Forest Health Conditions in Ontario 2022

Ministry of Natural Resources and Forestry

Ontario

Forest Health Conditions in Ontario 2022

Compiled by Ontario Ministry of Natural Resources and Forestry, Science and Research Branch.

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Sommaire
État de santé des forêts 2022

Le début de l'année a été plus froid que la normale, mais les températures observées pour le reste de l'année ont été proches de la normale saisonnière. Le printemps a été plus humide que d'habitude au nord-ouest, marqué par des températures variables et des précipitations à l'échelle de la province jusqu'à l'automne. Parmi les événements météorologiques notables figuraient des tornades dans le sud et plusieurs périodes de précipitations fortes au cours de l'été et de l'automne. Plus de 10 000 hectares de forêt affectés par le chablis ont fait l'objet d'une cartographie aérienne, surtout dans la région du Sud — la plus grande superficie recensée depuis 2016.

Principaux insectes nuisibles et zones où les feuilles et les aiguilles d'arbres ont été mangées :

- la tordeuse de pin gris a poursuivi son déclin, mais la zone touchée s'est décalée vers l'est;
- la tordeuse des bourgeons de l'épinette est restée présente, la zone touchée ayant augmenté, principalement dans le nord-est;
- la livrée des forêts a augmenté, surtout dans le nord-est, mais a également été cartographiée dans le nord-ouest;
- la spongieuse a connu un déclin important dans le sud et le centre de l'Ontario, caractérisé par des observations accrues de parasites et d'agents pathogènes;
- la tordeuse du tremble a diminué et se trouvait principalement dans le nord-est.

Nous avons continué de documenter la présence de la maladie corticale du hêtre, qui est une combinaison d'un insecte envahissant (cochenille du hêtre) et d'un champignon à tige envahissant. Elle continue de se propager à travers le sud de la province. La maladie de la feuille du hêtre a été signalée dans de nouvelles zones des districts où cette maladie avait été signalée précédemment. Des occurrences non signalées de l'agrile du frêne envahissant ont été détectées dans la zone réglementée dans les districts de Bancroft, de Sudbury, et de North Bay. La présence du puceron lanigère de la pruche a été confirmée à deux nouveaux emplacements dans la région du Sud.

Introduction

Forest health monitoring in Ontario is conducted by the Ontario Ministry of Natural Resources and Forestry (MNRF).

The annual forest health monitoring program has five components:

- Aerial mapping of major forest disturbances to quantify the extent and severity (e.g., insect outbreaks, weather events, decline, and disease damage)
- Biomonitoring through the collection of insect and disease samples to track occurrence, changes in range or host species attacked, or changes in abundance
- Surveying for pests of interests, particularly invasive species or pests affecting high value trees such as plantations or seed orchards
- Conducting or supporting research in forest entomology, pathology, or weather effects
- Establishing and surveying temporary and permanent sample plots to monitor health of select forest ecosystems

Forest health monitoring in Ontario includes documenting the occurrence of biotic (e.g., insects, disease) and abiotic (e.g., snow and drought damage) disturbances and events. All forested area in the province, regardless of ownership, is monitored and reported on each year.

In 2022, insect diagnostics were executed through a partnership among MNRF, the Canadian Forest Service (CFS), and the Invasive Species Centre (ISC). Samples collected by forest health monitoring program staff were identified by ISC staff. The CFS provided laboratory space and access to its historical insect reference collection. Disease samples were identified at the MNRF's Ontario Forest Research Institute (OFRI).

Maps, tables, and graphs were produced from aerial surveys of major forest disturbances. Results from the annual monitoring program were reported provincially as part of the MNRF's Science Insights seminar series and nationally at the Forest Pest Management Forum and are described in more detail in this report.

Weather patterns

Weather affects the growth, phenology (timing of life cycle stages), dispersal, and survival of forest insects. Forest pathogens, especially leaf diseases and needle cast fungi, can be more common during wet or humid periods. Also, extreme weather events such as drought, snowfall, flooding, tornadoes, microbursts, frost, freezing, scorch, and rapid temperature fluctuations can affect tree health, causing foliage or twig death, or tree

decline and mortality.

In the first four months of 2022, temperatures were cooler than normal particularly in the northwest part of the province while elsewhere in the province they were below or close to normal with several fluctuations from mild to cold, particularly in the later months. Precipitation was well above normal in the northwest while the rest of the province had closer to or a little above normal levels of precipitation.

To start 2022, January was colder than normal across the province, with the usual lower temperatures in the north than in the south. In the northeast some days got below −34 °C, for example, Sudbury had a low of −34.8 °C and Timmins dipped to −41.5 °C. Overall, precipitation was below normal in January, except for the far western part of the province to the Manitoba border. Kenora had almost 20 cm more snowfall than is normal for January. Most of the snow in the south fell in the first few weeks of 2022 as strong winds caused blowing snow in the early part of the month and a January 17 snowstorm added to above normal snowfall totals.

In February, temperatures were well below normal in the northwest, while in the south and northeast they fluctuated from below to above normal but overall were close to or below normal. In the northwest, temperatures were 4-8 °C below normal with locations like Fort Frances recording lows of −43 °C. Thunder Bay also had cold weather reaching −36 °C near the end of the month. In the northeast and south, temperatures dipped down below −30 °C but within two days were above 0°C. Precipitation was above normal across most of the south and the northwest, which is a bit of an anomaly when associated with cold weather, but a series of Alberta clippers brought moderate amounts of snow followed by cold temperatures. Kenora had a record amount of snow (82.6 cm) in February.

For the next four months, average monthly temperatures were relatively close to normal but with large fluctuations in some areas and precipitation was variable but near normal across the province, with the northwest getting a bit of a reprieve from the wet weather in June and August, but still above normal precipitation in May and July. May was a little warmer than normal, with really hot days in mid May in the south and northeast. In the northwest, temperatures were very close to the 30 year normal. Precipitation was near to below normal across Ontario except for the Far North, where less than half of the normal precipitation fell. In the northwest precipitation was higher than normal, with May precipitation as high as 175% of normal values. Kenora, for example, had 156.5 mm of precipitation when the normal is 80.8 mm. in southern Ontario, on May 21, a major storm passed through the Hwy 401 corridor creating an EF-2 tornado at Uxbridge, two EF-1 tornadoes near London, and a downburst in southern Ottawa with winds up to 190 km/h uprooting and snapping trees and causing power outages.

Other than a few hot days, particularly in the northwest where a few days were above 30 °C as well as in southern Ontario in the third week of June when temperatures hovered around 35 °C, June temperatures were close to normal but in many parts of the province it was drier than normal. Some cooler days were recorded in the southwestern part of the province, with record lows on June 19 (6.1 °C) in Sarnia and Chatham-Kent. The northwest finally got a break from the wet weather as precipitation was well below normal in places like Kenora and Thunder Bay, where 61 mm and 45 mm of precipitation fell compared to the 30 year normals of 119 mm and 86 mm,

respectively. Some areas in the province had heavy localized rainfall such as Kingston with 50 mm of rain within a few hours on June 1 and Savant Lake in the northwest with 50 mm on June 14.

On June 16, thunderstorms swept across southern Ontario bringing hail in the east Scarborough area and the Northern Tornadoes Project (NTP) determined that an EF-0 downburst caused damage near Belleville, Shannonville, and Mallorytown.

Average temperatures in July were near normal but some areas had some cooler temperatures, for example, in the northwest 3 °C and 4 °C were recorded in the early part of the month while in the Far North warmer than normal weather was recorded in the second week of July. Mid month had warmer temperatures in the northeast and south, but it cooled down towards the end of the month. Precipitation was close to or below normal in the province, except for the northwest, with some areas getting as much as 175% of the normal from a few thunderstorms that produced large amounts of rain in a short period of time, particularly in the Kenora/Dryden area. Rain was also heavy in the south on July 24, with the Brockville area receiving 84 mm in just a few hours. On the same day an EF2 tornado occurred in eastern Ontario from Rockdale near Belmont Lake to Actinolite along the Hwy 7 corridor.

In August, temperatures were again near normal with some areas in the Far North and southern Ontario a couple degrees above normal. A few periods of heat occurred across southern Ontario in early August and the Far North had a warm spell in mid August. Precipitation for much of the province was below normal, especially in the north areas, while wetter than normal conditions were common in the south. Ottawa had its rainiest August on record with 189 mm of rain and localized thunderstorms with heavy downpours in other parts of the south. In early August an EF-0 downburst occurred in Wellington County in the northern parts of Waterloo Region causing tree uprooting. A week later another EF-0 tornado affecting a small area was reported in Winchelsea in the southwestern part of the province.

The final four months of 2022 were marked by large fluctuations in temperatures and precipitation with hot and cold days, rain and snowstorms, and some wind. In September, temperatures in much of the province were close to normal except the northwest and Far North where they were slightly above normal. In the Far North, near Fort Severn, only two days in August were below normal temperatures. Precipitation was below normal for most of the province particularly from southwestern Ontario to the Golden Horseshoe as well as in the Far North. Some areas had higher than normal precipitation including Thunder Bay with 107 mm compared to the normal 88 mm and Timmins with 106 mm compared to the normal of 85 mm.

In October temperatures in much of the province were above normal, reaching the upper teens and low twenties from October 22-25. Much of the province had below normal precipitation except for the Far North and parts of the northeast. Snowfall did arrive in the northeast in mid October, with Kapuskasing getting 22.7 cm of snow over a three-day span. The northwest part of the province was substantially drier than normal as Thunder Bay and Kenora had only 26 mm and 22 mm of precipitation compared to the normal of 63 mm.

November started out warm with temperatures near 20 °C in Sioux Lookout and Wawa breaking daytime records, but for the next few weeks were below normal returning to above normal for the last week of the month. Despite the fluctuations, overall average temperature for the month was only a few degrees above normal for the province. Precipitation was well above normal in the northeast as places like Timmins received over twice the normal precipitation. Most of this precipitation was a storm that occurred November 10-11 when some areas received over 100 mm of rainfall. In contrast, much of southern Ontario was drier than normal other than substantial snowfall in some areas in the south, such as Wiarton where over 120 cm of snow fell November 17-20. Other areas with higher than normal amounts of snowfall included the Niagara Region and parts of Prince Edward County. Precipitation in the northwest part of the province was close to normal.

In December the average temperature was near to above normal with large fluctuations throughout the month. The first part of the month was cold as some areas were below −30 °C, then a warming trend began November 10 and lasted for a week with temperatures reaching 12 °C above normal in some parts of northern Ontario. Southern Ontario temperature fluctuations were less extreme but late December was relatively cold with temperatures as low as 10 °C below normal. By the end of December temperatures across the province were well above normal with some areas in the northeast recording temperatures more than 16 °C above the average. Precipitation was above normal in the north while the south was closer to normal, with localized areas from Toronto to Ottawa receiving above normal precipitation. Some northern areas had almost 40 mm more precipitation than the monthly normal, with much of it coming as snow during a December 23-26 snowstorm.

Disturbances from abiotic events

In 2022, 268 forest fires were recorded in Ontario, a large decrease from the 1,198 recorded in 2021. Only 2,517 ha of forest burned in 2022 compared to the record breaking 793,325 ha recorded in 2021. The largest fire was Timmins1 at 1,445 ha, more than half the provincial total.

The area of blowdown increased from 704 ha in 2021 to 10,563 ha in 2022. Most of the 2022 blowdown was in Southern Region, with small areas documented in Northwest and Northeast regions. In the south, much of this blowdown was caused by a major storm on May 21 as well as several tornadoes throughout the summer months.

Insect infestations

The area of moderate to severe spongy moth defoliation decreased considerably, from 1,779,744 ha in 2021 to 22,427 ha in 2022. All the moderate to severe defoliation was recorded in Southern Region, most of it (20,215 ha) in Aylmer and Guelph districts. In 2022, more of the defoliation was categorized as light (35,604 ha) than moderate to severe. All light defoliation was in Southern Region, most of it (22,038 ha) in Aylmer District. Varying levels of spongy moth pathogens, such as *Entomophaga maimaiga* and NPV, were recorded in Southern Region. Varying levels of egg parasitism were also observed across Southern Region.

In 2022, spongy moth defoliation forecast surveys were done in four districts in Southern Region. Severe defoliation is forecasted for 2023 in four of the 14 locations surveyed, with moderate defoliation forecasted in five, light in three, and none in two locations.

For the third consecutive year, moderate to severe defoliation by jack pine budworm decreased in the province. It dropped from 346,266 ha in 2021 to 130,674 ha in 2022. Defoliation shifted from most of it (119,912 ha) occurring on the east side of Northwest Region into Northeast Region, where jack pine budworm was mapped for the first time in Hearst District, plus a small area in Wawa District, totalling 10,762 ha. Moderate to severe jack pine budworm defoliation was recorded in all seven districts in Northwest Region, most of it in Nipigon and Thunder Bay districts, while most other districts had less defoliation compared to 2021. Light jack pine budworm defoliation was also mapped in all districts in Northwest Region totalling 2,050 ha. Jack pine tree mortality, caused by consecutive years of moderate to severe jack pine budworm defoliation, was mapped in all districts in Northwest Region totalling 1,494 ha. Almost half the mortality was in Dryden District.

In early October 2022, jack pine budworm defoliation was forecast based on surveys of the number of overwintering jack pine budworm larvae on tree branches in Northwest and Northeast regions. Seventeen locations were surveyed, 14 in Northwest Region in Dryden, Nipigon, and Thunder Bay districts and three in Northeast Region in Hearst and Wawa districts. The forecast for all locations was light defoliation for 2023, with the highest average number of larvae per branch at 15 near Long Lac in Nipigon District.

For the fourth consecutive year, the area of moderate to severe spruce budworm defoliation increased in the province, jumping from 1,302,537 ha in 2021 to 2,029,039 ha in 2022. Most of this defoliation (2,012,433 ha) was in Northeast Region where defoliation increased in all districts except Hearst where it decreased slightly. In Southern Region, all moderate to severe defoliation was recorded in Parry Sound District with an increase from 348 ha mapped in 2021 to 16,606 ha in 2022. In 2022, 17,088 ha of tree mortality caused by spruce budworm were mapped in Ontario. Most of this mortality was mapped in Northeast Region (16,698 ha), the bulk of it in Timmins, Chapleau, Cochrane, and North Bay districts, adding to 15,007 ha of mortality. Tree mortality was also mapped in Parry Sound District, Southern Region, totalling 390 ha.

In October 2022, spruce budworm defoliation was forecast in Northeast Region based on surveys of the number of overwintering larvae on tree branches. In all, 34 locations were surveyed in Cochrane, Timmins, Hearst, Chapleau, Kirkland Lake, and North Bay districts. Results indicated that severe defoliation would persist at three of the locations in 2023, with another 22 locations forecast to have moderate defoliation, and nine locations with light defoliation.

For the second consecutive year, the area of moderate to severe forest tent caterpillar defoliation increased, from none in 2020 to 36,926 ha in 2021 and 261,255 ha in 2022. Most of this defoliation was in Northeast Region (236,791 ha) but, for the first time in fours years, forest tent caterpillar defoliation was recorded in Northwest Region (24,465 ha), most of it in Thunder Bay and Nipigon districts (23,535 ha). Most of the defoliation in Northeast

Region (224,461 ha) was in Hearst, Timmins, Kirkland Lake, and Cochrane districts.

Moderate to severe large aspen tortrix defoliation decreased from 5,486 ha in 2021 to 2,319 ha in 2022. The defoliation was in Northeast Region, most of it in Kirkland Lake District (1,875 ha) and the remainder in North Bay and Sudbury districts.

The area of moderate to severe cedar leaf miner defoliation increased from 12,636 ha in 2021 to 14,133 ha in 2022. Most of this defoliation was aerially mapped in Southern Region. Pembroke District had the most defoliation with 11,206 ha, but new areas of defoliation were also mapped in Guelph, Aurora, Aylmer, and Midhurst districts. Kemptville District had only 44 ha of defoliation, a decline from 2021. In 2022, 163 ha of light cedar leaf miner defoliation was also mapped in Pembroke District.

Several other insects caused localized defoliation or damage in various parts of Ontario. These occurrences did not develop into provincially significant areas of defoliation but do contribute to overall effects on forest health.

Forest pathogens and tree decline

Most tree pathogens do not cause symptoms over areas large enough to be aerially mapped, except when the damage is severe. In 2022, brown spot needle blight damage was severe enough to map in the Southern and Northeast regions. Most of the damage (1,796 ha) was in six districts in Southern Region, while the remainder (77 ha) was in Sault Ste. Marie District Northeast Region. Cedar apple rust damage was also severe enough to map in 2022, but it was very localized in an old apple orchard in Kemptville District. The area of moderate to severe damage was 43 ha. Other damage from rusts was also observed in the province but not aerially mapped, including hawthorn rust in Southern Region and white pine blister rust in Northeast Region. Leaf spot was observed during ground surveys in small, localized areas in Northeast and Southern regions. Septoria leaf spot of white birch was more common in late summer in Northeast and Southern regions.

Beech leaf disease was first reported in Ohio in 2012 and in 2017 symptoms were confirmed in Aylmer District. Since then, beech leaf disease has also been confirmed in Guelph and Aurora districts. During 2018 and 2019, ministry forest health experts worked with AgCanada and U.S. researchers to describe the nematode found in symptomatic leaves and reproduced symptoms in beech using solutions containing the nematode. They also determined how the nematode overwinters and the types of tissues that are infected during the growing season. Knowing the causal agent, they plan to investigate how the nematode is being spread locally and regionally. In 2022, beech leaf disease was reported in new areas of districts where the disease was previously reported.

Invasive species

Emerald ash borer is an invasive insect that is regulated by the Canadian Food Inspection Agency (CFIA). As of June 30, 2016, the area regulated to control emerald ash borer in Ontario includes Southern Region and the southern part of Northeast Region, south of Montreal River, which is at the northern end of Sault Ste. Marie District. The City of Thunder Bay in Northwest Region is also regulated for this borer. In 2022, 411 ha of ash decline caused by emerald ash borer were aerially mapped in the southern part of Northeast Region in Sault Ste. Marie District, all in the quarantined area. During ground surveys, unrecorded occurrences were found in the quarantined area in Bancroft, Kemptville, and Parry Sound districts in Southern Region as well as Sudbury, North Bay, and Sault Ste. Marie districts, Northeast Region.

In 2022, unrecorded occurrences of beech bark disease were observed in Southern Region in Aurora, Aylmer, Kemptville, Parry Sound, Pembroke, and Midhurst districts.

Two unrecorded locations with hemlock woolly adelgid were confirmed by the Canadian Food Inspection Agency in Southern Region. One in Guelph District and the other in Peterborough District.

Pest index — Major forest disturbances

Major forest disturbances occur when an insect, disease, or weather event affects a very large area, is not specific to a region, or has affected more than one region in the past. These disturbances, listed below, are considered of provincial significance.

Pest index — Minor forest disturbances

Minor forest disturbances are identified regionally using forest health surveys. These disturbances, listed below, could have local or regional significance to forest health conditions.

Pest index — Invasive forest species

Invasive forest species are insects or diseases that are not native to Ontario. Invasive species have the potential or proven ability to have deleterious effects on forest health, tree health, ecosystem functioning, or social and economic values. Invasive species found during forest health monitoring field work in Ontario in 2022 are listed below.

Host index

Tree and shrub species mentioned in this report and their scientific names.

Common name	Scientific name
American beech	*Fagus grandifolia* Ehrh.
American elm/white elm	*Ulmus americana* L.
Austrian pine	*Pinus nigra*
Balsam fir	*Abies balsamea* (L.) Mill.
Balsam poplar	*Populus balsamifera* L.
Basswood	*Tilia americana* L.
Black spruce	*Picea mariana* (Mill.) BSP
Black walnut	*Juglans nigra* L.
Eastern hemlock	*Tsuga canadensis* (L.) Carrière
Eastern white cedar	*Thuja occidentalis* L.
Eastern white pine	*Pinus strobus* L.
Green ash	*Fraxinus pennsylvanica* Marshall
Jack pine	*Pinus banksiana* Lamb.
Red maple	*Acer rubrum* L.
Red oak	*Quercus rubra* L.
Red pine	*Pinus resinosa* Ait.
Scots pine	*Pinus sylvestris* L.
Sugar maple	*Acer saccharum* Marsh.
Tamarack/larch	*Larix laricina* (Du Roi) K. Koch
Trembling aspen	*Populus tremuloides* Michx.
White ash	*Fraxinus americana* L.
White birch	*Betula papyrifera* Marsh.
White oak	*Quercus alba* L.
White spruce	*Picea glauca* (Moench) Voss
Willow species	*Salix spp.*

Major forest disturbances

Mapped area

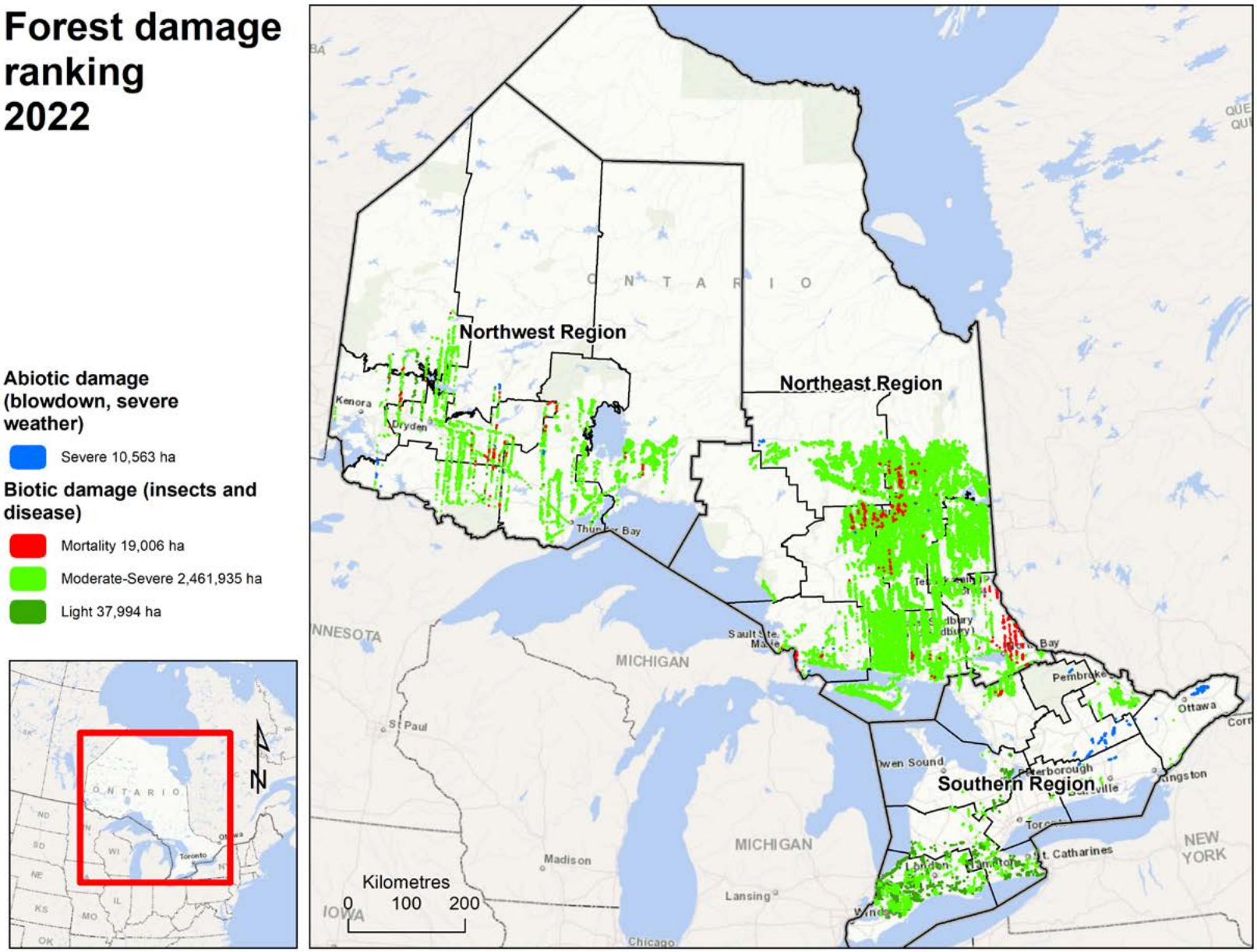
Major forest disturbances are mapped to quantify annual status and support trend analysis. The following table outlines area (in hectares) of mapped defoliation/damage by severity class for major disturbances in 2022.

Common name	Light	Moderate to severe	Tree mortality	Total
Blowdown	0	10,563	NA	10,563
Brown spot needle blight	0	1,873	NA	1,873
Cedar apple rust	0	43	NA	43
Cedar leafminer	163	14,133	NA	14,296
Emerald ash borer	0	411	NA	411
Forest tent caterpillar	177	261,255	NA	261,432
Jack pine budworm	2,050	130,674	1,494	134,218
Large aspen tortrix	0	2,319	NA	2,319
Larch casebearer	0	21	NA	21
Pine needleminer	0	50	NA	50
Spongy moth	35,604	22,427	NA	58,031
Spruce budworm	0	2,029,039	17,088	2,046,127
Whitespotted sawyer beetle	NA	100	NA	100

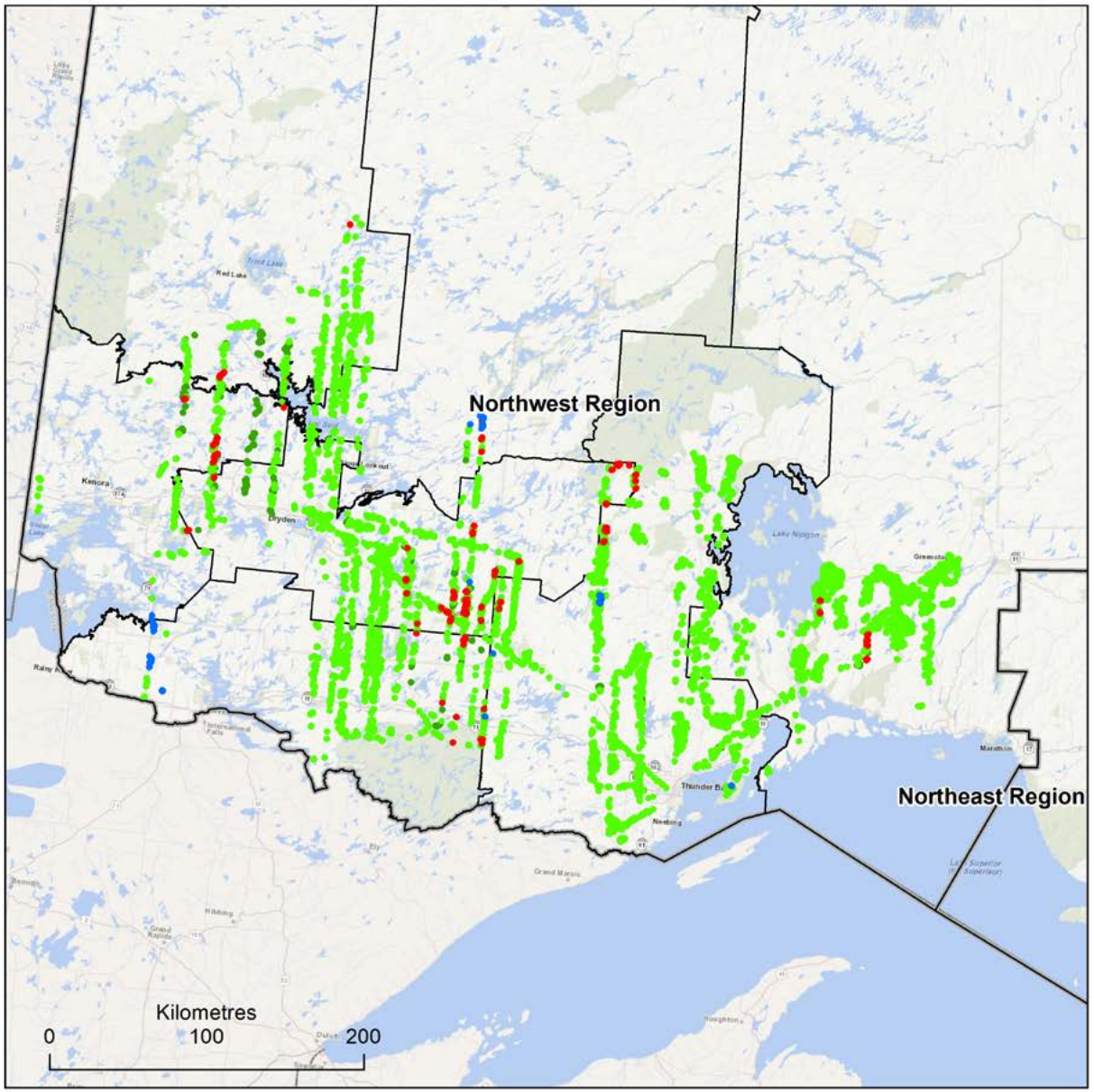
Major forest disturbances maps

Provincial overview

Forest damage ranking 2022



Northwest Region Forest damage ranking 2022



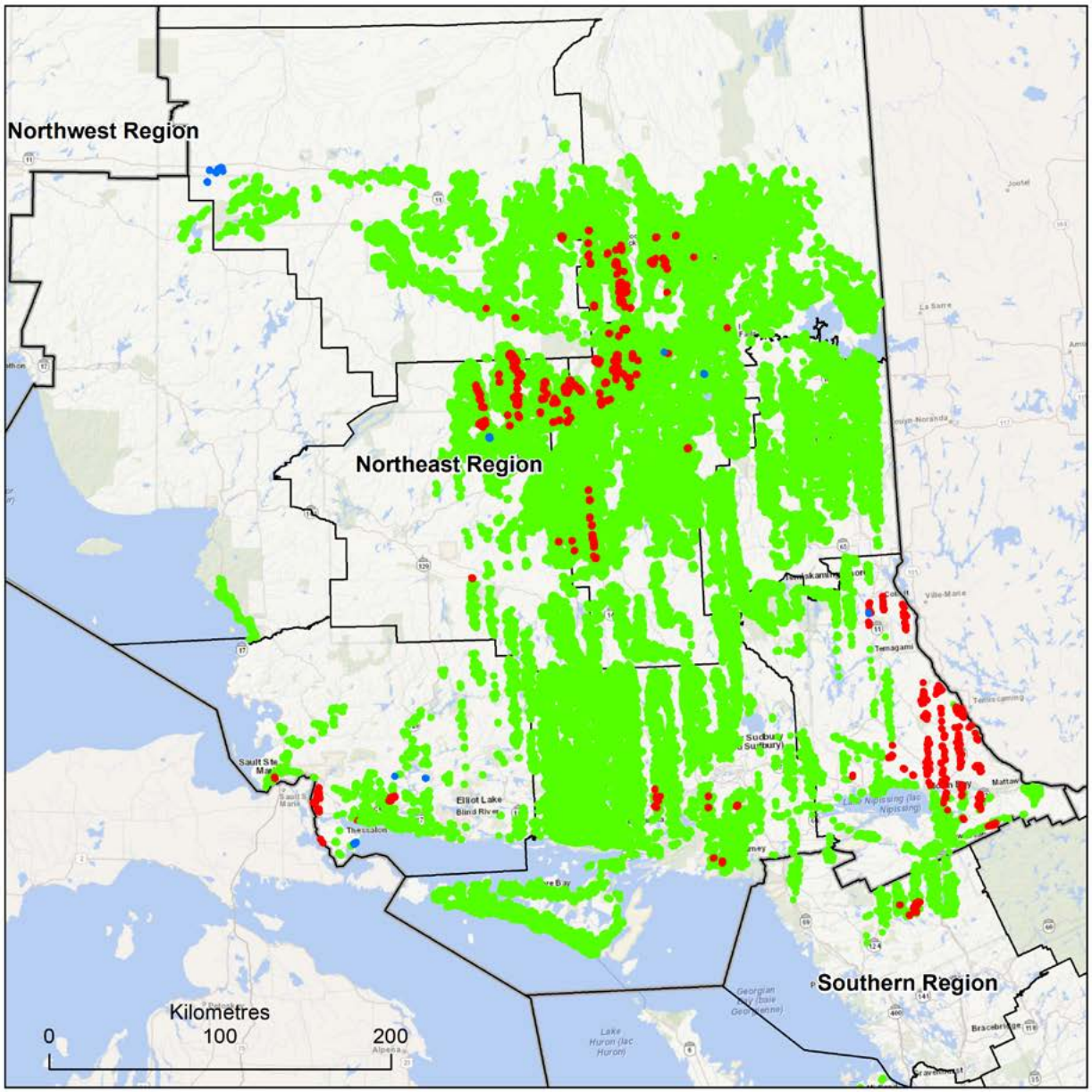
Abiotic damage (blowdown, severe weather)

- Severe 622 ha

Biotic damage (insects and disease)

- Mortality 1,507 ha
- Moderate-Severe 144,461 ha
- Light 2,227 ha

Northeast Region Forest damage ranking 2022



Abiotic damage (blowdown, severe weather)

