DEPARTMENT OF AGRICULTURE

Status of Invasive Forest and Landscape Pests in Minnesota

2022 Annual Report

2/1/2023

Contents

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Emerald Ash Borer

Emerald ash borer (EAB) (*Agrilus planipennis*) was discovered in eight new counties (Carlton, Isanti, Kandiyohi, Lake, Le Sueur, Sherburne, Waseca, and Watonwan) in Minnesota in 2022. Overall, the rate of spread in Minnesota continues to be slower than the national average (Figure 1).

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 eight new county level detections (Figure 2). New county detections all received a delimit visual survey by MDA staff to understand the extent and severity of the infestations. Additionally, MDA staff visually surveyed ash trees in 51 communities throughout 13 counties in November and December of 2022. Most communities surveyed were located within 20 miles of a known infestation or were along key transportation corridors. This has produced four new city detections. The goal of surveying 100 communities over the winter of 2022-2023 is on track for completion. This survey work is funded in part by a grant from the United States Forest Service (USFS) and Minnesota's Environment and Natural Resources Trust Fund. All known EAB-infested areas can be viewed online at www.mda.state.mn.us/eabstatus

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

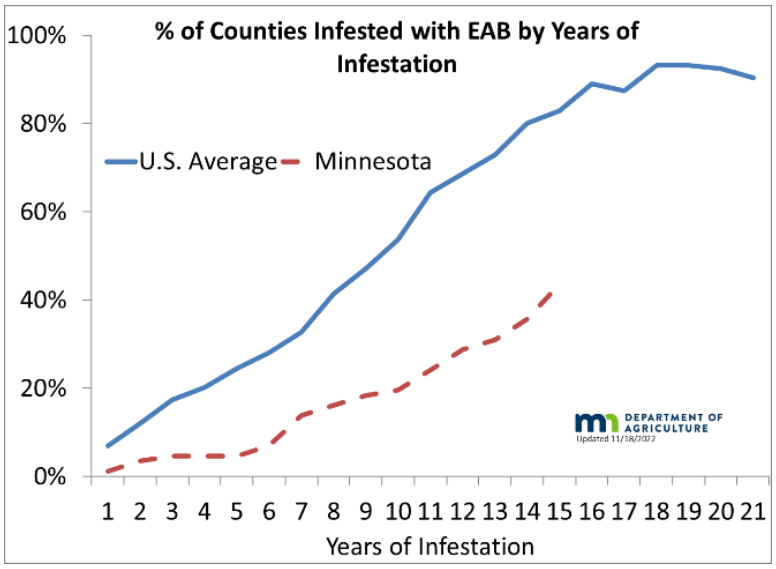
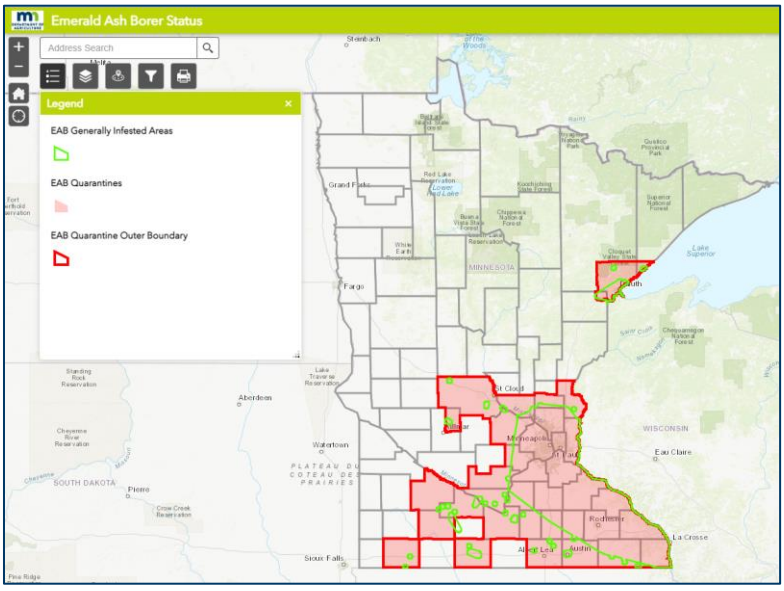


Figure 2. EAB-infested counties in Minnesota as of January 4, 2023.



