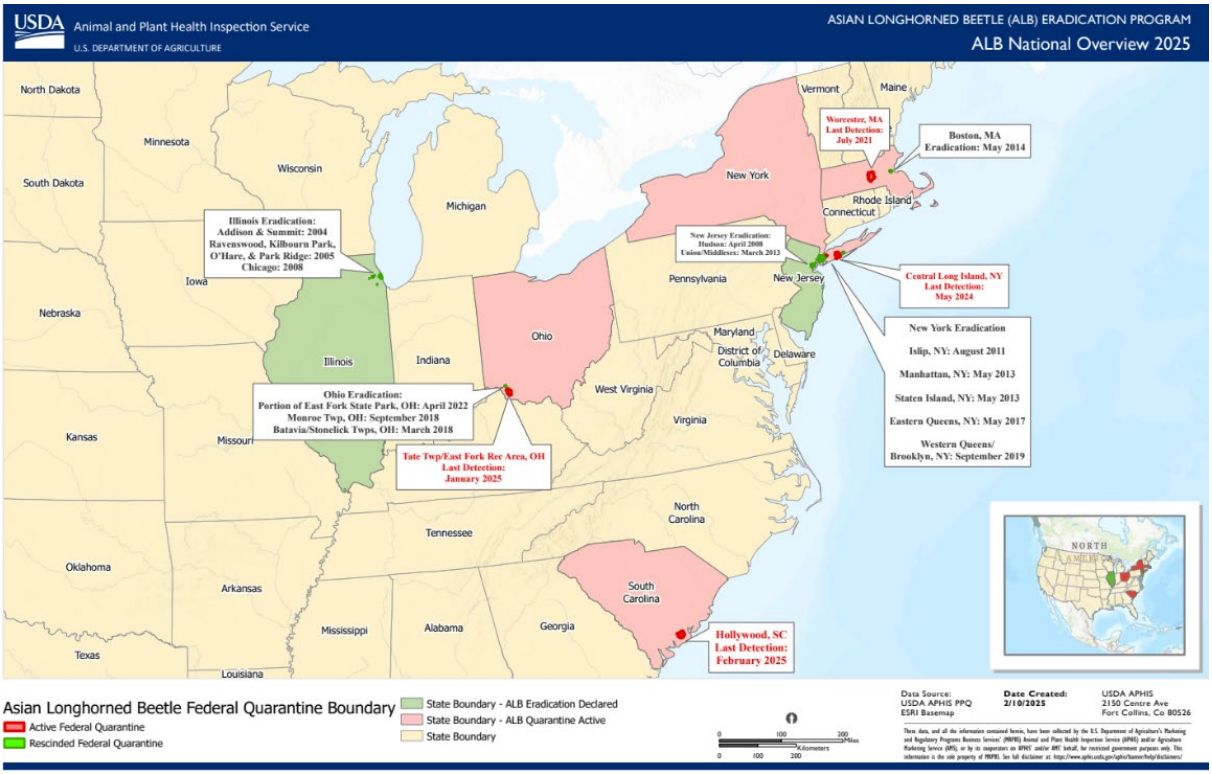
Asian Long-horned Beetle: Michigan's Most Undesired

Keep an eye out for high priority invasive species on Michigan's Watchlist. Invasive species continue to plague Michigan with exotic species being introduced into the US every year, but if these introductions are detected early, often impacts can be mitigated.

One of those high priority species is the Asian long-horned beetle or ALB. It would severely impact Michigan's economy and forest habitats across the state. ALB can feed on more than 200 woody species, but the biggest concern is Michigan's maple trees, which beetles prefer to feed on.

Adult Asian longhorned beetle. Photo courtesy of USDA Forest Service

Although this beetle hasn't been detected in Michigan, infestations have occurred in neighboring states and provinces including Illinois, Ohio and Ontario, Canada. Since 1996, infestations have occurred in six states and Ontario. Several infestations have been eradicated through extensive surveys and host tree removal. These are expensive, resource-intensive efforts that require many years to complete. In most cases, infestations have been present eight or more years before getting reported. To help prevent ALB from reaching Michigan, don't move untreated firewood long distances. Firewood and wood packing materials are common ways to inadvertently move ALB and other invasive species.



USDA's Animal and Plant Health Inspection Service map of Asian Longhorned Beetle Federal Quarantine Boundary from the ALB National Over.

Adult beetles are easier to recognize than many other invasives, with shiny black bodies displaying irregular white spots and long, black-and-white striped antennae that can be longer than the beetle. Beetles are often 1.5 inches long, and their legs and feet often have a bluish cast to them.

Adults are rarely noticed in new infestations. Instead, damage to trees is often observed first. In fall -- after leaf drop but before snow -- is the best opportunity to detect an ALB infestation. Look for signs along branches, tree trunks and the base of maple trees. Signs include pencil-width round exit holes, dime-sized depressions in the bark that beetles chew away to lay eggs, bark cracking, and piles of small wood shavings called frass where beetles exit the tree. Feeding can cause structural damage, weakening branches making them subject to breakage. Unusual breakage of seemingly healthy maple branches should be investigated.

If you think you may have found an Asian long-horned beetle, collect it if possible, take a picture and report it immediately by phone to 1-800-292-3939 or by email to MDA-Info@michigan.gov. Store the beetle(s) in the freezer in a container or zip-lock bag until experts can take a look. It is essential to report right away if you suspect the presence of ALB to give us the best chance of eradication.

Budworms: Destructive native pests if left unchecked

Signs of jack pine budworm infestation.

Michigan is no stranger to defoliation by native spruce and jack pine budworms. Cycles of jack pine, balsam fir and white spruce defoliation have always occurred. Decades of budworm management have helped land stewards better understand these pests and how to best address them.

Jack pine budworm (*Choristoneura pinus*), as the name implies, prefers jack pine. Caterpillars feed on pollen cones and chew needles off at the base. It is a messy eater, leaving webbing and partially consumed needles behind. Affected trees turn a rust color that can be easily observed during an active outbreak. Jack pine budworm is always present but remains endemic (at low levels) for six to 12 years until conditions are right for populations to build to outbreak levels. Outbreaks typically last two to four years. After a few years of severe defoliation, many factors help bring the population under control. Some of these factors include predatory insects, birds, parasites, and diseases.

The most recent outbreak began in 2022, peaking with 81,000 acres of defoliation recorded during 2024 aerial surveys. In 2025, 25,806 acres of defoliation were mapped. The most extensive defoliation was in the northern Lower Peninsula; however localized defoliation also occurred in the Upper Peninsula. We anticipate the current outbreak to continue to collapse in 2026.

Younger jack pine under 40 to 45 years of age typically bounces back after an outbreak. However, older stands can see significant damage and mortality after a few years of consecutive defoliation. Management recommendations are to harvest jack pine before vigor is lost or when they reach 50 years of age.

Spruce budworm (*Choristoneura fumiferana*) prefers balsam fir and white spruce. Mature and over-mature stands dominated by balsam fir are most vulnerable. Caterpillars can cause significant damage by feeding on new growth and buds. Spruce budworm is also a messy eater, with webbing and partially consumed needles leaving a rusty appearance easily observed during an active outbreak. Spruce budworm outbreaks last longer than jack pine budworm outbreaks, usually 10 to 15 years, but occur less frequently, with 30 to 40 years between outbreaks. Feeding often leads to top kill or tree mortality after several years of heavy defoliation.

Spruce budworm pupae detected in Pigeon River Country in 2025.