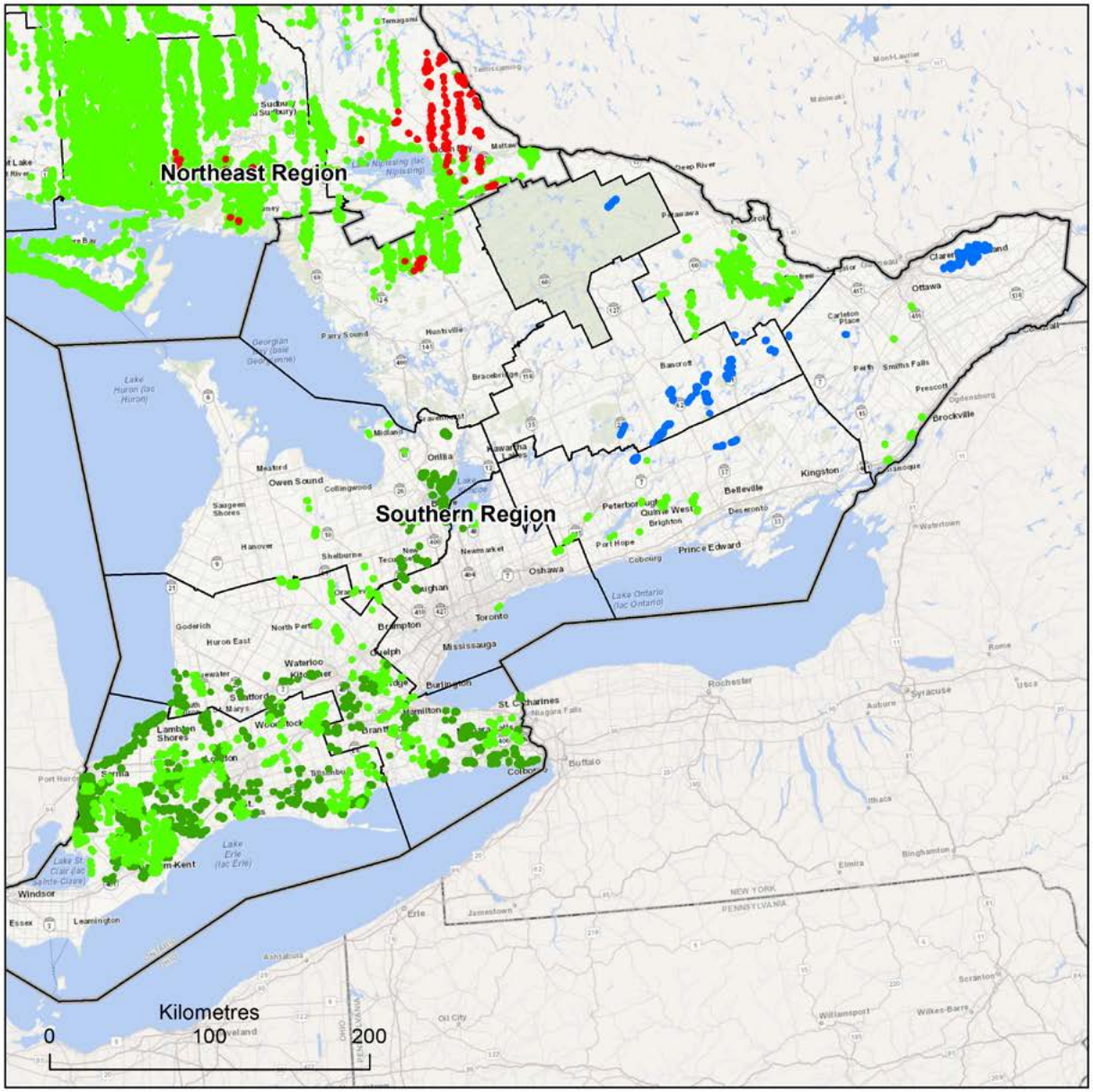
Severe 607 ha

Biotic damage (insects and disease)

Mortality 17,109 ha

Moderate-Severe 2,626,397 ha

Southern Region Forest damage ranking 2022



Example report

How to read a major disturbance report

Each report summarizes information about an event or disturbance affecting the health of Ontario's forests, and may include:

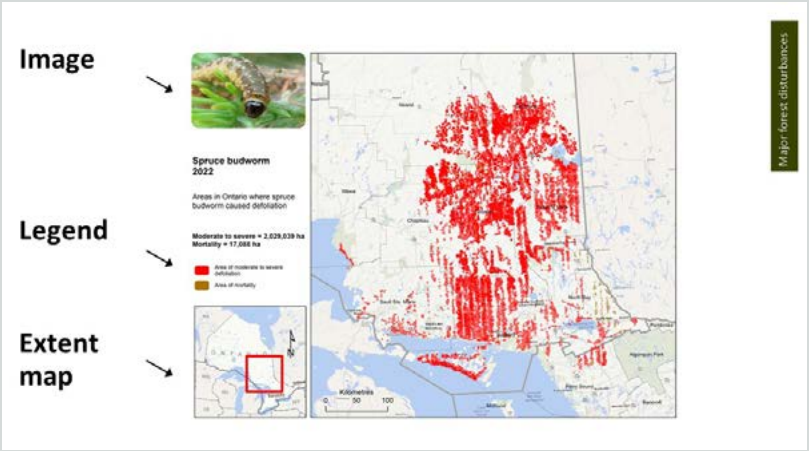
- **Pest/damage information** – basic information about the disturbance, including the type, origin, host species, and area affected that year
- **Key facts** – overview of the disturbance, including provincial scale information about the disturbance, possible effects, and annual activity
- **Regional summary** – regional summaries, outlining more specific information by MNRF administrative region (Northwest, Northeast, Southern)
- **Image** – a photo of the disturbance or pest
- **Outlook** – where applicable, an overview of potential future implications and developments for the disturbance
- **Trends** – where applicable, additional information about possible trends
- **Area summary** – where applicable, information about the total area in which the disturbance caused moderate to severe damage from 2018 to 2022 by MNRF region and district.

Example map

How to read the maps in this report

For major disturbances, the following spatial information is provided:

- **Damage map** – shows the areas of infestation or damage. Light damage is typically shown in orange, moderate to severe damage in red, and mortality in yellow. Smaller areas are outlined in pink to make them stand out.
- **Image** – photo of the disturbance or pest
- **Legend** – describes map features
- **Extent map** – map of Ontario with the focal area outlined in deep red



Beech bark disease

Pest information

Common name:	Beech bark disease
Scientific name:	*Neonectria faginata* (Lohman, Watson & Ayers) Castl. & Rossman*, Neonectria ditissima* (Tul. & Tul.) Samuels & Rossman
Pest origin:	Invasive — native to Europe
Pest type:	Disease
Host species:	American beech
Infestation area:	Localized

Provincial key facts

- Beech bark disease is the result of an insect-fungal pathogen complex initiated by the infestation of beech scale *(Cryptococcus fagisuga)* on American beech.
- As the insect and fungus become established in a stand, they reduce growth, deform trees, decrease wood quality and mast production, and usually cause early tree death.
- Beech bark disease has been identified across the range of beech in Ontario, as far north as St. Joseph Island, Sault Ste. Marie District.
- Three distinct phases of beech bark disease development are evident in Ontario:
  - Advancing front: Beech scale populations have recently colonized unaffected beech trees. Scale infestations combined with other stressors can contribute to beech decline.
  - Killing front: Scale populations build rapidly, and the fungus colonizes trees. The killing front is characterized by high tree mortality.
  - Aftermath forest: The disease has passed through and remains endemic. Large remnant trees continue to decline and young trees become infected, disfigured, and gradually decline. Only 1% of trees are expected to be resistant to the disease.
- In 2022, new locations with beech bark disease were identified in Southern Region.

Regional summary

Southern

- In Aurora District, beech bark disease was reported at two sites in Halton Region. A collection was made in a beech stand at the intersection of North Service Road and Waterdown Road in Burlington where high levels of beech bark disease damage were observed. All beech trees surveyed had stems covered with old cankers and had chlorotic, undersized leaves and sparse crowns. Beech bark disease damage was also observed at Mansfield Park in Oakville where light canker damage was reported.
- In Parry Sound District, moderate beech bark disease damage was documented along Maple Ridge Drive (east of Dorset), Barlochan Rd (northwest of Walker's Point), Blackstone-Crane Lake Road (west of Horseshoe Lake), and Beechwood Drive (south of Humphrey).
- In Kemptville District, moderate levels of beech bark disease were documented in Leeds-Grenville County at Mill Pond Conservation area on Briton-Houghton Bay Road on the south shore of Big Rideau Lake.
- In Midhurst District, moderate beech bark disease damage was observed on beech trees at Allan Park Conservation Area near Hanover in Grey County.
- In Aylmer District, light beech bark disease damage was observed at two locations in Elgin County. Evidence of cankers was found on several mature beech adjacent to the Ravine Creek Trail in Port Burwell Provincial Park. Traces of fruiting cankers were also detected in the southern part of John E. Pearce Provincial Park, near Wallacetown.
- In Pembroke District, light beech bark disease damage was observed on Grant Road near Ashdad in the northeast corner of Greater Madawaska Twp.

Beech Bark Disease and Beech Scale in Ontario 1999 - 2022

- Beech bark disease detected
- Beech scale detected

Produced by:
Biodiversity and Monitoring Section
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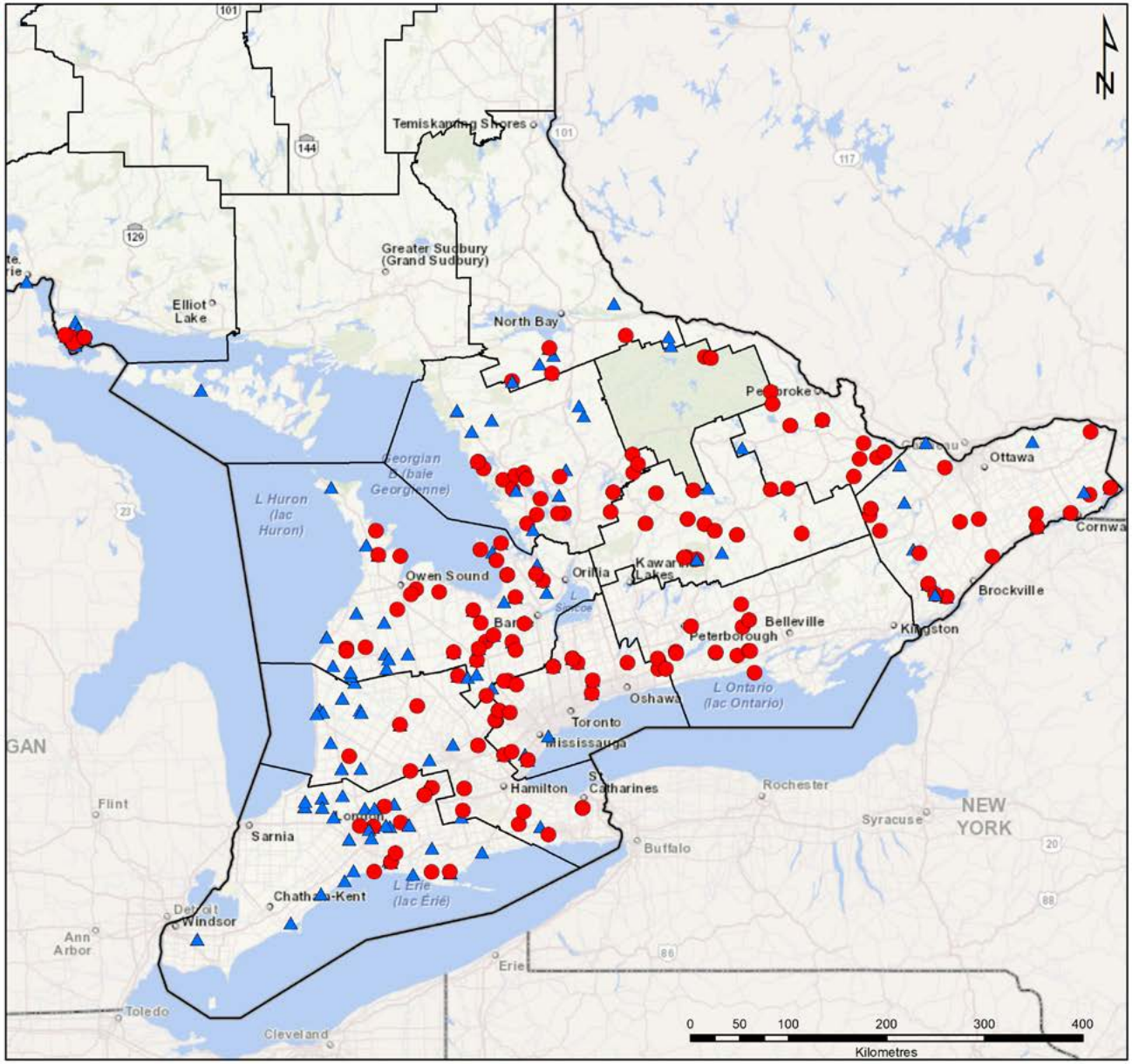


Blowdown

Pest information

Common name:	Blowdown
Scientific name:	NA
Pest origin:	NA
Pest type:	Abiotic
Host species:	NA
Infestation area:	10,563 ha

Provincial key facts

- Blowdown, damage to trees caused by high winds or extreme weather events, is a natural disturbance process in forests. The extent and frequency of such damage is sporadic.
- In 2022, several extreme weather events resulted in increased blowdown damage mapped across the province.
- On May 21, 2022, a severe storm system travelled through southern Ontario, roughly parallel to the northern shores of Lake Erie and Lake Ontario and continued to Quebec. The straight-line winds and long track of this storm system fit the criteria for the weather phenomenon called a derecho (NASA, Earth Data). Wind speeds reached up to 190 km per hour and several tornadoes were reported, causing extensive damage.

Regional summary

Northwest

- In Fort Frances District, 266 ha of blowdown were mapped. A severe thunderstorm with strong winds occurred on July 17 causing trees to be uprooted and snapped off in and around Caliper Lake Provincial Park, along Hwy 71, south of Little Pine Lake and north of Westra Road, and south of the community of Barnhart.
- In Thunder Bay District, 263 ha of blowdown were mapped in Sleeping Giant Provincial Park, south of Kearns Lake and southeast of Pyramid Lake. This damage may have resulted from a severe thunderstorm on May 30, 2022.

- In Sioux Lookout District, 79 ha of blowdown were mapped southwest of Saint Raphael Provincial Park near Elam Lake, Moose Lake, and Runway Lake.
- In Kenora District, 12 ha of blowdown were mapped north of Nestor Falls on Marsh Bay Road. This damage was also the result of the severe thunderstorm on July 17.
- In Dryden District, 2 ha of blowdown were mapped east of Sowden Lake.

Northeast

- In Hearst District, 350 ha of blowdown were mapped north of Nagagamisis Provincial Park in McCoig, Kohler, and Mercer townships.
- In Sault Ste. Marie District, 119 ha of blowdown were mapped on the southeast side of St. Joseph Island in Hilton Twp near Garfield Bay, between Mississagi River and Shaw Road on the border of Otter and Haughton townships, and north of Kynoch in Grasett Twp, southwest of Wakomata Lake in Little White River Provincial Park. This was part of a blowdown event that took place in August of 2021.
- In Chapleau District, 65 ha blowdown were mapped southeast of Mishionga Lake in Lemoine Twp.
- In Timmins District, 60 ha of blowdown were mapped southwest of Frederick House Lake in Matheson Twp, and east of Hwy 655 in Prosser Twp.
- In North Bay District, 13 ha blowdown were mapped south of Latchford by Island Lake.

Southern

- In Bancroft District, 5,180 ha of blowdown were mapped during aerial surveys from the May 21 derecho event. Due to the path of the storm, blowdown was mapped in scattered areas north of Hwy 7 east of Peterborough and into Kemptville District. Areas of blowdown were mapped in North Kawartha Twp near Burleigh Falls, and extending east through Hastings, Lennox and Addington, and Frontenac counties. The most severe areas of damage were along Hwy 41 from Cloyne to Upper Mazinaw Lake, including parts of Bon Echo Provincial Park and the Addington Highlands. During ground surveys, small areas of blowdown were observed along Shabomeka Lake Rd and Buckshot Rd, Frontenac County, and along Weslemkoon Lake Road, north of Gunter, Hastings County.
- In Kemptville District, 2,462 ha of blowdown from the May 21 derecho event were mapped during aerial surveys. Large areas were mapped in a corridor starting near Navan in southeast Ottawa, extending east through the City of Clarence-Rockland into Plantagenet Twp, and ending at Hwy 16 near Rockdale. Small areas of blowdown were mapped east of Clyde Forks in the Lanark Highlands and southwest of Carleton Place on Lanark Concession Road 12B in the village of Boyds. During ground surveys, scattered areas of blowdown were observed in the City of Ottawa, Lanark County, and Leeds and Grenville County. In the City of Ottawa, blowdown was observed along Hwy 417 from Leitrim Road to Ramsayville Road, south of Manotick at the intersection of Century Avenue and Second

Line Road South, and in the west parts of the city along Hwy 417 at Hwy 7. In Lanark County, blowdown was observed intermittently on South Lavant Road west of Lavant Station, Ranger Park Road, Black Creek Road especially at the north end around Joe Lake, northeast of Carleton Place along River Road near Appleton, and along Ramsay Conc. 12 and Golden Line Road from Turners Road to March Road. In Leeds-Grenville County, blowdown was observed along Old Kingston Road on the east shore of Big Rideau Lake.

- In Peterborough District, 977 ha of blowdown were mapped from two 2022 storm events. Blowdown from the May 21 derecho event was mapped in Douro-Dummer Twp, south of Stoney Lake, and during ground surveys damage was reported in Rockdale, Actinolite, Hastings County, Mark S. Burnham Provincial Park in the City of Peterborough, along Northeys Bay Road in North Kawartha Twp, and along Hwy 7A in Yelverton, City of Kawartha Lakes. On July 24, 2022, an EF2 tornado was reported with maximum windspeeds of 190 km per hr that travelled through the communities of Rockdale and Actinolite. Blowdown from this storm was mapped along Hwy 7 east and west of Actinolite.
- In Algonquin Park, 667 ha of blowdown caused by a 2021 tornado were mapped southwest of Lake Travers.
- In Pembroke District, 49 ha of blowdown were mapped in the southwest corner of Greater Madawaska Twp, north of Matawatchan Provincial Park.

Total area (in hectares) in which blowdown caused severe damage and/or mortality in 2018–2022 by MNRF district.

Region	Area of damage (ha)				
District	2018	2019	2020	2021	2022
Northeast					
Chapleau	653	1,238	-	-	65
Cochrane	-	-	38	-	-
Hearst	36	24	-	-	350
Kirkland Lake	123	-	-	13	-
North Bay	-	-	-	39	13
Sault Ste. Marie	-	25	-	364	119
Sudbury	11	-	-	188	-
Timmins	-	207	55	-	60
Wawa	133	254	-	-	-
Subtotal	956	1,748	93	604	607

Region	Area of damage (ha)				
District	2018	2019	2020	2021	2022
Northwest					
Dryden	497	-	-	7	2
Fort Frances	113	-	1,169	-	266
Kenora	-	-	-	-	12
Nipigon	-	-	-	-	-
Red Lake	1,120	2,832	-	-	-
Sioux Lookout	1,032	3,188	204	30	79
Thunder Bay	9	-	-	-	263
Subtotal	2,771	6,020	1,373	37	622
Southern					
Algonquin Park	-	-	-	-	667
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	-	-	-	5,180
Guelph	-	-	-	-	-
Kemptville	-	77	-	-	2,462
Midhurst	-	-	-	-	-
Parry Sound	14	-	-	63	-
Pembroke	98	645	-	-	49
Peterborough	-	-	-	-	977
Subtotal	112	722	0	63	9,334
Provincial total	3,839	8,490	1,466	704	10,563

Blowdown 2022

Areas in Ontario where blowdown caused damage

Severe = 10,563 ha

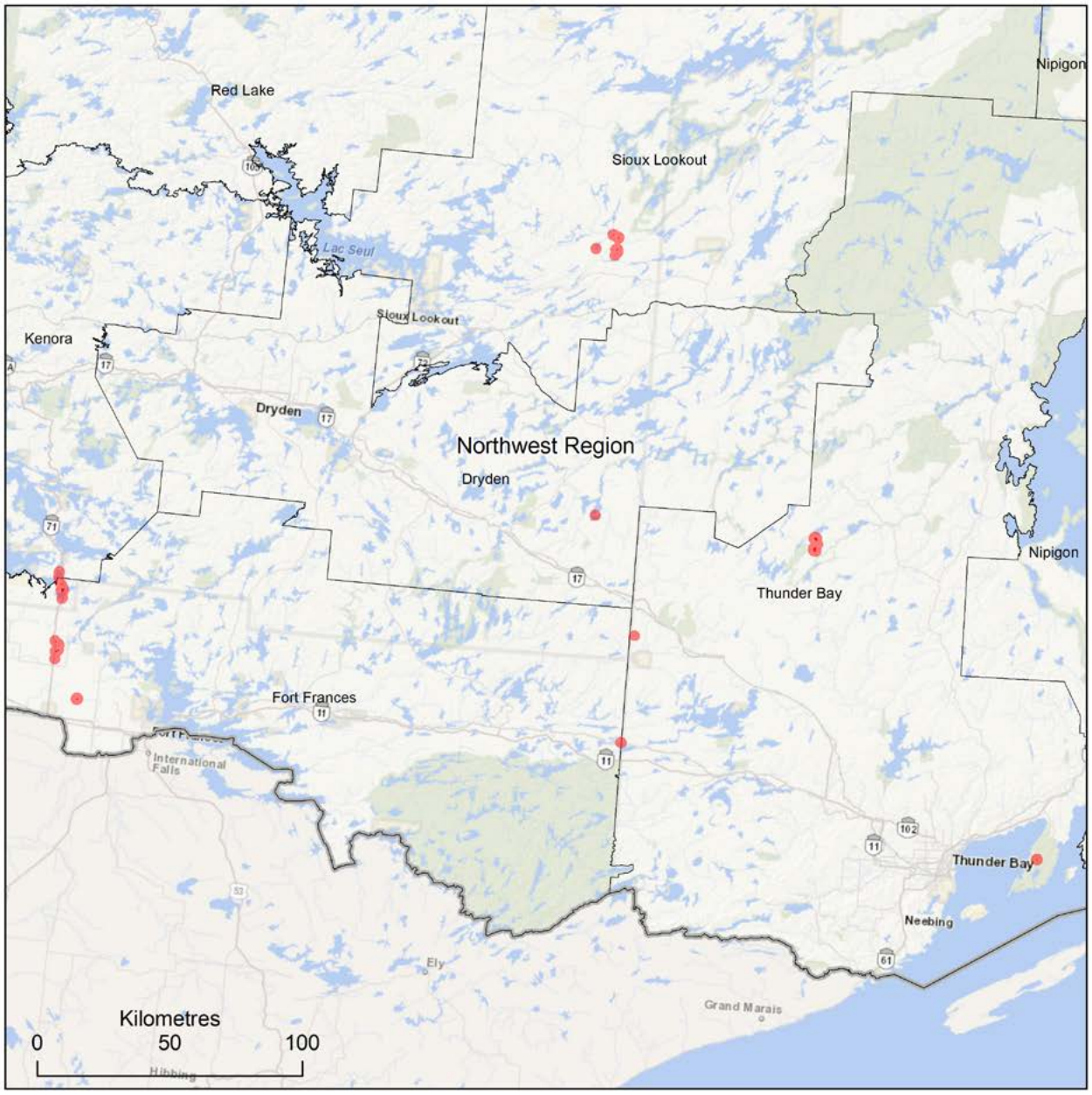
Area of severe damage

Blowdown 2022

Areas in the Northwest Region where blowdown caused damage

Severe = 622 ha

Area of severe damage

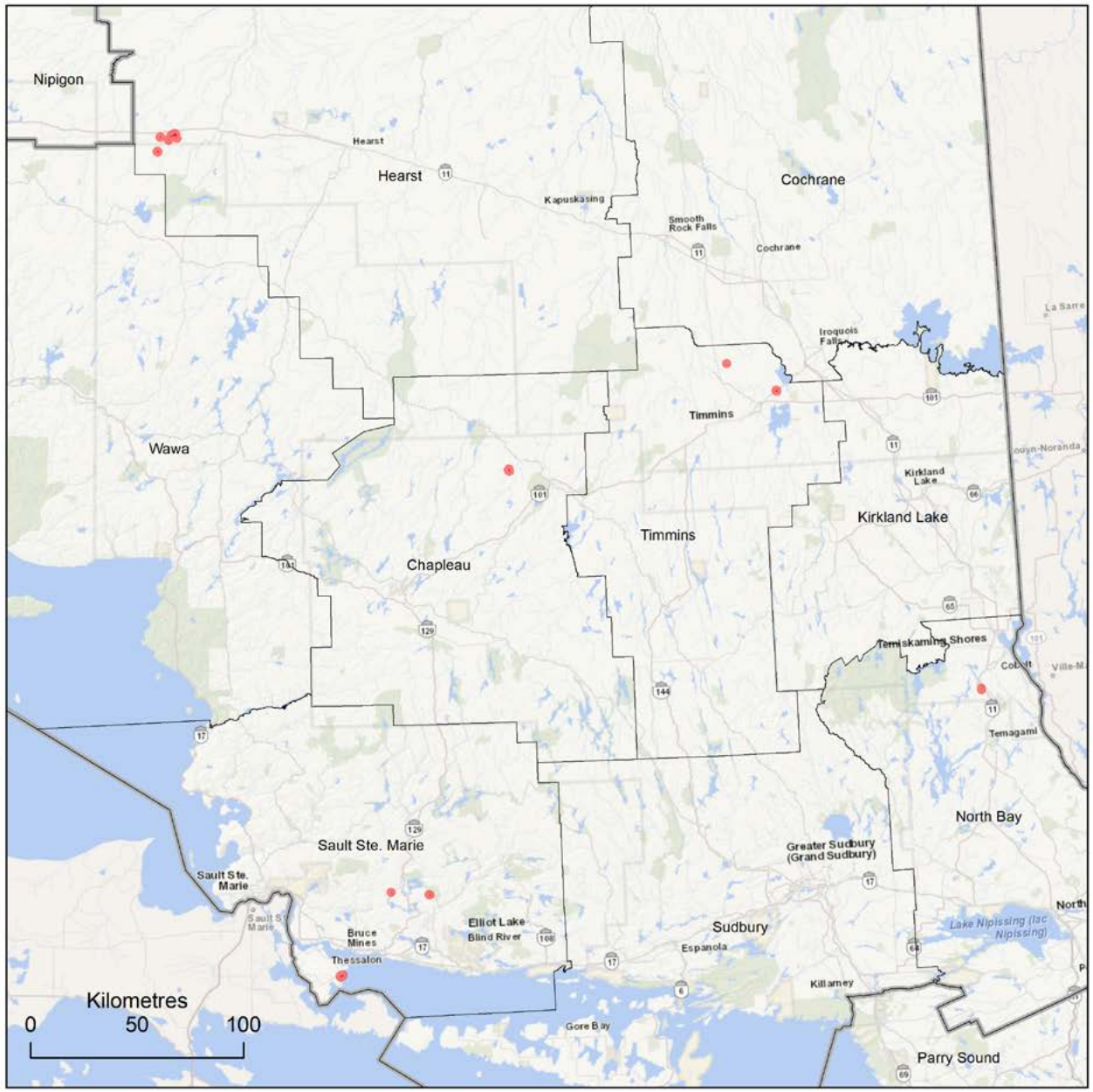


Blowdown 2022

Areas in the Northeast Region where blowdown caused damage

Severe = 607 ha

Area of severe damage

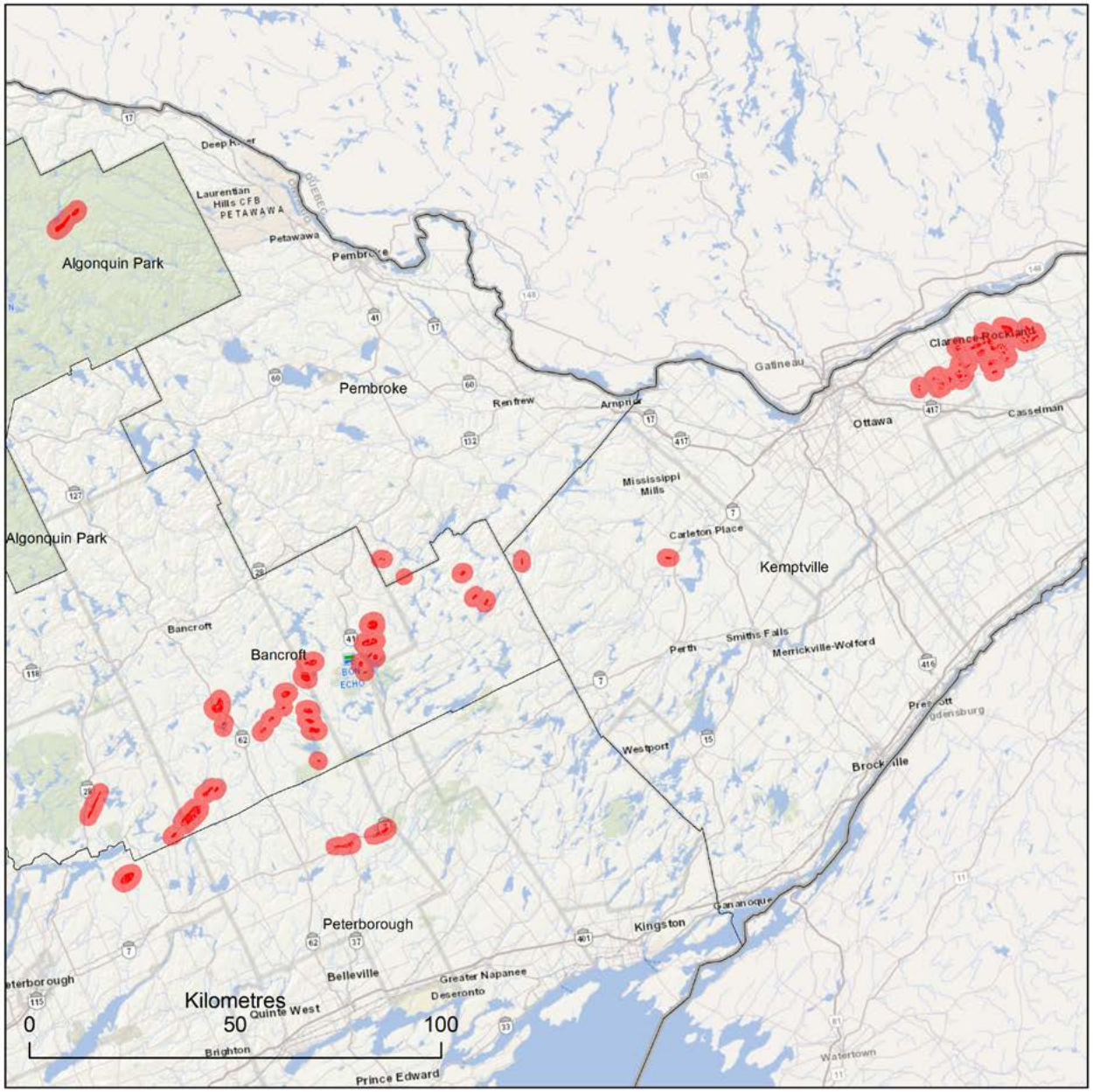


Blowdown 2022

Areas in the Southern Region where blowdown caused damage

Severe = 9,334 ha

Area of severe damage



Brown spot needle blight

Pest information

Common name:	Brown spot needle blight
Scientific name:	*Lecanosticta acicola* (M.E. Barr)
Pest origin:	Native
Pest type:	Needle blight
Host species:	Scots pine, eastern white pine, red pine, Austrian pine
Infestation area:	1,873 ha

Provincial key facts

- This disease affects Scots and Austrian pine of all ages but is most damaging to seedlings and smaller trees.
- Several years of infection by brown spot needle blight reduces tree growth. Coupled with other factors, such as drought and secondary insect attack, this blight may result in branch and tree mortality.
- In some affected locations, previous years' needles turn brown and drop in June, leaving only current years' shoots on trees.
- In 2022, scattered areas of brown spot needle blight damage were observed, mainly in Southern Region but also in the southern part of Northeast Region.

Regional summary

Northeast

- In Sault Ste. Marie District, two small areas of severe brown spot needle blight damage totalling 77 ha were aerially mapped on the southwest side of St. Joseph Island in Jocelyn Twp.

Southern

- In Aylmer District, 669 ha of small, scattered areas of moderate to severe brown spot needle blight damage were mapped in between Delhi and Simcoe, between Walsingham and Vittoria, between Port Ryerse and Renton, near Staffordville (Bayham), in Strathroy-Caradoc between Strathroy and Delaware West, between Woodstock and Princeton (Blandford-Blenheim Twp), and along Outer Drive in Port Franks (Lambton Shores).

