DEPARTMENT OF AGRICULTURE

Status of Invasive Forest and Landscape Pests in Minnesota

2023 Annual Report

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Minnesota Department of Agriculture

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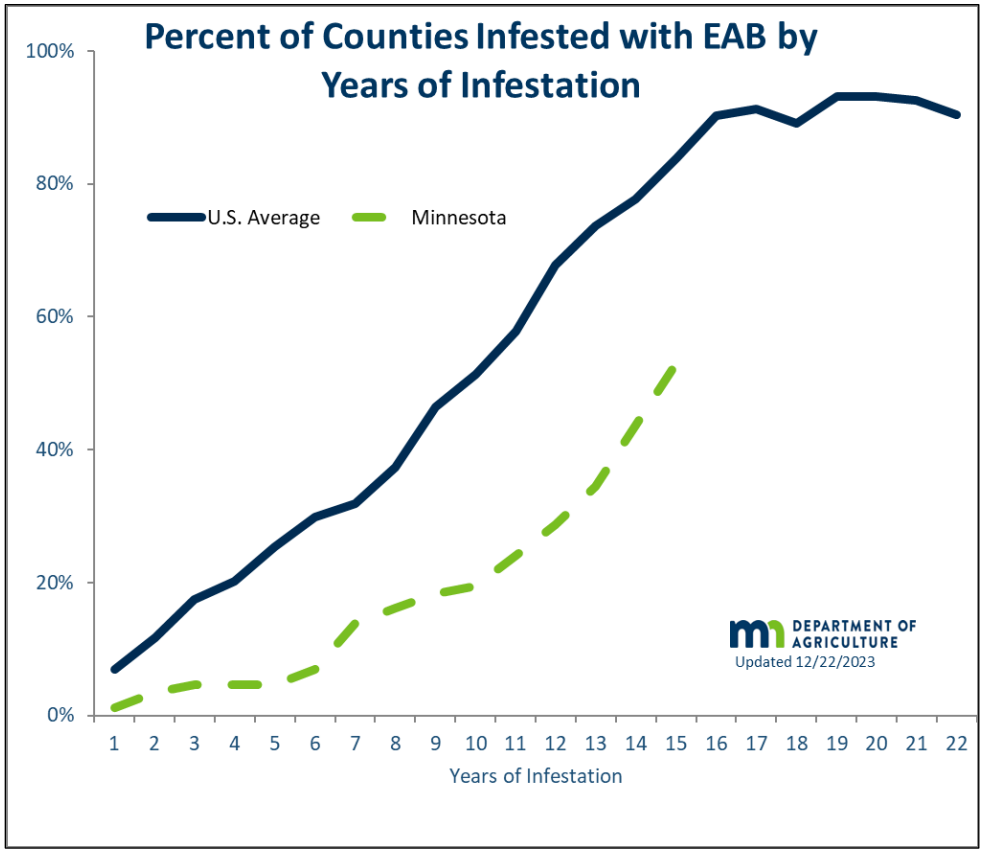
Emerald Ash Borer (*Agrilus planipennis*)

Emerald ash borer (EAB) (*Agrilus planipennis*) was discovered in nine new counties (Benton, Cass, Clay, Faribault, Kanabec, Lyon, McLeod, Mille Lacs, and Morrison) in Minnesota in 2023. Overall, the rate of spread in Minnesota continues to be slower than the national average (Figure 1).

