DEPARTMENT OF AGRICULTURE

Status of Invasive Forest and Landscape Pests in Minnesota

2024 Annual Report

3/24/2025

Minnesota Department of Agriculture

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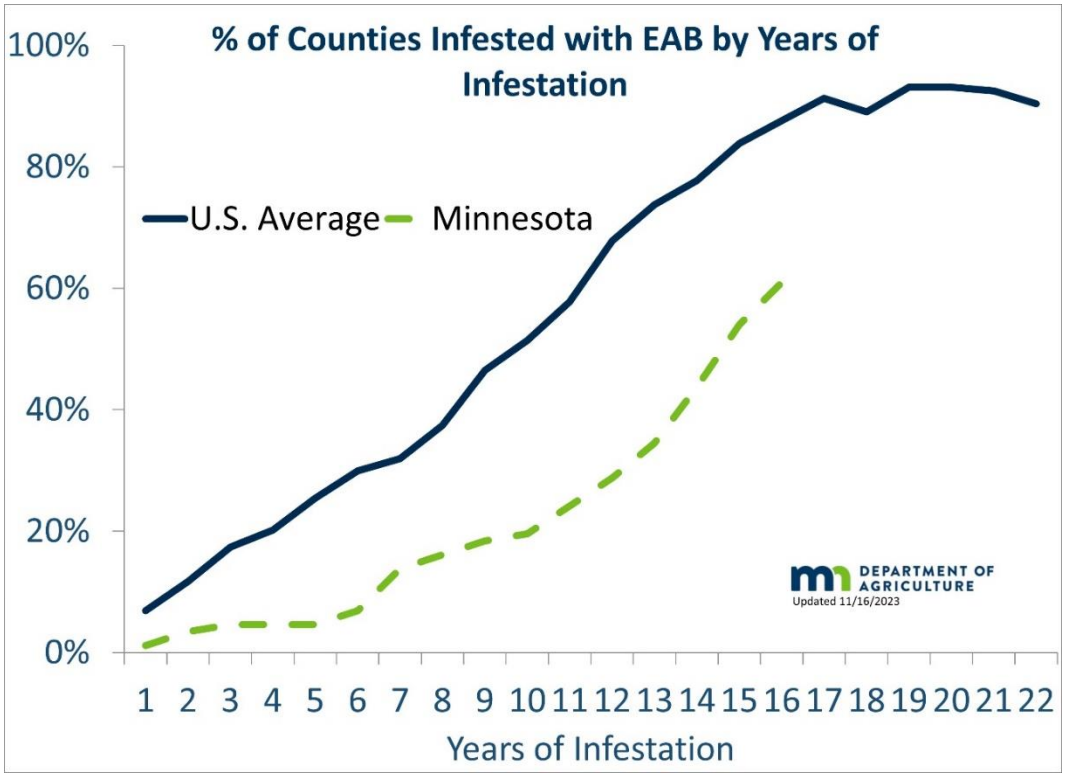
Contents

Emerald Ash Borer (*Agrilus planipennis*)

Emerald ash borer (EAB) (*Agrilus planipennis*) was discovered in six new counties - Crow Wing, Jackson, Pine, Pope, Renville, and Rock - in Minnesota in 2024. Overall, the rate of spread in Minnesota continues to be slower than the national average (Figure 1).

Figure 1. Rate of emerald ash borer spread to new counties in Minnesota compared with the U.S.