In addition, moderate to severe damage from brown spot needle blight was detected along Hwy 401 East near Curry Road (Dutton-Dunwich).

- In Midhurst District, 603 ha of moderate to severe brown spot needle blight damage were mapped around Borden, Baxter, Tiny, Lafontaine, Waverley, Penetanguishene, Cardwell, Farmington, and along Hwy 4 through Flesherton. During ground surveys, moderate to severe brown spot needle blight damage was observed in Allan Park Conservation Area outside Hanover, along Hwy 6 outside Tobermory, along Hwy 6 north of Wiarton in Northern Bruce Peninsula, by Lefaives Corners, and along Hwy 11 and Hwy 12 north of Lake Simcoe. Light brown spot needle blight damage was also reported near Beeton.
- In Aurora District, 213 ha of moderate to severe brown spot needle blight damage was mapped north of Leskard and near Brown Hill.
- In Peterborough District, 130 ha of moderate to severe brown spot needle blight damage was mapped north of Hwy 115 in Cavan Monaghan Twp, south of Pontypool along Sandy Hook Road, the City of Kawartha Lakes, and in Northumberland County Forest near Caradoc Road. Moderate to severe brown spot needle blight damage was also reported along Pogue Road north of Dundonald, and at Garden Hill Conservation Area, west of Campbellcroft.
- In Guelph District, 129 ha of scattered areas of moderate to severe brown spot needle blight damage were mapped around Guelph (Puslinch and Guelph/Eramosa townships), south of Elora in Centre Wellington Twp, and west of Luther Lake at the intersection of Sideroad 13 and Line 8 in Wellington North Twp. During ground surveys, small areas of moderate to severe brown spot needle blight damage were detected in Wellington County around Mt. Forest, Wellington North Twp.
- In Parry Sound District, 52 ha of small areas of moderate to severe brown spot needle blight were mapped south of Sundridge, west of Lorimer Lake, and northeast of Byng Inlet. Moderate damage was also observed along Ahmic Lake Road (south of Ahmic Lake), Hwy 518/Deer Lake Road (east of Sprucedale), Muskoka Road 3 (southwest of Huntsville), Muskoka Road 4 (east of Ufford), Pevensey Road east of Hwy 11 (north of Burks Falls), Rattray Road (north of Huntsville), along Hwy 11 (south of Huntsville), Muskoka Road 2 (south of Huntsville), intersection of Hwy 60 and Hwy 35 (east of Dwight), and by Muskoka District Road 8 and Hwy 60 (east of Huntsville).
- In Bancroft District, severe brown spot needle blight damage was observed on Hwy 6, from Sebright to Sedowa, City of Kawartha Lakes.

Total area (in hectares) in which brown spot needle blight caused moderate to severe damage in 2018–2022 by MNRF district.

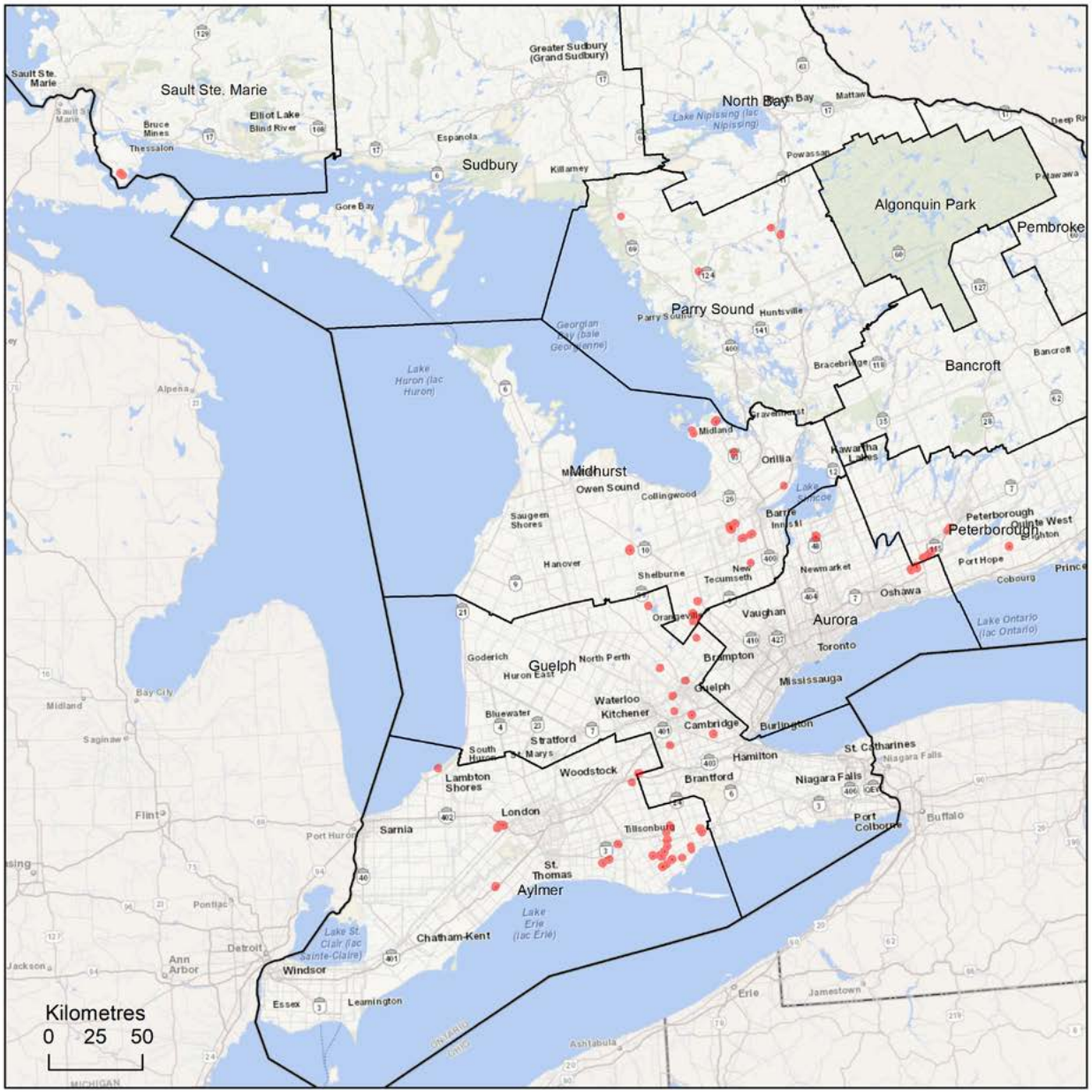
Region	Area of damage (ha)				
District	2018	2019	2020	2021	2022
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	76	-	-	-
Sault Ste. Marie	-	154	-	-	77
Sudbury	67	58	-	-	-
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Subtotal	67	288	0	0	77
Southern					
Algonquin Park	-	-	-	-	-
Aurora	121	557	-	-	213
Aylmer	68	678	-	-	669
Bancroft	-	13	-	-	
Guelph	-	207	-	-	129
Kemptville	-	8	-	-	-
Midhurst	1,569	2,796	-	-	603
Parry Sound	-	1,527	-	327	52
Pembroke	-	-	-	-	-
Peterborough	3	67	-	-	130
Subtotal	1,760	5,852	0	327	1,796
Provincial total	1,827	6,140	0	327	1,873

Brown spot needle blight 2022

Areas in Ontario where brown spot needle blight caused defoliation

Moderate to severe = 1,873 ha

Area of moderate to severe defoliation



Brown spot needle blight 2022

Areas in the Northeast Region where brown spot needle blight caused defoliation

Moderate to severe = 77 ha

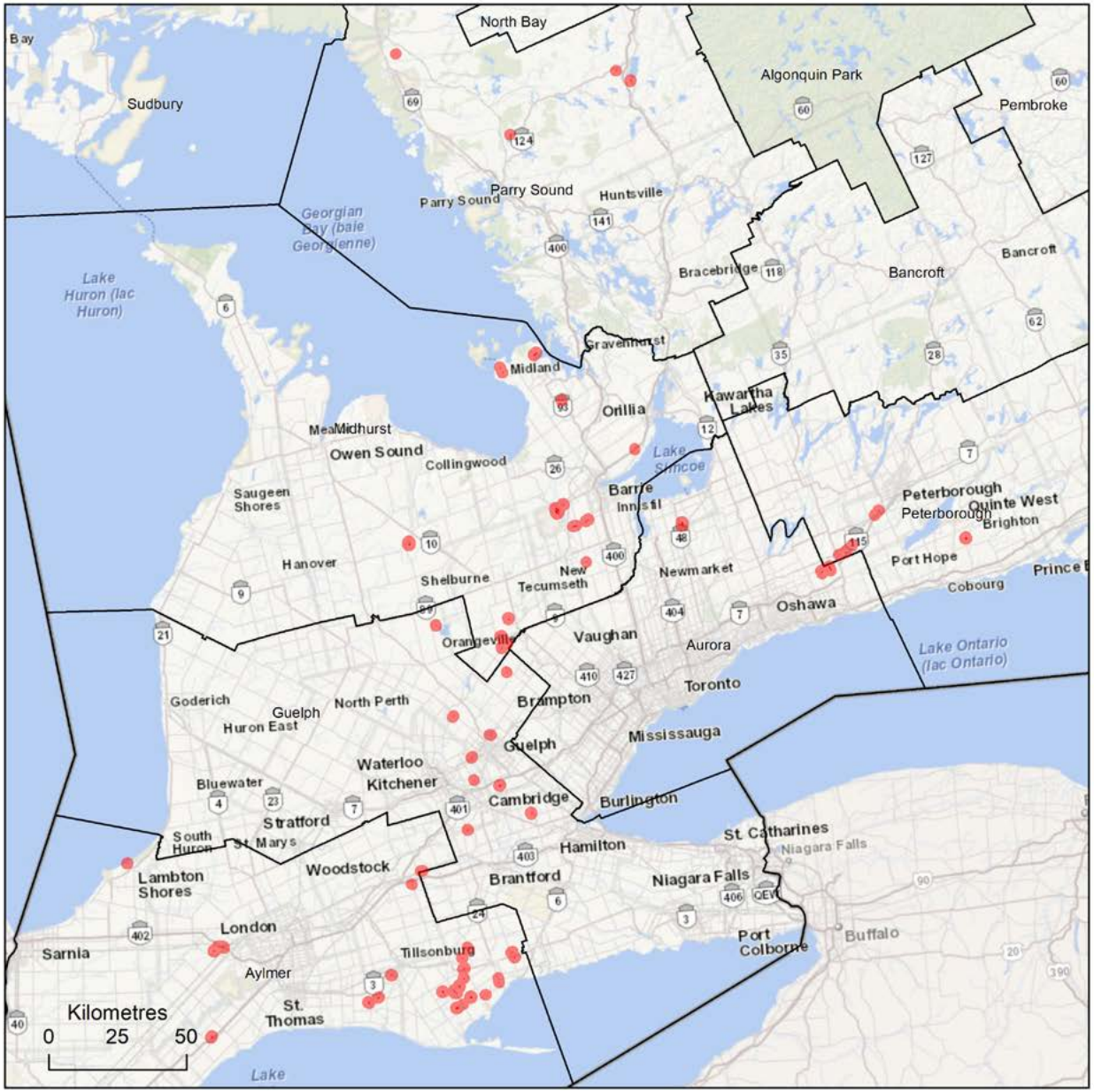
Area of moderate to severe defoliation

Brown spot needle blight 2022

Areas in the Southern Region where brown spot needle blight caused defoliation

Moderate to severe = 1,796 ha

Area of moderate to severe defoliation



Cedar apple rust

Pest information

Common name:	Cedar apple rust
Scientific name:	*Gymnosporangium juniperi-virginianae* Schwein.
Pest origin:	Native to North America
Pest type:	Fungal disease
Host species:	Eastern red cedar and apple species
Infestation area:	43 ha

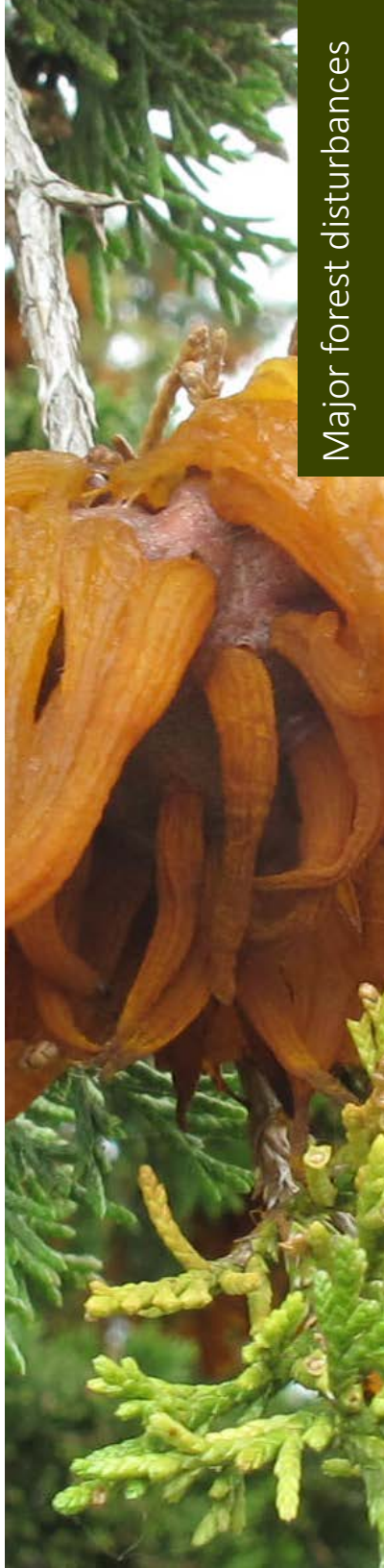
Provincial key facts

- The causal pathogen of this disease requires a second host, apple, to complete its two-year lifecycle.
- Symptoms look completely different on each host; on apple it appears as lesions on the leaves and on cedar it forms galls on the stem.
- As with other foliar fungal diseases, cedar apple rust is often more prevalent in years with a wet spring.
- In 2022, localized infections of this rust were observed in Southern Region.

Regional summary

Southern

- In Kemptville District, 43 ha of moderate to severe cedar apple rust damage were mapped during aerial surveys in a former apple orchard on Dulcemaine Road south of Charleston Lake (Leeds and the Thousand Islands Twp). The orchard was overgrown with eastern red cedar. Both host species had signs and symptoms of the disease.



Cedar leafminer complex

Pest information

Common name:	Cedar leafminer complex
Scientific name:	*Argyresthia aureoargentella* Brower, *Argyresthia canadensis* Freeman, *Argyresthia thuiella* (Peck), *Coletechnites thujaella* (kft.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Eastern white cedar
Infestation area:	14,133 ha moderate to severe defoliation, 163 ha light defoliation

Provincial key facts

- Cedar leafminer complex is a group of similar insects that mine cedar foliage, including:
  - *Argyresthia aereoargentella* Brower
  - *Argyresthia canadensis* Freeman
  - *Argyresthia thuiella* (Pack)
  - *Coletechnites thujaella* (Kft.)
- The last widespread cedar leafminer outbreak occurred in Southern Region from 2002 to 2007, resulting in substantial crown dieback and some whole tree mortality.
- In 2022, 14,296 ha of moderate to severe and light cedar leafminer defoliation were aerially mapped in Southern Region, a slight decrease from 14, 628 ha in 2021.

Regional summary

Southern

- In Pembroke District, 11,206 ha of moderate to severe cedar leafminer defoliation and 45 ha of light defoliation were aerially mapped, a slight increase from 2021. Defoliation was concentrated in the centre, southeast, and southwest of the district. In the centre, the most severe defoliation was found between the Town of Golden Lake, Lac Dore, and Constant Lake. Large, continuous areas of severe defoliation were mapped around Eganville and southward along Hwy 41 to Dacre. In the southeast, large areas of moderate to severe defoliation were

mapped along Hwy 52 from Burnstown to the City of Renfrew and on Highways 132 and 34 from the village of Shamrock to Ashdad Road. Smaller areas of defoliation were mapped around Norway Lake between Ashdad and Calabogie Road (Hwy 508), west of the City of Renfrew around Ferguslea, north of the City of Renfrew where Hwy 17 meets Hwy 4, and south of the City of Pembroke on Stafford Third and Second Lines. Moderate to severe defoliation was observed intermittently throughout Whitewater Region Twp and the northwest half of Horton Twp. Small, isolated areas were observed on Baron Canyon Road in Laurentian Valley Twp, in the Town of Petawawa, and northwest of Golden Lake in Algona-Wilberforce Twp. In the west part of Pembroke District, small areas of defoliation were mapped along Hwy 514, from Hardwood Lake to Palmer Rapids and in Rosenthal, Harriet's Corners, and south of Rockingham.

- In Pembroke District 163 ha of light cedar leafminer defoliation were observed on Hwy 515 from Palmer Rapids to Combermere in Brudenell-Lyndoch-Raglan Twp. and from Mount Saint Patrick to White Lake in Greater Madawaska Twp.
- In Guelph District, 1,903 ha of moderate to severe defoliation were aerially mapped. Defoliation was primarily detected in the northeast part of the district and near the City of Cambridge. In Wellington County, defoliation was concentrated along the Grand River, with a few smaller areas mapped around Luther Marsh Wildlife Management Area, Mt. Forest, and Minto around Pike Lake. Many small, scattered areas of defoliation were aerially mapped around Valens, Freelton, and Carlisle in the City of Hamilton.
- In Aurora District, 441 ha of moderate to severe defoliation were aerially mapped in Peel Region in the town of Alton along the border of Guelph District, in York Region in the town of Brown Hill, and at Sibbald Point Provincial Park. Defoliation was also observed in Halton Region in the town of Milton.
- In Aylmer District, 310 ha of moderate to severe defoliation were aerially mapped. Most were small areas in Oxford County along the Thames River from Woodstock to Innerkip, in Embro, south of Ingersoll, and west of Tavistock along the boundary of Oxford and Perth Counties. Defoliation was also mapped in Norfolk County near Renton, south of Hwy 3.
- In Midhurst District, 229 ha of moderate to severe cedar leafminer defoliation were aerially mapped. In Grey County, defoliation was mapped in the town of Priceville, and surrounding the towns of Beaverdale, Woodhouse, and Flesherton. Moderate to severe defoliation was also observed near Singhampton, Sebright, and Dutnroon and along Hwy 4 from Wiarton to Tobermory. In Dufferin County, moderate to severe defoliation was mapped around the towns of Shelburne and Bowling Green and, in Simcoe County, a small area of defoliation was mapped near Oro. Defoliation was also observed in Barrie, Innisfil, and along Hwys 11 and 12 between Barrie and Brechin.
- In Kemptville District, 45 ha of moderate to severe cedar leafminer defoliation were aerially mapped in Manotick in the City of Ottawa. Intermittent moderate to severe defoliation was observed in the south part of Ottawa from Dwyer Hill Road in the southwest to York's Corners Road in the southeast. In the City of Clarence-Rockland, defoliation was observed in Cheney, and in Lanark County it was observed along Ramsay Conc 12 from March Road

to the village of Appleton. Light defoliation was observed south of Perth in Tay Valley Twp.

- In Bancroft District, moderate to severe cedar leafminer defoliation was observed along Hwy 506 near Fernleigh, Fronteanc County.
- In Peterborough District, moderate to severe cedar leafminer defoliation was observed along Division Road and in scattered hedgerows throughout Douro-Dummer Twp.

Total area (in hectares) in which cedar leafminer caused moderate to severe defoliation in 2018–2022 by MNRF district.

Region	Area of moderate to severe defoliation (ha)				
District	2018	2019	2020	2021	2022
Northwest					
Dryden	-	-	-	-	-
Fort Frances	366	-	-	-	-
Kenora	-	-	-	-	-
Nipigon	-	-	-	-	-
Red Lake	-	-	-	-	-
Sioux Lookout	-	-	-	-	-
Thunder Bay	-	-	-	-	-
Subtotal	366	0	-	-	-
Southern					
Algonquin Park	-	-	-	-	-
Aurora	2,709	-	-	-	441
Aylmer	-	-	-	-	310
Bancroft	98	-	-	-	-
Guelph	4,396	-	-	-	1,903
Kemptville	500	226	-	3,342	44
Midhurst	17,852	-	-	-	229
Parry Sound	-	-	-	-	-
Pembroke	-	-	-	9,294	11,206
Peterborough	527	118	-	-	-
Subtotal	26,082	344	-	12,636	14,133
Provincial total	26,448	344	-	12,636	14,133

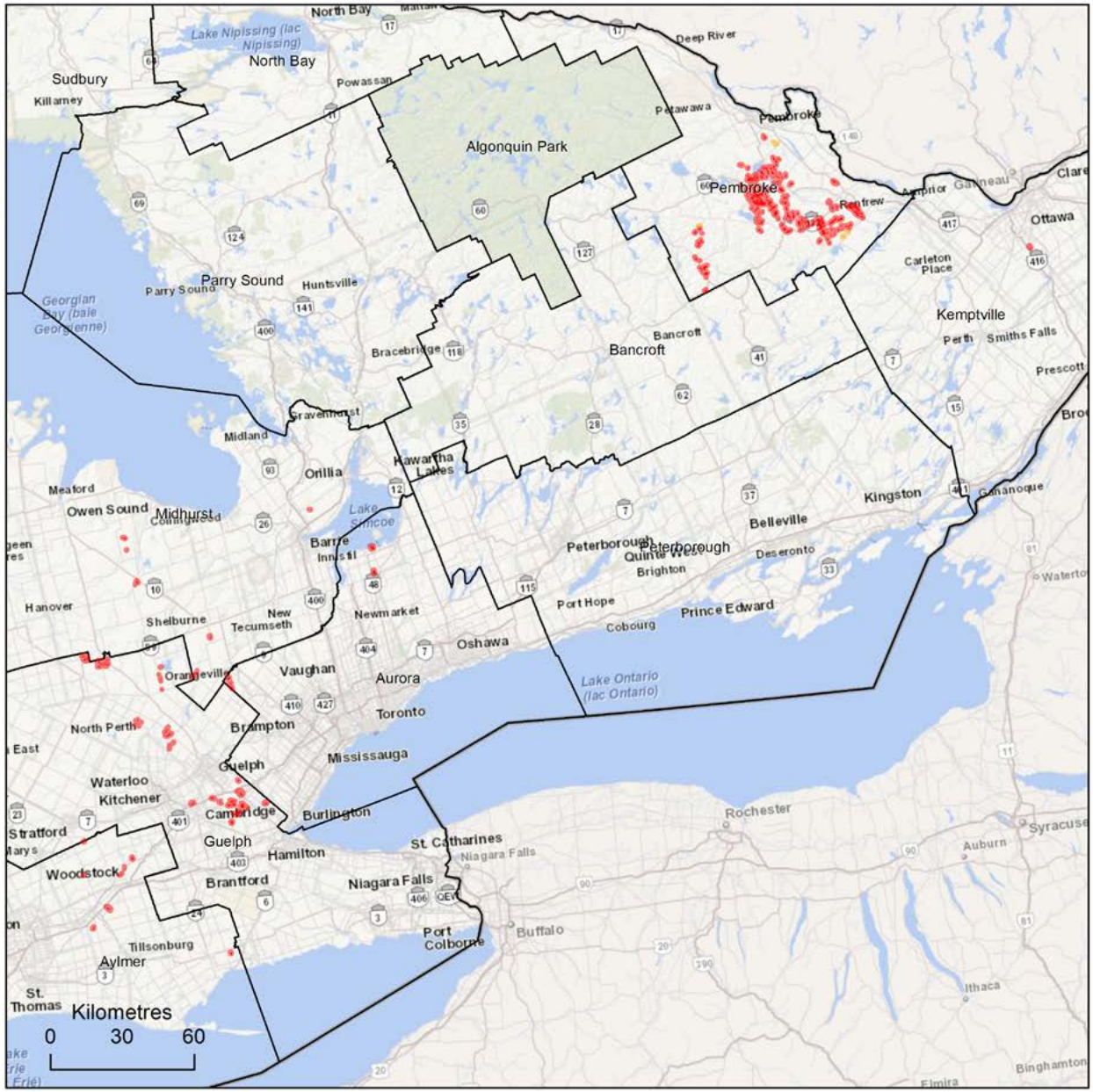
Cedar leafminer 2022

Areas in the Southern Region where cedar leafminer caused defoliation

Light = 163 ha
Moderate to severe = 14,133 ha

Area of light defoliation

Area of moderate to severe defoliation



Emerald ash borer

Pest information

Common name:	Emerald ash borer
Scientific name:	*Agrilus planipennis* (Fairmaire)
Pest origin:	Invasive — native to Asia
Pest type:	Wood borer
Host species:	Ash species
Infestation area:	411 ha

Provincial key facts

- Since it was discovered in Windsor in 2002, emerald ash borer has been a significant threat to ash in Ontario.
- Since 2002, emerald ash borer has spread east to Ottawa and north to Sault Ste. Marie and Thunder Bay.
- This beetle is expected to spread across the entire range of ash, causing widespread mortality in Ontario.
- In 2022, ash decline caused by emerald ash borer was aerially mapped in Northeast Region and collected and verified in the quarantine area in northeast and southern regions.

Regional summary

Northeast

- In 2022, 411 ha of ash mortality caused by emerald ash borer were mapped on the southwest side of Sault Ste. Marie District. Most of the mortality was between the east shoreline of Lake George and Hwy 17 and between Echo Bay and Neebish. The mortality was mapped in Laird Twp and the townships of MacDonald, Meredith, and Aberdeen Additional. Smaller areas of ash mortality were also mapped on the west side of St. Joseph Island, including two small areas recorded along Munuscong Lake near Court and Sunset points, one in St. Joseph Twp the other in Jocelyn Twp. A small area of ash mortality was also observed in the Town of Bruce Mines. Several large dead ash trees were observed on the west side of the town between Crawford and Pilgrim streets. New finds of emerald ash borer were recorded at the Chippewa Falls rest area and a location 1.5 km north along

Hwy 17 where the insect was collected from a small ash tree. The infested trees at Chippawa Falls rest area were in severe decline while the singular tree further north was only mildly affected.

- In Sudbury District, emerald ash borer was collected at Simon Lake Park (west of Lively). Increased ash tree mortality has been observed around the City of Sudbury, particularly around Barrydowne Road, Lasalle Boulevard, and Falconbridge Road.
- In North Bay District, emerald ash borer adults were collected in the City of North Bay near a parking lot for Ontario Northland that borders an apartment complex. The row of ash trees had epicormic shoots and showed signs of crown dieback.

Southern

- Ash decline and mortality from emerald ash borer continues to be reported in Bancroft District. Signs and symptoms of emerald ash borer were reported along the northern extent of the district infestation on open-grown ash trees in Kinmount, Kawartha Lakes Region.
- In Parry Sound District, high levels of emerald ash borer, causing varying levels of decline, were observed along Muskoka Road 3/Aspdin Road (southwest of Huntsville), Lookout Park/George St (Gravenhurst), Harrison Trail (north of Twelve Mile Bay), and Blue Lake Road (north of Otter Lake). Ash trees displayed signs and symptoms of emerald ash borer including woodpecker damage, D-shaped exit holes, S-shaped galleries, epicormic shoots, and crown dieback.
- In Kemptville District, ash decline from emerald ash borer has now spread to the western boundary of the district. Ash trees appeared more stressed in 2022 because of heavy seed crop and dry conditions in the second half of the summer that contributed to early fall colour change and leaf drop. In Lanark Highlands Twp, new areas of ash decline were observed during ground surveys on Lavant Mill Road, South Lavant Road, and Black Creek Road in the northwest parts of the township. Emerald ash borer larval galleries were confirmed on Lavant Mill Road where open-grown ash trees had severe dieback, epicormic shoots, and some mortality.
- In Lanark County, low levels of ash mortality were observed in the southern half of Tay Valley Twp, including Murphy's Point Provincial Park, and areas south of Silver Lake near Frontenac County boundary. In Leeds and Grenville County, ash mortality was noted in Rideau Lakes Twp and at Charleston Lake in Leeds and the Thousand Islands Twp., where severe damage and less than 10% ash mortality were observed.

Trend analysis/outlook/issues

Emerald ash borer parasitoid release

The ministry continues to collaborate with the Natural Resources Canada-Canadian Forest Service on the emerald ash borer biological control program in Ontario. Forest health technical staff support the operational component of the project, for example, by selecting release sites and releasing parasitoids.

The biological control program involves the release of three species of parasitoid wasps that target various life stages of the borer, with the goals of reducing emerald ash borer populations and establishing parasitoid populations in infested areas. Originally from China and Russia, these wasps are highly host specific to emerald ash borer with high parasitism levels in their native range. Both *Tetrastichus planipennisi*, a larval parasitoid, and *Oobius agrili*, an egg parasitoid with two generations per year, originate from China. The third species, *Spathius galinae*, is a larval parasitoid from Russia that is effective on the borer in green ash. Canadian Forest Service researchers provide regular updates on the status of this biological control program. For more information, visit https://inspection.canada.ca/plant-health/invasive-species/insects/emerald-ash-borer/wasps/eng/1371137262586/1371137530758.

In 2022, all three species of parasitoids were released in the City of Pembroke. Releases were scheduled by the Canadian Forest Service based on emerald ash borer phenology.

Emerald ash borer 2022

Areas in Ontario where emerald ash borer caused mortality

Mortality = 411 ha

Area of mortality

Forest tent caterpillar

Pest information

Common name:	Forest tent caterpillar
Scientific name:	*Malacosma disstria* Hbn.
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Various deciduous species
Infestation area:	261,255 ha

Provincial key facts

- On average in Ontario, forest tent caterpillar outbreaks have occurred every ten to twelve years, with each outbreak continuing for about three to five years.
- In the south, forest tent caterpillar feed primarily on sugar maple and oak, and in the north this pest is found mainly on trembling aspen but also feeds on several other deciduous species.
- In 2022, 261,255 ha of moderate to severe defoliation were aerially mapped in Northeast and Northwest regions, with some forest tent caterpillar in Southern Region detected during ground surveys. The last time forest tent caterpillar defoliation was aerially mapped in Northwest Region was 2018.

Regional summary

Northwest

- In 2022, 13,971 ha of moderate to severe defoliation from forest tent caterpillar were aerially mapped in Thunder Bay District. Small areas of defoliation were mapped predominantly on the east side of the district from the southern part of Wabakimi Provincial Park to the southern district boundary. Two areas of defoliation were recorded in Wabakimi Provincial Park, one south of Loop Lake and one north of Laparde Lake. A large concentration of defoliation was found west of Armstrong south of Caribou Lake and continued southward ending at Hwy 527 just west of Waweig Lake. East of Hwy 527, along the shore of Lake Nipigon, defoliation was found from Windigo Bay Provincial Park in the area around Wabinosh Lake and south to Kabitotikwia River Provincial Nature Reserve. In the southeast part of the district, large areas of defoliation west of Hwy 527 were mapped southeast of Eaglehead Lake around Hosking Lake, southeast of Abigogami Lake to west of Innes

Lake near Cavern Lake Provincial Park, south of Wolf Lake and southwest to Hwy 527, and in Sleeping Giant Provincial Park west of Hwy 587. West of Hwy 527, large concentrations of defoliation were found northeast of Hazelwood Lake to Crock Lake, in and around Kakabeka Falls Provincial Park, northwest of Stephens Lake towards Hwy 11, east of the Community of Shebandowan, west of Upsala south of Hay Lake, north of Kaministiquia towards Eayrs Lake, in and around Fraleigh Lake Provincial Park, and southeast of Pine Lake.

- In Nipigon District, 9,564 ha of moderate to severe defoliation were aerially mapped in the southern part of the district, mostly south of Hwy 11. Along Hwy 11, forest tent caterpillar defoliation was recorded in MacLeod Provincial Park, southeast of Wildgoose Lake, south of Oxaline Lake crossing the highway at Jellicoe, surrounding Beardmore, east of Jessie Lake near Cameron Falls heading southeast towards Kama Hills Provincial Park, near Macdiarmid, and southwest of the town of Nipigon to the western district boundary line. Smaller areas of defoliation were recorded southwest of Black Sturgeon Provincial Park towards Hwy 527, around Lake Jean south of Beardmore, and north of Hays Lake to McLuskey Lake.

- In Fort Frances District, 579 ha of moderate to severe defoliation were aerially mapped in the eastern part of the district. South of Hwy 11, small areas of defoliation were found in the northern part of Quetico Provincial Park largely west of Pickerel Lake, with one small area found east of Pickerel Lake near the eastern district boundary line. Two additional areas of defoliation were found west of Quetico Provincial Park, one east of Frederickson Lake and the other east of Lindgren Lake. North of Hwy 11, the largest concentrations of forest tent caterpillar defoliation were detected near Marion Lake and northeast of Eltrut Lake heading towards Hwy 622. Other small areas include north of Atikokan, Reserve Island on the Seine River, north of Nydia Lake, and close to the northern district boundary near Gulliver Lake south of Hwy 17.