Outreach

With support from the United States Forest Service (USFS), 18 EAB field workshops and one management webinar were held during 2022. The EAB field workshops were held in Chaska, Dodge Center, Sanborn, St. Clair, Rockville, and Duluth, with over 110 people in attendance. Over 115 individuals from local governments, tree care services, and the public attended the management webinar hosted by the MDA. The webinar focused on research updates from the University of Minnesota and an in-depth look at the issue of increasing wood waste in heavily infested areas of the state. The webinar was recorded and made available for viewing afterwards. Additional delimit surveys, EAB biology, detection, and management workshops were conducted with 19 other units of local government to train staff. Over 750 people attended EAB-related outreach events in 2022. Additional field workshops and webinars are planned for March and April 2023. To register for the free hour-long workshops, webinars, or to view previously recorded webinars, please visit www.mda.state.mn.us/eab

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

Through an outreach grant from the United States Department of Agriculture (USDA) Plant Protection Act 7721, the MDA also conducted an advertising campaign in 2022 to highlight the risk of moving invasive species via firewood. Forest pest advertising occurred via contract with Wildlife Forever that concluded in April 2022. Advertisements included a variety of media, including online, billboards, streaming television, radio, and print. The MDA contracted Don't Move Firewood billboard advertisements on central and northeastern major roadways in late summer (Figure 3). More outreach and advertisements will be done in April 2023 using the federal forest pest outreach grant.

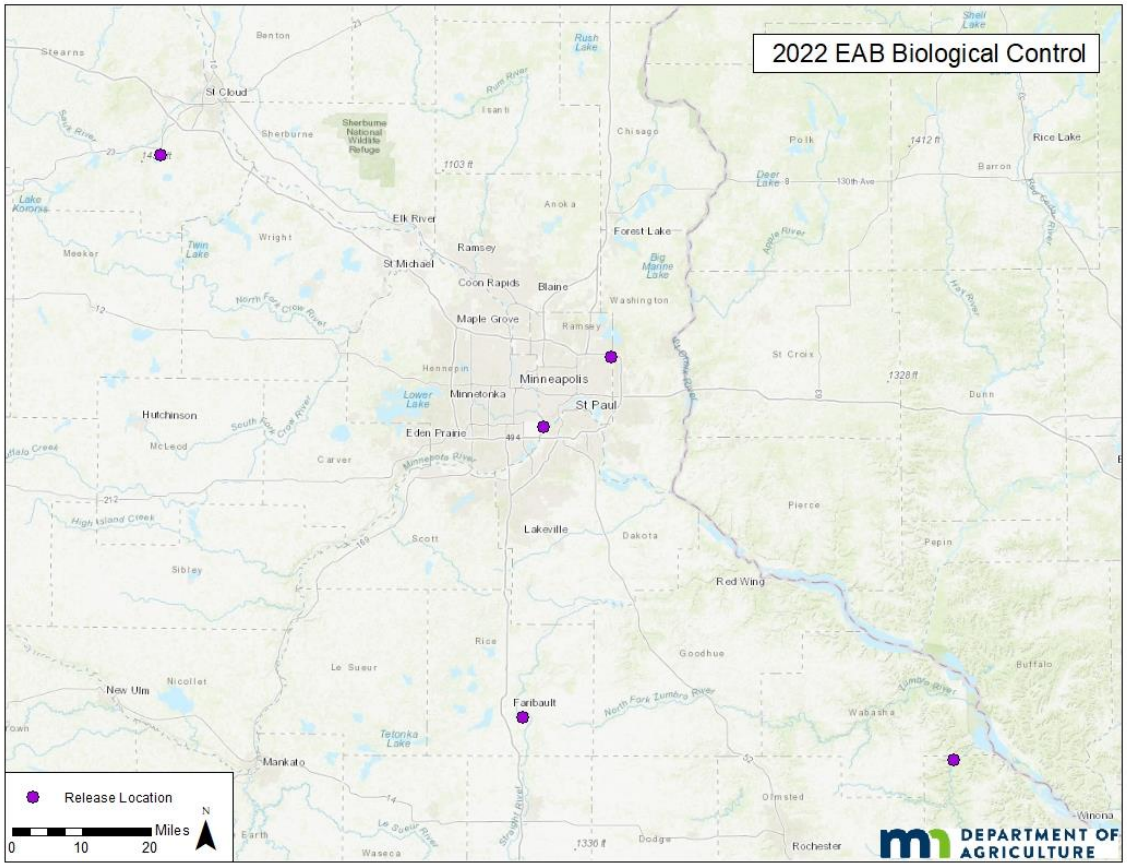
A new invasive species online reporting system has replaced Arrest the Pest. The new website, electronic form, logo, and email is named Report A Pest: www.mda.state.mn.us/reportapest and reportapest@state.mn.us. To request copies of EAB handouts or other outreach materials, please use the Report A Pest email or electronic form.