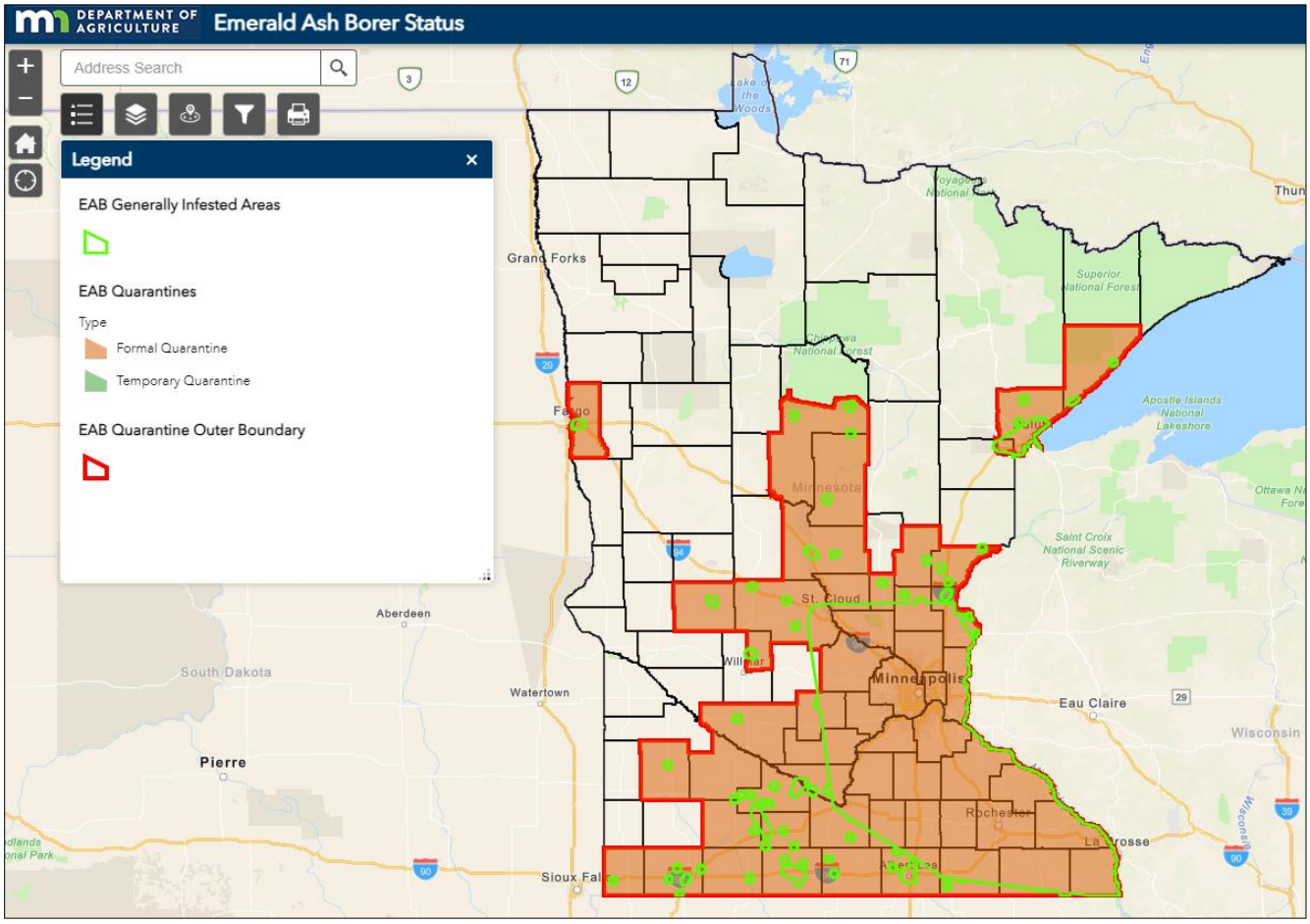
Survey

Through Minnesota Department of Agriculture (MDA) visual surveys and follow-up on citizen reports submitted to Report a Pest, EAB infestations were discovered in many new locations within regulated areas, as well as in six newly detected counties (Figure 2).

Most new county detections received a delimit visual survey conducted by the MDA to understand the extent and severity of the infestations. Additionally, the MDA visually surveyed 59 communities in 21 counties throughout 2024. This survey produced nine new city detections in two additional counties.

This work was funded in part by a grant from the United States Department of Agriculture (USDA) Forest Service and the Minnesota Environment and Natural Resources Trust Fund (ENRTF). All known EAB-infested areas can be viewed on the MDA EAB Status Map. The MDA has surveyed a total of 213 communities since the start of the project in the fall of 2022.

Figure 2. EAB-infested counties in Minnesota as of December 5, 2024.



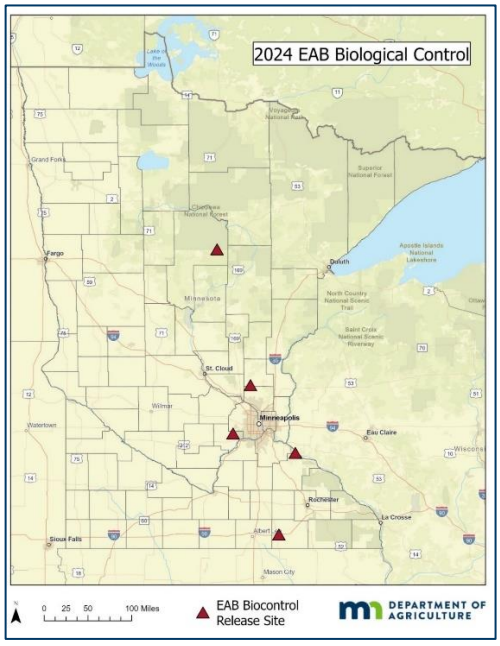
Biological Control

With support from the USDA EAB Parasitoid Rearing Facility, the MDA released 14,530 parasitoid wasps at five sites: Austin, Carver, Isanti, the Chippewa National Forest near Remer, and on tribal lands at the Prairie Island Indian Community (Figure 3). Two of these sites will receive additional parasitoids in summer 2025. Since this project began in 2010, over 680,000 wasps have been released at 54 EAB-infested sites across 17 counties and tribal lands in Minnesota.

Two parasitoid species, *Oobius agrili* and *Tetrastichus planipennisi*, have been in use since 2010. A third species, *Spathius galinae*, was introduced in 2016.

The USDA rearing facility is accepting applications for about 100 new sites in 1025 for first year releases, with priority given to states and counties that have not previously participated. The MDA has applied for two new release sites.

Figure 3. Map of EAB biocontrol sites that received wasp releases in 2024.