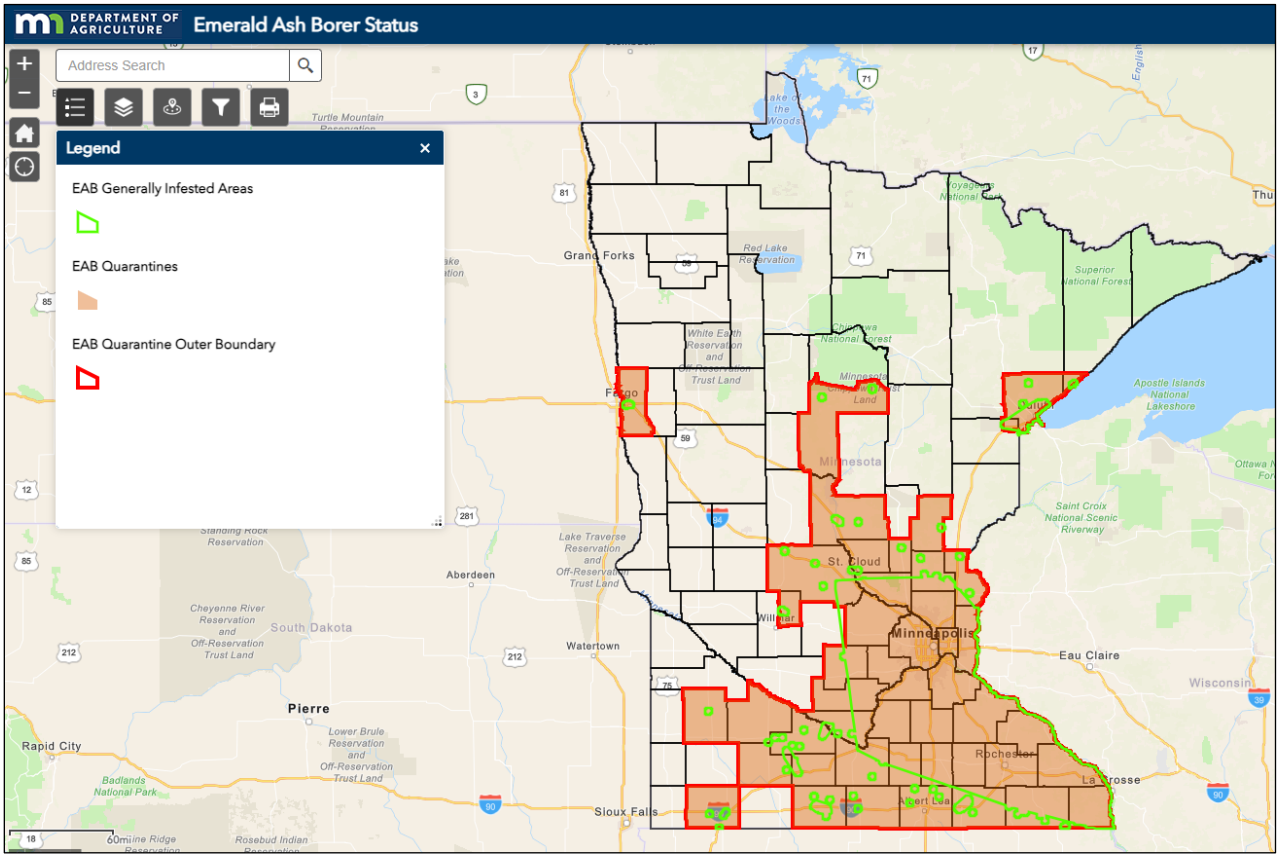
Figure 1. Rate of emerald ash borer spread to new counties in Minnesota versus the U.S.



Survey

Through Minnesota Department of Agriculture (MDA) visual surveys and follow-up on citizen reports to Report A Pest, EAB infestations were discovered in many new locations within regulated areas as well as nine new county level detections (Figure 2). New county detections all received a delimit visual survey by the MDA to understand the extent and severity of the infestations. Additionally, the MDA visually surveyed 101 communities in 38 counties throughout 2023. Most communities surveyed were located within 20 miles of a known infestation and along key transportation corridors. This survey produced 20 new city detections in 2023. This work was funded in part by a grant from the U.S. Forest Service and the Minnesota Environment and Natural Resources Trust Fund. All known EAB-infested areas can be viewed on the MDA ArcGIS webpage. The MDA has surveyed a total of 154 communities since the start of the project in the fall of 2022.

Figure 2. EAB-infested counties in Minnesota as of January 10, 2024.