Spruce budworm moth and damage from budworm larva feeding.

In 2025, roughly 10,000 acres of spruce budworm defoliation were mapped, with a majority of the damage occurring in the Upper Peninsula. Acres of defoliation have been fairly consistent the past few years as the most recent outbreak subsides. Management recommendations are to harvest spruce and fir stands when they reach 50 years of age and salvage stands with significant damage. Both budworm species pose a significant wildfire risk when stands are left unmanaged, resulting in heavy mortality across impacted landscapes.

Mountain Pine Beetle: A potential threat from the west

In western states, mountain pine beetle (*Dendroctonus ponderosae*) is a native species, but it can be an aggressive and devastating pest of pine trees outside its native range.

Recent range expansion has resulted in the death of an estimated 125 million conifer trees as the beetle moves north and eastward. Expansion has been attributed in part to warmer winters which allow the insect to survive farther north. Currently, Michigan is not known to have mountain pine beetle and known infestations are still more than 1,000 miles away in western states and provinces. However, introduction could happen via infested pine materials crossing state lines or through existing natural pathways because beetles have expanded into forested areas of western Canada, potentially reaching the eastern United States and Canada by going around the Great Plains. To date, cold winters have kept this pest from spreading farther east, but this may not be enough to keep populations at bay indefinitely.

Mountain pine beetle was added to Michigan's Watchlist to help spread awareness and deter introductions. If this pest were to become established in Michigan, severe losses could impact multiple industries including tourism, nursery stock and timber products. Sawtimber alone for Michigan's native pines is estimated at more than $3 billion. Beetle infestations could also affect wildlife habitat and unique ecosystems. Most notable would be the recovery of the Kirtland's Warbler, a Michigan-based songbird recently removed from the federal endangered species list.

Pine pitching due to mountain pine beetle infestation. Photo by Whitney Cranshaw, Bugwood.org

Mountain pine beetles lay their eggs under the bark. The adults introduce a blue stain fungus into the wood that will help disrupt the tree's defenses and provide a critical food source for larvae to feed on when they hatch. The joint feeding from the larvae and fungus will cause the tree to die within a few weeks of attack.

Fluctuations in climate and tree stress can cause insect populations to increase quickly, ultimately becoming more problematic across landscapes.

To help prevent unwanted introductions into Michigan, the Michigan Department of Agriculture and Rural Development (MDARD) enacted an exterior quarantine in September 2020 (Mountain Pine Beetle Exterior Quarantine - Sept 10, 2020). Similar quarantines have been implemented by states such as Minnesota and Wisconsin, which are closer to known infestations. The quarantine regulates movement of all firewood and any pine products with attached bark from infested areas in the western U.S. and Canada. These pathways are known to spread the beetle to new locations nearby or over long distances.

In Michigan, a number of native bark beetles can cause similar signs and symptoms in pine. However, native bark beetles typically attack stressed or dying trees. If you suspect mountain pine beetle, remove the outer bark to expose the inner wood. The blue stain fungus would be visible along with galleries left by the larvae. If no blue stain is visible, it is most likely something else affecting your pine trees. However, the presence of blue stain does not necessarily mean mountain pine beetle is the culprit.

If you suspect mountain pine beetle, take photos and report it immediately by phone to 1-800-292-3939 or by email to MDA-Info@michigan.gov. Early detection and confirmation are key to successfully managing this pest.

Diseases

White pine needle diseases: An increasing concern in a changing climate

Reports of white pine needles turning yellow in late June or early July have been common over the past few years. These reports predominantly have come from the northern Lower Peninsula and southeast Michigan. This year reports from southeast Michigan included extensive needle loss. The Plant and Pest Diagnostics lab at Michigan State University diagnosed a sample as brown spot needle blight, a fungal disease caused by *Lecanosticta acicola*. In other areas of Michigan, white pine needle diseases caused by *Lophophacidium dooksii* and *Septorioides strobi* have been confirmed over the past few years.

These needle diseases have been implicated in widespread premature needle drop, causing white pine health issues in the northeastern United States over

the past 15 years. Typically, these diseases affect older needles; new growth is not impacted. However, the needle loss thins the crown. Repeated defoliation leaves affected trees increasingly stressed and vulnerable to other problems.

These diseases are favored by wet spring weather followed by dry weather later in the growing season. Increasingly erratic weather with heavy spring precipitation as well as higher humidity levels and nighttime temperatures have been associated with disease development. Because infection may occur the year prior to symptom development, severe symptoms might not be observed until a year after conditions conducive to infection have occurred.

Needle drop in late June in southeast Michigan caused by brown spot needle blight. Photo by Julie Stachecki

White pine needle diseases are often confused with other white pine issues. Trees where all the needles are affected may be impacted by root diseases or other issues. Cankers (stem infections) and insect issues may kill individual branches, whereas needle diseases impact older needles only and are often worse in the lower canopy. Individual needle symptoms often include dark bands and spots on needles. Fungal fruiting bodies are visible with a hand lens and look like dark bumps. Loss of the oldest needles is a normal process in the fall, when 2- to 3-year-old needles will change color and drop on healthy white pine.

Good stand management, including thinning to reduce tree density, can reduce disease severity and improve tree vigor. Similarly, good tree care practices, including watering during drought, can reduce the impact to yard trees.

Oak Decline: When Oak Stressors Converge

The term "oak decline" is intentionally vague. It refers to the convergence of multiple stressors that result in declining oak health. A few common stressors include tree age, tree density, drought, late frosts, low site quality (poor soil), and insect defoliation.

Northern pin oak exhibiting symptoms of oak decline in Crawford County, Sept. 2025.

In Michigan, we have many oak stands that have experienced some, if not all of these stressors. For example, many of our oak-dominated stands originated after extensive logging of the historic mixed oak-pine stands in the late 1800s and early 1900s. On sites with poor soils, these trees are now experiencing decreased vigor due to age, climate and site-related factors. Additionally, since the 1980s, Michigan's oaks have been subjected to varying intensities of defoliation by spongy moth. Consecutive years of defoliation is stressful and can also contribute to decreased tree vigor.

The most recent defoliation event peaked four years ago, when 1.3 million acres were defoliated. In 2025 our aerial survey recorded spongy moth defoliation on only 355 acres of the 18.2 million acres surveyed. In combination, these stressors can make an oak tree vulnerable to attack by additional pests and pathogens. In fact, most oak trees suffering from oak decline are killed by two-lined chestnut borer, other insects, Armillaria root rot and/or diseases that affect weakened trees. Tree death often occurs a few years after tree stress events.

Oak decline is episodic, or occurs in waves. Over the past few years, it has been extensive in the northern Lower Peninsula similar to a trend in the 1970s

and "80s. Here are a couple tips to help distinguish it from other oak maladies:

- Oak decline usually takes several years to result in tree mortality. Over the course of that time, the tree may exhibit epicormic branching (small branches protruding from the trunk) and/or branch die-back beginning at the top of the crown. In most cases, the leaves on dying branches will turn brown and stay on the tree for the rest of the growing season. This contrasts with oak wilt, which will result in the wilting and shedding of the crown foliage in a single season.
- At a stand or landscape scale, oak decline usually results in scattered oak mortality. Oak wilt creates expanding pockets of dead trees.

Oak decline in Kalkaska County.