Figure 3. Billboard advertisement along major roadways.

Biological Control

With support from the USDA EAB Parasitoid Rearing Facility, the MDA released 20,333 parasitic wasps at five sites in the Twin Cities area, southeast Minnesota, Rockville, and Faribault (Figure 4). Since this biological control project began in 2010, over 650,000 wasps have been released at 50 EAB-infested sites in Minnesota. Two species, *Oobius agrili* and *Tetrastichus planipennisi*, have been in use since 2010, and an additional species, *Spathius galinae*, was made available in 2016. Release numbers in 2022 have somewhat rebounded compared to previous years from reduced production at the USDA Rearing Facility due to impacts from COVID-19. The facility was accepting applications for about 100 new sites in 2023 with priority given to states and counties without previous releases. The MDA applied for three new release sites.

Figure 4. Map of EAB biocontrol sites that received wasp releases in 2022.



The USDA is working with states where parasitoids have established to study the population dynamics of parasitoids and EAB once the EAB population density starts to decline after the initial outbreak phase. Study sites are in Iowa, Missouri, and Minnesota (Fort Snelling State Park, Whitewater Wildlife Management Area (WMA), and Lincoln Park in Duluth was added in 2022). EAB traps, tree felling, bark sifting, yellow pan traps, and sentinel logs are used to determine the population density of EAB and to determine the percent of parasitism. Yellow pan trap sampling was completed over the summer but many of the samples still must be screened and verified. So far suspected *T. planipennisi* have been found at all three sites, *O. agrili* suspects have been found at Lincoln Park and Fort Snelling State Park, and suspected *S. galinae* have been found at Fort Snelling State Park.

Sentinel logs were deployed at all persistence study sites, Fort Snelling State Park, Whitewater WMA, and Lincoln Park. Some logs were deployed in June but there were rot issues and larvae did not develop in these logs. These issues were resolved for the later months. Fifteen additional logs were deployed, five in July, five in August, and five in September. The sentinel logs were made by infesting cut logs with EAB eggs so not every log deployed ended up with viable EAB larvae.

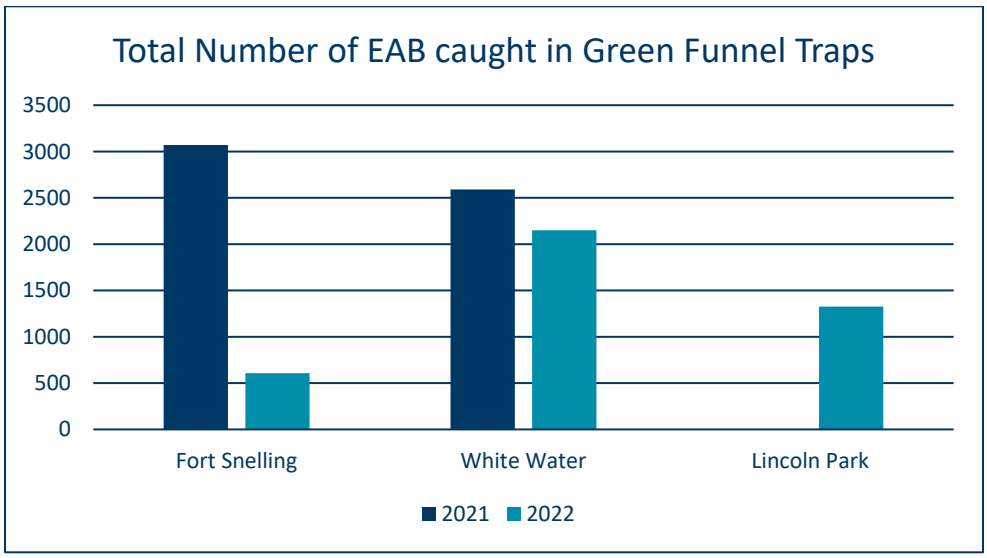
Figure 5. Cup of adult parasitoid wasps for release at EAB biological control sites.