- In Dryden District, 326 ha of moderate to severe forest tent caterpillar defoliation were aerially mapped in small areas around the central part of the district. North of Hwy 17, small areas of defoliation were recorded near Indian Lake west of Hwy 599, east of Hwy 599 north of Downhill Lake, northwest of Raven Lake above the railroad tracks, south of Hwy 642 east of Hut Lake, and on the shoreline of Lake of Bays. South of Hwy 17, small areas of defoliation were recorded along Hwy 622 east of Stormy Lake, east of Dinorwic Lake heading southeast towards Hwy 622, and south of Gulliver River heading towards the southern district boundary. One small area of moderate to severe defoliation was recorded northeast of Dryden, east of Six Mink Lake along the railroad tracks.

- In 2022, 24 ha of moderate to severe defoliation were aerially mapped in the south-central part of Sioux Lookout District. Five small areas of moderate to severe defoliation were detected south of Hwy 516, three small areas in Northeast Bay on the east side of Marchington Lake, and two small areas east of Stanzhikimi Lake. Another small area of defoliation was located north of Hwy 516 north of Runway Lake.

Northeast

- In 2022, 113,510 ha of moderate to severe forest tent caterpillar defoliation were aerially mapped in Hearst District, a notable increase from 26,041 ha in 2021. Most of the defoliation was recorded in the central part of the district. Defoliation was mapped north of Opasatika in McCowan and Neely townships, defoliation continued across Hwy 11 at Opasatika and to the southwest of Opasatika Lake. A large continuous area of defoliation was recorded in Orkney, Magladery, and Rykert townships north of Brunswick Lake. Large areas of defoliation were also observed north and south of Kapuskasing and northeast of Lake Nagagamisis. Small areas of defoliation were found north of Mattice and near Hearst. Early season ground observations indicated a moderate to severe defoliation west of Constance Lake.

- In Timmins District, 63,141 ha of moderate to severe defoliation were aerially mapped in 2022, a substantial increase from 1,606 ha in 2021. In the northern part of the district defoliation was recorded north and south of Hwy 101 from Horwood Lake in the west to Frederick House Lake in the east. The largest areas of defoliation were northeast of Horwood Lake in Keith and Penhorwood townships and southwest of Night Hawk Lake in Deloro, Shaw, and Eldorado townships. In the southern part of the district, defoliation was detected at Sinclair Lake and continued south towards Hwy 560 just north of Morin Village. Several areas of defoliation were found along the Timmins-Kirkland Lake district boundary in Hutt, Mond, and Natal townships. Two small areas of defoliation were recorded northwest of La Motte Lake Provincial Park in Stetham and Noble townships.

- In Kirkland Lake District, 30,542 ha of moderate to severe forest tent caterpillar defoliation were mapped, mostly in the northern part of the district. Higher levels of defoliation were mapped just south of Round Lake northeast towards Victoria Lake, with a larger area of defoliation north of Kirkland Lake. Small to large areas of defoliation were recorded west and east of Hwy 11 from Hwy 66 south of Kenogami Lake to Hwy 101 east of Matheson. Moderate to severe defoliation was also observed from Watabeag Lake to north of Matheson, with the highest concentration around Matheson. Scattered areas of forest tent caterpillar defoliation were also mapped close to the Cochrane District boundary south of Lake Abitibi and Abitibi River, north of Hwy 101. In the southern part of the district, three small areas of defoliation were recorded, one along Hwy 560 west of Charlton, one northwest of Hubert Lake west of Hwy 65, and one east of Englehart near Hwy 569 in Ingram Twp.

- In Cochrane District, 17,268 ha of moderate to severe defoliation were aerially mapped in 2021, an increase from 3,027 ha in 2021. Most of the increase in defoliation was mapped in the southern part of the district. Large areas of defoliation were detected north of Lake Abitibi along the Ontario-Quebec border stretching north to Abbotsford Twp, northwest of Lake Abitibi with large areas reported in Findlay and Marathon townships, and north of Cochrane in Glackmeyer Twp. Small areas of defoliation were found north and west of Iroquois Falls, west and southwest of Smooth Rock Falls, and near the Fraserdale Wetland Complex accessible by Hwy 634.

- In 2022, 7,287 ha of moderate to severe defoliation were aerially mapped in Sudbury District. The largest area of defoliation was recorded north of Sudbury from Whitson Lake to Hanmer Lake in Blezard, Hanmer, Capreol, and Garson townships. Small pockets of defoliation were recorded in and around Azilda, south of Whitewater Lake in Snider Twp, and north of Hwy 35 in Rayside and Lumsden Twps. West of Azilda, two small areas of defoliation were recorded, one southwest of Chelmford west of Joanette Road and one south of Hwy 144 at Onaping Falls. One small area was mapped east of Onaping Lake in Rhodes Twp.

- In 2022, 4,875 ha of moderate to severe forest tent caterpillar defoliation were aerially mapped in Chapleau District. Large areas of defoliation were recorded along Hwy 101 in the eastern part of the district in Ivanhoe, Foleyet and Muskego townships, with more widespread defoliation in Ivanhoe Provincial Park than recorded in 2021. Forest tent caterpillar damage remained close to Hwy 101 on the east side of Chapleau District near the Timmins District border and has not moved west of Ivanhoe Lake, except for a small area in Murdock Twp. Two small areas of defoliation were also detected in the southeast corner of the district in Earl and Specht townships, close to the Sudbury District border.

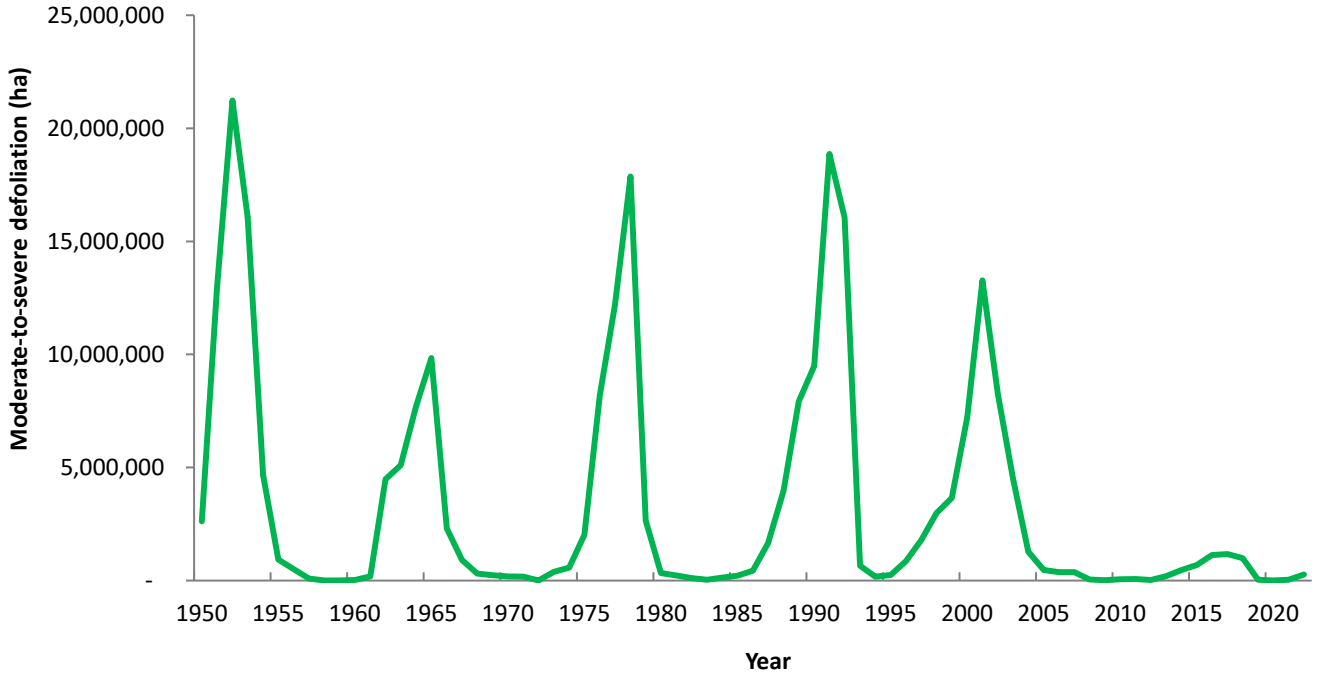
- In the northern part of Wawa District, 168 ha of moderate to severe forest tent caterpillar defoliation were aerially mapped around Nagagami Lake: one area on the northwest side of the lake west of Whitefish Bay, three areas south of Nagagami Lake, one area west of the Obakamiga River in Nagagami Twp, and two south of Hilltop Rapids along the Nagagami and Lessard township borders.

Southern

- In Pembroke District, trace forest tent caterpillar defoliation was found on red oak during ground surveys in a mixed forest on Paugh Lake Road in Madawaska Twp. Spongy moth larvae were also present and likely the primary cause of the defoliation.

- In Peterborough District, larvae were observed at trace levels on white ash trees in Ferris Provincial Park during ground surveys in June. No defoliation was reported, and larvae were found feeding alongside spongy moth larvae.

- In Bancroft District, forest tent caterpillar larvae were observed at trace levels on American beech tress at Indian Point Provincial Park, City of Kawartha Lakes. No defoliation was reported.



Area (in hectares) of moderate to severe defoliation caused by forest tent caterpillar in Ontario, 1950–2022.

Total area (in hectares) in which forest tent caterpillar caused moderate to severe defoliation from 2018 to 2022 by MNRF district.

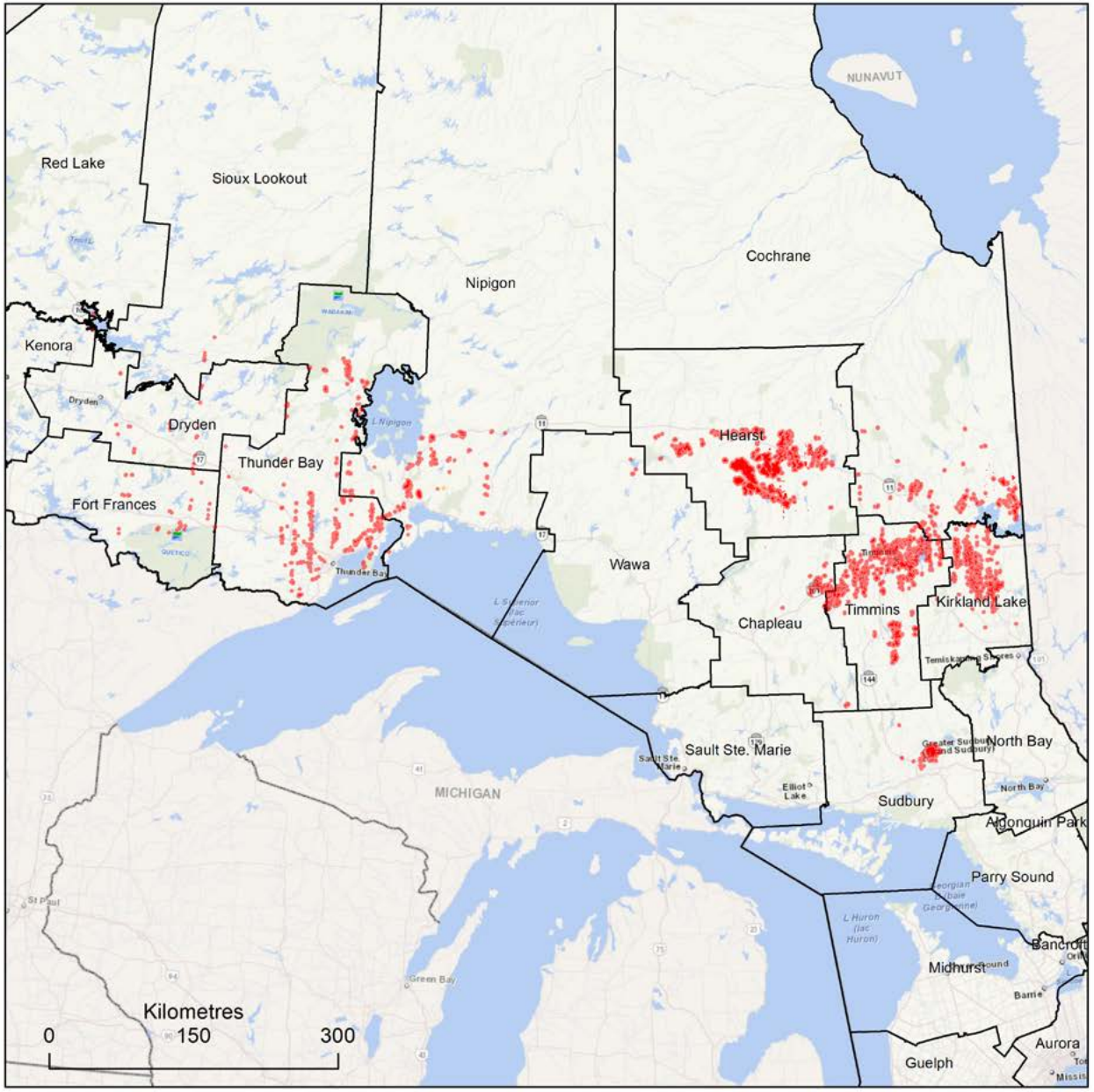
Region	Area of defoliation (ha)				
District	2018	2019	2020	2021	2022
Northeast					
Chapleau	-	-	-	359	4,875
Cochrane	33,428	7,732	-	3,027	17,268
Hearst	237,395	22,470	-	26,041	113,510
Kirkland Lake	521	-	-	-	30,542
North Bay	25,724	69	-	-	-
Sault Ste. Marie	148,442	50	-	-	-

District	2018	2019	2020	2021	2022
Sudbury	72,435	3,073	-	5,893	7,287
Timmins	888	-	-	1,606	63,141
Wawa	-	-	-	-	168
Subtotal	518,833	33,393	0	36,926	236,791
Northwest					
Dryden	-	-	-	-	326
Fort Frances	-	-	-	-	579
Kenora	9	-	-	-	-
Nipigon	-	-	-	-	9,564
Red Lake	-	-	-	-	-
Sioux Lookout	-	-	-	-	24
Thunder Bay	29	-	-	-	13,971
Subtotal	38	0	0	0	24,465
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	235,831	-	-	-	-
Guelph	-	-	-	-	-
Kemptville	126,179	-	-	-	-
Midhurst	434	-	-	-	-
Parry Sound	11,618	95	-	-	-
Pembroke	27,731	-	-	-	-
Peterborough	71,543	-	-	-	-
Subtotal	473,337	95	-	-	-
Provincial total	992,207	33,488	0	36,926	261,255

Forest tent caterpillar 2022

Areas in Ontario where forest tent caterpillar caused defoliation

Light = 177 ha
Moderate to severe = 261,269 ha



Area of light defoliation

Area of moderate to severe defoliation

Forest tent caterpillar 2022

Areas in the Northwest Region where forest tent caterpillar caused defoliation

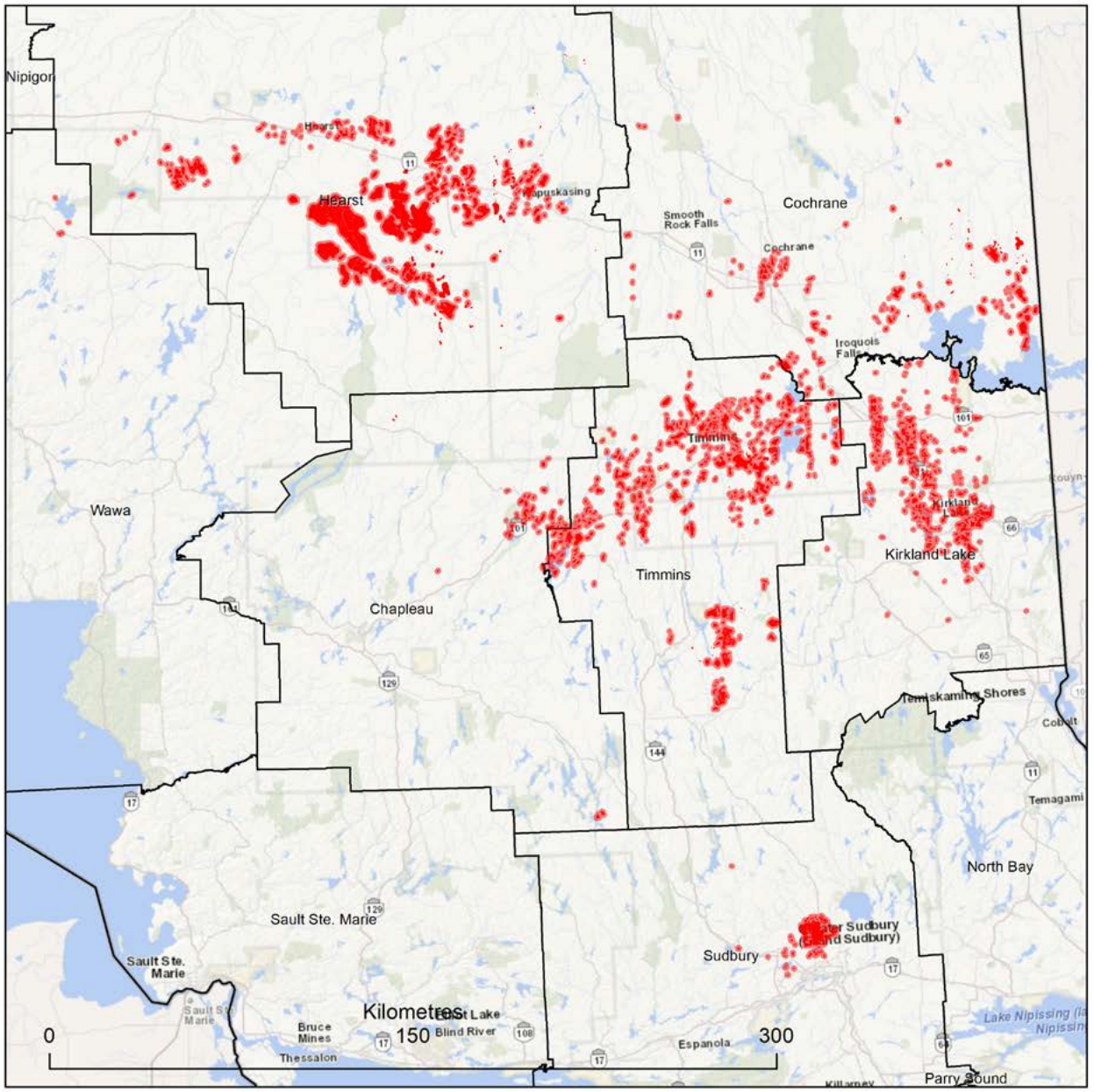
Light = 177 ha
Moderate to severe = 24,479 ha

Forest tent caterpillar 2022

Areas in the Northeast Region where forest tent caterpillar caused defoliation

Moderate to severe = 236,791 ha

Area of moderate to severe defoliation



Jack pine budworm

Pest information

Common name:	Jack pine budworm
Scientific name:	*Choristoneura pinus pinus* Freeman
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Jack pine
Infestation area:	130,674 ha moderate to severe defoliation; 2,050 ha light defoliation; 1,494 ha mortality

Provincial key facts

- Jack pine budworm outbreaks occur in Ontario about every eight to 10 years.
- Operational control programs have been undertaken to protect high value jack pine stands during an outbreak, with the most recent one carried out in 2021 in Northwest Region.
- For the third consecutive year, the area of moderate to severe jack pine budworm defoliation has decreased in Ontario. In 2022, 130,674 ha of moderate to severe jack pine budworm defoliation were aerially mapped. Of that, more than 90% was in Northwest Region with a small area of new infestation in Northeast Region.

Regional summary

Northwest

- In 2022, 42,888 ha of moderate to severe jack pine budworm defoliation were mapped in the southern part of Nipigon District, which is quite a shift from the 36,380 ha mapped in the northwest part of the district in 2021. New areas of defoliation were recorded between Beardmore and the southeast side of Lake Nipigon, just north of Jellico and Geraldton, southwest of Geraldton from Hwy 11 to Upper Roslyn and McKnight lakes in the Gravel River area and northeast of Cameron Falls between Hwy 11 and Jessie Lake. Smaller, more scattered areas of moderate to severe jack pine budworm defoliation were recorded on the southwest side of the district north of Black Sturgeon Lake to the east side of Eagle Lake near the Thunder Bay/Nipigon District boundary. Similar areas were observed between Wintering Road and Long Lake. Small areas of defoliation were also mapped south of Nezah, between Barbara and Kabamichigama lakes and south of Black Sturgeon Lake to Shillabeer Lake

near the Thunder Bay/Nipigon district boundary. A small area (19 ha) of light jack pine budworm defoliation was mapped in Nipigon District between Lowen Lake and West Gravel River.

- In 2022, 32,253 ha of moderate to severe jack pine budworm defoliation were mapped in Thunder Bay District. Defoliation was scattered across the district, with more concentrated areas of defoliation in and south of Obonga Ottertooth Provincial Park (Waterway Class) to Buck Lake north of Raith, south of Armstrong to Kopka River Provincial Park (Waterway Class) near Wabinosh Lake, on the southwest side of Lake Nipigon between Kabitotikwia River and Black Sturgeon River provincial parks, and northwest of Loon in the Greenwich Lake area. Medium-sized areas of defoliation were recorded in the southern part of the district west of Neebing to Whitefish Lake in the Fraleigh Lake Provincial Park and Fallingsnow Lake areas. Smaller, more scattered areas of moderate to severe jack pine budworm defoliation were mapped north of English River to the Dryden/Thunder Bay District boundary, between English River and Upsala, northeast of Raith between Lac des Iles and Demars Lake, southwest and north of Shabaqua as well as north of Lappe on the east side of Dog Lake. A small area (224 ha) of light defoliation was aerially mapped in Thunder Bay District northwest of Raith south of Muskeg Lake, southeast of English River, and a tiny area on the east side of Dog River near Dog Lake. In 2022, 145 ha of jack pine mortality were recorded on the northwest side of the district north of Obonga Ottertooth Provincial Park and a small area in Kopka River and Wabakimi provincial parks.

- For the second consecutive year, the area of moderate to severe jack pine budworm defoliation decreased in Dryden District from 82,098 ha in 2021 to 23,460 ha in 2022. Most of the defoliation was in the central part of the district north of Wabigoon to the Sioux Lookout/Dryden District boundary, northwest of Ignace on the north side of Hwy 17 to Basket and Keikewabik lakes area, and on the south side of Hwy 17 from Raleigh Lake to the Fort Frances/Dryden district boundary near Turtle River in White Otter Lake Provincial Park.

- Smaller, more scattered areas of defoliation were observed north and south of Vermillion Bay, north of Minnitaki, east of Sandbar Lake and East English River Provincial parks to English River, and north of O'Briens Landing to the Sioux Lookout/Dryden district boundary. Another small area of scattered defoliation was recorded south of Shikag Lake to the Thunder Bay/Dryden district boundary. In 2022, 815 ha of light jack pine budworm defoliation were mapped in various areas in Dryden District, including in Blue Lake Provincial Park, northeast of Vermillion Bay between Wildrice and Colenso lakes, between Eton Rugby and Amesdale, south of Oxdrift, northeast of Dinorwic near Big Sandy Lake, and on the southeast side of the district from Sowden Lake south to Raven Lake. Jack pine mortality (651 ha) was also mapped in Dryden District. Most of this mortality was mapped on the southeast side of the district west of Ignace and west of the community of English River between Sowden and Raven lakes. Small areas of mortality were also recorded south of O'Briens landing, between English River and Squeedunk Creek near the Thunder Bay District boundary. One small area of mortality was also observed on the district's west side on the northeast side of Edward Lake.

- In Fort Frances District, the area of moderate to severe jack pine budworm defoliation was similar in 2022, at

11,412 ha, to that recorded in 2021 at 11,843 ha. Defoliation continued in the east-central part of the district, concentrated in the Turtle River Otter Lake Provincial Park area down to the Hwy 11 corridor between Mine Centre and Atikokan. Small areas of defoliation were evident south of Hwy 11 into the northwest end of Quetico Provincial Park near Beaverhouse and Quetico lakes. Small areas of defoliation were also found along the eastern Fort Frances boundary with Thunder Bay District. Small areas were mapped around and south of Scotch Lake to Norway Lake and along the district boundary between Old Man Lake and Crooked Pine Lake. The small areas of defoliation continued into the northeastern part of Quetico Provincial Park in the area of Tilly, Pickerel, Rawn and Cache lakes. In 2022, 159 ha of light defoliation were mapped, most of it small and scattered in the northeast part of the district. Areas included were in the Scotch, Norway, and Red Paint lakes area and between Below Bow and Highland lakes. Small areas of light defoliation were also mapped south of Sapawe, four areas north of Pickerel Lake close to the northern extent of Quetico Provincial Park, and one small area along the Thunder Bay District boundary between Elbow and Windgoostigwan lakes.In 2022, 113 ha of jack pine mortality were mapped on the east side of Fort Frances District, most of it in the northeast corner on the west side of Scotch Lake. The remaining mortality was in small areas north of Irene Lake, and further south near Hwy 11 on the west side of Eva Lake, between Sapawee and Osinawi lakes, east of Crooked Pine Lake and in Quetico Provincial Park south of Tilly Lake.

- After a year of no mappeable jack pine budworm defoliation In Red Lake District, in 2022, 6,000 ha of moderate to severe defoliation were mapped in the southeast corner of the district. Most of this defoliation was in the far southeast part of the district, from Bertha Lake in the north to the northside of Lac Seul near McKenzie Bay. Smaller areas of moderate to severe defoliation were recorded north and west of Little Bear Lake, on the north and southwest side of Pakwash Lake, south of Wegg Lake to the Red Lake/Kenora District boundary, and from Longlegged Lake to Sumac Lake along the southern Red Lake District boundary.

- In 2022, 408 ha of light jack pine budworm defoliation were mapped in Red Lake District. This light defoliation was recorded in the southeastern part of the district, north of Ear Falls between Bruce and Detector lakes as well as east of Ear Falls in the Chilcott and Cramp lakes areas.Three small areas of light defoliation were also recorded northeast of Longlegged Lake. A small area (172 ha) of mortality caused by consecutive years of severe jack pine budworm defoliation was observed in the southern part of Red Lake District on the south side of Wegg Lake between Goose and Zizania lakes.

- In 2022, 2,246 ha of moderate to severe jack pine budworm defoliation were aerially mapped in the southern part of Sioux Lookout District, a decrease from 55,644 ha mapped in 2021. Most of the defoliation was on the southwest side of the district on the north side of Lac Seul to Upper Wapesi Lake, close to the Red Lake District boundary. Small areas of defoliation were also observed on the south side of Lac Seul near Clear Lake. A bit further south, three small areas of defoliation were recorded west of Hudson between Jackfish and Lost lakes. Further east, several small areas of jack pine budworm defoliation were observed on the north and south sides of Hwy 516 in the Moose and Black Beaver lakes areas. In 2022, only 7 ha of light defoliation were mapped in Sioux

Lookout District. This area was between Stanzhikimi and Yet lakes just south of Hwy 516.

- Only 28 ha of jack pine mortality caused by consecutive years of severe jack pine budworm defoliation were mapped in the district. These four areas were recorded near Binson and North River Drive lakes and north of Black Beaver Lake.

- In 2022, 1,652 ha of moderate to severe jack pine budworm defoliation were recorded in Kenora District, a decrease from the 52,726 ha aerially mapped in 2021. Most of the defoliation was mapped on the east side of the district, with a small area on the southwest side. On the east side of the district, a line of small, scattered areas of moderate to severe defoliation were recorded from the southeast side of Oak Lake near the north district boundary to Canyon Lake near the southern district boundary. Small areas were also recorded near the southeast Kenora District boundary south and north of Moose Lake. Several small areas were observed in the central part of the district near Campfire Lake, Unexpected Lake, Maynard Lake, and southeast of Grassy Narrows Lake between Deadfish and Wolf lakes. One medium-sized area of defoliation was also mapped south of Favel Lake, east of Hwy 671.On the southwest side of the district small areas of moderate to severe defoliation were recorded near the Manitoba border north and south of Hwy 17. Most small areas were on the north side of Hwy 17 between Lingwood and Beauport lakes on the west side of Whitefish Road, with a small area between Gundy and Harvey lakes. Two small areas of defoliation were on the south side of Hwy 17, one close to the junction of Hwy 17 and Shoal Lake Road and the other farther south on the north side of Shoal Lake.

- Light defoliation (418 ha) was also mapped in Kenora District. Light defoliation was recorded on the east side of the district on the north and south sides of Oak Lake, between Maynard and Wolf lakes, north and south end Clay Lake, south of Bridge Lake along Deer Lake Road, and along Hwy 105 corridor in small areas of defoliation from the Dryden District boundary to camp Robinson and north of Cliff Lake.

- Some jack pine mortality was caused by consecutive years of severe jack pine budworm defoliation. Most of this mortality was on the north and south sides of Clay and Segise lakes, with a tiny area on the northeast side of Maynard Lake. These areas of jack pine mortality totalled 249 ha.

Northeast

- In 2022, a new infestation of jack pine budworm was detected in Hearst District, marking the first time moderate to severe jack pine budworm defoliation has been mapped in this area. A total of 9,470 ha of defoliation were aerially mapped on the southwest side of the district, south of Hwy 11 along Hwy 631. Most of the defoliation was north and south of Nagagamisis Provincial Park, north of West Arnott Road to Newlands Road. Two small areas of moderate to severe defoliation were also observed south of Hwy 11 along Nassau Lake/Domtar Road, southwest of Nassau Lake.

- In 2022, 1,292 ha of moderate to severe jack pine budworm defoliation were mapped in the northeast corner

of Wawa District. This infestation is new and was recorded on the north and northwest sides of Nagagami Lake extending up to Nagagami Road.

Jack pine forest health plots

In the mid-1990s, plots were established in jack pine stands in the northern regions to monitor the effects of jack pine budworm and the overall health of jack pine forests across northern Ontario.

In 2021, 96 plots (45 in Northeast Region, 51 in Northwest Region) comprising 4,800 jack pine trees were assessed. Trees were rated for any pest, disease, or abiotic factors that affect health/condition and the abundance of male flowers.

Regional plot summary

In Northeast Region, 94% of the live jack pine trees were less than 25% defoliated, and in the Northwest Region, 95% were less than 25% defoliated. In comparison, only 70% of trees were less than 25% defoliated in 2021 in the northwest so it appears the jack pine trees are recovering from the jack pine budworm outbreak. In Northeast Region, 98% of live jack pine trees had live tops, and in Northwest Region 93% had live tops, while 5% had bare tops and 2% had dead tops (no change compared to 2021).

In 2022, 31 trees in jack pine plots in Northeast Region died. Most of this mortality was caused by armillaria root rot (77%). Abiotic factors such as blowdown were responsible for 16% of the mortality, while the remainder of the mortality was attributed to other diseases and abiotic factors.

In Northwest Region, 45 trees in jack pine plots died but the cause is unclear.

Surveys revealed abundant male flowers in Northeast Region, with 69% of the live jack pine trees having moderate to high numbers. In contrast, in Northwest Region 95% of the live trees assessed had nil to light numbers of male flowers, possibly due to the jack pine budworm outbreak.

In Northwest Region, 98% of the live trees were affected by jack pine budworm, and 74% of these were 5% defoliated. Average defoliation of assessed trees was 7%. The highest defoliation recorded was 40% but occurred only on four trees. In Northeast Region, jack pine budworm defoliation was not observed in the forest health plots.

In Northeast Region, live trees in the forest health plots were not affected by any noteworthy pests. Western gall rust was observed on 30% of the live trees. Varying levels of whitespotted sawyer beetle infested trees were observed in the plots, but only on 2% (22 trees) of the live jack pine trees.

Trend analysis/outlook/issues

Jack pine budworm pheromone trapping

Jack pine budworm pheromone trapping was completed across the province in 2022. Traps were deployed at 72 locations: 31 in Northwest Region, 32 in Northeast Region, and nine in Southern Region. Southern Region had the highest average number of moths per trap at 43 male moths. The highest average number was at a trap location in Bonnechere Provincial Park, Pembroke District, with 216 male moths per trap.

In Northeast Region, the average number of male moths per trap was lower than in Southern Region at 24 male moths per trap, slightly higher than 2021 results. The location with the highest average number of catches was in Sudbury District, with an average of 77 male moths per trap. Six other locations had an average of over 40 moths per trap, five in Sudbury District and one in North Bay District.

In Northwest Region, the average number of moths declined from 80 moths per trap in 2021 to 12 in 2022. The highest trap count was in a jack pine plantation in Kakabeka Falls, Thunder Bay District, with 135 moths per trap. Most of the sample locations averaged less than 10 moths per trap.