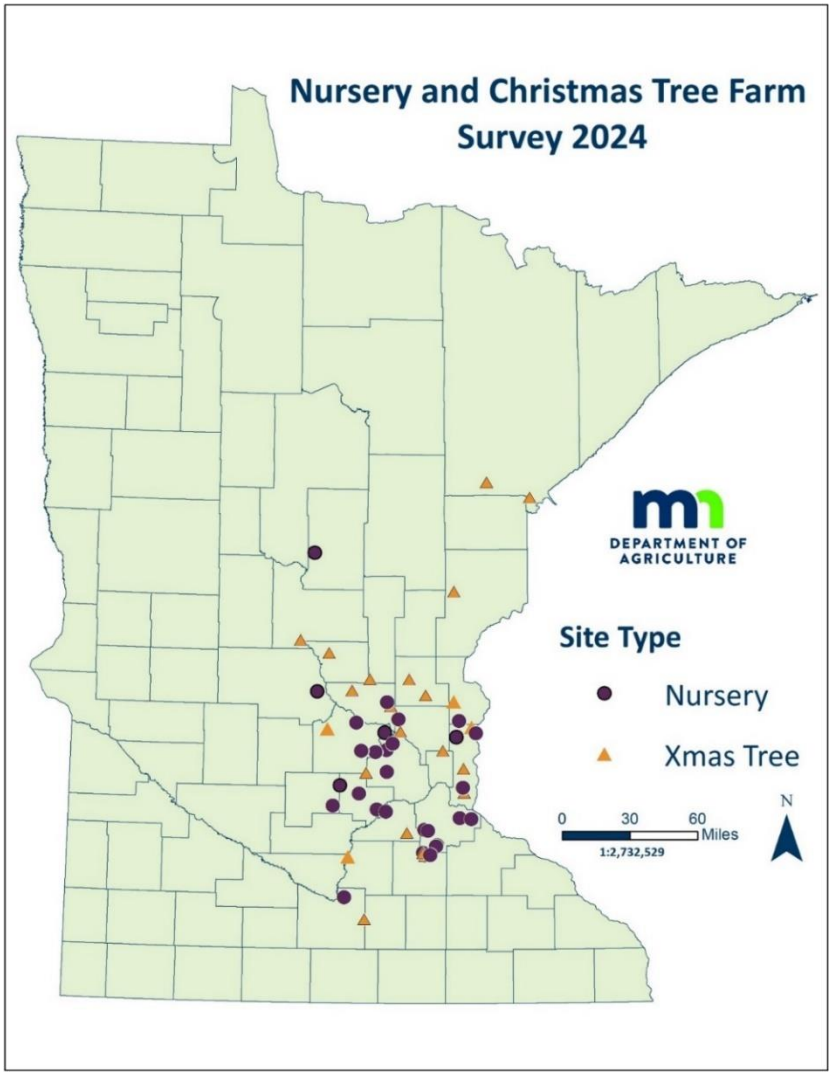
Nursery and Christmas Tree Farm Survey

The introduction of pests through the nursery industry and Christmas tree farms is a threat to urban forests, natural ecosystems, and agricultural crops in the United States. In recent years, multiple invasive species have been intercepted in Minnesota and neighboring states through these industries.

Past introductions of plant pests, such as elongate hemlock scale and *Ralstonia* have led to trace forward events, delimit surveys, regulatory actions (including stop sale orders), and collect and destroy events. These incidents demonstrate the need for continued comprehensive survey, along with our robust nursery program, to monitor for invasive insects and pathogens in the nursery industry and Christmas tree farms in Minnesota.

This was the third year of surveys funded by the Plant Protection Act 7721. There were 17 insect pests and 13 plant pathogens of concern included in the surveys (Tables 1 and 2). Targets were chosen based on their potential to cause significant damage to Minnesota's crops and native plant communities. Survey staff conducted inspections at 24 nurseries and 20 Christmas tree farms across 18 counties (Figure 4). Six nurseries were in rusty patched bumble bee (RPBB) habitat zones. White wing traps for rosy moth (*Lymantria mathura*) and oak processionary moth (*Thaumetropoea processionea*) were cut entirely at the nursery sites since there is not an approved alternative survey method.

Figure 4. Nursery and Christmas tree farm survey site locations.



Insect Survey

Trapping and visual insect surveys began the week of May 3, 2024. A total of 129 traps were set. Traps were placed in different areas of the sites to avoid any intermingling of pheromones that might inhibit insect attraction to the traps. Each trap was checked biweekly by survey staff, and baits were refreshed as needed. Staff also began visual surveys for insect pests and continued biweekly until host material was no longer available. Results from trap samples sent to federal labs for additional screening are pending.

Table 1. Plant insect pests.

Common Name	Scientific Name	Survey Site Type	Survey Method
Asian longhorned beetle	*Anoplophora glabripennis*	Nursery	Visual
Box tree moth	*Cydalima perspectalis*	Nursery	Trap and Visual
Boxwood leaf miner	*Monarthropalpus flavus*	Nursery	Visual
Japanese wax scale	*Ceroplastes japonicus*	Nursery	Visual
Rosy moth	*Lymantria mathura*	Nursery	Trap
Spotted lanternfly	*Lycorma delicatula*	Nursery	Visual
Summer fruit tortrix	*Adoxophyes orana*	Nursery	Trap
Balsam wooly adelgid	*Adelges piceae*	Christmas Tree	Visual
Elm zigzag sawfly	*Aproceros leucopoda*	Nursery	Visual
Elongate hemlock scale	*Fiorinia externa*	Christmas Tree	Visual
European spruce bark beetle	*Ips typographus*	Christmas Tree	Trap
Hemlock wooly adelgid	*Adelges tsugae*	Christmas Tree	Visual
Oak processionary moth	*Thaumetopoea processionea*	Nursery	Trap
Pine processionary moth	*Thaumetopoea pityocampa*	Christmas Tree	Trap
Pine sawfly	*Diprion pini*	Christmas Tree	Trap
Six-toothed ips	*Ips sexdentatus*	Christmas Tree	Trap
Spongy moth	*Lymantria dispar*	Christmas Tree	Visual

Disease Survey

In 2024, the MDA conducted a visual survey for emerging and invasive diseases. A minimum of 10 host plants were monitored biweekly for symptoms of target diseases. All suspect materials were collected and sent to the MDA lab for analysis. In addition to visual surveys, water and soil samples were collected to test for invasive species of *Phytophthora*. Leaf samples from *Prunus* species were also collected to test for plum pox virus.

Table 2. Plant disease pests.

Common Name	Scientific Name	Survey Site
Almond witches' broom	*Candidatus* Phytoplasma phoenicium 16SrIX-B	Nursery
Apple proliferation phytoplasma	*Candidatus* Phytoplasma mali 16SrX-A	Nursery
Bacterial wilt; Southern bacterial wilt	*Ralstonia solanacearum* race 3 biovar 2	Nursery
Boxwood blight	*Calonectria pseudonaviculata*	Nursery
European stone fruit yellows	*Candidatus* Phytoplasma prunorum 16SrX-F	Nursery
Scots pine blister rust	*Cronartium flaccidum*	Christmas tree farm
Beech bleeding canker	*Phytophthora kernoviae*	Nursery
Elm yellows	*Candidatus* Phytoplasma ulmi	Nursery
Jujube witches' broom	*Candidatus* Phytoplasma ziziphi	Nursery
Plum pox	plum pox virus	Nursery
Red Star Rust	*Gymnosporangium yamadae*	Nursery
Root and collar rot	*Phytophthora* spp.	Nursery
Sudden oak death	*Phytophthora ramorum*	Nursery

Red Star Rust

Red star rust, caused by the fungus *Gymnosporangium yamadae*, is native to Japan, China, and Korea. This disease was first identified in the U.S. in 2009 in several northeastern states and was first reported in Wisconsin in 2021 and Minnesota in 2022.