In the month of July, 80% of the logs at Whitewater WMA and Lincoln Park were attacked by *T. planipennisi* and 20% of the logs at Fort Snelling State Park were attacked.

In the month of August, 60% of the logs at Whitewater WMA, 100% of the logs at Lincoln Park and 0% of the logs at Fort Snelling State Park were attacked.

EAB trapping with green funnel traps was conduct from June until August. Traps were hung in EAB-infested ash trees throughout the sites and checked every two weeks.

Figure 6. Graph of total number of EAB caught in green funnel traps in 2021 and 2022.



Trees were sampled in February and March 2022. Bark was scrapped from a 100 cm^2 area and sent to Dr. Toby Petrice for sifting and analyzing to look at the percentage of parasitism by *O. agrili*. Whitewater WMA had the highest *O. agrili* parasitism of any site in the study at 17.81%. Fort Snelling State Park had a percentage of 1.86. Lincoln Park was not added until after sampling was done for the year.

Regulatory

During 2022, Carlton, Isanti, Kandiyohi, La Sueur, Lake, Sherburne, Waseca, and Watonwan counties were formally quarantined. Once an emergency quarantine is put in place, public meetings are held and a 45-day opportunity for comment follows before the quarantine is formalized. Due to in-person meeting restrictions caused by the pandemic, virtual public meetings were held instead. The most current state quarantine information can be found at www.mda.state.mn.us/pestregs

The MDA now has 11 USDA or MDA certified firewood producers in the state (Figure 7). A list of certified firewood producers can be found at www.mda.state.mn.us/plants-insects/firewood-producers

Figure 7. Example of the MDA certified firewood logo.

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 www.mda.state.mn.us/spongymoth

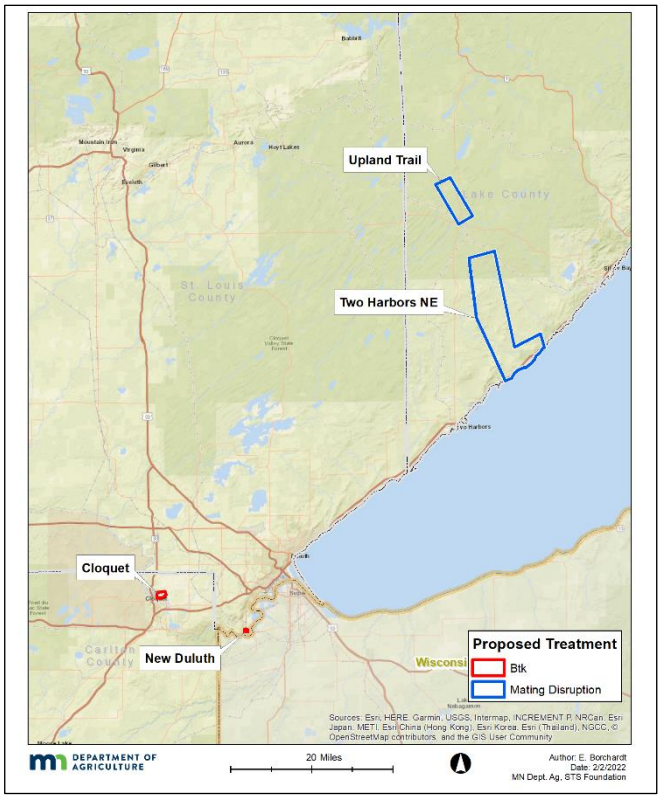
Figure 8. Spongy moth life stages found on burlap wrapped around the root ball of an oak tree at a nursery.

Treatments

The MDA proposed four areas for spongy moth treatments based on a combination of alternate life stage surveys conducted in the fall of 2021 at high-catch trapping survey sites and the analysis of 2021 trapping survey results through the Slow the Spread (STS) Program Decision Algorithm. Two USDA federal Decision Notices were signed, and the proposed treatment sites were approved by Minnesota's interagency committee that advises on spongy moth management.

In 2022, Minnesota conducted 45,648 acres of aerial application treatments for spongy moth within four sites across three counties (Figure 9) and oversaw one regulatory treatment for an additional 25 acres (not pictured on map). The treatments were mostly conducted along the leading edge in northeast Minnesota.

Figure 9. Locations of 2022 spongy moth treatment sites.



Survey

The 2022 trapping survey season ran from May through October and resulted in a record-breaking number of male moths being trapped in one season in Minnesota. 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 in the quarantine (Lake and Cook counties) where higher trap catches were anticipated.