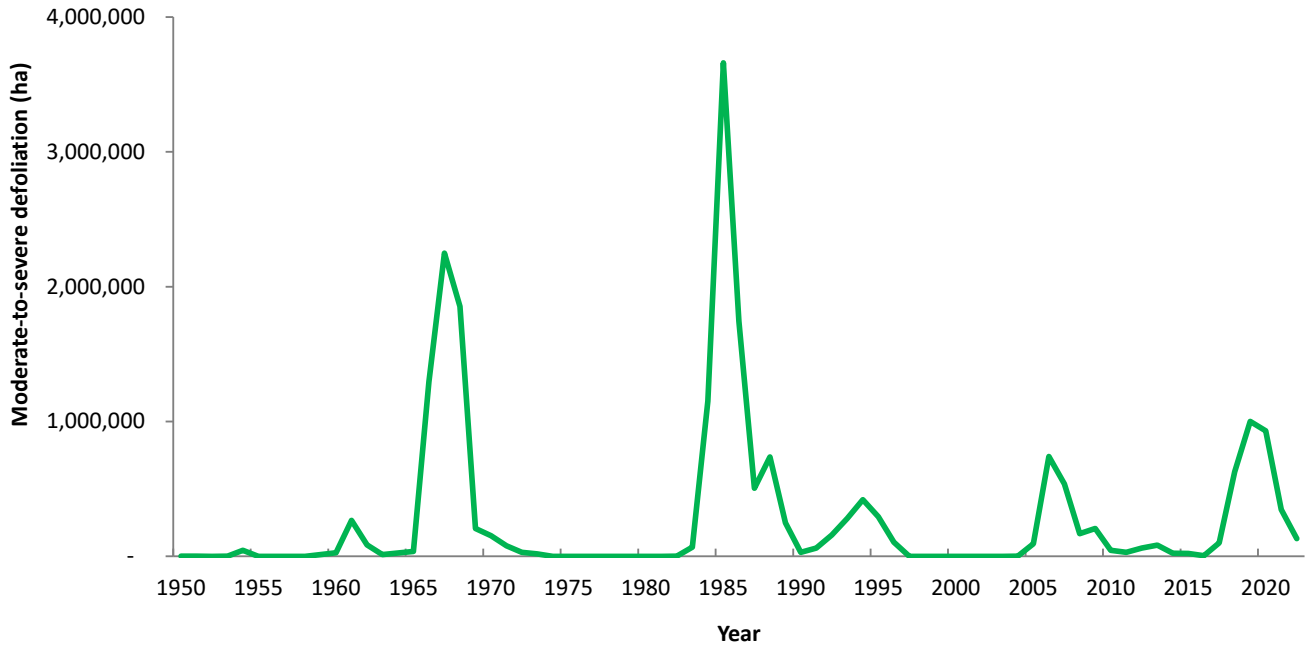
Jack pine budworm defoliation forecast survey

In Ontario, jack pine budworm defoliation forecasting is based on surveys of the number of overwintering larvae on jack pine branches. Jack pine budworms overwinter as second instar larvae (L2) by encapsulating themselves in silken shelters (hibernacula) under branch scales and bark cracks. Larvae are typically in these shelters from late August until the following spring. This overwintering stage of the lifecycle provides an opportunity to collect branches to extract and count larvae to forecast the potential severity of defoliation for the following year. Defoliation forecasts are used to determine which stands should be considered for protection.

Locations for L2 surveys are selected based on defoliation mapped during the current infestation. For our annual surveys, areas historically prone to jack pine budworm defoliation were also selected, as were high-value jack pine stands near infestations. From each location, 10 jack pine trees were selected, and a 1 m branch was sampled from the mid- to upper crown of each tree. Branches were sent to a laboratory to be processed in a sodium hydroxide washing procedure used to extract the second instar larvae from their hibernacula. These larvae were then separated from other fine debris using hexane and a separatory funnel and put onto filter papers for microscopic examination. Larvae were counted under a microscope to determine the average number of larvae per branch for each sample location. This average was used to forecast expected jack pine budworm defoliation in 2023. An average of more than 54 larvae per branch indicates potential for severe defoliation. Moderate defoliation is forecast when 16 to 54 larvae are found per branch. Light defoliation can be expected when 15 or fewer larvae are found on each branch.

In Northwest Region, 14 locations (140 trees) were sampled for overwintering larvae in 2022. Nine locations were in Nipigon District, three in Dryden District, and two in Thunder Bay District. The 2023 forecast for all 14 locations was light defoliation. The highest average number of second instar larvae was found in Nipigon District near the Town of Geraldton, with an average of 8.8 larvae per branch.

In Northeast Region, three locations (30 trees) were sampled for overwintering larvae in 2022. Two locations were in Hearst District and the other in Wawa District. The 2023 forecast for all locations was light defoliation. The highest average number of second instar larvae per branch was found in Hearst District along West Elgie Road, with 9.8 larvae per branch.



Area (in hectares) of moderate to severe defoliation caused by jack pine budworm in Ontario, 1950–2022.

Total area (in hectares) in which jack pine budworm caused moderate to severe defoliation from 2018 to 2022, by MNRF district.

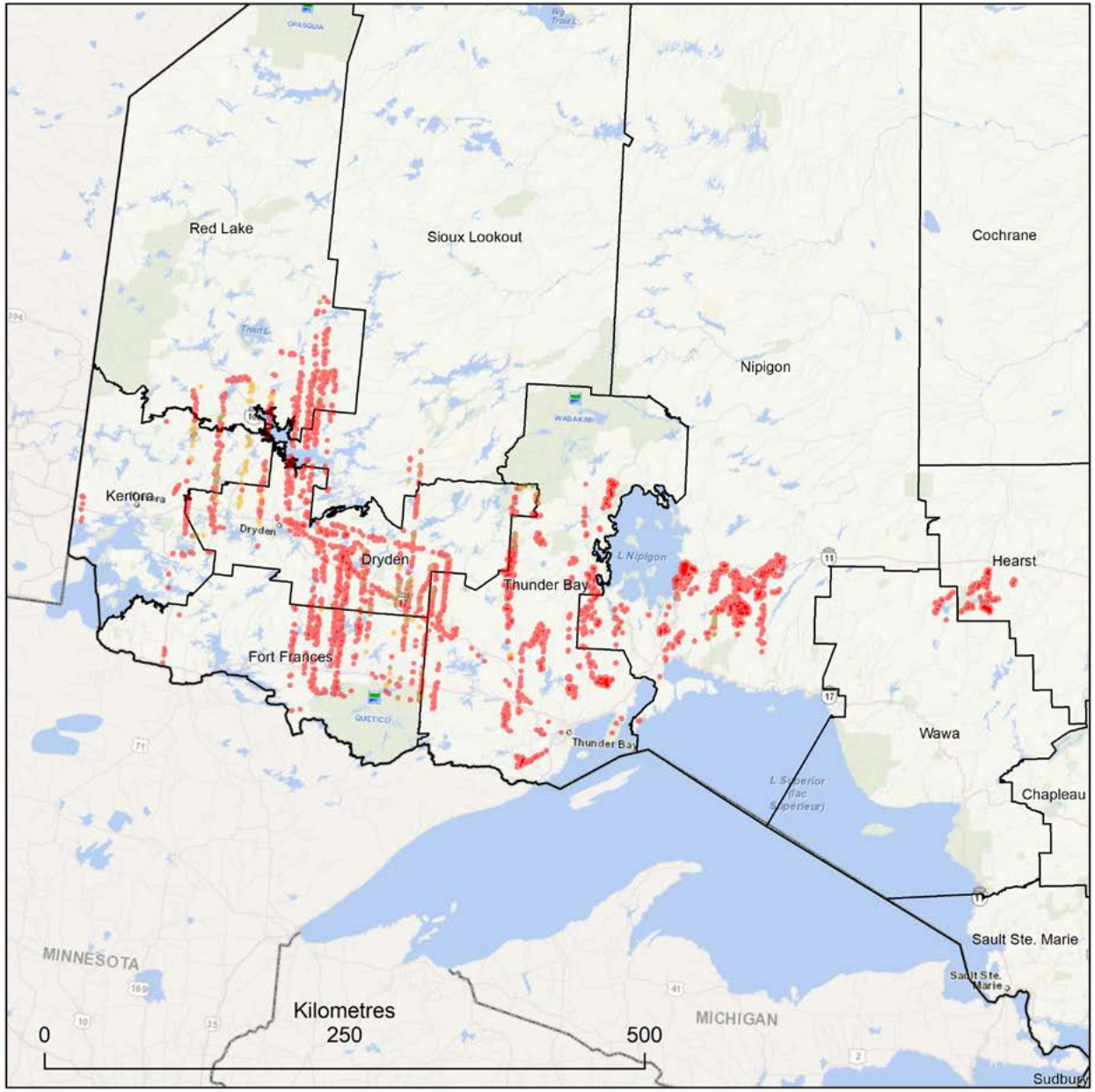
Region	Area of defoliation (ha)				
District	2018	2019	2020	2021	2022
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	9,470
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	-	-	-	-	-
Sudbury	-	-	128	137	-
Timmins	-	-	-	-	-
Wawa	-	-	-	-	1,292
Subtotal	0	0	128	137	10,762
Northwest					
Dryden	3,603	105,209	321,062	82,098	23,460
Fort Frances	-	139	2,442	11,843	11,412
Kenora	10,278	51,126	112,902	52,726	1,652
Nipigon	-	-	-	36,380	42,888
Red Lake	613,574	771,404	112,425	-	6,000
Sioux Lookout	-	73,381	377,043	55,644	2,246
Thunder Bay	-	10	3,761	107,439	32,253
Sub total	627,455	1,001,269	929,635	346,129	119,912
Provincial total	627,455	1,001,269	929,763	346,266	130,674

Jack pine budworm 2022

Areas in Ontario where jack pine budworm caused defoliation

Light = 2,050 ha
Moderate to severe = 130,674 ha
Mortality = 1,494 ha

- Area of light defoliation
- Area of moderate to severe defoliation
- Area of mortality



Jack pine budworm 2022

Areas in the Northwest Region where jack pine budworm caused defoliation

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Moderate to severe = 119,912 ha
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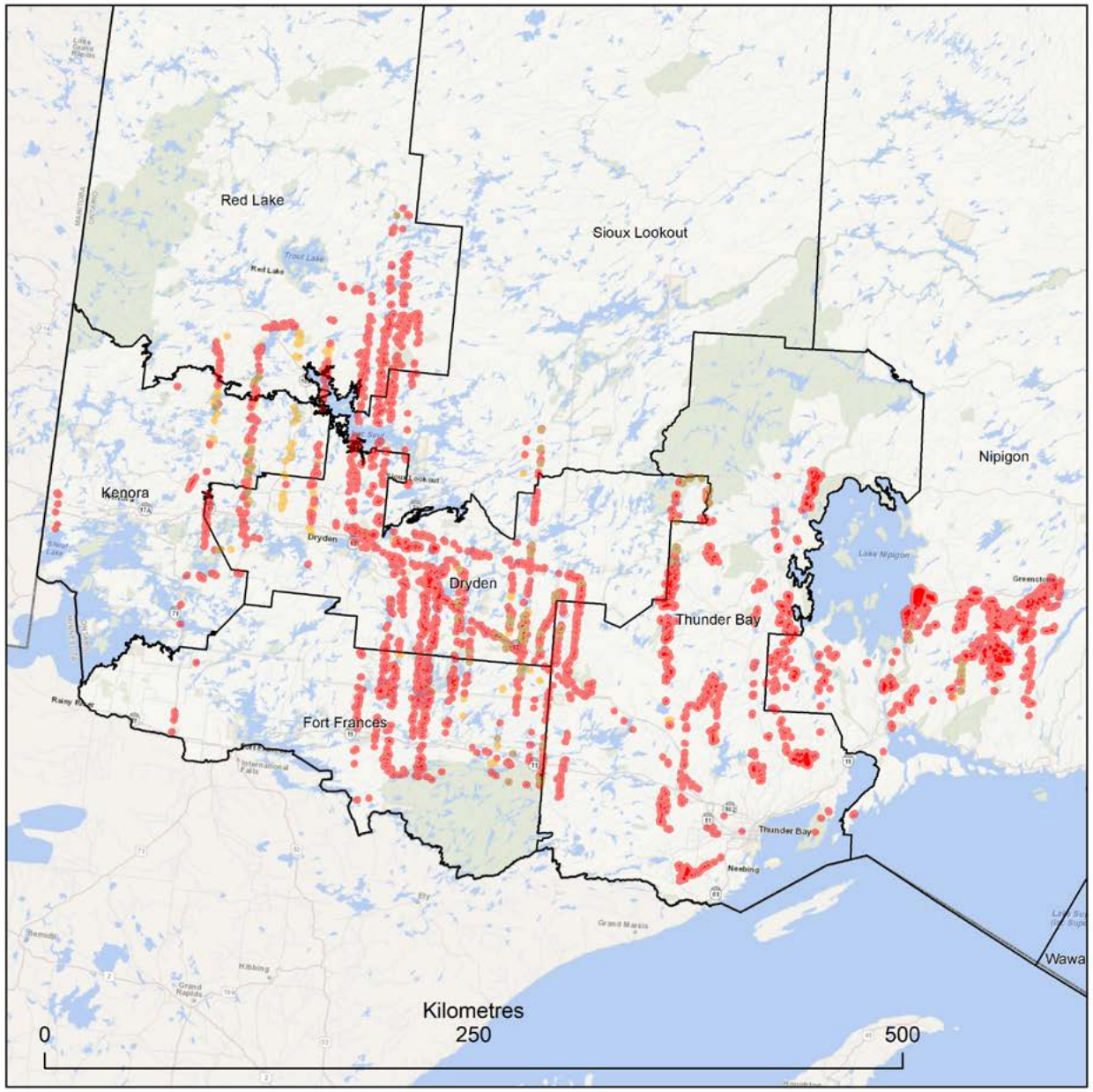
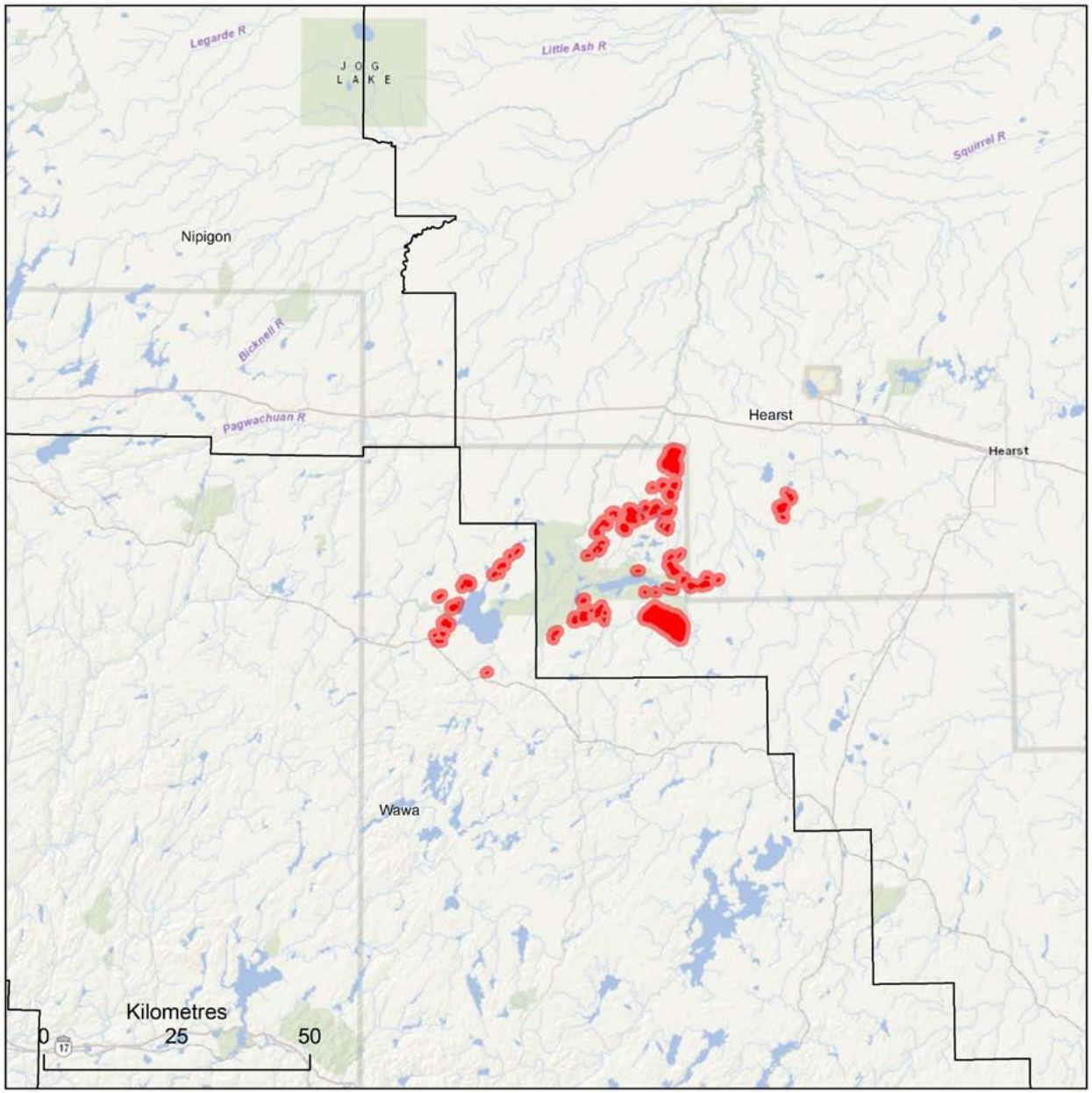


Jack pine budworm 2022

Areas in the Northeast Region where jack pine budworm caused defoliation

Moderate to severe = 10,762 ha

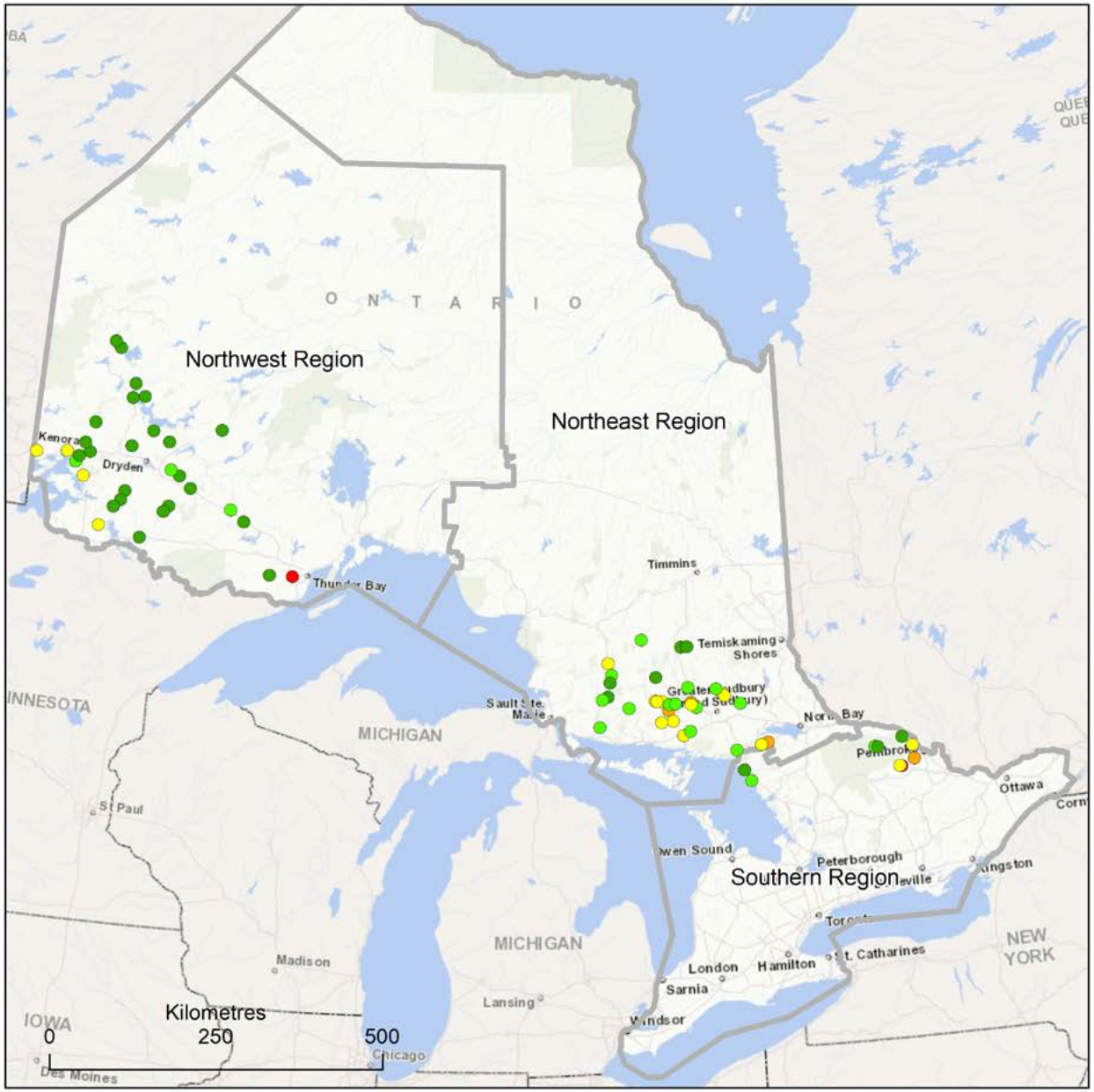
Area of moderate to severe defoliation



Jack pine budworm pheromone trapping results 2022

Average number of moths per trap

- < 10
- 10 - 25
- 25 - 50
- 50 - 100
- > 100



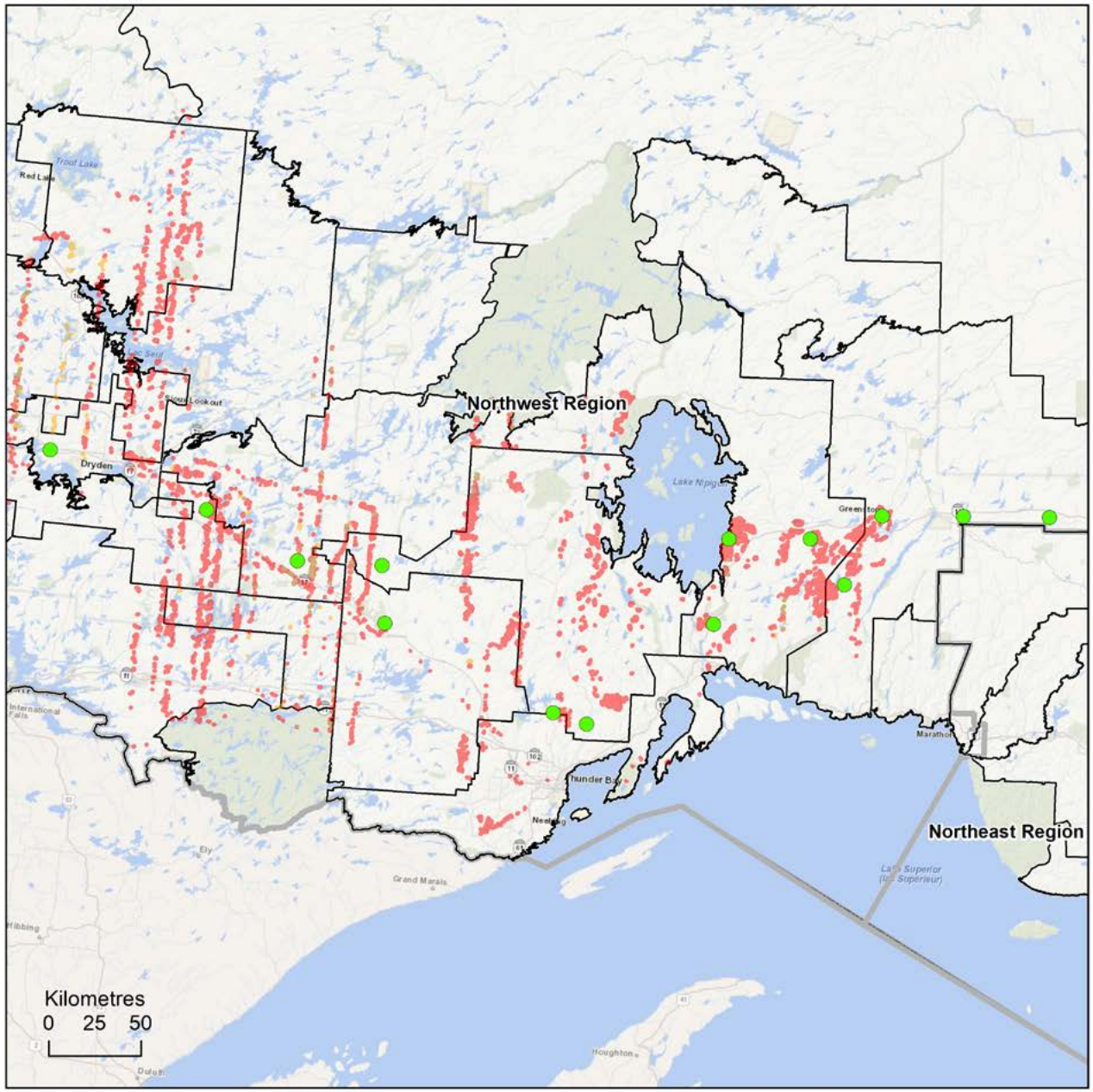
Jack pine budworm second instar larvae survey results Northwest Region

Defoliation forecast 2023

- Light

Jack pine budworm defoliation 2022

- Area of light defoliation
- Area of moderate to severe defoliation
- Area of mortality



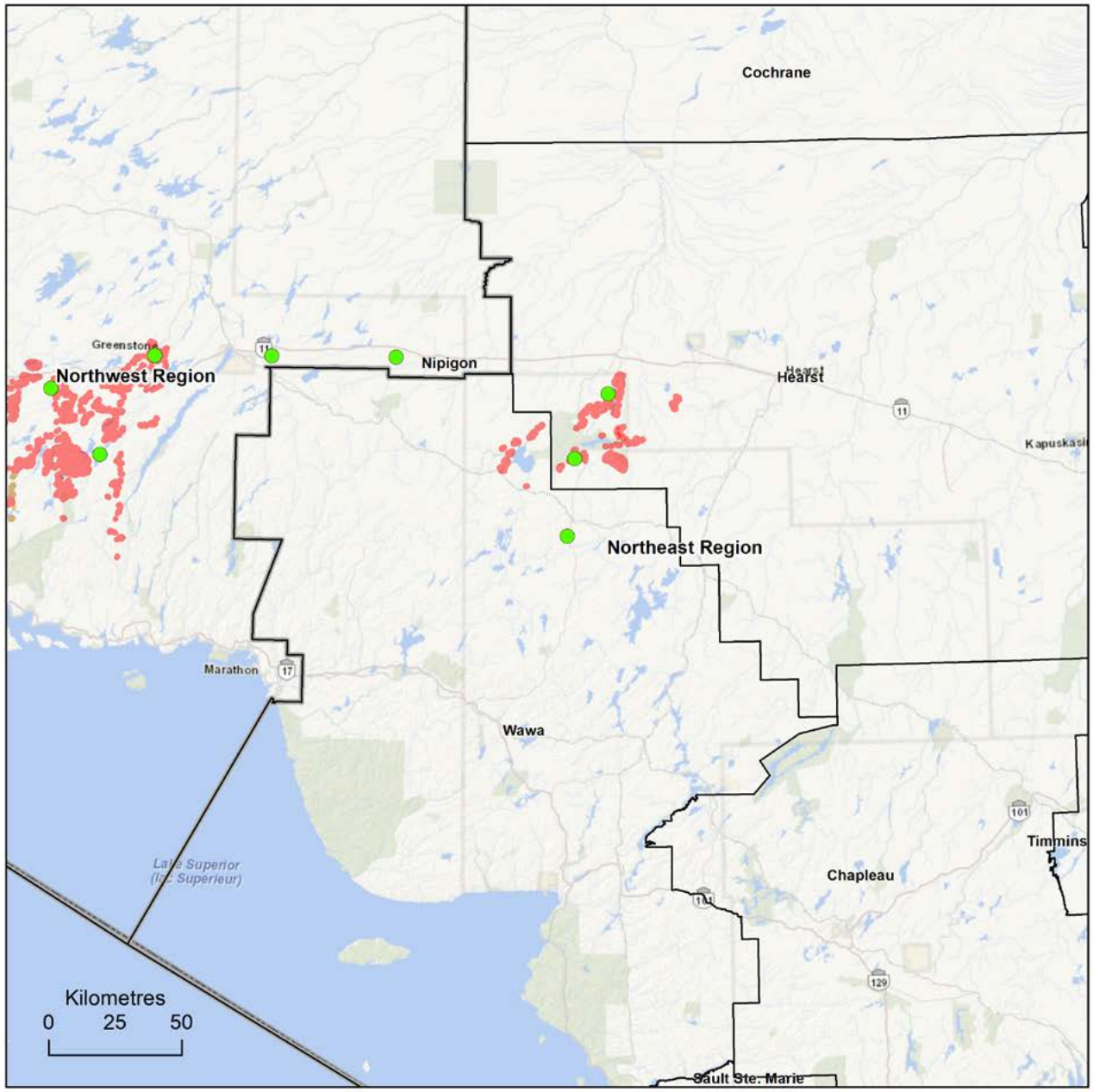
Jack pine budworm second instar larvae survey results Northeast Region

Defoliation forecast 2023

- Light

Jack pine budworm defoliation 2022

- Area of light defoliation
- Area of moderate to severe defoliation
- Area of mortality



Larch casebearer

Pest information

Common name:	Larch casebearer
Scientific name:	*Coleophora laricella* (Hübner)
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	Tamarack
Infestation area:	21 ha

Provincial key facts

- Larch casebearer was introduced to North America in Massachusetts in 1886 and was detected in Ontario in 1905. This pest is now found across the range of tamarack and throughout European larch plantations in Ontario.
- Larch casebearer is a serious defoliator of tamarack. In Southern Region, defoliation was last mapped in 2018.
- Since 2019, observations of small populations and resulting defoliation were only detected during ground surveys.
- In 2022, one area of defoliation was mapped during aerial surveys in Southern Region.

Regional summary

Southern

- In Peterborough District, 21 ha of moderate to severe defoliation were mapped during aerial surveys along Hwy 44 north of Havelock. One stand of young tamarack trees in a wetland were affected.

Larch casebearer 2022

Areas in Ontario where larch casebearer caused defoliation

Moderate to severe = 21 ha

Area of moderate to severe damage

Large aspen tortrix

Pest information

Common name:	Large aspen tortrix
Scientific name:	*Choristoneura conflictana* (Wlk.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Trembling aspen
Infestation area:	2,319 ha

Provincial key facts

- Large aspen tortrix is second only to forest tent caterpillar as an aspen defoliator.
- It is an early season defoliator that prefers trembling aspen, but if aspen are completely defoliated before larvae finish feeding, it will feed on other trees and shrubs (e.g., birches, alder, and choke cherry).
- This pest has periodic outbreaks, with sharp increases and quick decreases after two to three years of moderate to severe defoliation.
- In 2022, scattered areas of moderate to severe large aspen tortrix defoliation were mapped in Northeast Region.