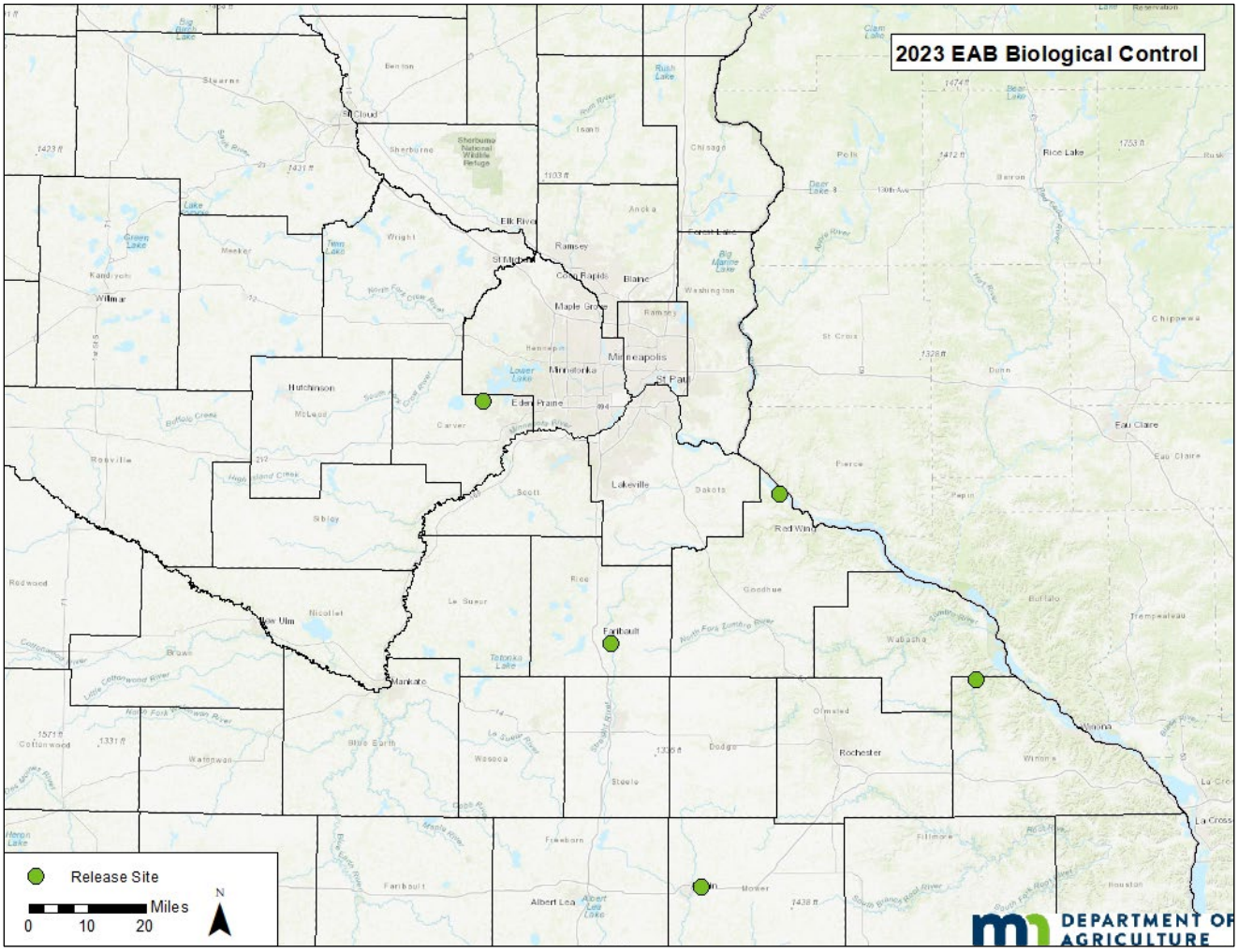


Biological Control

With support from the USDA EAB Parasitoid Rearing Facility, the MDA released 15,257 parasitoid wasps at five sites in Austin, Carver, Faribault, a Wildlife Management Area in southeastern Minnesota, and on tribal lands at the Prairie Island Indian Community (Figure 4). Three of these sites will receive parasitoids again in the summer of 2024. Since this project began in 2010, over 665,000 wasps have been released at 52 EAB-infested sites in Minnesota across 15 counties and tribal lands. Two species, *Oobius agrili* and *Tetrastichus planipennisi*, have been in use since 2010. An additional species, *Spathius galinae*, was made available in 2016. The USDA rearing facility was accepting applications for about 50 new sites in 2024 for first year releases with priority given to states and counties without previous releases. The MDA has applied for two new release sites.

Figure 3. Cup of adult parasitoid wasps for release at EAB biological control sites.

Figure 4. Map of EAB biocontrol sites that received wasp releases in 2023.