While the stressors contributing to oak decline are complex, the management response doesn't necessarily have to be. First, consider the severity of decline and future stand goals. In many situations, the goal may be to increase species diversity and vigor of the future stand while maintaining an oak component. On low quality sites with severe decline managers may consider harvesting all overstory oak. While thinning can increase the resources available to the remaining trees, managers should assess the risk of exacerbating the oak decline with harvesting stress.

Delaying harvest by a few years after major tree stress events may allow more vigorous trees to recover and respond positively to the harvest. Stands with less oak decline and higher site quality (better soils) will likely respond more positively to thinning. Consultation with local forestry professionals may help when making management decisions.

Stopping the Spread for 75 Years: Oak Wilt Remains a Forest Health Priority

Oak wilt impacted canopy.

Oak wilt kills thousands of oak trees each year, yet efforts to address the fungal disease can protect many more healthy oaks on the landscape.

The state began trial treatments to protect oak trees in 1951, after initial detections of the invasive disease. Seventy-five years later, oak wilt management is a success story due to collective efforts to protect our oak resource. Approximately 600 million oaks remain in Michigan forests. Consequently, oak wilt surveys, treatments, monitoring and awareness efforts remain priorities for the Michigan DNR forest health program.

Ongoing surveys on state-managed land include following up on reports from foresters, partners, as well as aerial survey activities and on-the-ground stand evaluations in high priority locations. Across the state, the recently added forest health forester and biologist positions have confirmed oak wilt infections that would otherwise have gone undetected.

For many years, oak wilt has been widespread in the Lower Peninsula and along the Upper Peninsula border with Wisconsin. Last year, we confirmed oak wilt in Marquette County for the first time. This year we had additional confirmations in Marquette County and the first confirmation of oak wilt in Delta County in many years. See the interactive online oak wilt map created by the DNR for confirmed and suspected locations across land ownerships. It is important to note that many oak wilt infections go undetected, and the map does not reflect the full extent of oak wilt in Michigan. Visit Michigan.gov/ForestHealth and click on "View and report oak wilt locations."

During the critical fall oak wilt treatment period, this is a primary focus for forest health program staff, with assistance from other internal and external partners. While oak wilt infections start when beetles bring oak wilt spores to

fresh tree wounds, the underground spread of the disease through root grafts, or connected root systems is responsible for up to 90% of the trees that die from oak wilt. Consequently, we sever oak root systems with a vibratory plow to stop tree-to-tree spread of oak wilt where the treatment will have the greatest impact in protecting oak stands. Decades of experience indicate this is extremely effective when done correctly. This year we treated 23 sites across the northern Lower Peninsula.

Trenching an oak wilt pocket in Pigeon River Country with a vibratory plow.

In some locations, buried boulders, steep terrain or other issues prevent vibratory plow treatments. Consequently, we are trialing the use of an herbicide treatment to kill oak root systems to prevent the tree-to-tree spread of the disease. This treatment involves girdling healthy trees surrounding the infected trees and spraying triclopyr herbicide into the girdle. While at least six years of monitoring are suggested to determine success, treatments monitored at three to five years appear promising.

Other states and programs have also been trialing herbicide treatments in oak wilt management with variable levels of success. Efforts continue to refine and monitor herbicide treatments with a goal of developing successful methods for widespread operational use. Six additional herbicide treatments were completed this year.

The forest health program also continues to raise statewide awareness of the disease through press releases, presentations and trainings for diverse audiences. Prevention is critical to protecting the oak resource. A core message is avoiding oak wounds during the April 15-July 15 high-risk infection period. At this time, sap beetles carrying oak wilt spores from the spore mats that develop under the bark of recently killed oak trees will visit fresh wounds and oak trees are quite vulnerable to infection. To eliminate a low risk of infection during the rest of growing season, winter is the ideal time to prune oak trees. To reduce the amount of oak wilt that goes undetected and ensure

effective management activities, trainings often focus on oak wilt detection and management. This year, four oak wilt trainings occurred across the state for internal DNR staff and partners with the Hiawatha and Ottawa National Forests.

2025 Oak wilt training for staff.

More information on oak wilt can be found on this DNR website and on this Michigan State University website.

Need help? A variety of programs address the threat of oak wilt and oak decline on private land.

- MDARD's Forestry Assistance Program has foresters associated with county conservation districts to help private landowners with oak wilt and oak decline outreach, confirmation and treatment. Click here to learn who to contact in your area.
- The DNR's Forest Health Program provides oak wilt advice. Contact the program by emailing DNR-FRD-Forest-Health@Michigan.gov.
- MSU Extension can provide valuable insight on oak wilt.
- Private arborists offer fee-based oak wilt assistance. Find a list of oak wilt qualified arborists.

HRD surveys continue; no new counties added this year

Young red pine dying from HRD.

Heterobasidion root disease (HRD) is a damaging fungal disease affecting Michigan pine forests, especially planted red, white, and jack pines. It threatens future growth and causes losses in existing stands.

Once the disease is present, it may become impossible to grow susceptible species on that site for several decades or longer. Forest health staff prioritize surveys in high-risk areas to help managers protect pine stands.

HRD is caused by the fungus *Heterobasidion irregulare*, thought to be native to Michigan but acting invasively in dense, managed planted stands. Infection occurs when spores land on fresh stumps, spreading through root connections at 3 to 6 feet per year, killing trees over time.

HRD is most easily identified in the fall when the fruiting bodies, or mushroom-like growths, are more obvious at the base of affected stumps and trees. The fruiting bodies are leathery brown on top and white on the bottom, with elongated pores or tiny holes, not gills like many other common fungi. The risk of infection to nearby areas through fresh-cut stump surfaces increases with the abundance of fruiting bodies and spore production.

Many detections are found when pockets of dead pine are reported by DNR field staff, private foresters or the public. Landowners and managers are encouraged to watch for and report slowly expanding pockets of dead pines.

Thinning can improve tree health but can increase HRD spread by exposing fresh stumps. Infections often appear three to eight years after thinning and persist as long as infected material remains. Protecting fresh cut stumps after thinning is crucial.

Multiple mortality pockets potentially caused by HRD.

State-managed lands have a 5-mile advisory zone around known HRD sites. To prevent new infections, harvests within this zone are restricted to winter logging only, from Jan. 1 to March 31, when spore production is suppressed, or requires a stump treatment with Cell-u-treat at the time of harvest. These measures do not stop existing infections from spreading. National forest lands have similar protective restrictions around known HRD infection sites. Similar restrictions are encouraged across all land ownerships to prevent establishment of this persistent disease.

In 2025, HRD was not confirmed in any new counties. However, new infection pockets were found in previously positive counties. Survey activities are ongoing and currently HRD is found in 17 Lower Peninsula counties and two counties in the eastern Upper Peninsula.

An interactive, online map shows confirmed locations of the fungus in Michigan and the 5-mile advisory zone as well as locations where surveys did not detect HRD. The map also includes information on identification and tools for reporting new or suspected locations of the disease for follow-up by DNR forest health staff.

To use the map, visit michigan.gov/foresthealth and click on "View and report Heterobasidion root disease locations." Reporting potential infection pockets helps protect our forests.

Eastern Spruce Dwarf Mistletoe

In Michigan, eastern dwarf mistletoe is an ongoing concern in black spruce stands. In 2025, several declining spruce stands with extensive infections were reported in the central to western Upper Peninsula. This parasitic flowering plant is native to the lake states. Among all host species, black spruce suffers the most severe damage. White spruce (*Picea glauca*) is also vulnerable, however infections are less frequent. Symptoms are occasionally observed in other conifer species growing near infected spruce.