Regional summary

Northeast

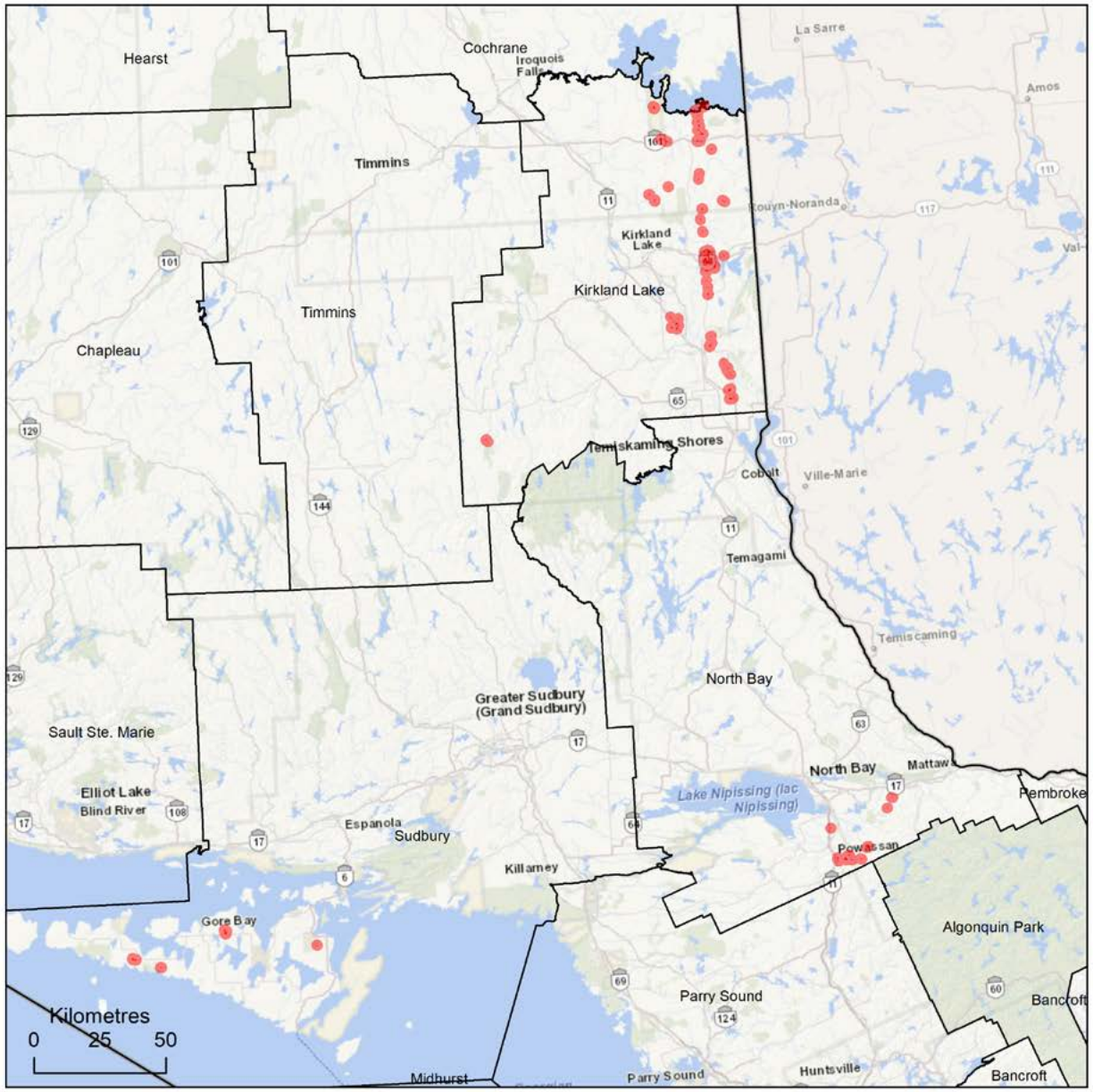
- The area of moderate to severe large aspen tortrix defoliation decreased in Kirkland Lake District from 5,354 ha in 2021 to 1,875 ha in 2022. Scattered areas of moderate to severe defoliation were mapped across the eastern half of the district from south of Thornloe to the southern shore of Lake Abitibi. The largest area of concentrated defoliation was mapped west of Larder Lake.
- In the southern part of North Bay District, 231 ha of moderate to severe large aspen tortrix defoliation were mapped in Himsworth, Chisholm, and Bonfield townships, which was a slight increase from the 132 ha aerially mapped in 2021.
- In Sudbury District, 213 ha of moderate to severe large aspen tortrix defoliation were mapped on Manitoulin Island, east of Gore Bay, and around Misery Bay Provincial Park. In addition, light to moderate defoliation was observed during ground surveys on Jacklin Road, northeast of Espanola, and along Slash Road, southeastern Manitoulin Island.

Large aspen tortrix 2022

Areas in Ontario where large aspen tortrix caused defoliation

Moderate to severe = 2,322 ha

Area of moderate to severe defoliation



Pine needleminer

Pest information

Common name:	Pine needleminer
Scientific name:	*Exoteleia pinifoliella* (Cham.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Jack pine
Infestation area:	50 ha

Provincial key facts

- Pine needleminer occurs in the eastern half of Canada and the United States.
- In Ontario, pine needleminer feeds on jack pine and sometimes Scots, red, and pitch pine, occasionally causing extensive defoliation.
- Pine needleminers have one life cycle per year.
- In 2022, localized pine needleminer defoliation was observed in Southern Region.

Regional summary

Southern

- In Kemptville District, 50 ha of moderate to severe pine needleminer defoliation was recorded during aerial surveys in a jack pine stand on Roger Stevens Drive, west of Dwyer Hill Road in the City of Ottawa. Jack pine trees in the stand were discoloured and on average were 50% defoliated.

Spongy moth

Pest information

Common name:	Spongy moth
Scientific name:	*Lymantria dispar dispar* (L.)
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	Most hardwood species
Infestation area:	22,427 ha moderate to severe; 35,604 ha light

Provincial key facts

- Spongy moth (formerly known as LDD or gypsy moth) was discovered in Ontario in 1969, with the first incidence of severe defoliation recorded in Kemptville District in 1981.
- Spongy moth outbreaks are cyclical, typically occurring every seven to 10 years. In Ontario, major outbreaks have peaked in 1985, 1991, 2002, and 2008. The most recent outbreak, which peaked in 2021, was the most widespread recorded in the province.
- Spongy moth prefers a range of hosts including oak, birch, and aspen, and occasionally softwoods, such as eastern white pine and Colorado blue spruce. In 2022, defoliation was recorded on all preferred host tree species.
- Moderate to severe spongy moth defoliation decreased substantially from 1,779,744 ha in 2021 to 22,427 ha in 2022, with areas of light defoliation totalling 35,604 ha in 2022. This decrease indicates a population collapse in northeastern Ontario and parts of southern Ontario, particularly in the southeast and Parry Sound District.
- In 2022, defoliation was aerially mapped in eight of the nine districts in Southern Region. No defoliation was reported in Northeast Region.

Regional summary

Southern

- In Aylmer District, 17,057 ha of moderate to severe defoliation and 22,038 ha of light defoliation were mapped in 2022, a decrease in extent and severity from 120,487 ha of moderate to severe defoliation mapped in 2021. This year was the sixth consecutive one that defoliation was mapped in the district. In Chatham-Kent,

defoliation was mapped in woodlots between Ridgetown, Muirkirk, and Dresden, extending to areas around Oil Spring and Petrolia in Lambton County. Smaller, more scattered areas were mapped west and southwest of London through Middlesex County to Kerwood Road (County Road 6). Small areas of defoliation were mapped southwest of St. Thomas to Fingal in Elgin County, and in woodlots along the Hwy 401 corridor from Woodstock to Drumbo in Oxford County. In Norfolk County, small areas were also mapped east of Walsingham to Port Ryerse, including areas of Backus Woods, St. Williams Conservation Reserve, and Turkey Point Provincial Park.

- In Guelph District, 3,158 ha of moderate to severe defoliation and 7,722 ha of light defoliation were mapped during aerial and ground surveys, a decrease in extent and severity from 112,978 ha of moderate to severe defoliation mapped in 2021. This year was the sixth consecutive one that defoliation was mapped in the district. Moderate to severe and light defoliation was scattered in the east and southern part of the district. In eastern Guelph District, defoliation was mapped in parts of the Dundas Valley Conservation Area, and areas around Brantford and eastern Haldimand County near Cayuga. Defoliation continued east into Niagara Region where it was concentrated between Pelham, Montrose, and Thorold, including parts of Short Hills Provincial Park. In southern Guelph District, moderate to severe defoliation was mapped in Huron County in parts of the Hay Swamp Complex near Exeter and light defoliation was recorded in woodlots along the shoreline of Lake Huron from Grand Bend to Bayfield. Light defoliation was scattered and mapped along the entire southern boundary of the district.

- In Peterborough District, 942 ha of moderate to severe defoliation were mapped in the central part of the district during aerial surveys, a substantial decrease from 374,268 ha mapped in 2021. This year was the fourth consecutive one that spongy moth defoliation was mapped in the district. Defoliation was mapped in parts of Northumberland County around Cambellford, along Hwy 30 south to Seymour Conservation Area, around Meyersburg in Trent Hills, and along Hwy 9 south of Rice Lake in Hamilton Twp. Small areas of defoliation were also mapped along Trent River in Glen Ross and Frankford in Quinte West. Mortality and decline of spruce and pine from previous years' spongy moth defoliation were observed in Buckhorn and Woodview, North Kawartha Twp. White spruce mortality was observed along McDonald Road in Northumberland County Forest. In Frontenac County, branch dieback of white and red oak was observed in Meisel Woods.

- In Kemptville District, 685 ha of moderate to severe defoliation were mapped, a decrease from 226,000 hectares in 2021. This year is the third consecutive one that spongy moth defoliation was mapped in the district. Small areas of defoliation were mapped in southwestern Kemptville District, concentrated in Leeds and Grenville County between the Thousand Islands Parkway and Hwy 401 at Landon's Bay (Leeds and the Thousand Islands Twp). Small areas were also mapped south of Hwy 401 at Lyn Road (Hwy 46), west of Brockville in Elizabethtown-Kitley Twp.

- In Pembroke District, 452 ha of moderate to severe defoliation were mapped, a decrease from 152,000 hectares in 2021. In Renfrew County, one large area was mapped on Round Lake Road west of Alice in

Laurentian Valley Twp. Two small areas of defoliation were mapped on Hwy 62 south of Barry's Bay in Madawaska Valley Twp. During ground surveys a small area of moderate defoliation of red oaks and poplars were observed on Baron Canyon Road east of Algonquin Park (Laurentian Hills Twp).

- In Bancroft District, 125 ha of moderate to severe defoliation was mapped, a decrease from 371,806 ha of moderate to severe defoliation and 944 ha of light defoliation mapped in 2021. Defoliation was mapped at the north end of the district in Hastings Highlands, on the banks of Kamaniskeg Lake along the Pembroke District border.

- In Midhurst District, 4,956 ha of light defoliation were mapped, a decrease from 176,264 ha of moderate to severe defoliation in 2021. This year was the fifth consecutive one that spongy moth defoliation was mapped in the district. Defoliation was concentrated in the south and east of Simcoe County along the western shore of Lake Simcoe in Innisfil and Barrie. Defoliation was also mapped in Simcoe County near Borden, Baxter, and Egbert. North of Lake Simcoe, light defoliation was mapped in the towns of Craighurst and Gilchrist (Oro-Medonte Twp), in the town of Carlyon (Severn Twp).

- In Aurora District, eight hectares of moderate to severe defoliation and 887 ha of light defoliation were mapped, a decrease from 97,164 ha moderate to severe defoliation mapped in 2021.This year is the fifth consecutive one that spongy moth defoliation has been mapped in the district. Light defoliation was concentrated in northern areas of the district. In Peel Region, defoliation was mapped north of Humber Grove in Caledon, at Caledon Tract, and west of Palgrave at the intersection of Humber Station Road and Finnerty Side Road. In Georgina, defoliation was mapped in along the south shore of Lake Simcoe around Brighton Beach. In York Region, defoliation was mapped in the town of Ravenshoe at the intersection of Ravenshoe Road (Regional Road 32) and Warden Avenue (Regional Road 65). Four small areas of defoliation were mapped northwest of Burlington in Halton Region west of Hwy 407, near the town of Cedar Springs.

Trend analysis/outlook/issues

In 2022, a substantial decrease from the record high levels of spongy moth defoliation reported in 2021 was evident. Increased populations of spongy moth allowed for increased populations of associated parasites and the proliferation of fungus and viruses, which resulted in the population collapse. Major contributing factors observed included *Entomophaga maimaiga*, nuclear polyhedrosis virus (NPV), *Ooencyrtus kuvanae*, and cold mortality.

Cool, wet conditions provide an ideal environment for *Entomophaga maimaiga (E. maimaiga)*, a fungus known to cause spongy moth populations to collapse. In 2022, spring was generally hot and dry across Southern Region, and not until August did parts of the region have prolonged rainfall. The presence of spongy moth larvae infected with *E. maimaiga* was reported across all districts in the region in 2022. Most districts in Southern Regionhad populations of *E. maimaiga,* but at varying levels. The dry, hot weather may have contributed to these varying levels of larval infection.

Nuclear polyhedrosis virus (NPV) is a viral infection that is known to kill spongy moth larvae. Higher infection rates were reported in areas that had consecutive years of spongy moth defoliation, particularly in southeastern Ontario.

Spongy moth egg mass viability surveys

In spring 2022, spongy moth egg mass viability surveys were conducted across Southern Region, with the intent to provide insight into the general health of the spongy moth population in areas previously defoliated. Surveys were undertaken in locations where modified Kaladar plots (MKP) had been established in fall 2021 and a targeted survey was completed in High Park, Toronto. Surveys were scheduled in late May/early June to ensure ample time for any viable egg masses to hatch. Ideally 50 new egg masses are evaluated, 25 above 30 cm and 25 below 30 cm, to assess differences in mortality from snow cover. Egg masses are considered hatched when either completely or partially hatched. The number of hatched and unhatched egg masses are compared to give a per cent hatched overall. None of the sites surveyed had a 100% hatch rate, and many of the egg masses above 30 cm were partially hatched with many (>50%) of the eggs unhatched. This finding can be attributed to a combination of parasitism and several consecutive days of cold (≥-20 ˚C) temperatures. Egg masses below snow cover would be insulated from these temperature fluctuations, while those above it would freeze.

Spongy moth forecast surveys

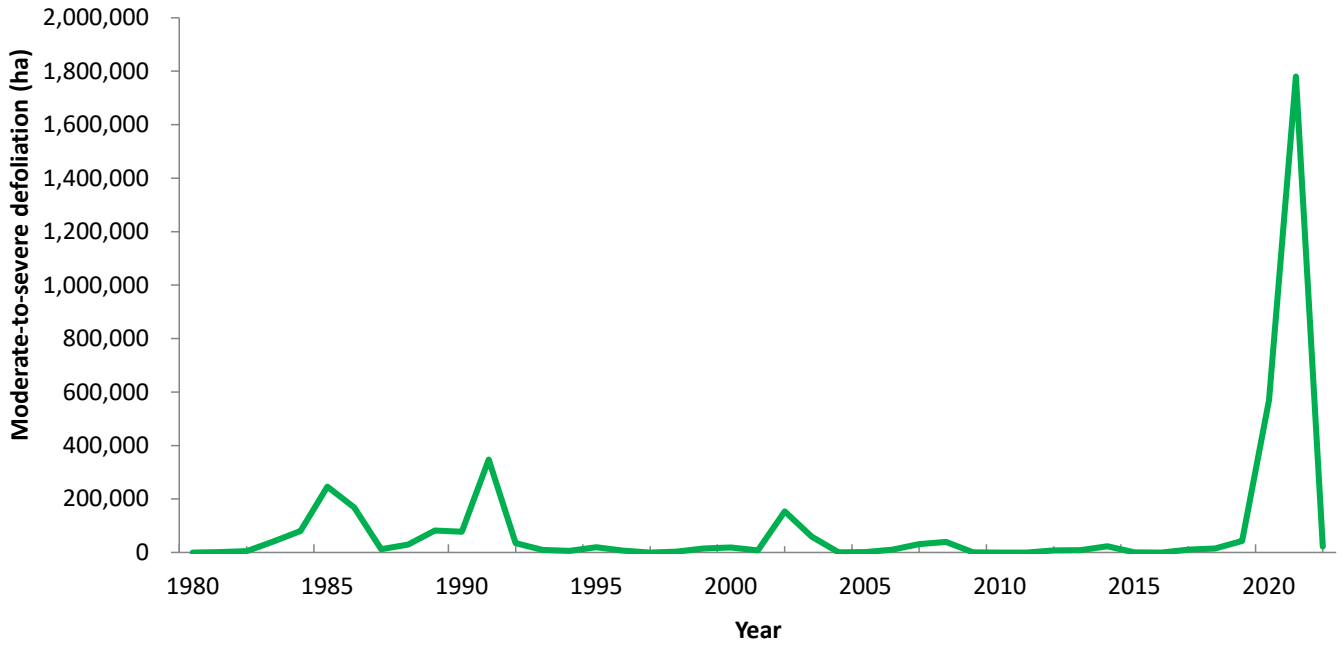
In Ontario, spongy moth defoliation forecasting is based on surveys of the number of overwintering egg masses on tree trunks, branches, woody debris, leaf litter, and other surfaces. Female adult spongy moths lay eggs in August in brownish tan coloured masses in which the number of eggs varies from 100 to 1,000. In the egg, the embryo develops into a small larva, the stage in which it spends the rest of the winter. This overwintering stage of the lifecycle provides an opportunity to count egg masses to forecast the potential severity of defoliation the following spring and summer. Several methods are used to estimate the number of egg masses, including timed walks and fixed-area plots. In Ontario, the modified Kaladar plot (MKP), which is a fixed area plot (10 m X 10 m = 0.1 ha), is used to forecast defoliation. In this method, all egg masses above the ground (>30 cm) are counted in the fixed area plot and egg masses on the ground (<30 cm) are counted in 10 mini-plots (1 m X 1 m) in the fixed plot. Locations for MKPs are selected using current areas of defoliation and host availability.

To forecast spongy moth defoliation, formulas from the MKP protocol, which factor in egg mass location and the proportion of new versus old egg masses, are used to calculate the number of egg masses per hectare. More than 6,175 egg masses per hectare indicates potential for severe (>75%) defoliation. Estimates of 1,236 to 6,175 egg masses per hectare indicate potential for moderate (40–75%) defoliation and 1 to 1,235 egg masses per hectare indicate potential light defoliation (1–40%).

After leaf drop in November 2022, 14 locations representing all districts across Southern Region were surveyed for spongy moth egg masses: Aurora (1), Aylmer (2), Bancroft (4), Guelph (1), Kemptville (1), Midhurst (1), Parry Sound (2), Pembroke (1), and Peterborough (1). The defoliation forecast for 2023 was severe for four locations, moderate for five, light for three, and nil for two.

During the survey, investigation of egg masses revealed predation by birds and small mammals ranged from low to high, with

highest predation reported at locations in Aylmer, Bancroft, Pembroke, and Kemptville districts. Small pinholes in egg masses indicated the presence of the tiny parasitic wasp, *Ooencyrtus kuvanae*, which was reported at moderate to high abundance in all districts, with the highest abundance reported at locations in Aylmer, Kemptville, and Parry Sound districts. Moderate abundance was reported at locations in Guelph, Midhurst, Aurora, Bancroft, and Pembroke districts. Parasites and predators can help to reduce spongy moth populations, but we won't know their effects until the spongy moth larvae emerge in spring 2023.



Area (in hectares) of moderate to severe defoliation caused by spongy moth in Ontario, 1980–2022.

Total area (in hectares) in which spongy moth caused moderate to severe defoliation from 2018 to 2022, by MNRF district.

Region	Area of defoliation (ha)				
District	2018	2019	2020	2021	2022
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	52	-
North Bay	-	-	407	3,349	-
Sault Ste. Marie	-	-	246	3,641	-
Sudbury	-	93	24,262	68,875	-
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Subtotal	0	93	24,916	75,916	-
Southern					
Algonquin Park	-	-	-	2,255	-
Aurora	2,764	1,949	15,613	97,164	8
Aylmer	983	19,994	47,219	120,487	17,057
Bancroft	-	-	127,992	371,806	125
Guelph	11,154	17,557	52,168	112,978	3,158
Kemptville	-	-	84,563	226,362	685
Midhurst	36	2,978	41,743	176,264	-
Parry Sound	-	177	2,046	75,350	-
Pembroke	-	-	13,547	146,848	452
Peterborough	-	409	159,578	374,313	942
Subtotal	14,937	43,065	544,468	1,703,827	22,427
Provincial total	14,937	43,158	569,384	1,779,744	22,427

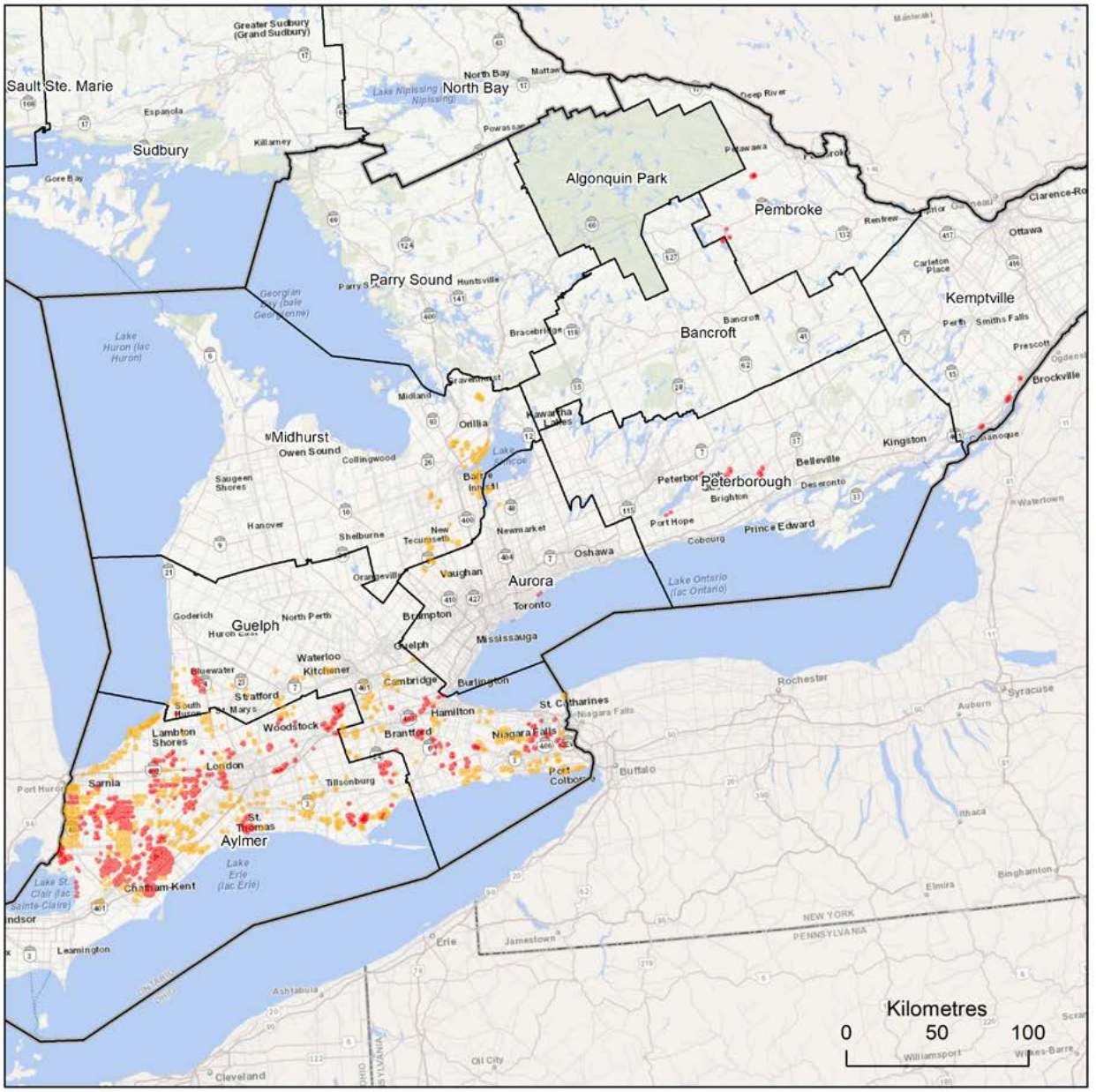
Spongy moth 2022

Areas in the Southern Region where spongy moth caused defoliation

Light = 35,604 ha
Moderate to severe = 22,427 ha

Area of light defoliation

Area of moderate to severe defoliation



Spongy moth egg mass survey results

Defoliation Forecast 2023

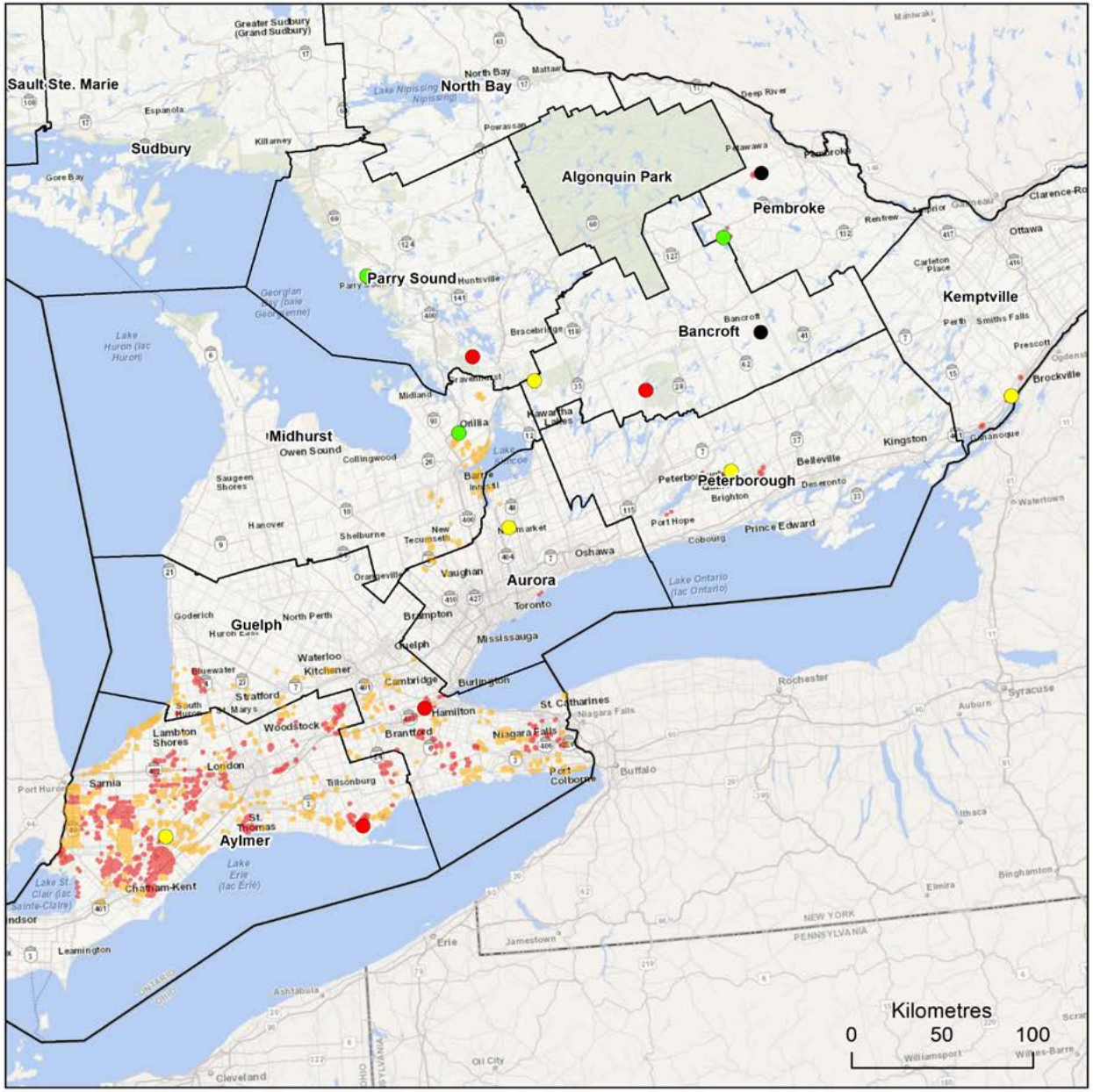
- Severe
- Moderate
- Light
- Nil

Spongy moth damage 2022

- Area of moderate to severe defoliation
- Area of light defoliation

Disclaimer:
This map is illustrative only. Do not rely on this map as a precise indicator of routes, locations of features, nor as a guide to navigation. This map was produced for the Ministry of Natural Resources and Forestry.

Ontario



Spruce budworm

Pest information

Common name:	Spruce budworm
Scientific name:	*Choristoneura fumiferana* (Clem.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Balsam fir, white spruce, black spruce, tamarack, eastern white pine
Infestation area:	2,029,039 ha moderate to severe defoliation; 17,088 ha mortality

Provincial key facts

- Spruce budworm is one of the most damaging native insects affecting fir and spruce in Ontario.
- Spruce budworm outbreaks occur periodically when the primary host — balsam fir — reaches 40 years of age.
- Outbreaks can last several decades and can result in widespread balsam fir and spruce mortality.
- In 2022, moderate to severe spruce budworm defoliation in the province increased to 2,029,039 ha from 1,302,537 ha in 2021, with most of the defoliation mapped in Northeast Region and some in Southern Region. All districts in Northeast Region except one had more total area of moderate to severe spruce budworm defoliation in 2022 than in 2021.
- A total of 17,088 ha of spruce budworm mortality were mapped in 2022 compared with 31,673 ha in 2021. Most of the mortality was in Northeast Region with small areas in Southern Region.

Regional summary

Northeast

- In 2022, 501,152 ha of moderate to severe spruce budworm defoliation were mapped in Timmins District, an increase of 184,413 ha from 2021. Moderate to severe defoliation was detected throughout the district in 2022. North of Gogama to the northern district boundary, large areas of moderate to severe spruce budworm defoliation mapped in 2021 had expanded and merged. South of Gogama to the southern district boundary, size of moderate to severely defoliated areas varied and were mapped in new areas as well as those mapped in 2021. Large areas of defoliation were detected south of Threecorner Lake in Vrooman Twp and they continued in a southeast direction east of Hwy 144 toward Baynes Lake, extending to the north end of Onaping Lake

just north of the Sudbury District boundary. Medium-sized areas of defoliation were mapped south of Morin Village west of Opikinimika Lake in Moffat Twp and near Meteor Lake in Beulah Twp. Smaller, more scattered areas of moderate to severe spruce budworm defoliation were found southeast of Meteor Lake with the bulk of defoliation in Hodgetts Twp. In addition, ground observations revealed light defoliation south of Hwy 560 in Ogilvie Twp on the eastern district boundary. In 2022, 4,666 ha of spruce budworm mortality were mapped in Timmins District. Most white spruce and balsam fir mortality were recorded in the northwest corner of the district north of Hwy 101, north and southwest of Kamiskotia from Mahaffy Twp near the Cochrane District boundary to Melrose Twp southwest of Bromley Lake. Smaller, more scattered areas of mortality were recorded southwest of Hwy 144 from Regan Twp south of Kenogaming Lake to Somme, Neville, and Frater townships near Mesomikenda and Pebonishewi lakes. Two smaller isolated areas of mortality were also mapped north and south of Timmins, one south in Douglas Twp southwest of Night Hawk Lake and the other on the west side of Hwy 655 along the border of Prosser and Wark townships.

- In 2022, 437,456 ha of moderate to severe spruce budworm defoliation were mapped in Sudbury District, an increase of 279,623 ha from 2021. Spruce budworm defoliation was recorded across most of the district, including Manitoulin Island. Larger areas of contiguous defoliation were observed on the west side of the district west of Hwy 144 to the Sault Ste. Marie District boundary. Large areas of defoliation were also recorded on the east side of Hwy 144 north of Chelmsford to the Timmins District boundary north of Lake Wanapetei. On Manitoulin Island, spruce budworm defoliation increased in 2022, as large areas of moderate to severe spruce budworm defoliation were mapped on the south side of the island and medium-sized areas were mapped on the north side. Smaller, more scattered areas of defoliation were observed south of Sudbury to Killbear and French River provincial parks, as well as on the southeast side of the district between Alban and Noelville, stretching north along the Sudbury/North Bay district boundary to the north side of Veuve River, west of Verner. Small areas of balsam fir and white spruce mortality caused by consecutive years of moderate to severe spruce budworm defoliation were mapped east of Nairn Centre in Drury and Lorne townships, south of Lively in Waters and Eden townships around Long Lake, west of Estaire in Secord Twp and south of Killarney in Kilpatrick, Humboldt, and Travers townships. These four areas of mortality totalled 387 ha.
- In 2022, 434,305 ha of moderate to severe spruce budworm defoliation were mapped in the southern part of Cochrane District, an increase from 370,496 ha in 2021. Large areas of moderate to severe spruce budworm defoliation were mapped from the southcentral part of the district to the southwest side of the district. In the southwest corner of the district, large areas of defoliation persisted south of the Fraserdale Wetland Complex to the southern district boundary. Farther east, a large area of defoliation was aerially mapped in and north of Greenwater Provincial Park along the Abitibi River system as well as in and south of Little Abitibi Provincial Park. Medium-sized areas of defoliation were mapped north and west of Lake Abitibi. In 2022, 3,309 ha of spruce budworm mortality were mapped on the southwest side of Cochrane District. Most of the white spruce and balsam fir mortality was north and south of Smooth Rock Falls, around Greenwater Provincial Park, and along the western district boundary in the townships of Alexandra, Haggart, and Laidlaw. One small area of mortality

was mapped in Aurora Twp, north of Iroquois Falls.