The USDA is studying parasitoid and EAB population dynamics in Iowa, Minnesota, and Missouri where EAB population density has declined after the initial outbreak. Minnesota's sites are at Fort Snelling State Park, Whitewater Wildlife Management Area (WMA), and Lincoln Park in Duluth was 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 percent parasitism. Yellow pan trap sampling was completed over the summer. Results from that study are still pending. Suspected *T. planipennisi* have been found at all three sites, *O. agrili* suspects at Lincoln Park and Fort Snelling State Park, and suspected *S. galinae* at Fort Snelling State Park.

Sentinel logs were deployed at Fort Snelling State Park and Whitewater WMA. Twenty logs were placed at each site. Five logs were placed at a time for a four-week period from June through September. Logs were then put into emergence tubes for a set time and then debarked. The sentinel logs were made by infesting cut logs with EAB eggs, not every log deployed ended up with viable EAB larvae.

Adult EAB trapping with green funnel traps was conducted from June until August. Thirteen traps were hung in infested ash trees throughout each plot and checked every two weeks. Trap catch results are pending.

Table 1. Table of EAB parasitism in sentinel logs.

Sentinel Logs	Fort Snelling	Whitewater
Number of logs with parasitized EAB larvae	13	14
Average number of *T. planipennisi* that emerged per log (Emergence ranged from 3 to 258 individuals)	48.42	46.55
Average number of parasitized EAB larva by *T. planipennisi*	1.63	1.3
Average live EAB larvae per log	2	1.35
Average dead EAB larvae per log (not parasitized)	0.94	1.35
Totals	62	88

Regulatory

Eight counties were added the to the EAB quarantine in 2023: Benton, Cass, Clay, Faribault, Kanabec, Lyon, McLeod, Mille Lacs, and Morrison. Upon initial detection of EAB in a new area, the MDA places the area into emergency quarantine. The emergency quarantine places restrictions on regulated articles and starts the public scoping on the proposal of formal quarantine. When public scoping including comments are completed and reviewed, an area then joins the formal quarantine.

There are 14 heat treated certified firewood producers in Minnesota. Among the 19 kilns, approximately one million bundles of heat-treated firewood are produced annually. A list of certified firewood producers can be found on the MDA's Firewood Producers webpage.

Figure 5. Example of the MDA certified firewood logo.

Outreach

The Report a Pest reporting system allows people to report pests using an online form, by phone, email, or via EDDMaps (www.eddmaps.org), a citizen participation tool that can help focus awareness and make early detection campaigns more efficient. This was a slower year for reporting emerald ash borer with just over 300 reports via all the methods mentioned. As EAB 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 reporting form was updated to include new species and prompts citizens to input an address, picture, and contact information. This form has reduced the number of email correspondences needed with the public to correctly identify invasive species. It has also streamlined the tracking process by automatically assigning reports to the appropriate MDA staff based on the general public'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.

With support from the United States Forest Service (USFS) and the Minnesota Environment and Natural Resources Trust Fund, 15 EAB field workshops were held during 2023. The EAB field workshops were held in the cities of Austin, Fairmont, Otsego, and Two Harbors with 93 people in attendance. Additional delimit surveys and EAB early detection and management trainings were conducted with 11 other units of local government to train staff. A total of 20 EAB presentations were given to a variety of audiences including the general public, tree care professionals, and city governments. Five local radio, tv, and podcast interviews were also given throughout 2023. Over 900 people attended EAB-related outreach events in 2023. Additional field workshops are planned for March 2024. Visit the MDA EAB webpage to register for the free hour-long workshops, webinars, or to view previously recorded webinars.

Eight EAB informational meetings were held virtually for the public and local resource managers to address new county level finds. Informational webinars are held within several weeks after a new county EAB detection.

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 interceptions of invasive species to Minnesota and/or neighboring states have occurred through these industries. These introductions have led to trace forward events, delimit surveys, regulatory actions such as stop sales, and collect and destroy events. In 2019, over 1,500 Christmas trees were removed from sale due to detection of elongate hemlock scale, resulting in an estimated $75,000 -$100,000 loss in revenue. In 2020, an estimated 10,000 geraniums were destroyed due to detection of *Ralstonia solanacearum* race 3 biovar 2. Trace forward events for *Phytophthora ramorum* occurred in both 2019 and 2021. This data demonstrates the need for a comprehensive survey to monitor for invasive insects and pathogens in the nursery industry and Christmas tree farms in Minnesota.