Dwarf mistletoe spreads when female flowers shoot their seeds into the canopy of spruce nearby. Seeds can be carried longer distances on birds and other animals. The seeds stick to branches and germinate in the canopy, sending rootlike structures into branches that steal water and nutrients from host tree.

Witches' broom from dwarf mistletoe.

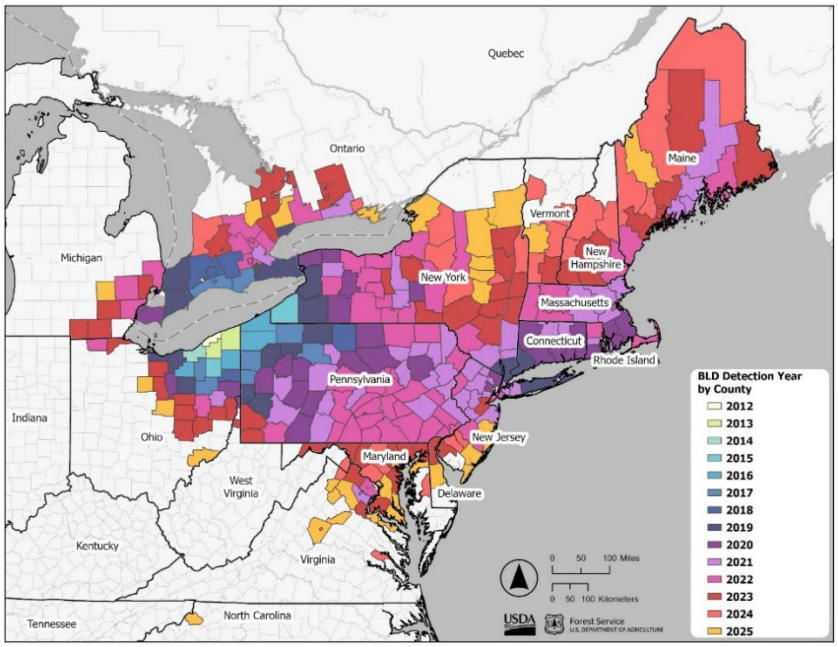
One of the most visible symptoms of infection is the formation of dense, tangled branch clusters called witches' brooms. These brooms persist as long as the host tree remains alive. It is common to find host trees with multiple mistletoe plants.

The consequences of dwarf mistletoe on black spruce are: Increased tree mortality, slower growth and reduced vigor, lower timber quality, diminished cone and seed production, and higher vulnerability to other pests and diseases due to resulting stress.

Management practices include clearcutting all black spruce in infected areas with a harvest buffer of 132 feet beyond the infected area. After harvesting, burning the slash left behind can help eliminate residual black spruce regeneration. Even a small number of infected trees left behind can lead to a resurgence of the parasite and significant losses in the next crop of trees. Planting or maintaining non-host species around the perimeter of the stand can act as a biological barrier, reducing the risk of reinfestation.

Michigan's Beech Trees at Risk: The 2025 Beech Leaf Disease Update

Beech leaf disease (BLD) threatens an estimated 291 million Michigan beech trees already endangered by beech bark disease. BLD is caused when an invasive microscopic nematode, *Litylenchus crenatae*, damages leaf tissues in dormant beech buds. Symptoms include bands of dark, thickened tissue between leaf veins, puckered, stunted leaves and aborted buds. They continue to develop rapidly across eastern North America on beech in natural and managed landscapes. BLD has been confirmed in eight counties in southeast Michigan, with the addition of Livingston County in 2025.



BLD detection by county in 2025.

While BLD was confirmed in a limited number of new southeast Michigan locations this year, dramatic symptom progression occurred in some locations where the disease was confirmed previously. Severe crown thinning and some understory mortality was observed at sites where BLD was first confirmed in 2022.

Several projects are ongoing to address this concern. Long-term monitoring plots have been established in southeast Michigan by University of Michigan scientists and the DNR's forest health program to evaluate the impacts of BLD on beech trees and our forests over time. This year, additional monitoring plots were established in other areas of the state to serve as a baseline for any future spread.

To help understand spread of the disease in locations where symptoms of BLD have not yet been detected, beech samples have been collected by Michigan State University and University of Michigan as well as the DNR forest health program and tested for *Litylenchus crenatae* DNA. This DNA was detected in Kalamazoo and Mason counties in 2019; however no symptomatic trees have been found. Asymptomatic trees have not tested positive elsewhere in Michigan.

Applying polyphosphite 30 in BLD treatment area.

Research continues on effective treatments to manage beech leaf disease. The DNR forest health program is conducting a trial with phosphite fertilizer, which in other studies has shown potential to slow the progression of BLD on symptomatic trees. Nematicides have also shown some promise in reducing nematode populations and alleviating symptoms. Products containing thiabendazole are labelled for use as a systemic injection; fluopyram products can be applied as a foliar spray. Chemical treatments may be viable for high-value landscape specimens but are not a cure and appear unlikely to significantly slow spread of the disease across the landscape. Examination of silvicultural treatment trials continues in other states where BLD is well established in beech stands.

Severe canopy thinning due to BLD.

For more information on BLD including symptoms to look for, see Invasive Species: Beech Leaf Disease.

Report observations of beech leaf disease. After becoming familiar with distinctive symptoms of the disease, take closeup and full photos of affected trees, record the location and choose one of the following reporting options:

- Email DNR-FRD-Forest-Health@Michigan.gov
- Use the Midwest Invasive Species Information Network (MISIN) online reporting tool.
- Download and use the MISIN app at MISIN.MSU.edu.

Invasive Plants

Dealing with invasive Japanese Barberry

Japanese barberry foliage color is variable. Source: Northwest Michigan Invasive Species Network.

While much of forest health work is rightly focused on trees, shrubs also are an important part of the forest. These compact woody plants help curb soil erosion, enrich soil with leaf litter, and provide important food and shelter for wildlife. Invasive plants (non-native plants that cause harm in the ecosystem), especially shrubs, can wreak havoc in a forest in a variety of ways; Japanese barberry (*Berberis thunbergii*) has a particularly wide-ranging list of impacts.

Japanese barberry is a compact shrub with wide habitat tolerance. Small, spoon-shaped leaves and sharp spines at every node are key characteristics. Its leaves are usually green, but display red, purple, orange, yellow, or even variegated coloration, making the colored cultivar popular in the nursery trade, although escapes often grow into plants with regular green leaves. Its fruits are red and dangle below the stem like holiday lights; movement of these fruits by wildlife allows Japanese barberry to spread from landscapes into wild areas.

Japanese barberry foliage color is variable.

When it's established, Japanese barberry can outcompete native plants, including native tree seedlings, which can slow forest regeneration and harvest timelines; disturbances caused by normal forestry activity may even aid its spread, furthering the impact. Many herbivores avoid

eating Japanese barberry, allowing the shrub to grow at the expense of native plants that are browsed instead.

Perhaps most alarming, however, is Japanese barberry's connection to human health impacts. The shrub's dense thickets create the perfect moist environment for the black-legged tick, which can transmit Lyme disease to humans. One study found an incredible increase in Lyme-infected ticks where barberry was present: 120 infected ticks per acre in a thick barberry infestation, 40 ticks per acre in a moderate infestation, and only 10 infected ticks per acre where there was no Japanese barberry.

Prevention is key to any invasive species management; using native or non-invasive alternatives to make a big difference. Practice decontamination with PlayCleanGo/WorkCleanGo ethics when you you're outside. Working with your local Cooperative Invasive Species Management Area is a great way to get the local scoop on Japanese barberry and other invasive species. You can also report invasive species on MISIN to connect your sightings with invasive species managers.