In 2024, the MDA identified red star rust in Carver, Scott, McLeod, and Washington counties. Infected apple trees were present in commercial apple orchards and nurseries. This was the first detection in McLeod County.

The red star rust fungus infects apple, crabapple, and juniper at different stages of its life cycle. The most common symptoms on apples and crabapples are bright red, orange, or yellow leaf spots. Some susceptible apple varieties may drop infected leaves, resulting in yield loss. On juniper twigs, the fungus produces small (less

than 0.4 inches in diameter) woody galls. In wet spring weather, these galls produce a bright orange gelatinous mass full of fungal spores. Spores produced on infected junipers are carried by wind and rain to infect apple and crabapple leaves in spring. In fall, chestnut brown powdery spores produced on infected apple and crabapple leaves are carried by wind to infect nearby junipers.

Figure 5. Red and orange leaf spots caused by red star rust on a Zestar apple leaf.

Figure 6. Bright red leaf spot with long finger-like spore producing structures emerging from the lower leaf surface on a crabapple tree infected with red star rust.

Water and Soil Sampling for Phytophthoras

In 2024, the MDA collected soil and water samples from all nursery survey sites to look for invasive species of *Phytophthora*. *Phytophthora* can cause root rot, crown rot, and die back in many plants. Infected plants often wilt and die or become so severely damaged that they are unsellable.

The USDA has identified two invasive priority species: *Phytophthora ramorum* and *Phytophthora kernoviae*. Phytophthoras are water molds, fungus-like organisms that survive and spread through infected soil and water. By testing water in puddles, runoff areas, irrigation ponds, and soil near water sources and diseased or dead plants, the MDA can test large production areas for the presence of invasive *Phyophthoras*. In collaboration with Dr. Bob Blanchette and Nick Rajtar of the University of Minnesota Department of Plant Pathology, an inventory of native and introduced *Phytophthora* species was created from soil samples.

Soil and water samples were collected in spring and fall from nurseries, and soil samples were collected from Christmas tree farms during the same periods (Table 3).

Neither of the USDA priority invasive *Phytophthoras* species (*P. ramorum* and *P. kernoviae*) were found in Minnesota. The most common species of *Phytophthora* identified from soil samples collected in 2024 were *Phytophthora cactorum* and *Phytophthora pini*, both of which cause root rot, crown rot, and foliar symptoms in many common trees and shrubs.

Figure 7. Collecting soil and water samples.

Table 3. Number of water and soil samples collected in 2024.

	Spring	Fall	Counties
Water Samples from Nurseries	24	20	12
Soil Samples from Nurseries	24	24	12
Soil Samples from Christmas Tree Farms	20	20	15

Outreach

The Report a Pest reporting system allows the public to report pests online, by phone, email, or via EDDMaps (www.eddmaps.org). This citizen participation tool helps raise awareness and makes early detection campaigns more efficient. In 2024, over 700 reports were submitted across all methods. As emerald ash borer becomes more common in metro areas, citizens contact their municipality for more information, which has reduced reports to the MDA.

The Report a Pest online form was updated to include new species and prompts citizens to input an address, picture, and contact information. This has reduced email correspondences needed to correctly identify invasive species. It has also streamlined the tracking process by automatically assigning reports to the appropriate MDA staff based on the reporter's selection of species or question. The benefits from this activity include the development of a broader audience awareness of invasive pests and better early detection of quarantine pests.

The MDA started a podcast called *Smarty Plants* as an outreach tool to highlight the work of the Plant Protection Division. Through engaging discussions with subject matter experts, researchers, and agency leaders, the podcast explores a range of topics including noxious weed regulation, pest management, emerging plant diseases, and more. The number of podcast listeners has grown exponentially over the previous decade, and the medium offers an exciting opportunity for public entities to connect with stakeholders in a new, engaging, and informative way. Listen online at *Smarty Plants*.

Figure 8. The *Smarty Plants* podcast was highlighted at the MDA's State Fair exhibit area.

With support from the USDA Forest Service and the Minnesota Environment and Natural Resources Trust Fund, the MDA hosted 16 EAB field workshops in 2024. The EAB field workshops were held in the cities of Brainerd, Dilworth, and Jordan, with 124 attendees. Additional delimit surveys and EAB early detection and management trainings were conducted with six other units of local government to train staff. A total of 12 EAB presentations were given to a variety of audiences including the public, tree care professionals, and city governments. Over 575 people attended EAB-related outreach events in 2024.

Six virtual EAB informational meetings were held for the public and local resource managers to address new county level finds. Informational webinars were held within several weeks following a new county EAB detection.

Communication of elongate hemlock scale and other invasive pests in Christmas trees and holiday greenery was provided to the nursery industry and the public. Further information was also provided in press releases on proper holiday greenery disposal. Two short videos were created to inform the public on which pests to watch out for and proper disposal methods of holiday greenery. The short videos ran on social media platforms and can be viewed at www.youtube.com/@mnagriculture/videos. The MDA worked with the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency to combine outreach efforts on evergreen trees and holiday greenery disposal. Social media posts across all three agencies in December 2024 and January 2025 focused on invasive pests and disposal options.

Collaborative Research

The MDA's Pest Detection Unit collaborates with organizations such as the University of Minnesota, the USDA Forest Service - Northern Research Station, and the USDA Animal and Plant Health Inspection Service on research projects. The MDA helps secure funding, collect data, and deliver outreach about the results of the research. Funding comes from both state and federal sources.

Emerald Ash Borer Biocontrol

The USDA is working on a multi-year project titled "Long-term Establishment of *T. planipennisi* and *O. agrili* at Sites Along a Gradient of Suitability." The goal of this project is to study parasitoid and EAB population dynamics in Iowa, Minnesota, and Missouri, where EAB population density has declined after the initial outbreak.