Although the MDA has a robust nursery program, findings such as these highlighted the need for additional comprehensive survey to allow the state to visit high risk sites multiple times throughout the growing season to monitor for pest targets.

This is the second year of survey funded by the Plant Protection Act 7721. There were 15 insect pests and 12 pathogens of concern included in the surveys (Tables 2 and 3). Targets were chosen based on their potential to cause significant damage to crops and native plant communities in Minnesota. Survey staff conducted surveys at 28 nurseries and 19 Christmas tree farms in 19 counties (Figure 6). Five nursery sites and one Christmas tree farm were in rusty patched bumble bee (RPBB) habitat zones. White wing traps were cut entirely at the nursery sites since no alternative is approved for survey. The MDA has typically used white delta traps for pine processionary moth; locations that fell within RPBB habitat were switched to an alternative color from the approved methods.

Insect Survey

Traps and visual survey for insects began the week of May 8, 2023. A total of 104 traps were set. Traps were placed in different areas of the sites to avoid any intermingling of pheromones that might inhibit 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 bi-weekly until host material was no longer available. All trap catches have been screened. No target insect pests were found in 2023.

Table 2. Plant insect pests.

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

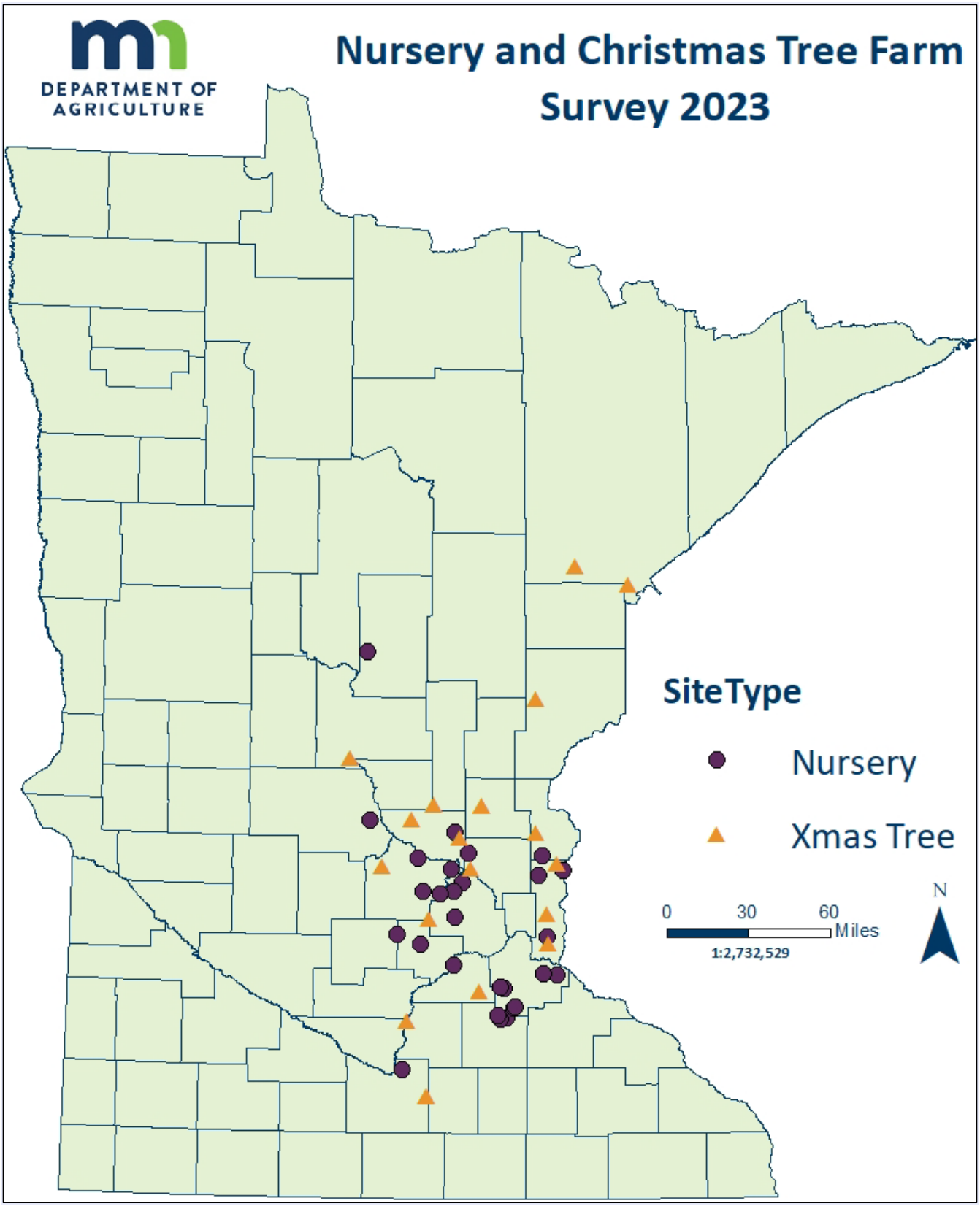
Disease Survey

In 2023, the MDA conducted a visual survey for emerging and invasive diseases. A minimum of 10 host plants were monitored biweekly. 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.

Table 3. Plant disease pests.

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

Figure 6. Survey site locations.



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 US in 2009 in several northeastern states and was reported in Wisconsin in 2021 and Minnesota in 2022. In 2023, the MDA identified red star rust in Carver and Washington counties. Infected apple trees were present in commercial apple orchards and nurseries.

The red star rust fungus infects apple, crabapple, and juniper at different stages of its life cycle. The most common symptom on apple and crabapple are bright red, orange, or yellow leaf spots. Some susceptible varieties of apple will drop infected leaves, resulting in yield loss. Small (<0.4 inches in diameter) woody galls form on juniper twigs. These produce a bright orange gelatinous mass full of fungal spores in wet spring weather. 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 7. Red and orange leaf spots caused by red star rust in a Zestar apple.