Statewide Traps and Moths Caught

- 19,307 traps placed
  - 19,273 set by MDA survey staff
  - 34 set by Three Rivers Parks District staff at their parks
- 101,763 male moths captured
- 6,475 positive traps

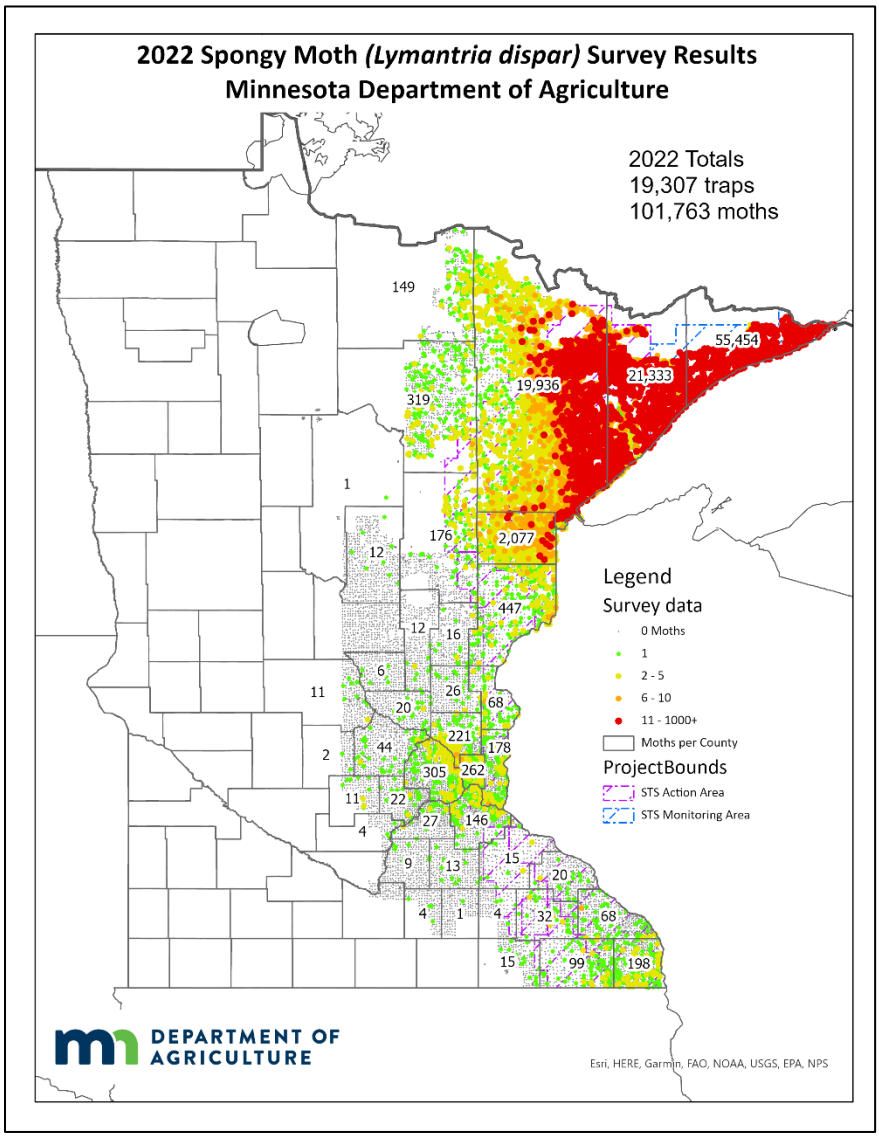
Moths by Region

- Southern Region = 1,848 moths
- Northern Region = 99,915 moths

Figure 10. Delta Trap

Figure 11. Milk Carton Trap

Figure 122. Locations of spongy moth traps placed and male moth catches in 2022.