Minnesota's study sites include Fort Snelling State Park, Whitewater Wildlife Management Area (WMA), and Lincoln Park in Duluth (added in 2022). Green funnel traps, tree felling, bark sifting, yellow pan traps, and sentinel logs are used to determine the population density of EAB and parasitism rates. Yellow pan trap sampling was completed throughout the summer, and results for 2024 are awaiting identification. All three species of parasitoids have been recovered from the Minnesota sites in previous years.

Sentinel logs, made by infesting cut logs with EAB eggs, were deployed at Fort Snelling State Park and Whitewater WMA (20 logs per site). Five logs were placed at a time over four-week periods from June through September. Logs were then put into emergence tubes for a set time and then debarked. Not all logs developed viable EAB larvae. Results from 2024 are pending.

Adult EAB trapping with green funnel traps (13 traps per site) were deployed from June to August. The traps were hung in infested ash trees throughout each plot and checked biweekly. Trap catch results are pending.

Ten small ash trees were selected in Lincoln Park and Fort Snelling State Park and 20 EAB eggs were affixed to each tree in the late spring 2024. These trees will be felled and peeled by MDA in spring 2025 and the larvae from each egg will be collected. This will help determine the annual mortality rates of EAB, and to investigate the various factors leading to EAB mortality at each site.

Red Star Rust

The detection of red star rust (*Gymnosporangium yamadae*) in Minnesota in 2022 revealed many gaps in information about how to manage this novel disease. In response, the MDA Plant Protection Division and the University of Minnesota (UMN) Departments of Horticulture and Plant Pathology received funding and began work on a Specialty Crop Block Grant titled "Identifying Best Management Practices for Red Star Rust, an Invasive Pathogen of Apple & Nursery crops." The goals of this project are:

- Test Minnesota grown apple and crabapple cultivars for resistance or susceptibility to red start rust.
- Identify fungicides to protect junipers from infection.
- Monitor for spores to refine spray recommendations for Minnesota's climate.

All management information will be shared with nurseries, landscape professionals, and apple growers. Research is ongoing at the UMN Horticulture Research Station.

Figure 9. Trial to test juniper susceptibility and fungicide sprays.

Figure 10. Difference in red star rust disease response in crabapple varieties 'Sutyzam' Sugar Tyme® (A) and 'Bob White' (B) leaves 10 weeks after infection. Photos by T. Enzenbacher.

Elongate Hemlock Scale Cold Tolerance

Cold tolerance refers to the ability of a species to survive low temperatures. Understanding how cold tolerant an invasive insect is allows researchers to predict how much of its population will survive a given winter.

Elongate hemlock scale (EHS) is an invasive insect that is a major pest of hemlock and Fraser fir but is not known to be permanently established in Minnesota. However, EHS was found on Christmas trees (Fraser fir) imported into the state between 2018 and 2021.

The MDA worked with the University of Minnesota (Prof. Brian Aukema) and the USDA Forest Service (Dr. Robert Venette) to measure how well the insect survived brief exposures to freezing temperatures and found that EHS might be able to overwinter in at least the southern third of the state. A follow up project by this team ended in September 2024 and determined the effect of host and prolonged cold exposure on EHS winter survival. The team received infested branch tips of eastern hemlock and Fraser fir from North Carolina during the winter and early spring. The insects were held in an approved lab at 37°F, 14°F, or -4°F.

Scales consistently survived exposure to 37°F or 14°C for up to five weeks, then began to die off slowly. EHS collected in midwinter survived longer at -4°F than those collected in spring, but all scales were dead by 8 weeks. Host tree species did not consistently affect EHS cold tolerance.

In recent winters, Minnesota has not been cold enough for long enough to prevent EHS establishment across most of the state. The MDA shared information about these efforts with growers and the public at strategic times throughout the year to influence best management practices surrounding the import, inspection, use, and disposal of holiday greenery. The MDA's outreach campaign was successful, and deliverables were even used by neighboring states.

Spotted Lanternfly Cold Tolerance

Spotted lanternfly (SLF) is an invasive insect with a broad host range capable of feeding on at least 65 host plants. Its primary hosts in Minnesota include grapes, apples, and several trees (especially maple and walnut) are significant specialty crops. It was first detected in the United States in 2014 and is now quickly spreading across the country. SLF is not permanently established in Minnesota but is now as close as Illinois. The potential arrival in Minnesota is a particular concern to grape growers, apple growers, winemakers, and the nursery industry.

Researchers at the University of Minnesota are studying SLF cold tolerance by testing egg masses, which is the insect’s overwintering stage. This information will help determine the geographical range that SLF might be able to inhabit in Minnesota and where the most suitable area would be. This is complex work because the temperature that is lethal for one SLF egg might be different for another, depending on where it came from, the time of year, and general variation from bug to bug. In this study, SLF egg masses are collected in different months from various places across the country where SLF is already established, exposed to simulated winter conditions in the lab, and then assessed for survival. Results should yield a detailed assessment of spotted lanternfly’s cold tolerance.

The MDA is conducting early detection surveys for this insect around the state and has launched targeted outreach and invasive species messaging to areas of the state where SLF is most likely to establish.