Figure 8. 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 2023, the MDA collected soil and water 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. There are two species of Phytophthora that have been identified by the USDA as invasive priority pests: *P. ramorum* and *P. kernoviae*. Phytophthoras are water molds, fungus-like organisms that survive and spread in infected soil and water. By testing water in puddles, runoff areas, irrigation ponds, and soil from around water sources and diseased or dead plants, the MDA can test large production areas for the presence of invasive *Phyophthoras*. By collaborating with Dr. Bob Blanchette and Nick Rajtar of the University of Minnesota Department of Plant Pathology, an inventory of *Phytophthora* species, native and introduced, was created from soil samples.

Soil and water samples were collected in the spring and fall from nurseries in 13 counties. Spring samples were from 23 locations and fall samples were from 25 locations. Soil was collected from 15 Christmas tree farms in 14 counties in the spring and 14 Christmas tree farms in 11 counties in the fall. The USDA priority invasive Phytophthoras (*P. ramorum* and *P. kernoviae*) were not found at any site in Minnesota. Three species of Phytophthora were identified from soil taken from nursery sites in the fall of 2023; *P. cactorum, P. gonapodyides*, and *P. tropicalis*. *Phytophthora rosacearum* was identified from soil taken at a Christmas tree farm. These species are common in flooded soils and in ponds or waterways. They all are capable of infecting multiple species of trees and shrubs but cause varying levels of damage.

Figure 9. Examples of taking soil and water samples.

Outreach

Communication of elongate hemlock scale and other invasive pests in Christmas trees and holiday greenery was provided to the nursery industry and the general public. Further information was also provided in press releases on proper holiday greens disposal. The holiday greenery webpage was updated with flyers with the Report A Pest contact information. The MDA worked with the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency to combine outreach efforts regarding evergreen trees and holiday greenery disposal. Social media posts for all three agencies focused on the invasive pests and disposal options in December 2023 and January 2024.

Spongy Moth (*Lymantria dispar*)

The MDA's Spongy Moth Program consists of three components: a state-wide trapping survey, treatments for eradication and population management, and regulatory/quarantine enforcement. For more information visit the MDA Spongy Moth webpage.