Stiltgrass: New Detections of this Watchlist Species in Southern Michigan

Stiltgrass (formerly known as Japanese stiltgrass) is an invasive annual cool season grass native to Asia. Stiltgrass, or *Microstegium vimineum*, is considered to be one of the most damaging invasive plant species in the United States. It spreads rapidly to form dense monocultures, outcompeting native plant species and degrades wildlife habitat.

Stiltgrass has distinctive shiny, off-center midrib on their lance-shaped leaves.

Although stiltgrass can grow in dry, open conditions, it is especially well adapted to grow in moist, densely shaded areas that experience regular disturbance such as forest floodplains, roadsides,

and trail edges. Each plant can produce 100 to 1,000 seeds, which stick to clothing, tires, and fur and remain viable in the soil for three to five years.

Stiltgrass is dispersed by deer, who preferentially avoid browsing stiltgrass, aiding the displacement of native plants.

Stiltgrass is best identified by a distinctive shiny, off-center midrib on the lance-shaped leaves. Stiltgrass was first discovered in Michigan in 2017 in Washtenaw County, which has since become a hot spot for the species and home to the largest and most extensive infestations in the state. Since 2017, stiltgrass reports have been verified in eight other counties in southern Michigan (see distribution here). In 2025, new Invasive Species Wildlife Biologists conducted extensive surveys for this species across 1,474 acres of state-managed land in southern Michigan. They discovered new stiltgrass detections at Petersburg State Game Area in the southeast and Three Rivers, Augusta, and Barry State Game Areas in the southwest.

Following discovery, these detections were treated and will continue to be monitored and treated until eradication is achieved. These new detections have been found in recently mowed, forest-cut utility line right-of-ways as well as roadsides, parking lots, and trail edges, especially under dense hardwood forest canopies.

New Stiltgrass was detected in southern Michigan in 2025.

The Michigan Department of Natural Resources has written a stiltgrass response plan to help guide local and regional plans to address this species. Questions about stiltgrass should be directed to DNR-FRD-Forest-Health@Michigan.gov. Please report any new detections of stiltgrass on the Midwest Invasive Species Information Network (MISIN).

Cinnamon vine: A Sweet Name for a Bitter Problem

Cinnamon vine (*Dioscorea polystachya*), also known as Chinese yam, is an invasive perennial vine native to eastern Asia. This plant is included on Michigan's Invasive Species Watch List, identifying it as a priority species with the potential to cause significant ecological damage.

Cinnamon vine in Three Rivers, Michigan.

The plant earned the name cinnamon vine due to the fragrance of its aerial bulbils, often referred to as air potatoes, and small white flowers, which bloom in late summer. The plant is characterized by twining stems that can exceed 15 feet in length and by the tiny potato-like structures along its stems. These bulbils, along with underground tubers, allow cinnamon vine to spread rapidly via rain events, wildlife, and even machinery. Another key identifying feature is its fiddle-shaped leaves. In the plant's early stages, leaves are more heart-shaped, but as it begins to climb, they take on a more classic fiddle shape. Both forms exhibit a red hue in the "V" portion of the leaf, unlike the native yam.

Cinnamon vine can grow aggressively in moist forested areas, wetlands, and on disturbed sites. Unfortunately, its ornamental appeal often masks its negative ecological impact. Once established, cinnamon vine can smother and outcompete native vegetation, impairing forest regeneration and reducing overall biodiversity. The dried vines left behind at the end of each growing season also increase fire risk, as they can act as ladder fuels, helping fire reach a forest's canopy.

This plant was first detected in Michigan in 2015 and has since been reported in 14 counties. This year, Michigan's Invasive Species Response Team surveyed

709.61 acres of public land for this watch-list species. One detection was made in the Three Rivers State Game Area, where an infestation originating on private land had spread onto public land. The response team developed a management plan in collaboration with the local Cooperative Invasive Species Management Area and DNR Wildlife Division staff.

To learn if cinnamon vine has been reported in your county, use the Invasive Species Watch List Viewer. Any potential sightings of this species should be reported through Midwest Invasive Species Information Network (MISIN) or on the MISIN app.

Laboratory research and monitoring

MSU forest entomology lab takes aim at impact of insects

Michigan State University – McCullough Forest Entomology Lab

Projects conducted by the Michigan State University Forest Entomology crew in 2025 occurred across much of Michigan and most focused on invasive forest insects. We also studied impacts and management options for some well-established invaders including EAB, hemlock woolly adelgid and oak wilt – a foray into the world of pathology.

On the domestic side, we analyzed seven years of native longhorn beetles (Family *Cerambycidae*) captured in sites across much of the state.

Hemlock and hemlock woolly adelgid

We are continuing research in the western Lower Peninsula where hemlock mortality caused by the invasive hemlock woolly adelgid (HWA) is becoming more apparent.

One project, dubbed the "Lazarus study," involves pairing hemlocks representing different levels of canopy condition (healthy to nearly dead) and treating one tree in each pair with a basal trunk spray of dinotefuran. This compound, which is highly water soluble, moves into and through hemlocks relatively quickly. We are continuing to monitor the hemlock pairs to determine when tree condition is so poor that the pesticide application will be ineffective and how quickly trees in better condition recover following treatment. In a related project, we are collaborating with personnel from the West Michigan CISMA to examine cross-sections from hemlocks treated with imidacloprid trunk injections four years ago to assess any signs of injury associated with the injections and recovery of radial growth following treatment.

Deb McCullough applies a basal trunk spray of dinotefuran to a hemlock.

Researchers check a small balsam fir tree for BWA infestation.

Balsam woolly adelgid – our newest invader

Balsam woolly adelgid, the most recent invasive pest in Michigan, has infested patches of balsam fir in forests in north central lower Michigan.

We are collaborating with USDA Forest Service entomologists and personnel from the North Country CISMA to monitor BWA density on infested trees and determine how many generations are occurring in Michigan. We also set up a trial to assess whether applications of imidacloprid or dinotefuran can reduce BWA infestation levels and protect trees.

Blue ash – *Fraxinus quadrangulata* – Resistance to Emerald Ash Borer

Blue ash is a native species that occurs in southern Michigan but is most common in Ohio, Illinois and Kentucky. Over the past 15+ years, we have evaluated blue ash in forested areas and in plantations with other ash species. Results show that blue ash is largely resistant to EAB.

In 2025, we reported results from a long-running common garden study where various ash species were planted in random order in 2007. Black ash was by far the most preferred and vulnerable species followed closely by green ash (*F. pennsylvanica*). White ash (*F. americana*) was intermediate; most trees eventually succumbed. While a few EAB galleries are visible on branches, blue ash trees remain healthy with no evidence of canopy dieback. Manchurian ash (*F. mandshurica*) trees, native to Asia, are also resistant to EAB and have grown into large, attractive trees. In contrast, Chinese ash (*F. chinensis*), another Asian species, grew well for several years but nearly all were colonized and killed by 2022. In addition, we continue to monitor growth of blue ash

trees grown from seed collected from 58 populations across seven states by J. Carstens, USDA Agricultural Research Service. Seeds were germinated by Paul Bloese at MSU and planted in 2017. Clear differences among populations have emerged, but most of the trees are alive and have tolerated winter conditions well. Collectively, results indicate that both blue ash and Manchurian ash represent options for replacing dead ash in forested settings as well as in landscapes.