EAB Parasitoid Long Term Overwintering Study

Past research collaborations have included:

- Assessing the risk of our native pines to mountain pine beetle
- Determining host preferences of the velvet longhorned beetle
- Looking for the fungal pathogen and beetle complex that causes Thousand Cankers Disease of walnut

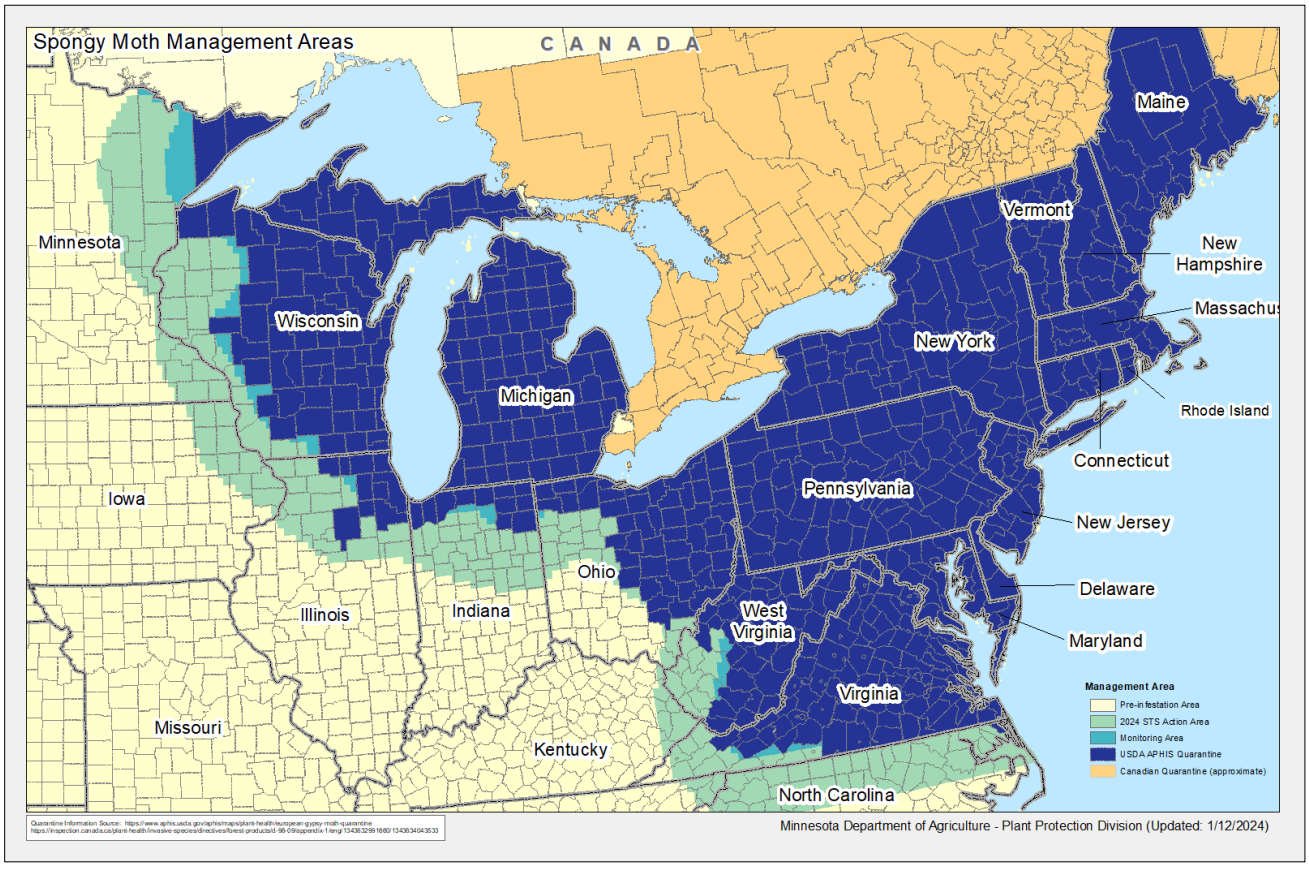
Over the past 10 years, the MDA has worked on multiple emerald ash borer research projects including various aspects of biological control and optimizing detection techniques.

Spongy Moth (*Lymantria dispar*)

Spongy moth is one of North America's most devastating and costly invasive forest pests. It defoliates trees and shrubs and is a human nuisance during outbreaks. Introduced from Europe to Medford, Massachusetts in 1869, spongy moth is one of the oldest and most researched invasive species.

Slowing its spread is important to protect the remaining uninfested forests and urban trees for as long as possible. The MDA monitors the movement of spongy moth into the state and treats localized infestations to protect the state's forests, property values, and the tourism industry. Minnesota is a member of the Slow the Spread (STS) Program carried out on a national level to reduce the spread of spongy moth to less than 5 miles per year (60% less than historical spread rates).

Figure 11. 2024 U.S. and Canadian spongy moth quarantine counties and management areas.



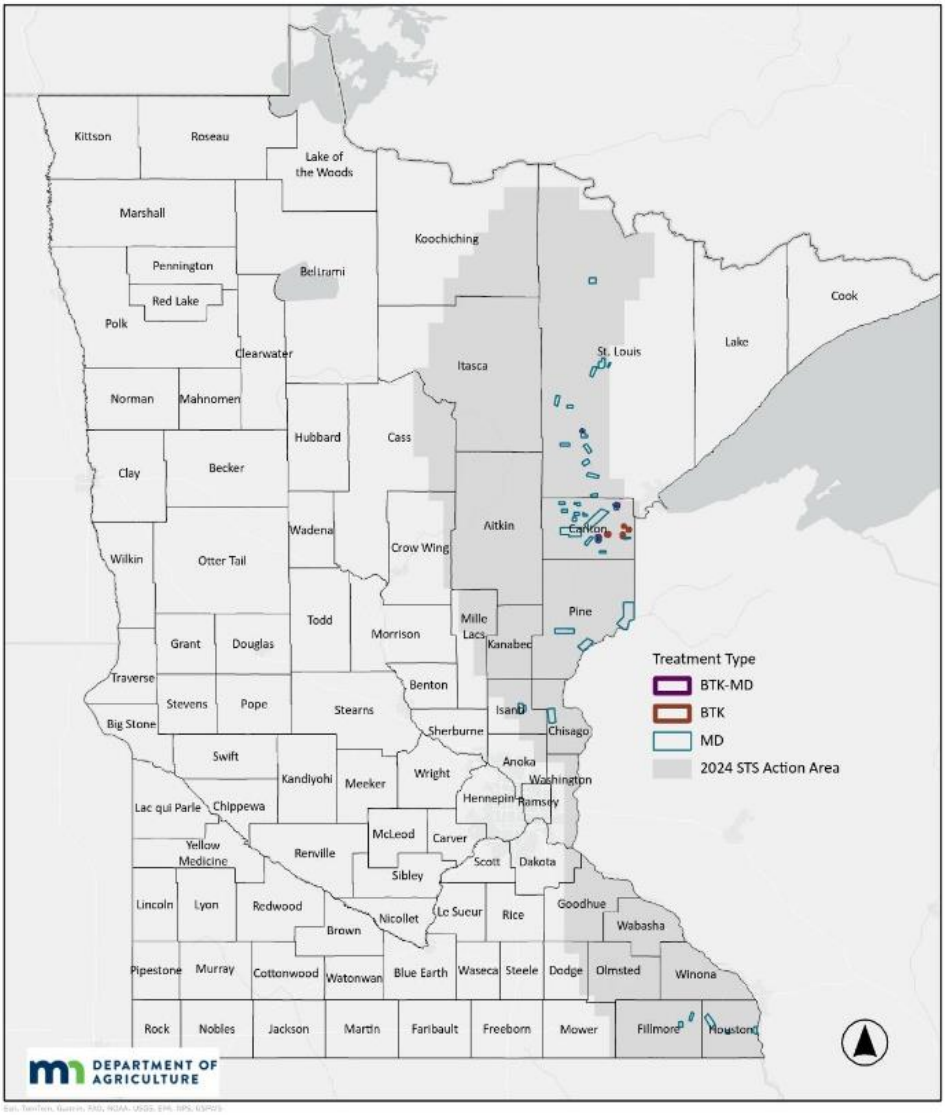
The MDA's Spongy Moth Program has three components: a state-wide annual trapping survey, treatments for eradication and population management, and regulatory/quarantine enforcement. For more information visit www.mda.state.mn.us/spongymoth.