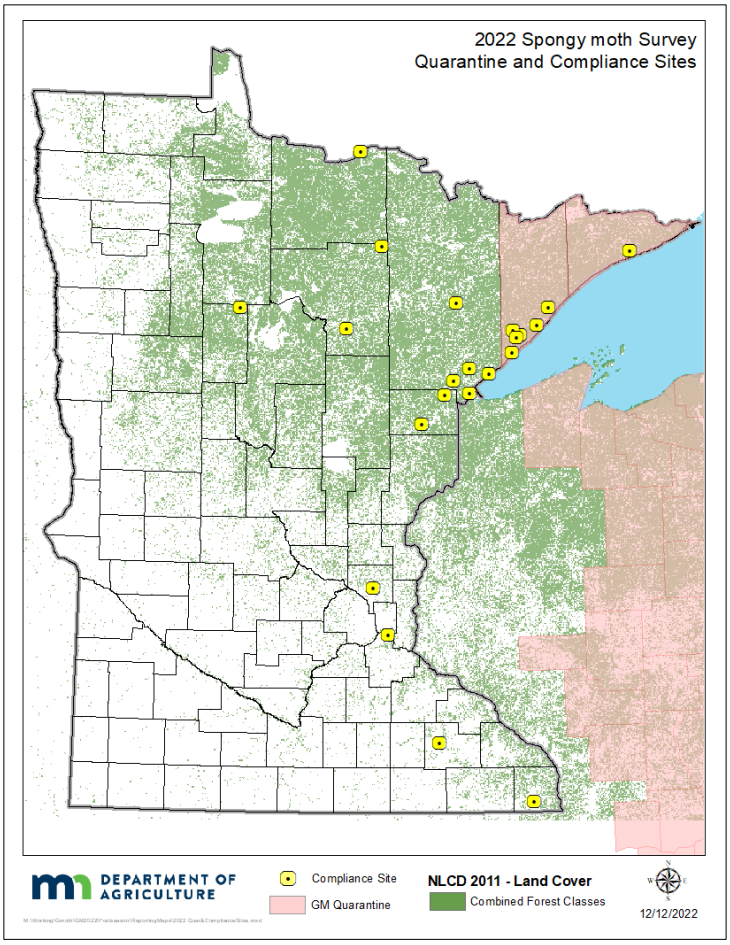
Regulatory - Quarantine Compliance

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 MDA cooperates with the Minnesota State Patrol to conduct commercial vehicle saturations where log trucks are inspected to ensure their documentation complies with quarantine regulations. The Plant Pest Regulatory Coordinator works closely with the Nursery Program to ensure that nurseries and Christmas tree growers adhere to the federal quarantine.

Figure 13. Locations of spongy moth quarantine and compliance sites in 2022.



Nursery and Christmas Tree Farm Survey

The introduction of pests through the nursery industry and Christmas tree farms is a threat to the urban forest ecosystems of 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. These data demonstrate 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 surveys to allow the state to visit high risk sites multiple times throughout the growing season to monitor for pest targets.

This is the first year of this survey funded by the USDA Plant Protection Act 7721. There were 13 insect pests and 10 pathogens of concern included in this surveys (Tables 1, 2, and 3). Survey staff conducted visual and trapping surveys along with water and soil sampling at 22 nurseries and 13 Christmas tree farms in 18 counties.

Insect Survey

Traps and visual survey for insects began the week of May 9, 2022. A total of 96 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 changed 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 2022.

Figure 14. Map of 2022 Nursery and Christmas Tree Farms Survey site locations.