- In 2022, 229,227 ha of moderate to severe spruce budworm defoliation were mapped in Chapleau District, an increase of 68,324 ha compared to 2021.Most of the defoliation was recorded on the east side of the district, with large areas of defoliation in the northeast corner of the district north of Foleyet to the Hearst District boundary, south of Ivanhoe Lake, west of Horwood Lake along the Timmins District boundary and between Ramsey and Biscotasi lakes in the southeast part of the district. Smaller areas of defoliation were observed west of the larger areas from Rollo Lake (Rollo Twp) to Travel Lake (Garnet Twp) and south of Sultan to the Sudbury/ Sault Ste. Marie district boundary near Wakami, Woman River, and Mississagi River provincial parks. In 2022, 4,384 ha of white spruce and balsam fir mortality caused by consecutive years of moderate to severe spruce budworm defoliation were mapped in Chapleau District. Most of the mortality was in the northeast corner of the district in small, scattered areas between Chapleau-Nemegosenda River Provincial Park (waterway park) and the Timmins/Hearst district boundary. One small area of mortality was recorded on the north end of Wakami Lake Provincial Park on the northeast side of Neelands Twp.
- In 2022, the total area of moderate to severe spruce budworm defoliation in Kirkland Lake District increased to 228,300 ha from 126,772 ha in 2021. This increase was in areas defoliated in 2021 and new areas of defoliation, particularly in the southwest corner of the district. Most of the district had some spruce budworm defoliation, but the largest areas of moderate to severe defoliation were observed at the south end of Lake Abitibi along the Cochrane District boundary, west of Matachewan close to the Timmins District boundary between Duncan and Little Whitefish lakes, and further south from Gowganda to the Sudbury/North Bay district boundary around McKee and Smith lakes. In the central part of the district, smaller to medium-sized areas of defoliation were recorded from Matheson to Engleheart on both sides of Hwy 11 and a little further south of Elk Lake in Makobe-Grays River Provincial Park (waterway park).
- In Hearst District, 113,894 ha of moderate to severe spruce budworm defoliation were mapped, a slight decrease from 128,557 ha in 2021. Defoliation from spruce budworm remains in the southeastern part of the district north and south of Hwy 11. On the south side of Hwy 11, moderate to severe defoliation was recorded from Moonbeam to the southern district boundary, with small to medium-sized areas of defoliation between Groundhog and Kapuskasing rivers. North of Hwy 11 defoliation reached as far as Clay Twp along the Mattagami River, about 90 km north of Fauquier and was recorded west to Teetzel and Pearce townships north of Kapuskasing. Ground observations in 2022 revealed light defoliation from spruce budworm along Fergus Road southwest of Opasatika. In 2022, 975 ha of spruce budworm mortality were mapped in Hearst District. Most of this mortality was in the southeast corner of the district along the Hearst/Chapleau district boundary in Lisgar Twp, with small areas of mortality a little further north in Seaton and Concobar townships. On the north side of Hwy 11, another small area of mortality was mapped northwest of Fauquier in Machin and Fauquier townships.

- A slight increase in moderate to severe spruce budworm defoliation — from 30,601 ha in 2021 to 41,767 ha in 2022 — was recorded in North Bay District. Most of the defoliation was in the northern part of the district, with smaller areas in the southern part, and small scattered areas in the central part. In the northern areas, large areas of defoliation were mapped on the northwest side of the district in Lady Evelyn Smoothwater Provincial Park and Solace Provincial Park. Smaller areas of defoliation were northwest of Latchford towards the Kirkland Lake District boundary near Lady Evelyn, Anima Nipissing, and Lepha lakes. In the southern part of the district areas of defoliation were observed north of Lake Nipissing between Sturgeon Falls and North Bay, west and north of Verner, south of North Bay to Trout Creek along Hwy 11 to the Parry Sound border and south of Lake Nipissing near Restoule Lake Provincial Park. Small areas of defoliation were also recorded south of Mattawa in Papineau and Cameron townships and north of Sturgeon Falls along Sturgeon River and Tomiko Lake. Small, scattered areas of moderate to severe spruce budworm defoliation in the central part of the district were recorded between Temagami and Marten River predominantly on the east side of Hwy 11. In 2022, 2,648 ha of balsam fir and white spruce mortality caused by consecutive years of moderate to severe spruce budworm defoliation were mapped in North Bay District. Most of this mortality were small areas on the southeast side of the district between Hwy 11 and the Quebec border from Thorne to Rutherglen (Hwy 17). Small areas of mortality were also recorded northwest of Sturgeon Falls near Lac Tonnere (Springer Twp) and between Tilden and Tomiko lakes. In the north end of the district, mortality was evident between Latchford and the Quebec border (Lake Temiskaming) in Gillies Limit, Lorrain, and South Lorrain townships.
- In 2022, 22,011 ha of moderate to severe spruce budworm defoliation were aerially mapped in Sault Ste. Marie District, an increase from the 6,435 ha mapped in 2021. Spruce budworm defoliation persisted in the same areas as in 2021 but new areas of defoliation were recorded farther north and northeast in the district. On the west side of the district, defoliation was recorded just north of the city of Sault Ste. Marie towards Heyden and west to the airport. New areas of defoliation were mapped east of the city, and north of Heyden around Karalash Corners at the junction of Fenwick, Havilland, and Vankoughnet townships, a small area near Northland in Deroche Twp, a little larger area south of Searchmont in Hodgin Twp, a few areas in the southwest corner of Gaudette Twp north of Searchmont, and farther north three areas were mapped on the west side of Daumont Twp. A larger area of defoliation was also recorded in the southern part of Hynes Twp in and east of Goulais River Provincial Park (a waterway park). Moderate to severe spruce budworm defoliation was also observed between Sylvan Valley and Blind River and north of Bruce Mines, Thessalon, and Iron Bridge to Kynoch, Wharncliffe, Wakomata Lake, Dunns Valley, and Poplar Dale. Numerous scattered areas of defoliation were also noted north of Wakomata Lake to Aubrey Falls Provincial Park and farther east between Mississagi Provincial Park and Little White River Provincial Park (Hwy 546). On the east side of the district, moderate to severe spruce budworm defoliation was mapped south of Elliot Lake to Spragge along Hwy 17 and north of Elliot Lake along the Sault Ste. Marie/Sudbury district boundary to Rawhide Lake and farther north to Bark Lake and Upper Green Lake along the Sault Ste. Marie/Chapleau district boundary. A little further west, several areas of defoliation were recorded between Grub and Dodge lakes in Gisborn, Lawlor, Morningstar, and Nuttall townships. In 2022, 330 ha of white spruce and balsam fir mortality caused by spruce budworm were recorded in Sault Ste. Marie

District. Most of this mortality was along the Little Thessalon River south of Tunnel Lake along the Shellrock Loop Road at the north end of Bridgeland Twp. One small area of mortality was also mapped on the west side of the City of Sault Ste. Marie close to Prince Twp between Second Line and Baseline on the east side of Leighs Bay Road.

- For the third consecutive year, moderate to severe spruce budworm defoliation was mapped in the southern part of Wawa District in Lake Superior Provincial Park totalling 4,322 ha, which was slightly more than the 3,855 ha recorded in 2021. Defoliation was recorded along Hwy 17 from Gargantua Road in the north to the southern district boundary south of Agawa Bay.

Southern

- In 2022, 16,606 ha of moderate to severe spruce budworm defoliation were mapped in the northern part of Parry Sound District. Most of this spruce budworm defoliation was on the northeast side of the district, south of Trout Creek to Burk's Falls and east to Dunchurch. On the northwest side of the district, moderate to severe defoliation was also mapped east of Grundy Lake Provincial Park to the North Bay District boundary along the McConkey and Blair township borders. White spruce and balsam fir mortality caused by consecutive years of moderate to severe spruce budworm defoliation was mapped north of Magnetawan in Chapman Twp on either side of Hwy 124. One small area of mortality was also recorded between Wauby Lake and Lake of Many Islands along the border of Ferrie and Croft townships. These areas of mortality totalled 390 ha.

Trend analysis/outlook/issues

Spruce budworm spray program

In 2022, the ministry undertook an insect pest management program for spruce budworm affected stands in Hearst, Cochrane, Chapleau, and Timmins districts. A double application of the bacterial insecticide Btk (Foray 76B) was applied at 1.5 L/ha to 53,914 ha of spruce/fir stands. An efficacy assessment, including both pre- and post-spray budworm populations and subsequent defoliation assessments, confirmed that the foliage protection program was successful in meeting its objective of keeping defoliation below 40% in all assessed stands.

As part of the efficacy assessment, 29 plots were established in areas that had been treated (sprayed) and 16 plots were established in untreated areas (control). Treated areas were divided into four project areas (districts), with each project area containing sprayed plots and nearby control plots.

- The Cochrane project area, in the Abitibi River Forest Management Unit (FMU), was 62,223 ha with average defoliation of 32% in sprayed plots and 62% defoliation in control plots.
- The Chapleau project area, in the Pineland (FMU), encompassed 20,526 ha with average defoliation of 31% in sprayed plots and 46% defoliation in control plots.

- The Hearst project area, mainly in the Gorden Cosens FMU, totalled 17,773 ha with average defoliation of 38% in sprayed plots and 65% defoliation in control plots.
- The Timmins project area, which included the Romeo Malette FMU, was 2,735 ha with average defoliation of 30% in sprayed plots and 64% defoliation in control plots.

2022 was the second consecutive year of managing the current outbreak of spruce budworm in Northeast Region. Planning is underway to initiate a pest management program in 2023.

Spruce budworm pheromone trapping

Spruce budworm pheromone trapping was carried out across the province. Traps were deployed at 59 locations: 14 in Northwest Region, 27 in Northeast Region, and 18 in Southern Region.

The highest average number of moths per trap recorded was in Northeast Region at 611 male moths per trap. The highest number of moths recorded per trap was 1,329 at one location in Sudbury District. Five other locations averaged more than 1,000 male moths per trap: one in Sudbury District, two in North Bay District, one in Sault Ste. Marie District, and one in Chapleau District. In Southern Region, the average number of male moths per trap was 617, with the highest count (985) in Midhurst District. In Northwest Region, the average number of moths increased from 88 moths per trap in 2021 to 207 moths per trap in 2022. In the northwest, the highest average number of moths per trap was 901 in Fort Frances District.

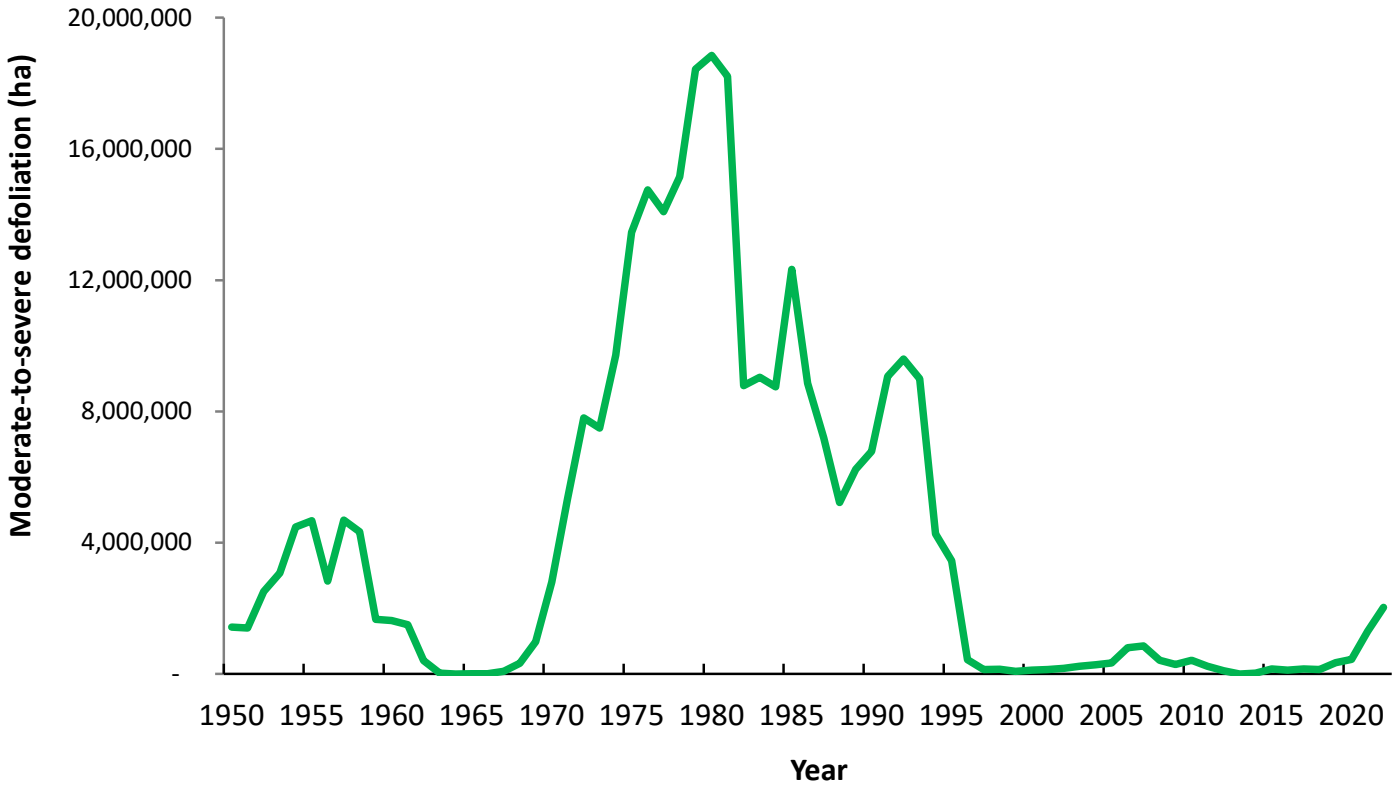
Spruce budworm defoliation forecast survey

In Ontario, spruce budworm defoliation forecasting is based on surveys of the number of overwintering larvae on tree branches. Spruce budworm overwinter as second instar larvae (L2) by encapsulating themselves in silken shelters (hibernacula) under branch scales and bark cracks. These larvae typically shelter from late August until the following spring. This overwintering stage of the lifecycle allows monitoring crews to collect branches and extract and count larvae to forecast the potential severity of defoliation the following spring and summer. Defoliation forecasts are used to determine which stands should be considered for protection. Locations for L2 surveys are selected based on defoliation mapped during the current infestation. From each location, 10 trees were selected, and a 1 m branch was sampled from the mid to upper crown of each tree. Branches were sent to a laboratory to be processed in a sodium hydroxide washing procedure to extract the second instar larvae from their hibernacula. Extracted larvae were collected and counted under a microscope to determine the average number of larvae per branch for each sample location. This average is used to forecast spruce budworm defoliation for 2023. An average of more than 65 larvae per branch indicates potential for severe defoliation, 26 to 65 larvae per branch indicates potential for moderate defoliation, and less than 25 larvae per branch indicates potential for light defoliation.

In Northeast Region, 34 locations (340 trees) were sampled for larvae in 2022. These locations were divided among districts: Timmins (8), Chapleau (8), Cochrane (7), Hearst (5), Kirkland Lake (4), and North Bay (2). The defoliation forecast for 2023 by district is:

- Timmins: severe for one location and moderate at seven.
- Chapleau: moderate for four locations and light for three.
- Cochrane: moderate for four locations and light for three.
- Hearst: severe for one location, moderate for two, and light for one.
- Kirkland Lake: severe for one location, moderate for one, and light for one.
- North Bay: moderate for one location and light for the other.

Only one location (Kirkland Lake District) averaged more than 100 larvae per branch (119).



Total area (in hectares) in which spruce budworm caused moderate to severe defoliation in Ontario from 1950 to 2022.

Total area (hectares) in which spruce budworm caused moderate to severe defoliation from 2018–2022 by MNRF district.

Region / District	Area of defoliation (ha) 2018	2019	2020	2021	2022
Northeast					
Chapleau	30,680	67,918	52,654	160,903	229,227
Cochrane	31,841	109,026	139,451	370,496	434,305
Hearst	16,522	72,338	77,840	128,557	113,894
Kirkland Lake	-	972	3,614	126,772	228,300
North Bay	33,933	15,154	29,431	30,601	41,767
Sault Ste. Marie	-	4,363	10,826	6,435	22,011
Sudbury	803	9,635	23,421	157,832	437,456
Timmins	23,230	60,175	97,342	316,739	501,152
Wawa	-	-	977	3,855	4,322
Subtotal	137,008	339,580	435,557	1,302,190	2,012,433
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	-	-	-	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	-
Parry Sound	-	2,753	6,869	348	16,606
Pembroke	-	-	-	-	-
Peterborough	74	-	-	-	-
Subtotal	74	2,753	6,869	348	16,606
Provincial total	137,082	342,333	442,426	1,302,537	2,029,039

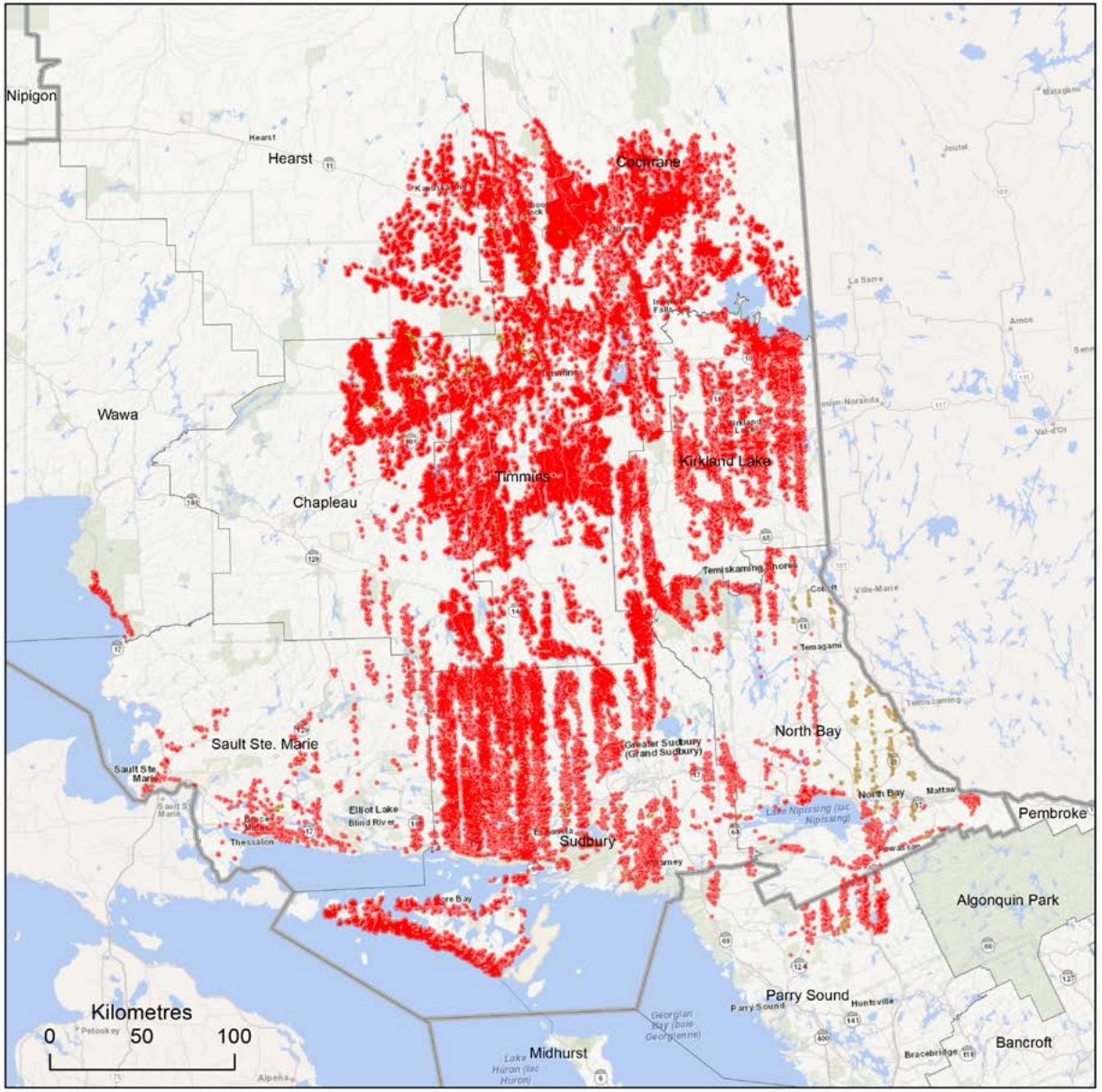
Spruce budworm 2022

Areas in Ontario where spruce budworm caused defoliation

Moderate to severe = 2,029,039 ha
Mortality = 17,088 ha

Area of moderate to severe defoliation

Area of mortality



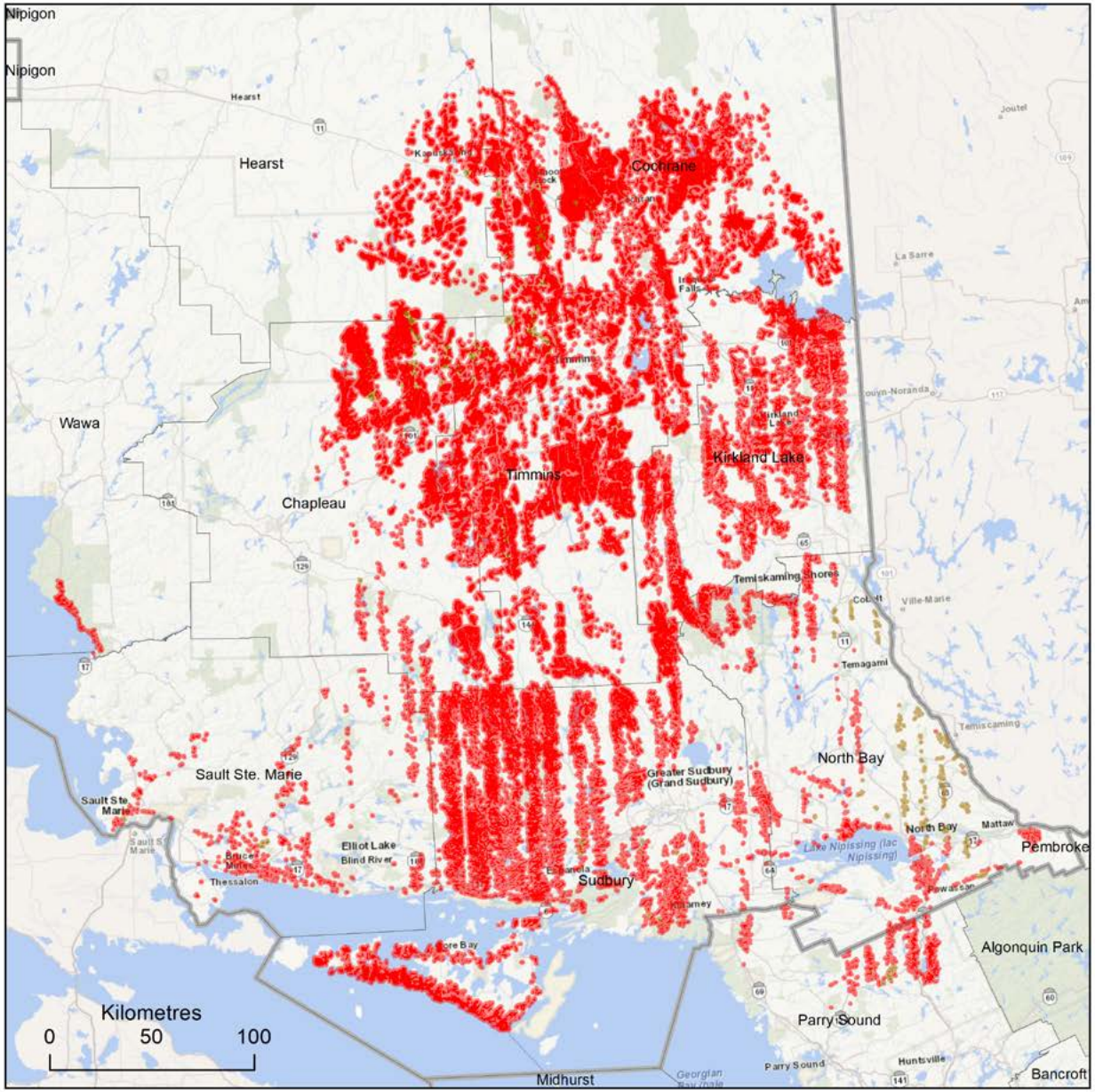
Spruce budworm 2022

Areas in the Northeast Region where spruce budworm caused defoliation

Moderate to severe = 2,012,433 ha
Mortality = 16,698 ha

Area of moderate to severe defoliation

Area of mortality



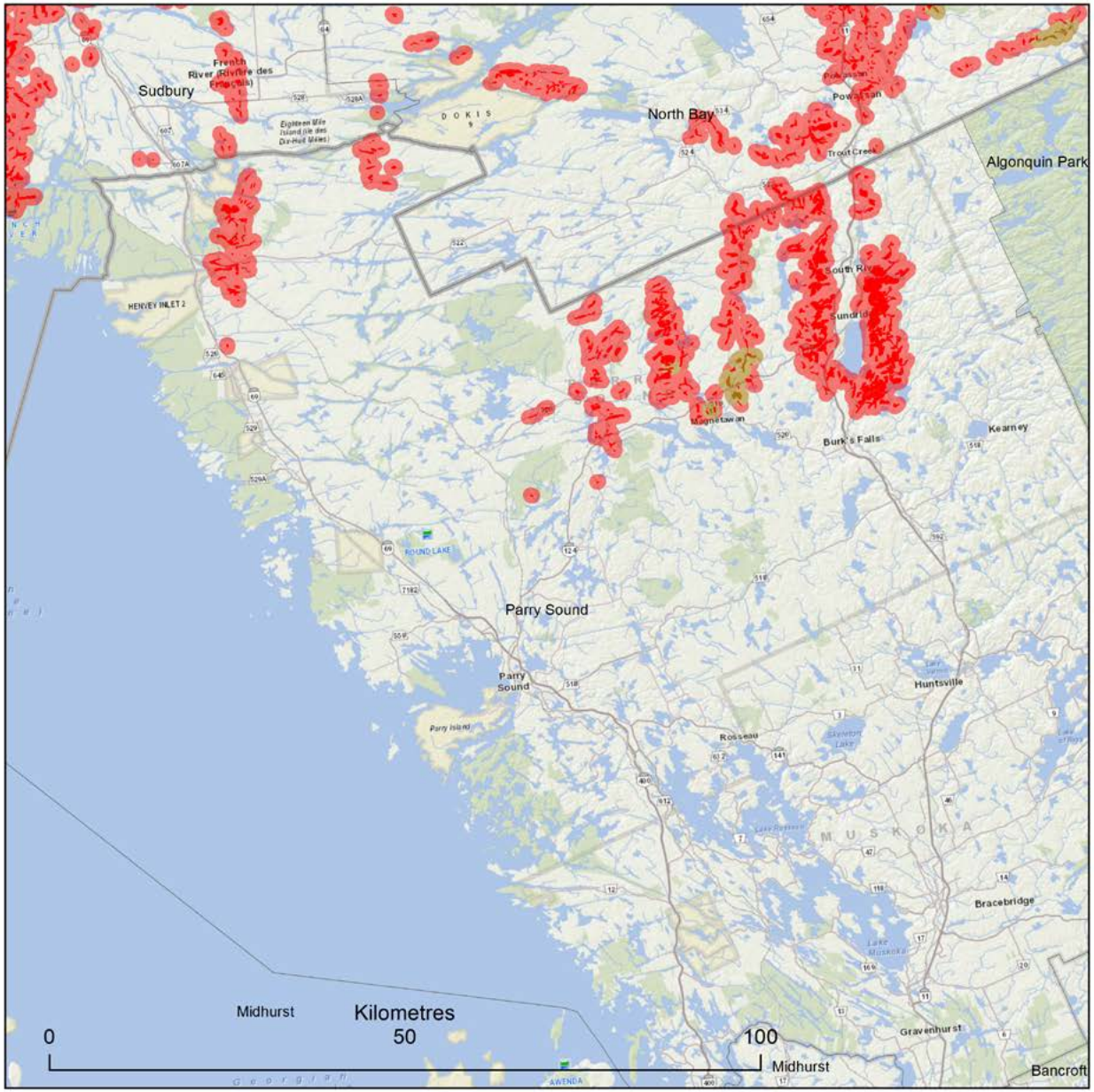
Spruce budworm 2022

Areas in the Southern Region where spruce budworm caused defoliation

Moderate to severe = 16,606 ha
Mortality = 390 ha

Area of moderate to severe defoliation

Area of mortality



Spruce budworm pheromone trapping results 2022

Average number of moths per trap

- < 10
- 10 - 25
- 25 - 50
- 50 - 100
- > 100

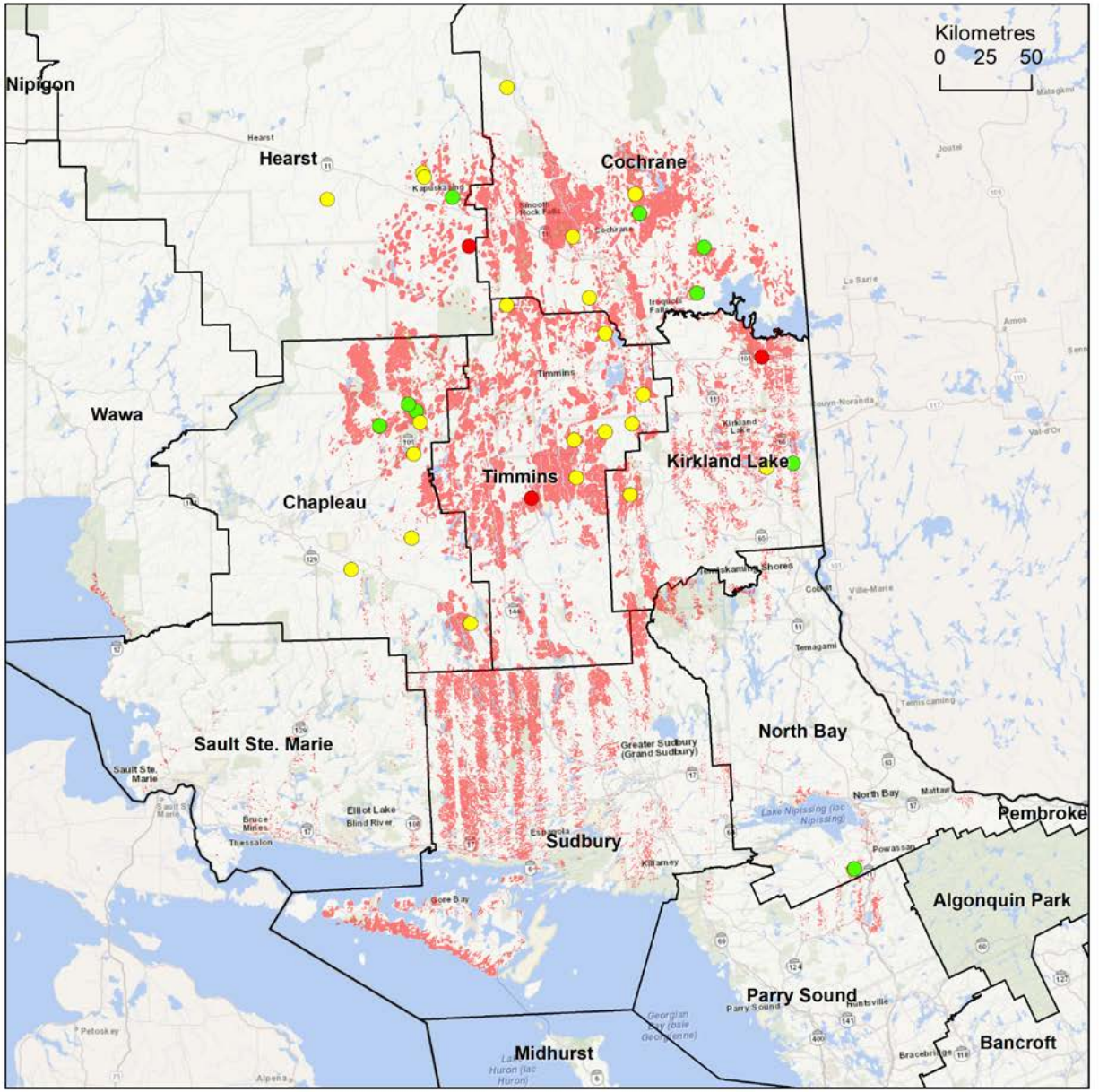
Spruce budworm second instar larvae survey results

Defoliation forecast 2023

- Severe
- Moderate
- Light

Spruce budworm defoliation 2022

- Area of moderate to severe defoliation
- Area of mortality



Whitespotted sawyer beetle

Pest information

Common name:	Whitespotted sawyer beetle
Scientific name:	*Monochamus s. scutellatus* (Say)
Pest origin:	Native to North America
Pest type:	Wood borer
Host species:	Jack pine
Infestation area:	100 ha

Provincial key facts

- Whitespotted sawyer beetle is one of the most widely distributed and common wood borers in North America.
- This pest is mainly found on recently dead or dying trees.
- Larvae tunnelling damage severely downgrades lumber value.
- Larger populations often occur near other forest disturbances, such as blowdown, drought, multiple years of defoliation, fire, and harvests.
- This beetle is often confused with the invasive Asian long-horned beetle.
- In 2022, 100 ha of moderate to severe whitespotted sawyer beetle damage were aerially mapped in Northwest and Northeast regions.

Regional summary

Northwest

- In Sioux Lookout District, 45 ha of moderate to severe whitespotted sawyer beetle damage were aerially mapped. Three areas of damage were detected south of Cover Lake alongside Wapesi River, roughly 3 km west of Hall Lake. One other smaller area of damage was located northwest of Great Portage Lake, south of Wapesi River.
- In Dryden District, 31 ha of moderate to severe damage were aerially mapped northeast of Dryden. The largest area was on the south access road leading to Six Mink Lake. Another small area of damage was recorded north of Centrefire Lake near the railroad tracks.