Paige Payter collects captured insects from a funnel trap.

Native longhorn beetle diversity, abundance and distribution

Since 2017, Paige Payter has handled day-to-day aspects of a statewide project designed for early detection of specific species of non-native forest insects, including woodborers and defoliators, in cooperation with Michigan Department of Agricultural and Rural Development and USDA Animal and Plant Health Inspection Service. Cross vane panel traps and funnel traps, baited with either pheromones or volatiles compounds produced by host trees of important pests, are deployed annually in 45 sites across the state, ranging from small patches of trees in industrial areas to campgrounds surrounded by extensive areas of forest. While potentially destructive, non-native species are targeted by this project, many native longhorn beetles (Family *Cerambycidae*) are also attracted to the baited traps. Native longhorn beetles colonize dying, severely stressed, recently cut or broken trees and play important roles in nutrient cycling and forest productivity.

Longhorn beetles pinned and ready for identification.

In addition to Paige's full-time technician position, she recently completed her master's degree by analyzing the diversity and species assemblages of

longhorn beetles captured over a seven-year period. More than 51,600 cerambycids representing 153 unique species were identified during the study. While species richness was greatest in forested sites, traps in urban areas, where a few trees are surrounded by asphalt and concrete, captured the most beetles. In addition to comparing trap placement and trap type x lure combinations, Paige identified 1,068 new county records, contributing to our knowledge of species distributions.

Undergraduate students prepare funnel traps for deployment.

Options for protecting red oaks from oak wilt

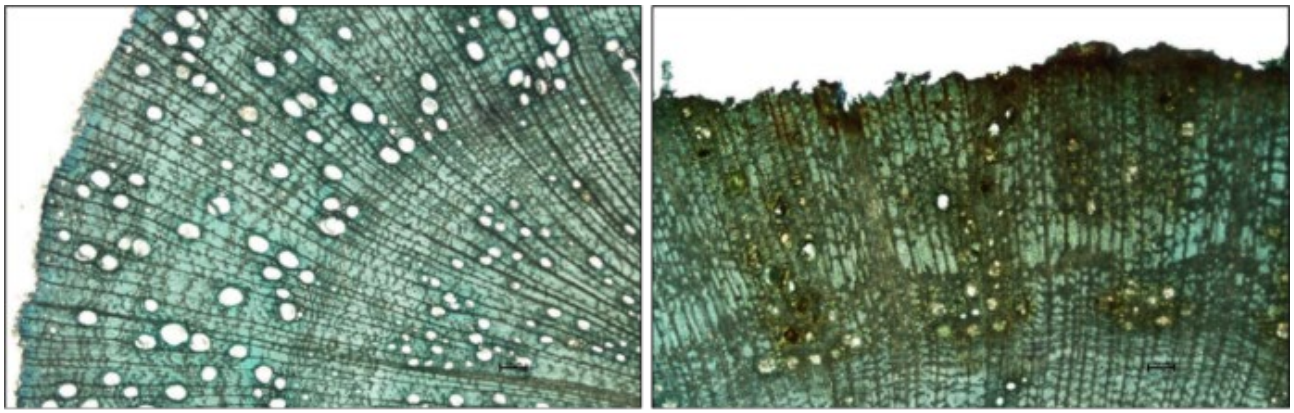
Ava Stallman continued her master's degree research on options to protect healthy red oaks when they are growing near oaks that have been killed by oak wilt. Oak wilt, which is lethal to red oaks, occurs when the *Bretziella fagacerum* fungus grows into and blocks water-conducting cells in the sapwood (xylem cells). The fungus can spread from an infected tree to healthy trees via root grafts or over longer distances when tiny picnic beetles introduce fungal spores into fresh wounds in healthy trees.

A newly infected red oak dying from oak wilt.

Ava is particularly interested in whether propiconazole, a fungistatic compound, or paclobutrazol, a plant growth regulator, can slow growth of the fungus that causes oak wilt. In a greenhouse study, paclobutrazol affected xylem cells and seedling growth, while both compounds protected inoculated seedlings from infection over a five-month period.

Ava uses an increment bore to collect sapwood tissue to evaluate oak wilt infection.

A parallel field study in a forest stand with 54 mature red oaks is ongoing, but results to date have been mixed. To date, five of 12 trees treated with paclobutrazol and one of 12 trees treated with propiconazole became infected after being inoculated with fungal spores. Tree condition and presence of the *B*. *fagacearum* fungus will continue to be monitored next spring.



Cross section from the stem of a healthy red oak seedling (left) and fungal growth in xylem cells in a stem of a seedling infected by oak wilt.

Spotted lanternfly: Evaluating options for detection, monitoring and management

Tim Harrison, a master's student, continued to monitor spotted lanternfly (SLF) life stages in high density sites in Toledo, Ohio, and in recently identified southeast Michigan sites where SLF densities remain low. Although Tree of Heaven (*Ailanthus altissima*) is SLF's preferred host, this sap-feeding, honeydew-spewing pest will also feed on maples, black walnut, numerous other hardwood trees and a variety of vines.

Results to date indicate that adult SLF females much prefer to lay their egg masses on lampshade traps, which provide the females with a dark, protected area and a rough surface. These traps could be useful for detecting new SLF populations or perhaps reducing densities by removing egg masses on the traps.

A second project with Jesse Randall at MSU's Upper Peninsula Forest Improvement Center involves determining if systemic insecticides could be used to protect maples that are tapped for syrup from SLF. Feeding by high densities of the lanternfly can reduce sugar levels in grapes and apples to the point that the fruit becomes unsalable. Whether this could happen in

Lampshade traps attract female SLF for egg-laying.

maples is not yet known. Our research includes quantifying persistence of systemic insecticides in leaves but also in sap collected the following winter, along with sap processed into syrup. While SLF is not present in the UP, understanding how these compounds are transported within trees and how quickly they break down could be useful in the future for managing SLF or other destructive maple pests.

Understanding persistence of systemic insecticides in maples is useful for identifying potential SLF control options.

Assisted Tree Migration: Working towards resilient forests

Michigan State University – Johnson Forest Genetics Lab

Michigan's iconic forests cover more than 20 million acres across the state and are essential to the ecological and economic well-being of Michiganders. Forests filter air and water, store carbon and provide wildlife habitat, timber and recreation. Yet these forests face mounting pressures. A changing climate, invasive pests and pathogens, and declining species diversity all threaten the resiliency of Michigan's forests.

Average temperatures in Michigan have already risen nearly 3°F (1.5°C) since the early 1900s, and growing seasons are lengthening. Projections suggest an additional 6 to 16°F (2 to 9°C) increase by the end of the century, coupled with wetter winters and drier summers. As northern species encounter heat and drought stress at the southern edge of their range, they may fail to reproduce or be replaced by more southerly adapted species. Michigan's forest composition and productivity will likely shift in unpredictable ways with unknown consequences. species. Michigan's forest composition and productivity will likely shift in unpredictable ways with unknown consequences.

What Is Assisted Tree Migration? Assisted migration is a future-forward forest management tool that intentionally moves selected trees to areas where they are better adapted to predicted future conditions. This proactive approach avoids relying on natural migration, which for most tree species is too slow to keep pace with environmental change.

In practice, assisted migration involves testing species and genotypes from different climates and soils in a common garden environment, identifying those that perform best, and using them in future restoration or reforestation efforts.