Treatments

In 2024, the MDA proposed 42 areas for spongy moth management based on alternate life stage surveys conducted in the fall of 2023 at high-catch trapping survey sites, along with an analysis of 2023 trapping survey results through the Slow the Spread (STS) Program Decision Algorithm. A USDA Decision Notice and Finding of No Significance was signed, approving the proposed management sites.

Minnesota conducted 158,884 acres of aerial application management for spongy moth in 42 blocks on the east side of the state. Btk *(Bacillus thuringiensis* var. *kurstaki)* was applied to 2,393 acres in Carlton and St. Louis counties to target the caterpillar life stage. A spongy moth mating disruption pheromone was applied to 156,491 acres along the leading edge of the spongy moth population in Carlton, Chisago, Fillmore, Houston, Isanti, Pine, and St. Louis counties.

Figure 12. 2024 spongy moth management areas.



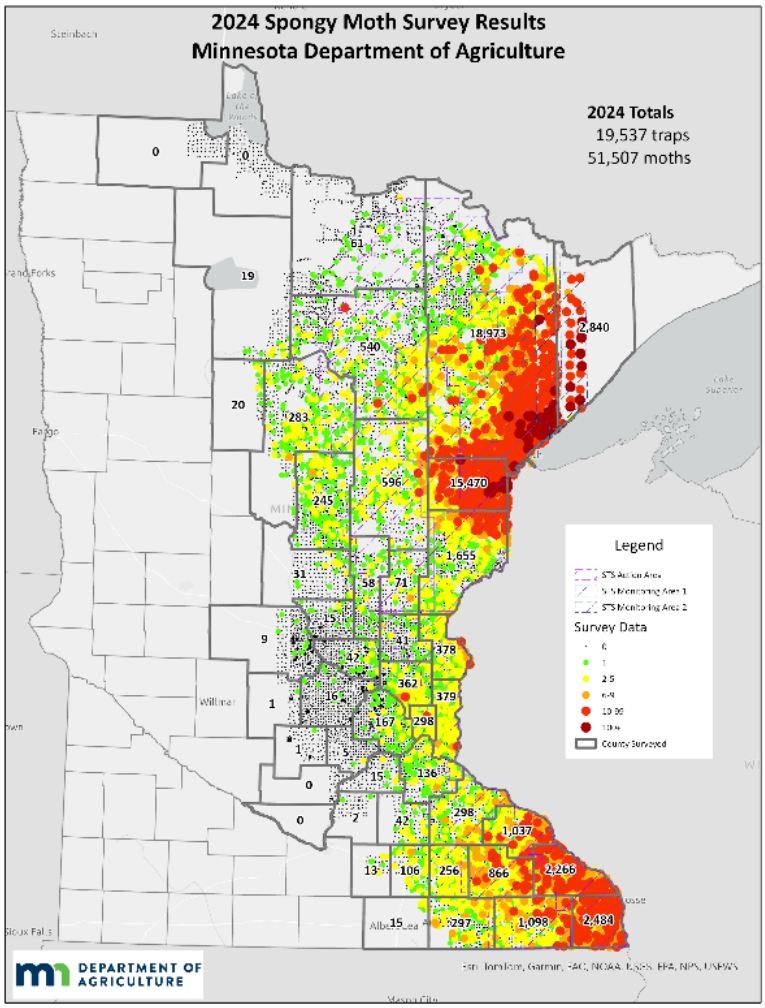
Trapping Survey

Spongy moth traps do not control populations but are used to estimate populations. Traps attract male moths using a lure that mimics the female pheromone. Most of the survey traps used in the 2024 season were delta traps, which are easily constructed but can reliably accommodate for only about 15 moths each. High-capacity milk carton traps, which can hold up to 1,000 moths, were used in northeastern Minnesota project areas where higher moth catches were anticipated.

Figure 13. Delta trap.

Figure 14. Milk carton trap.