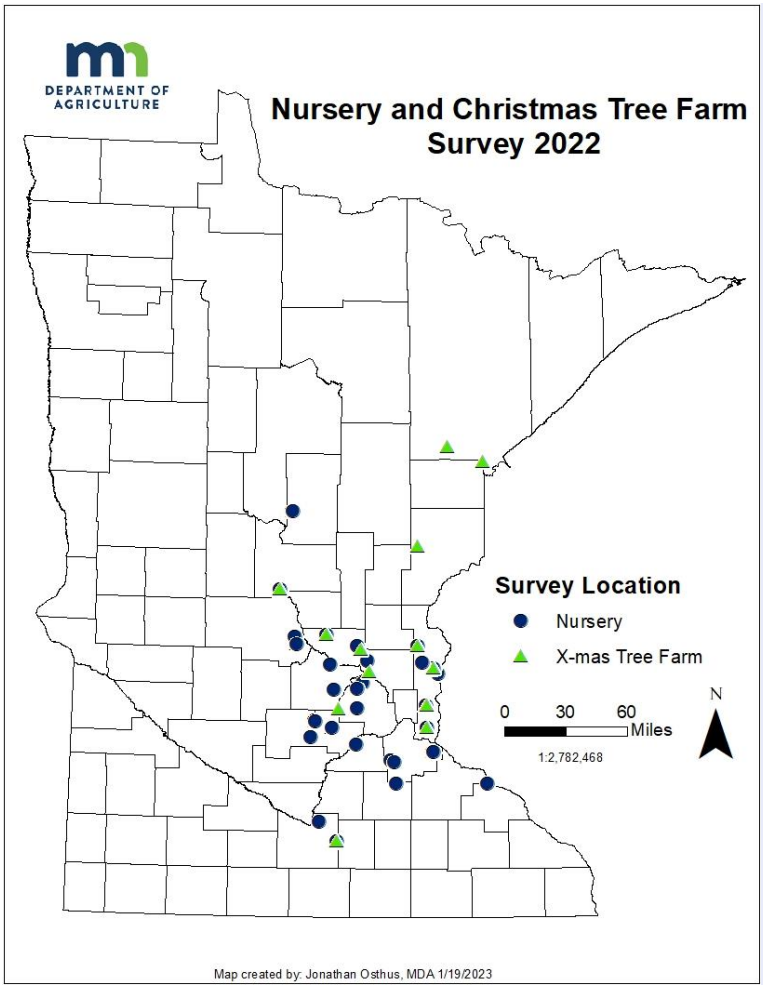


Table 1. Insect pests with pheromone trapping protocols.

Common Name	Scientific Name	Survey Site
Pine sawfly	*Diprion pini*	Christmas Tree Farm
Six-toothed Ips	*Ips sexdentatus*	Christmas Tree Farm
European spruce bark beetle	*Ips typographus*	Christmas Tree Farm
Pine processionary moth	*Thaumetopoea pityocampa*	Christmas Tree Farm
Summer fruit tortrix	*Adoxophyes orana*	Nursery
Box tree moth	*Cydalima perspectalis*	Nursery
Rosy moth	*Lymantria mathura*	Nursery

Table 2. Insect pests with visual observation protocols.

Common Name	Scientific Name	Survey Site
Spotted lanternfly	*Lycorma delicatula*	Nursery
Spongy moth	*Lymantria dispar*	Christmas Tree Farm
Balsam wooly adelgid	*Adelges piceae*	Christmas Tree Farm
Elongate hemlock scale	*Fiorinia externa*	Christmas Tree Farm
Hemlock wooly adelgid	*Adelges tsugae*	Christmas Tree Farm
Boxwood leaf miner	*Monarthropalpus flavus*	Nursery

Disease Survey

In 2022, the MDA conducted a visual survey for emerging and invasive diseases. Target pathogens were chosen based on their potential to cause significant damage to crops and native plant communities in Minnesota (Table 3). A minimum of 10 host plants were monitored biweekly. All suspect materials were collected and sent to the MDA Laboratory Services for analysis. In addition to visual surveys, water and soil samples were collected to test for invasive species of Phytophthoras.

Table 3. Plant disease pests with visual observation protocols.

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 Farm
Almond witches' broom	*Candidatus Phytoplasma phoenicium 16SrIX-B*	Nursery
European stone fruit yellows	*Candidatus Phytoplasma prunorum 16SrX-F*	Nursery
Plum pox	*Potyvirus plum pox*	Nursery
Beech bleeding canker	*Phytophthora kernoviae*	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 US in 2009 in several northeastern states and was reported in Wisconsin in 2021. In 2022, the MDA identified red star rust in Anoka, Carver, Dakota, Hennepin, Le Sueur, Ramsey, Rice, and Scott counties. Infected apple and crabapple trees were present in commercial apple orchards, nurseries, and landscape plantings.

Figure 15. Red and orange leaf spots caused by red star rust in a Zestar apple.

Figure 16. 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.

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.

Phytophthoras

In 2022, the MDA collected soil and water from all nursery survey sites and soil from all Christmas tree farm sites to look for 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, and irrigation ponds, 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 spring and fall from 22 nurseries and 13 Christmas tree farms in 18 counties. The USDA priority invasive Phytophthoras (*P. ramorum* and *P. kernoviae*) were not found at any site in Minnesota. Four species of Phytophthora were identified in soils collected from nursery sites in spring. No Phytophthora species were found in Christmas tree farm soils in spring. 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.

Table 4. Phytophthora species detected in soil.

Scientific Name	Survey Site
Phytophthora cactorum	Nursery
Phytophthora gonapodyides	Nursery
Phytophthora inundata	Nursery
Phytophthora pini	Nursery

For More Information

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