This approach builds on three complementary strategies:

- **Resistance** – Maintaining current species/genotypes where conditions remain suitable.
- **Resilience** – Introducing species/genotypes from slightly warmer, drier regions to enhance adaptive potential.
- **Transition** – Establishing new, climate-adapted species that can replace declining ones and fill key ecological roles.

By increasing species and genetic diversity within forests, AM boosts ecosystem resilience while also supporting continued carbon storage, habitat, and economic benefits in a changing environment.

The Michigan project

Students planting on research sites.

Michigan State University and the Michigan Department of Natural Resources are partnering to test how these concepts work across the state. The Assisted Tree Migration project establishes nine common-garden test sites spanning three climate regions (Western Upper Peninsula, Northern Lower Peninsula, and Southern Lower Peninsula) and three different site qualities (Xeric, Dry-Mesic, and Mesic) plus an additional three gardens to test the durability and climate adaptability of American chestnut.

Each site represents a different combination of climate (cool to warm) and soil moisture (xeric, dry-mesic, mesic) to simulate a range of future growing conditions. At each location, seed sources from across a wide latitudinal (i.e., climatic) range are planted for each species. Seven tree species are being tested, including:

- **Red pine, white pine, and jack pine** – regionally important native conifers.
- **Virgina pine, pitch pine, and shortleaf pine** – novel southern conifers that may fill functional roles of Michigan's key conifers, focusing on their adaptive potential to the Michigan climates.
- **American chestnut** – a hard mast producer which could help restore lost ecological functions or fill emerging niches. Testing will include blight resistant selections, examining their adaptative potential to Michigan climates and soil for reintroduction and expansion within the state.

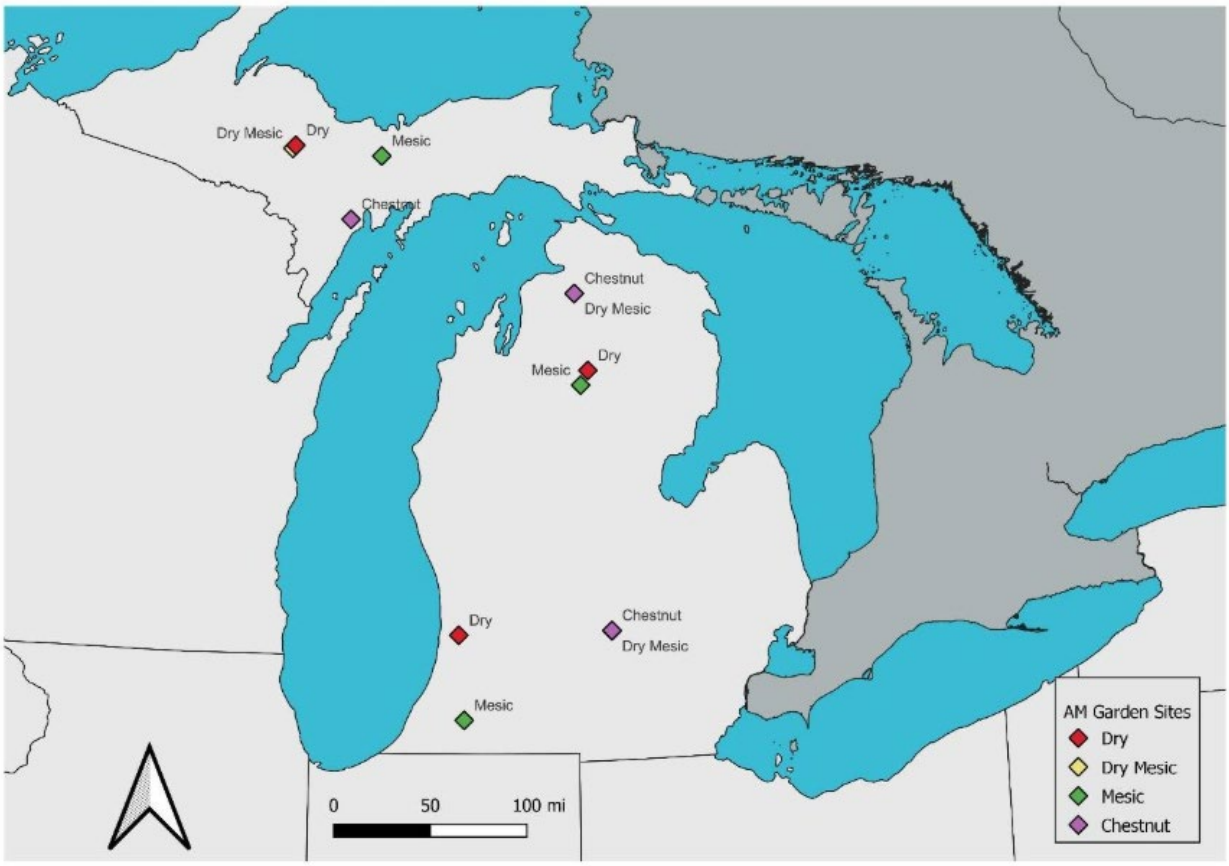
At each site, MSU and DNR researchers and managers will measure survival, growth and health, tracking how different species and seed sources respond to local conditions. These data will inform future reforestation strategies and seed source selection models across the region.

Assisted migration is not a single prescription but rather a suite of tools that help determine survival for future forests. Ultimately, the results from the Michigan assisted migration project will help managers choose the

right seed, planted in the right place, under the right conditions to sustain Michigan's forests into the next century.

Collaboration and contact

This project is a collaboration between Michigan State University Department of Forestry, The Michigan Department of Natural Resources, The Michigan Cooperative Tree Improvement Program, and MSU Partnership for Ecosystem Research and Management. Partners include local land managers, tribal nations, the USDA Forest Service, nurseries, and researchers contributing to long-term monitoring of forest adaptation.



Map of Michigan and the different location of the sites and gardens.

For more information, contact Dr. Jeremy Johnson, Email: jeremyjo@msu.edu

Michigan experimental garden array for the Michigan Assisted Tree Migration project. Three climate zones consisting of the lower-lower peninsula, upper-lower peninsula, and the western upper peninsula. Across each climate there are three site qualities: Dry (red), Dry Mesic (Yellow) and Mesic (Green). Additionally, there are three separate American Chestnut (Purple) gardens that are Dry Mesic across the three climate regions. Both lower peninsula Dry Mesic Sites are adjacent to the American chestnut gardens (points overlap).

MSU research evaluates oak wilt spread

By Ethan Wachendorf | Michigan State University Forest Pathology

Michigan State University oak wilt experiments conducted by graduate students in the northern Lower Peninsula of Michigan have been in progress since the 2023 growing season.

Symptomatic tree with oak wilt. (Photo by Ethan Wachendorf

Studies evaluate oak wilt susceptibility and symptom development within northern red oak stumps and mature northern red oak trees. Both fresh-cut stumps and standing mature oaks were inoculated with several spore concentrations of the oak wilt pathogen, *Bretziella fagacearum* at different times of the year to evaluate symptom development in relation to inoculum load. Visual symptom ratings were taken throughout the growing season and paired with microscopic measurements of xylem vessel occlusion (blockage) to get a multifaceted view of host response to infection.

Inoculated stumps and nearby red oaks have been monitored, and data for sapwood, petiole (leaf stalks), and root samples are being analyzed to evaluate risk and potential for root-graft spread. Data for standing oaks inoculated with increasing concentrations of *B. fagacearum* support a positive relationship between inoculum load and the presence and severity of disease.