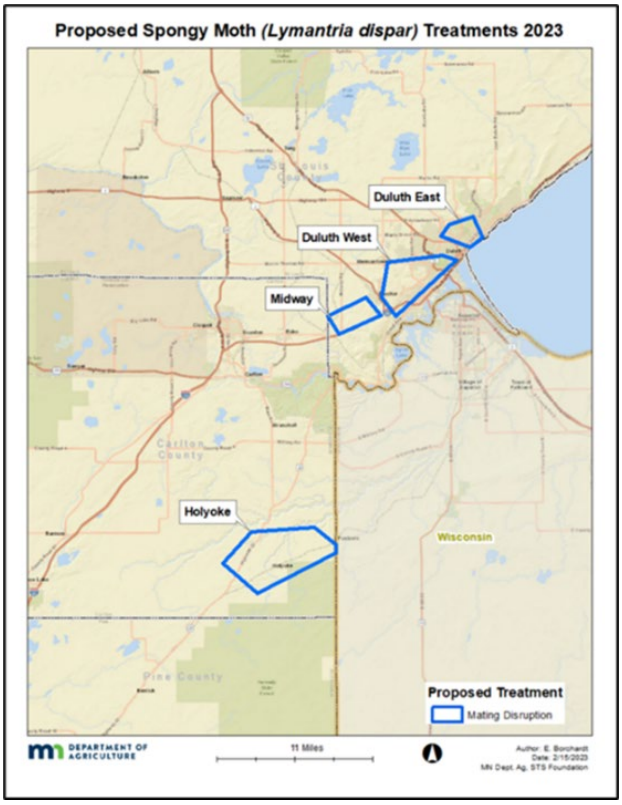
Figure 10. Spongy moth life stages on burlap on infested nursery stock.

Treatments

The MDA proposed four areas for spongy moth treatments based on a combination of alternate life stage surveys conducted in the fall of 2022 at high-catch trapping survey sites and the analysis of 2022 trapping survey results through the Slow the Spread (STS) Program Decision Algorithm. A USDA federal Decision Notice and Finding of No Significance was signed, and the proposed treatment sites were approved by the Spongy Moth Program Advisory Committee, Minnesota's interagency committee that advises on spongy moth management.

In 2023, Minnesota conducted 26,914 acres of aerial application treatments for spongy moth in four blocks within Carlton and St. Louis counties. The mating disruption treatments were mostly conducted along the leading edge of the spongy moth population in northeast Minnesota.

Figure 11. 2023 spongy moth treatment blocks in northeastern Minnesota.



Trapping Survey

The 2023 trapping survey season ran from May through October and resulted in another record-breaking number of male moths being trapped in one season in Minnesota. Traps attract male moths by a lure that mimics the female pheromone. Most of the pheromone baited survey traps used were delta traps, which are easily constructed and have a maximum capacity of approximately 15 moths. High-capacity milk carton traps can accommodate up to 1,000 moths and were used where higher trap catches were anticipated.

Statewide Traps and Moths Caught

- 20,730 traps placed
  - 20,689 set by MDA survey staff
  - 41 set by Three Rivers Parks District staff at their parks
- 112,932 male moths captured
- 8,140 positive traps