Figure 15. 2024 MDA spongy moth survey results map showing the total number of moths caught per county. [2024 MDA ArGIS Online Spongy Moth Trapping Survey Results Map]



Statewide Traps and Moths Caught

- Total traps set: 19,537
  - 19,507 set by MDA survey staff
  - 30 set by Three Rivers Parks District (TRPD) staff at their parks
- Total male spongy moths caught: 51,507
- Positive traps: 6,965

Moth Catch by Region

- Southern Region: 10,790 moths (20.9% of the statewide catch; up from 3.3% in 2023)
- Northern Region: 40,717 moths (79.1% of the statewide catch)

Moth Catches by Project Area (East to West)

- STS Monitoring Areas (western Lake and eastern St. Louis counties): 17,853 moths (35%)
- STS Action Area: 31,139 moths (60%)
- State Eradication Area: 2,515 moths (5%)

Figure 16. MDA annual trapping survey results for male spongy moths, 2015-2024.

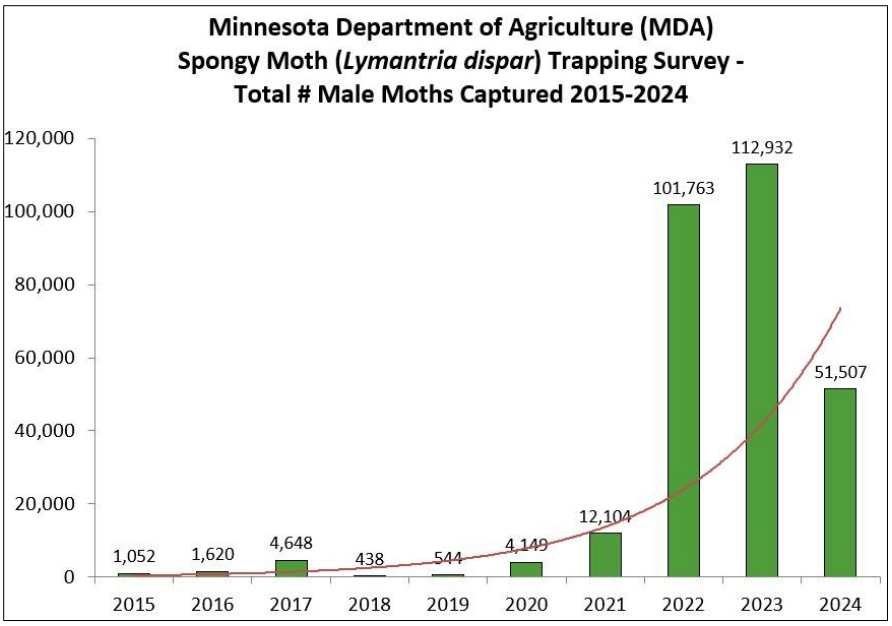
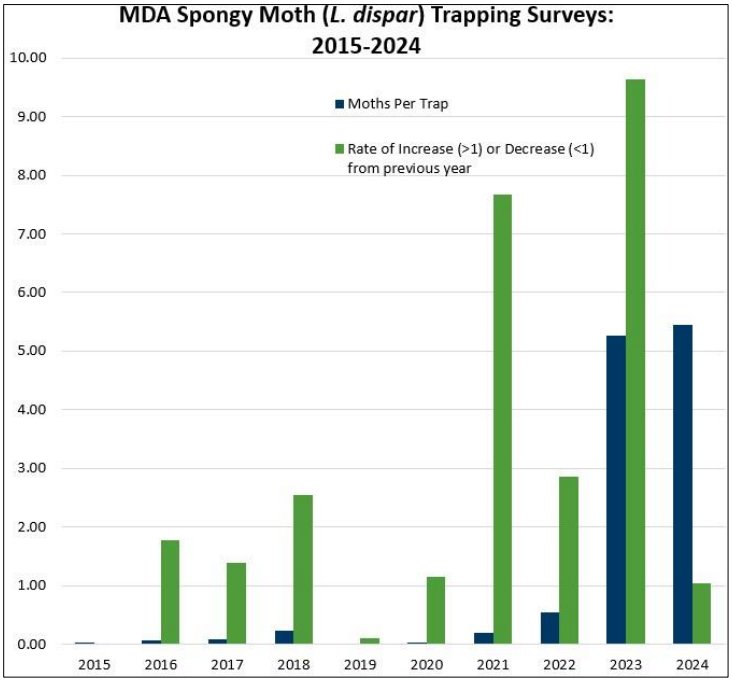


Figure 17. MDA male spongy moth average catch per trap and population trends, 2015-2024.



Alternate Life Stage (ALS) Surveys

Trapping surveys that had high thresholds of male moths are selected for more intense, visual surveys in the fall to search for alternate life stages (ALS), including egg masses, larvae, pupae, or adult female moths. The goal of ALS surveys is to find evidence of reproducing populations by searching for life stages other than the male moths caught in traps. This information helps determine management strategies. Survey staff may also find ALS conducting trapping surveys, and ALS finds may be reported from the public through EDDMaps or the MDA's Report a Pest.

Figure 18. Spongy moth life stages on burlap wrapped infested nursery stock.

Not all areas with positive traps can be surveyed for ALS, but sites are prioritized based several factors, including:

- The location of trap sites relative to the population front
- The number of moths captured in the trap(s)
- Other trap catches in the surrounding area
- Historical moth catch data,
- Proximity to high-risk or regulated sites.

Positive ALS finds may trigger follow-up treatments or a higher concentration of traps the following season.

All ALS finds in 2024 were within the newly determined 2025 STS Action Area, which serves as a transition area between the generally infested area to the east and the non-infested area to the west. ALS were found through trapping, ALS surveys, or public reports at 22 sites:

- Six sites in the southern region of the state in the following counties: Anoka (one site), Houston (one site), Goodhue (two sites), Winona (two sites).
- 16 sites in the northern region of the state in the following counties: Aitkin (one site), Carlton (eight sites), Itasca (two sites), Pine (one site), St. Louis (four sites).

There were no ALS finds in the State Eradication (non-infested) area. ALS surveys were not conducted by MDA staff in the quarantined Lake and Cook counties, or in the STS Monitoring area of eastern St. Louis and Carlton counties.

For More Information

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