Based on these data, every 10-fold increase in inoculum load corresponded with a nearly two-fold increase in infection probability. Inoculum load was also positively related to symptom development in the canopy, where spore loads above 50,000 seem to result in severe symptoms and mortality. Site conditions and infection timing can impact the likelihood of infection and speed of symptom development. Late-season infections in 2023 resulted in leaf stunting and slower symptom development compared to early-season infections in 2024.

As oak wilt infection progresses, the xylem vessels that carry water through the tree are occluded, or blocked, preventing water flow. To gain insight into how this occurs within our experimental trees, we counted and measured open and occluded vessels throughout the growing season. High early-season vessel

occlusion in 2024 was associated with late-season inoculation in 2023. While vessel size was not significantly related to occlusion development, the trees that became symptomatic had vessels that were 14% smaller than trees that did not become infected. Additionally, vessels became occluded more rapidly at higher inoculum loads, consistent with observations of more rapid symptom development in the canopy at higher inoculum loads.

Early (left) vs Late (right) season vessel occlusion in a symptomatic tree. (Photo by Ethan Wachendorf)

Our data, seasonal weather patterns, and stumps will continue to be evaluated for further insights into the pathogen and its risk in Michigan.

Michigan Technological University – Bal Forest Health Lab

Collaborative Oak Wilt Research Continues

Tara L. Bal and Katie Bershing

As new infection pockets of oak wilt continue to be discovered in counties farther north across Michigan and beyond, understanding the nitidulid beetle vector communities and their behaviors in these areas remains essential.

Our collaborative research team between Michigan and Canada continues to investigate nitidulid communities in regions north of the current known oak wilt range to improve early detection and management strategies.

Across four field sites in Michigan's Upper Peninsula (2023–2024), we collected nitidulid beetles and recorded oak phenology data from April through June. In just two seasons, more than 23,000 nitidulids were captured using hanging, baited flight traps, while only 97 were collected directly from fresh artificial

wounds on oak trees. None of these wound-associated beetles appeared before spring bud break began, suggesting limited early-season vector activity.

The most common species recovered from fresh wounds were *Glischrochilus fasciatus, Caplothorax sayi,* and *Colopterus truncatus*, species known to vector oak wilt, or carry it from tree to tree. Additional sampling was conducted in Ontario and New Brunswick, Canada. These findings contribute to a clearer understanding of seasonal beetle activity and potential disease transmission risk during the high-risk infection period in the spring.

Our ongoing analyses and forthcoming publications are being developed in collaboration with Natural Resources Canada, Ontario Ministry of Natural Resources, and forest health specialists at the Michigan Department of Natural Resources.

In parallel work, we also partnered this year with Quebec scientists sponsored by Genome Quebec, to collect air and tissue samples from oak wilt-infected northern red oaks in Michigan. This first season of a multi-year project aims to analyze volatile organic compound signatures unique to oak wilt infection, potentially providing another tool for early detection.

Nitidulid beetles underneath a loose piece of bark plug in an artificial wound. (Photo by K. Bershing).

Overall, research like this is vital to help us improve long-term forest health management, refine monitoring tools, and provide better risk assessments for forest managers.

Research Updates on Resistant Tree Propagation

Tara L. Bal, Tom Panella

Carrying on with research in forest health monitoring and applied management, we continue to care for grafted beech bark disease (BBD)-resistant trees in our greenhouse facilities in Houghton, Michigan, where we do not have beech leaf disease (BLD) present.

The BBD-resistant beech trees are being planted back into Pictured Rocks and Sleeping Bear Dunes National Lakeshores, where the resistant scions, or

grafted twigs, come from. Multiple greenhouse and planting trials have helped us refine beech propagation methods. For example, we compared growth, survival, and leaf nitrogen content of beech trees growing in containers using two media types and two fertilizer types. Beech trees fertilized only with slow-release granular fertilizer had very low survival after two growing seasons, while trees fertilized with liquid fertilizers had eight times greater survival. Trees grown in potting media with heavier peat moss and less pine bark content had greater vertical growth, greater diameter growth, and higher leaf nitrogen values. Refining these methods will mean better success and survival of planted BBD-resistant trees.

We also have initial results from a root suckering trial around known BBD-resistant trees using minimal root injury in 2024. In collaboration with the Michigan DNR, we wanted to test if beech suckers could be induced around known disease-resistant trees in places without thickets of sprouts of non-resistant beech.

BBD-resistant beech root suckers coming up along coarse woody roots that were lightly disturbed in Mackinac County, MI. (Photo by Tom Panella)

We used a garden tine to gently disturb soil with a twisting motion within a 3-meter radii half circle on one side of resistant trees. Out of the six resistant beech trees selected to trial in Luce and Mackinac counties, two of the trees had a clear root suckering response along exposed roots (an average of just over 1.5 individual sucker stems per square meter of root disturbance). These two trees were in sandier soils with minimal surrounding forest canopy, compared to the other sites that had a thicker organic soil horizon and no exposed woody roots at the time of our disturbance trial.

We'll continue to monitor the response of these trees, as this may be a promising way to reduce or eliminate the need for difficult and expensive scion grafting of our valuable disease-resistant beech trees.

Grand Valley State University - Partridge Lab

HWA: Deciphering an invasion

Hemlock woolly adelgid (HWA), is one of the top invasive pests in eastern North America. This small insect (*Adelges tsugae*) has devastating impacts on eastern hemlocks throughout the northeast and in Michigan.

The invasive populations of HWA originated from Japan, and since the insect's initial detection in Virginia in the 1950s, it has spread throughout most of the eastern hemlock distribution range. High winter mortality associated with cold temperatures is a factor limiting its spread farther north into Michigan's Upper Peninsula, which is prime habitat for Michigan's hemlock forests. However, research suggests that northern populations in eastern North America are becoming more cold-tolerant, and this could increase the rate of spread into these colder areas.

Graduate student, Grace Forthaus, uses a genomic tool to better understand how HWA can spread so rapidly.

Assistant Professor Charlyn Partridge and graduate student, Grace Forthaus at the Annis Water Resources Institute – Grand Valley State University (AWRI-GVSU) are using genomic tools to understand HWA's rapid spread throughout eastern North America and to assess how populations may be adapting to colder climates. They have sequenced the genomes of 140 individuals throughout the eastern North American distribution range, including samples from Georgia, Virginia, North Carolina, New York, Nova Scotia, Ohio, Michigan and HWA's native region in Japan.

They are using a population genomics approach to assess large-scale dispersal patterns as HWA has expanded its distribution range. These data will also allow them to evaluate genomic differences between invasive populations and their native counterpart in Japan to see how they may be adapting to their new environment. Partridge also recently received a National Science Foundation grant to assess how invasive traits, like the rapid population growth and range expansion experienced by invasive HWA populations, influence genetic diversity and their ability to adapt to new environmental pressures such as colder temperatures. This grant is in collaboration with researchers at the USDA Forest Service (Nathan Havill), Agriculture and Agri-Food Canada (Bryan Brunet) and Cornell University (Tonya Bittner and Mark Whitmore). Collectively, these data will help to improve future range expansion models for HWA and may help identify sources of new infestations.

Contact and acknowledgements

Contact

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DNR-FRD-Forest-Health@Michigan.gov

Forest Health team during a spring 2025 assessment of the ice storm damage.

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Cover photo: A branch coated in ice following a historic ice storm that took place in March 2025 in the northeast Lower Peninsula.

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- Fax: (833) 256-1665 or (202) 690-7442; or
- Email: program.intake@usda.gov.