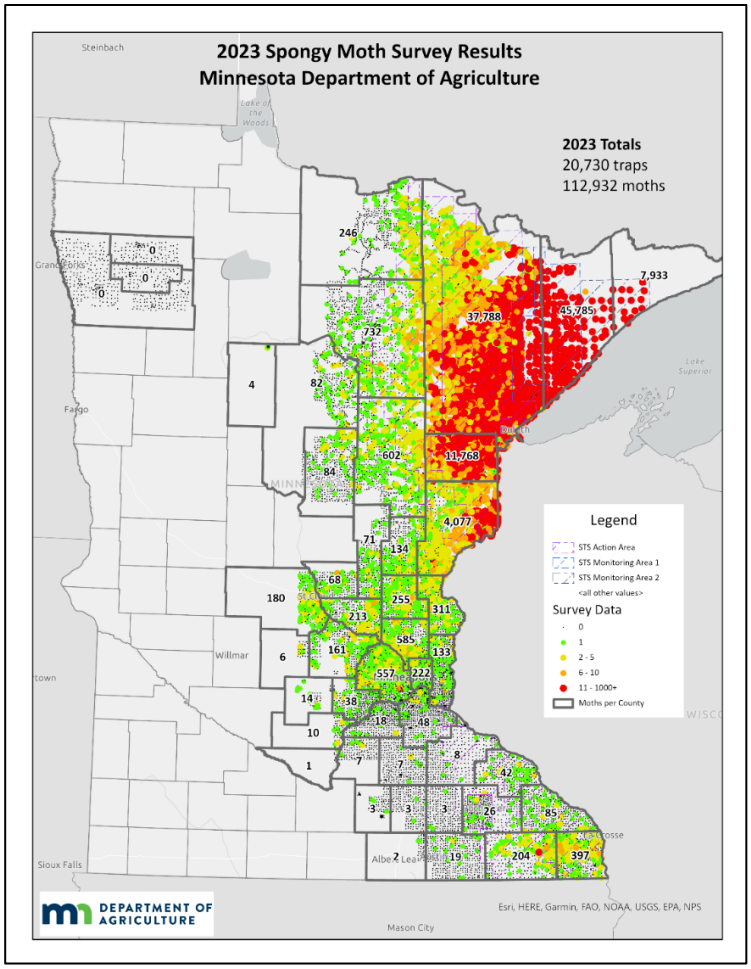
Moth Catches by Region

- Southern Region = 3,727 moths (3.3% of statewide catch)
- Northern Region = 109,205 moths (96.7% of statewide catch)

Figure 12. Delta trap.

Figure 13. Milk carton trap.

Figure 14. 2023 MDA spongy moth trap placements and male moth catches from the [2023 MDA AGOL Spongy Moth Trapping Survey Results Map]



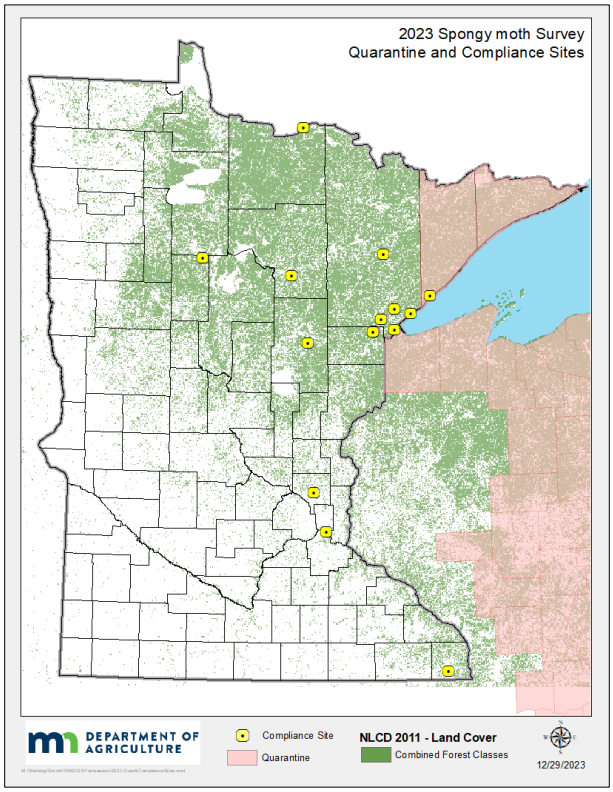
Regulatory - Quarantine Compliance

The MDA establishes compliance agreements with entities that wish to move regulated articles out of quarantine areas. Minnesota's Cook and Lake counties were quarantined in July 2014 and are also under a parallel federal quarantine. Most regulatory activities occur in northeast Minnesota.

Limited permits are required for the transport of pulpwood to approved receiving facilities, and they expire annually. Receiving facility and holiday greenery compliance agreements are also renewed annually.

The Spongy Moth Regulatory Program at the MDA is a multi-faceted program that relies on strong cooperative relationships with other state agencies and units within the MDA. The MDA cooperates with the Minnesota Department of Natural Resources to provide outreach at high-risk sites such as state parks, state forests, and public campgrounds. Outreach materials are also provided to privately owned campgrounds across Minnesota. The Pest Mitigation and Regulatory Coordinator works closely with the Plant Health Regulatory Inspectors to ensure that nurseries and Christmas tree growers adhere to the federal quarantine.

Figure 15. 2023 locations of spongy moth quarantine and compliance sites.



For More Information

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