- In Thunder Bay District, 8 ha of moderate to severe damage were aerially mapped in the western part of the district, northeast of Bedivere Lake, north of Hwy 11.
- In Fort Frances District, 1 ha of whitespotted sawyer beetle damage was aerially mapped west of Eltrut Lake, on the edge of a burn.

Northeast

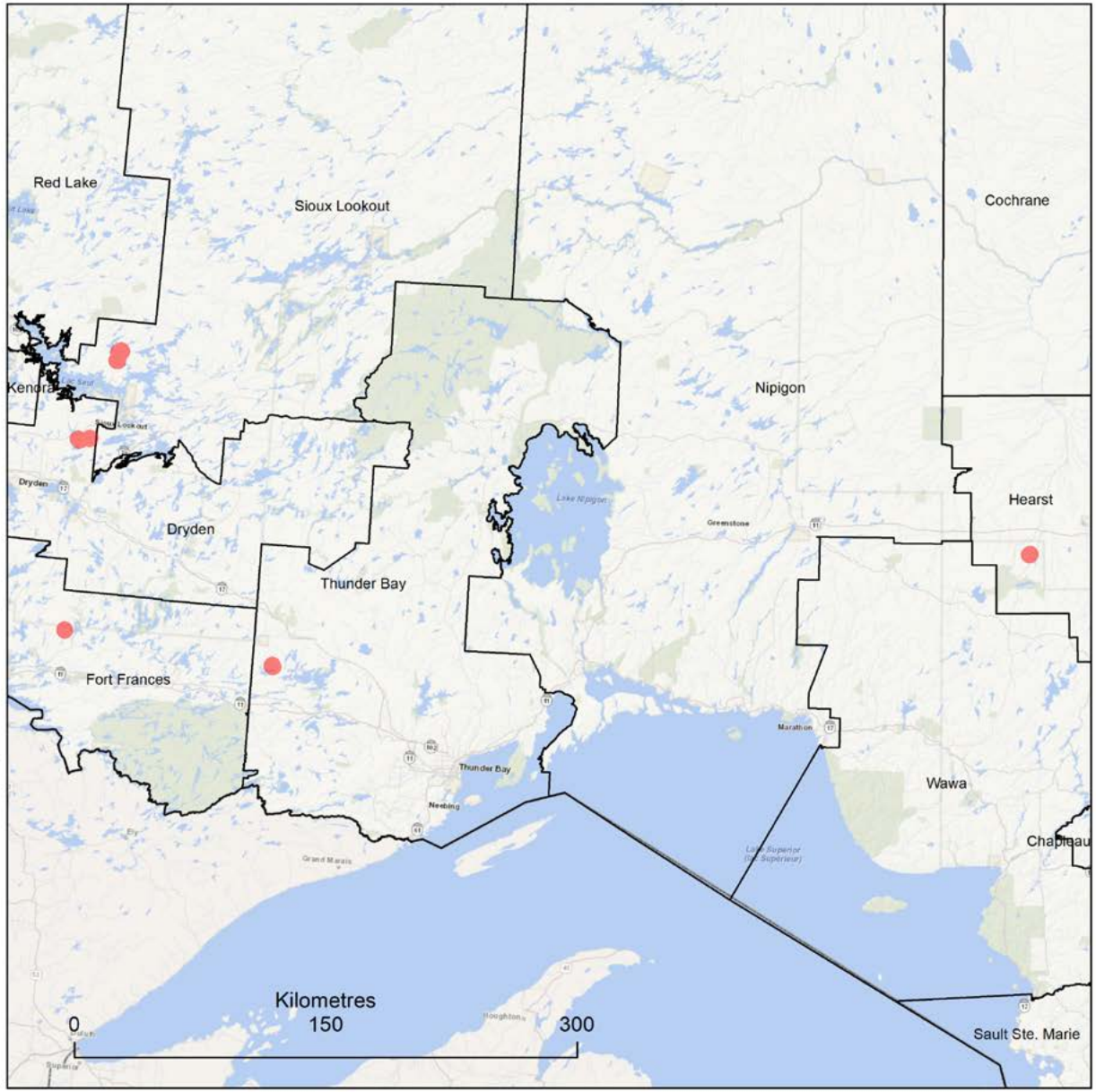
- In Hearst District, 15 ha of moderate to severe whitespotted sawyer beetle damage were mapped on a long narrow strip of semi-mature jack pine on West Arnott Road off Hwy 631.

Whitespotted sawyer beetle 2022

Areas in Ontario where whitespotted sawyer beetle caused damage

Moderate to severe = 100 ha

Area of moderate to severe damage

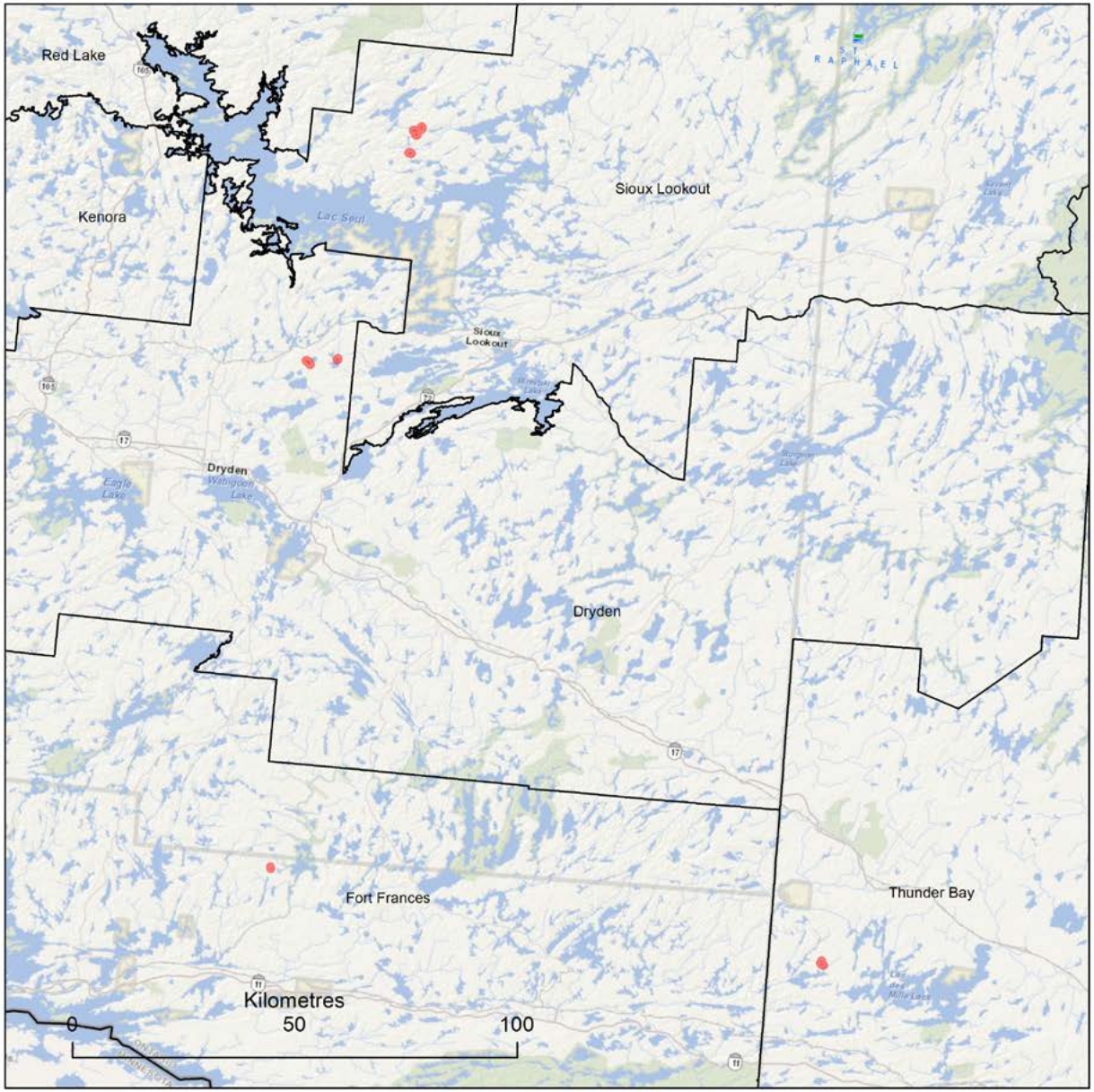


Whitespotted sawyer beetle 2022

Areas in the Northwest Region where whitespotted sawyer beetle caused damage

Moderate to severe = 85 ha

Area of moderate to severe damage

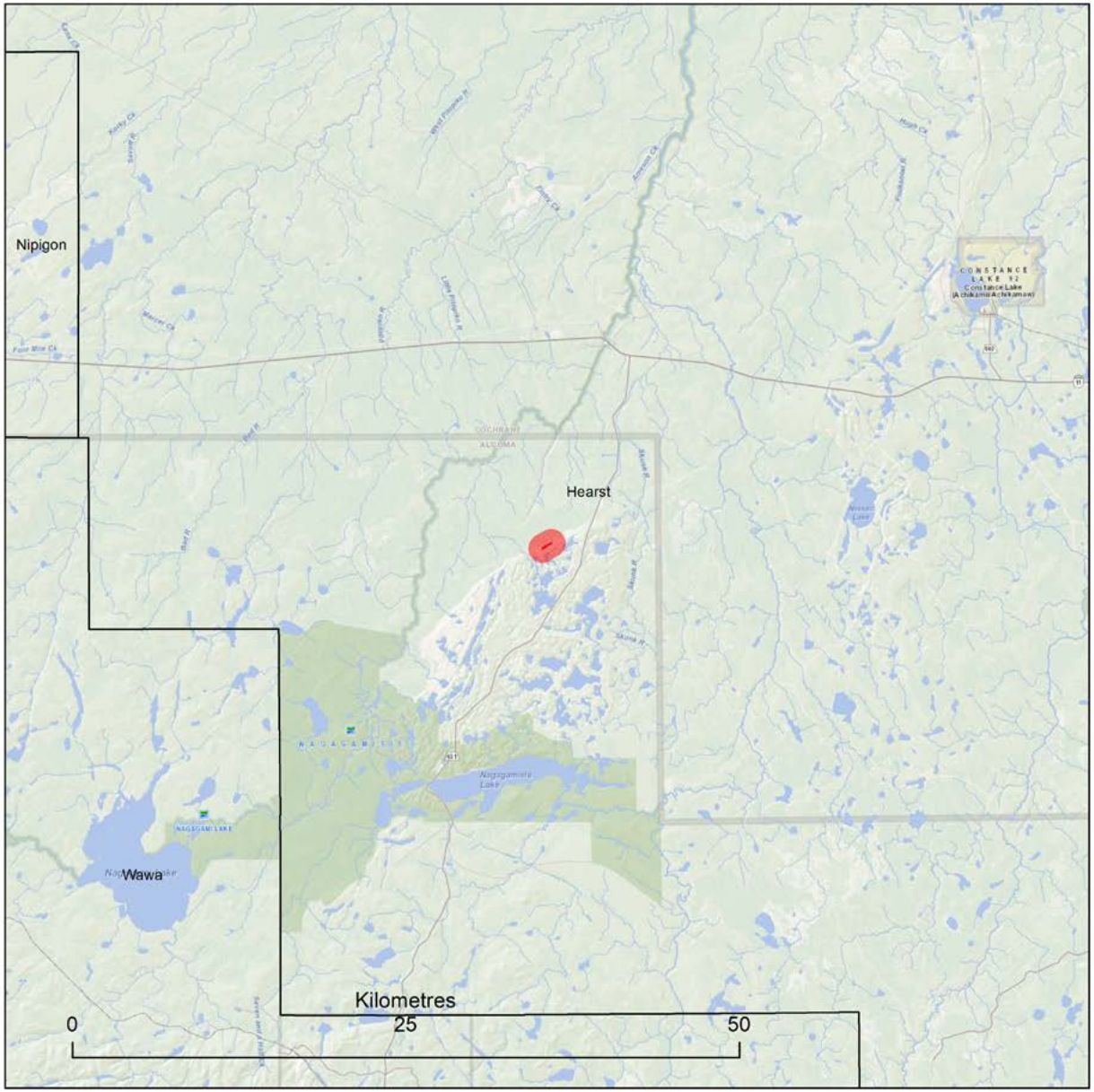


Whitespotted sawyer beetle 2022

Areas in the Northeast Region where whitespotted sawyer beetle caused damage

Moderate to severe = 15 ha

Area of moderate to severe damage



Minor forest disturbances

Armillaria root rot

Pest information

Common name:	Armillaria root rot
Scientific name:	*Armillaria spp.*
Pest origin:	Native to North America
Pest type:	Root disease
Host species:	White oak, black oak, white elm
Infestation area:	Localized

Provincial key facts

- Found throughout North America, armillaria root rot is a fungal disease that causes tree mortality and contributes to substantial wood volume losses in both hardwood and softwood stands.
- This fungus is common in forest soil and affects trees that are stressed by other biotic and abiotic factors. Trees can be infected for many years before they succumb to the disease.
- In forest stands, individual trees or groups of trees decline and die in a circular pattern. New trees are infected when they root graft with diseased trees or when shoestring-like filaments produced by the fungus reach nearby tree hosts.
- In 2022, the disease was reported in Southern Region in Aylmer District.

Regional summary

Southern

- Armillaria root rot was reported in eastern Aylmer District in a forest stand with declining and dead black and white oak and white elm trees at St. Williams Conservation Reserve's nursery tract in Norfolk County. Fruiting bodies were observed on the root collar of several oak and white elm trees that were in decline. Armillaria rhizomorphs and fruiting bodies were also detected at the base of several hardwood stumps in the forest at the time of survey in September. Spongy moth caused moderate to severe defoliation at this location for the past several years, which may have contributed to the reduced vigour of these trees.

Basswood leafminer

Pest information

Common name:	Basswood leafminer
Scientific name:	*Baliosus nervosus* (Panz.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Basswood
Infestation area:	Localized

Provincial key facts

- Basswood leafminer is distributed through the range of basswood in Ontario.
- The adults skeletonize the upper layer of the leaf and the larvae mine the leaves.
- Basswood leafminer are often found throughout southern Ontario, with minor feeding damage on edge and understory trees. During periodic outbreaks, mature trees can be defoliated to the upper crown.
- In 2022, basswood leafminer was observed in Southern Region.

Regional summary

Southern

- In Aylmer District, moderate to severe basswood leafminer defoliation was detected in most western counties. In Elgin County, areas of defoliation were detected in woodlots around Dutton and in West Elgin in areas around West Lorne and Rodney. The damage extended into parts of Middlesex County around Newbury and Glencoe and areas around Shetland in Lambton County. In the eastern part of Chatham-Kent County, defoliation was concentrated in woodlots around Thamesville, Ridgetown, and Blenheim. Populations of basswood leafminer also caused defoliation in woodlots around Wallaceburg and Dresden.
- In Midhurst district, moderate to severe basswood leafminer defoliation was observed at two locations in Grey County: Allan Park Conservation Area in West Grey Twp and at Inglis Falls in Georgian Bluffs Twp. In Simcoe County, moderate defoliation was observed at Devil's Glen Provincial Park in Clearview Twp. In Bruce County, light basswood leafminer defoliation was reported in areas of South Bruce Peninsula at Spirit Rock Conservation Area.

Beech leaf disease

Pest information

Common name:	Beech leaf disease
Scientific name:	NA
Pest origin:	Unknown
Pest type:	Nematode (*Litylenchus crenatae ssp. mccannii*)
Host species:	American beech
Infestation area:	Localized

Provincial key facts

- Beech leaf disease was first identified in the United States in Lake County, Ohio, in 2012 and has since been detected west from southwestern Ohio, east to Connecticut, north to Maine, and south to Virginia. In Ontario, it currently occurs along the shores of Lake Erie and Lake Ontario.
- Symptoms of beech leaf disease were first confirmed in southern Ontario in 2017 in Aylmer District.
- The primary symptom is striping or banding on leaves caused by the thickening of tissue between veins. Severely affected leaves have yellowed bands and are coarse and curled. Early leaf drop of severely affected leaves and bud abortion make tree crowns appear thin.
- Unknown is whether the nematode is the sole causal agent or part of a disease complex.
- Beech leaf disease symptoms have been confirmed in Southern Region in locations across Aylmer, Guelph, Aurora, and Peterborough districts.
- In 2022, beech leaf disease was reported in new locations in districts where it had previously been confirmed in Southern Region.

Regional summary

Southern

- In Aylmer District, beech leaf disease has been identified in all counties. In 2022, symptoms were observed at locations where the disease is already known to exist.
- In Guelph District, the presence of beech leaf disease was recorded for the first time in Brant County, Waterloo Region, and Wellington County. In Brant County, moderate to severe symptoms were detected on beech trees of all ages and canopy classes in a Crown forest south of Hatchley. In Waterloo Region, the disease was detected at light to moderate levels at Drynan Regional Forest, Sudden Regional Forest, and Sudden Tract near Cambridge. In Wellington County, light to moderate beech leaf disease symptoms were reported on understory beech trees at Starkey Hill Conservation Area near Guelph.
- In Peterborough District, two new detections of beech leaf disease were reported in Northumberland County. Symptomatic leaves were reported at Proctor Park Conservation Area in Brighton. The damage was severe in a beech-maple stand; banding, crinkled leaves, and sapling mortality were observed. Light damage was also reported on one beech tree in Peter's Woods Provincial Nature Reserve near Roseneath.
- In Aurora District, beech leaf disease was reported at four new sites, expanding the range of beech leaf disease in the district to include Durham and Halton regions. In Durham Region, moderate to severe leaf symptoms were observed on understory beech in a red pine forest at the east tract of Ganaraska Forest. In Halton Region, moderate to severe leaf symptoms were detected in Burlington at a forest at Mansfield Park, and at the intersection of North Service and Waterdown roads. Low levels of beech leaf disease symptoms were detected at the McCraney Creek Trails in Oakville and in a forest at Mountsberg Conservation Area near Campbellville.

Trend analysis/outlook/issues

Work on beech leaf disease is ongoing with several partners. Now that a causal agent has been identified, the ministry is investigating how the nematode is being spread locally and regionally. In 2019, a plot network was established to monitor effects of beech leaf disease on forests with and without beech bark disease. In 2022, understory beech tree mortality was observed along with changes in the amount of light reaching the forest floor. This change in light may alter the future plant community.

Two beech leaf disease monitoring studies were underway in 2022. One study was the continuation of the long-term beech health assessment plots in Aylmer and Guelph districts to determine the effects of beech leaf disease,

beech scale, and beech bark disease on the health of beech trees and beech forests in Ontario. The second was the continuation of a pilot study to identify potential insect spreaders of the Litylenchus crenatae mccannii (LCM) nematode associated with beech leaf disease. This work began in 2021 and involved establishing and monitoring Lindgren traps and collecting leaf/bud samples in Aylmer, Aurora, Peterborough, Kemptville, and Parry Sound districts as well as broad survey sampling of potential insect vectors across all districts in southern Ontario and areas of Sudbury District. A surprising discovery was the detection of nematode DNA in forests outside the range of symptoms. New research is focused on determining if beech leaf disease will develop at these locations and, if it does, how long it will take.

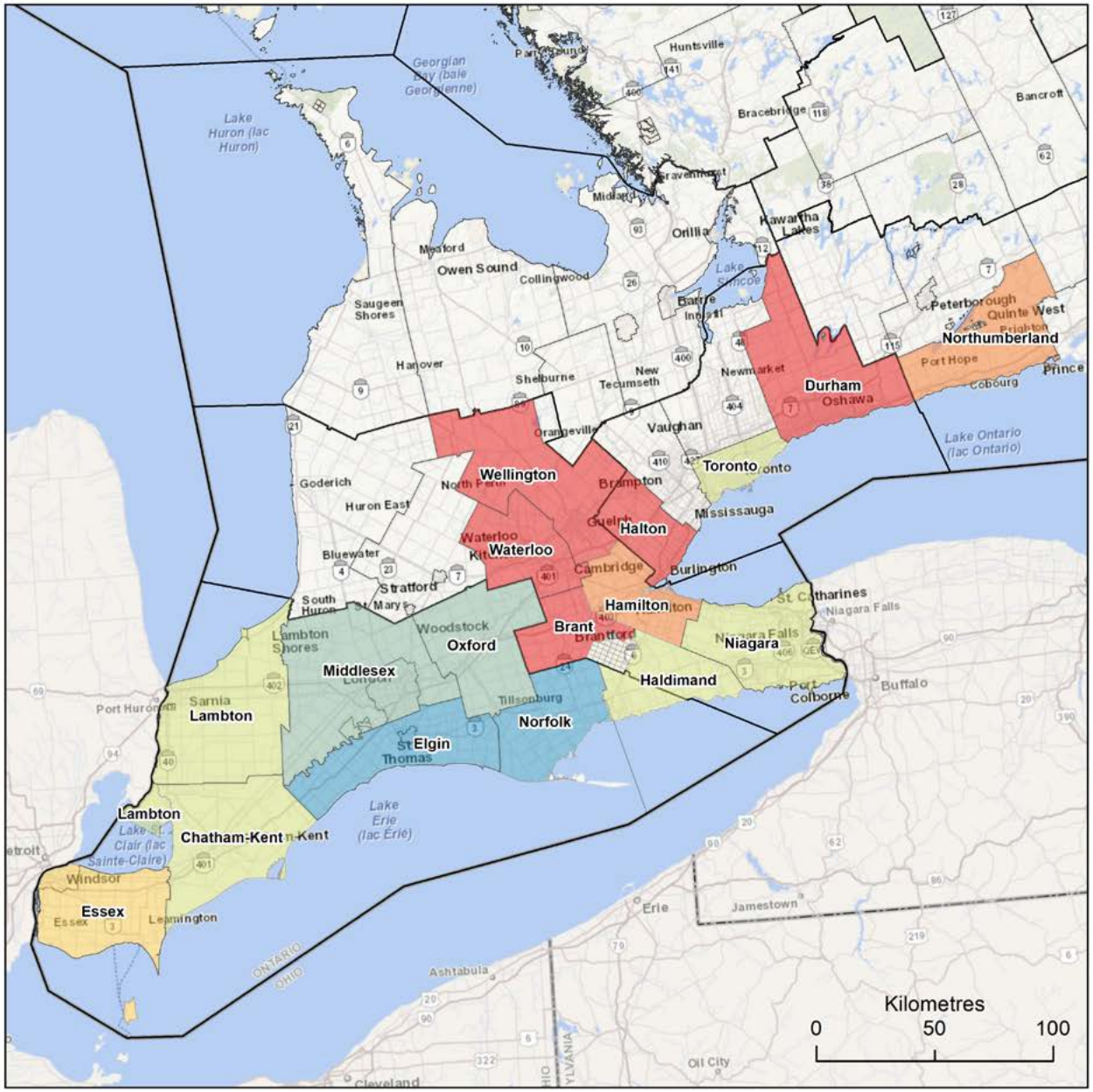
Future monitoring in Ontario will be focused on determining how far beech leaf disease will spread into the Great Lakes-St. Lawrence forest. The effect of beech leaf disease on beech bark disease affected forests in this region remains unknown. Beech bark disease has severely affected this forest, resulting in the death of mature, overstory beech and increased numbers of immature beech that later become infected. This contrasts with beech in the Carolinian forest where much less damage is evident.

Beech leaf disease in Ontario

Upper and single tier municipalities where beech leaf disease has been confirmed

Year of detection

- 2017
- 2018
- 2019
- 2020
- 2021
- 2022



Beech scale

Pest information

Common name:	Beech scale
Scientific name:	*Cryptococcus fagisuga* Linding.
Pest origin:	Invasive — native to Europe
Pest type:	Sucking insect
Host species:	American beech
Infestation area:	Localized

Provincial key facts

- Beech scale was first found in Canada in the 1890s in Halifax, Nova Scotia.
- In Ontario, it was first found in 1966 in Elgin County along the north shore of Lake Erie.
- This insect is now found across the range of beech in Ontario.
- Infestation with scale predisposes beech trees to beech bark disease, which substantially reduces vigour and eventually kills the tree.
- In 2022, varying levels of beech scale were observed in northeastern and southern Ontario.

Regional summary

Northeast

- In North Bay District, trace to moderate populations of beech scale were observed along Olrig Road in Mattawan Twp.

Southern

- In Parry Sound District, high populations of beech scale were observed along Maple Ridge Drive, east of Dorset in Sherborne Twp. Moderate populations of beech scale were noted along Barlochan Road northwest of Walker's Point in Wood Twp, Blackstone-Crane Lake Road west of Horseshoe Lake in Conger Twp, and Beechwood Drive south of Humphrey in Humphrey Twp. Low populations of beech scale were documented along Sandy Road east of Shawanaga in Shawanaga Twp.

- In Pembroke District, high populations of beech scale were observed along Grant Road near Ashdad in Greater Madawaska Twp.
- In Kemptville District, moderate populations of beech scale were observed at Mill Pond Conservation area on Briton-Houghton Bay Road on the south shore of Big Rideau Lake in Leeds-Grenville County. Low populations of beech scale were detected on Long Lake Road near Elmgrove in Tay Valley Twp.
- In Aylmer District, trace to moderate populations of beech scale were detected on mature beech northwest of Newbury in Southwest Middlesex Twp. Trace populations of beech scale were detected north of Ridgetown at Walter Devereaux Conservation Area in Chatham-Kent County, and at Maidstone Conservation Area, north of the Town of Essex in Essex County. This detection is the first record of beech scale in Essex County.

Birch casebearer

Pest information

Common name:	Birch casebearer
Scientific name:	*Cleophora serratella* (L.)
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	White birch
Infestation area:	Localized

Provincial key facts

- Birch casebearer was first reported in North America in 1927.
- Consecutive years of severe defoliation by this insect can cause branch and twig mortality and, when outbreaks are severe, may kill the tree.
- This casebearer produces one generation per year.
- Its preferred host is white birch but also defoliates other species of birch and alder.
- In 2022, tree and branch mortality by birch casebearer were observed in Sault Ste. Marie District.

Regional summary

Northeast

- In Sault Ste. Marie District, white birch branch and whole tree mortality were recorded along the Mississagi River, at the north end of Ranger Lake Road/Hwy 556 and along Hwy 129 south of Ranger Lake Road. Mortality was more prevalent at the north end of Ranger Lake Road/Hwy 556. These trees had been severely defoliated by birch casebearer in 2021, with moderate defoliation observed in 2022. Most of the birch were along the Mississagi River and of the 24 trees affected, six were dead and the other 18 had varying levels of branch mortality.

Birch leafminer

Pest information

Common name:	Birch leafminer
Scientific name:	*Fenusa pusilla* (Lep.)
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	White birch
Infestation area:	Localized

Provincial key facts

- Birch leafminer was first found in Quebec in 1929, with the first outbreak recorded in Ontario in 1939.
- In Canada, birch leafminer is found from Newfoundland to Alberta.
- Birch leafminer produces two to four generations per year.
- Birch leafminer damage is most severe on open-grown white birch.
- In 2022, localized defoliation was recorded in Algonquin Park in Southern Region.

Regional summary

Southern

- At the end of August, about 10% birch leafminer defoliation was observed intermittently along Baron Canyon Road from the Sand Lake gate to Lake Travers in Algonquin Park. Birch trees had large blotches of mined leaves and foliar discoloration. A native birch leafminer, *Phyllonorycter* species, and septoria leaf spot of birch were also present, contributing to the damage and early seasonal colour change.

Birch skeletonizer

Pest information

Common name:	Birch skeletonizer
Scientific name:	*Bucculartrix canadensisella* (Chambers)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	White birch
Infestation area:	Localized

Provincial key facts

- Birch skeletonizer has minimal effects on host trees as it is a late season defoliator.
- Its main host is white birch, but other birches can be affected.
- Outbreaks of this pest are cyclical and relatively short-lived (2–3 years).
- Defoliation by this pest has not been reported in Northeast Region since 2014.
- In 2022, birch skeletonizer defoliation was reported in Hearst District.

Regional summary

Northeast

- In Hearst District, various levels of birch skeletonizer defoliation were detected across the district. Moderate to severe defoliation was often observed on young to semi-mature white birch in the western half of the district. In the eastern half of the district, light to moderate defoliation was observed more sporadically on young white birch.

Eastern spruce gall adelgid

Pest information

Common name:	Eastern spruce gall adelgid
Scientific name:	*Adelges abietis* (L.)
Pest origin:	Invasive — Native to Europe
Pest type:	Sap feeding/gall forming
Host species:	Spruce
Infestation area:	Localized

Provincial key facts

- Eastern spruce gall adelgid was introduced from Europe before 1900.
- In Canada, it occurs in Ontario and eastward.
- Eastern spruce gall adelgid feeds only on spruce and forms galls at the base of shoots that weaken the stem and make trees vulnerable to breakage.
- In 2022, localized eastern spruce gall damage was reported in Southern Region.

Regional summary

Southern

- In Kemptville District, eastern spruce gall adelgid caused light damage to black and white spruce in a semi-mature conifer forest on Campbell Road north of Joe Lake in Lanark Highlands Twp. About half the spruce trees had characteristic pineapple-shaped galls. Affected trees were in decline, possibly from spongy moth defoliation in 2021.

Elm flea beetle

Pest information

Common name:	Elm flea beetle
Scientific name:	*Altica ulmi* (Woods)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	White elm
Infestation area:	Localized

Provincial key facts

- The elm flea beetle can be found from southern Ontario to the Maritimes and has one generation per year.
- Larvae skeletonize the underside of elm leaves between June and late August. Adults chew holes in young developing leaves.
- The elm flea beetle has periodic outbreaks in southern Ontario and may cause severe defoliation.
- In 2022, localized defoliation by elm flea beetles was found in Southern Region.

Regional summary

Southern

- In Pembroke District, less than 5% elm flea beetle defoliation was observed on open-grown white elm trees at the edge of agricultural fields on West Ross Road, east of Muskrat Lake in Whitewater Region, Renfrew County.

European pine sawfly

Pest information

Common name:	European pine sawfly
Scientific name:	*Neodiprion sertifer* (Geoff)
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	Scots pine
Infestation area:	Localized

Provincial key facts

- The first Canadian record of this pest was made in 1939 in Windsor, Ontario. Since then, it has spread throughout Ontario.
- Although it will feed on many species of pine, Scots pine is the preferred host in Ontario.
- In 2022, European pine sawfly defoliation was reported in two districts in Southern Region.

Regional summary

Southern

- In Peterborough District, light European pine sawfly defoliation was observed on Scots pine at Garden Hill Conservation Area and at a nature reserve property along Pogue Road, north of Dundonald. At both locations, defoliated Scots pine were also severely affected by brown spot needle blight.
- In Guelph District, trace to light European pine sawfly defoliation was detected on Scots pine at several locations near Mt. Forest in Wellington North Twp., Wellington County. At these locations, brown spot needle blight was the primary pest causing needle damage and crown discolouration.

Fall cankerworm

Pest information

Common name:	Fall cankerworm
Scientific name:	*Alsophila pometaria* (Harris)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Various hardwoods
Infestation area:	Localized

Provincial key facts

- Fall cankerworm is an early season defoliator of hardwood trees that can reach epidemic levels throughout its range in North America.
- The distribution of this native pest is thought to coincide with the range of basswood in Ontario.
- This pest has one generation per year.
- In North America, fall cankerworm has an outbreak cycle with large populations present for two to three years followed by sharp population declines for five to eight years.
- The most recent outbreak of fall cankerworm in Ontario occurred between 2016 and 2019, with areas of defoliation aerially mapped across Southern Region in 2016, 2017, and 2018. Fall cankerworm is often found feeding alongside spongy moth.
- In 2022, defoliation caused by fall cankerworm was not aerially mapped, however, localized defoliation was reported in several areas of Aylmer and Guelph districts.

Regional summary

Southern

- In 2022, fall cankerworm caused localized defoliation at several locations in Aylmer District. In Middlesex County, small populations were feeding on foliage of various hardwoods alongside spongy moth and other miscellaneous caterpillars at Komoka Provincial Park, at Parkhill Conservation Area, and around Thedford. At Parkhill Conservation Area, fall cankerworm larvae outnumbered spongy moth larvae, but only trace defoliation was detected. At Komoka Provincial Park, spongy moth was the primary defoliator with fall cankerworm secondary, but only trace defoliation was observed at the time of pupation. At Mosa Forest in Southwest Middlesex, small populations of fall cankerworm were observed causing trace defoliation on regenerating red maples in the understory. In Elgin County, small populations of fall cankerworm larvae caused trace defoliation of sugar maple

trees in the understory of a large forest complex near West Lorne. Larger populations of spongy moth larvae were also present on understory hardwoods causing trace defoliation at the time of survey. High numbers of fall cankerworm moths were detected at John E. Pearce Provincial Park during late November surveys.

- In Guelph District, small populations of fall cankerworm were detected during early season ground surveys at several locations in the Dundas Valley, City of Hamilton. These larvae were feeding on hardwoods alongside larger populations of spongy moth larvae at all sites surveyed. In mid-November, high numbers of fall cankerworm moths were detected along the Headwaters Trail at Dundas Valley Conservation Area.

Fall webworm

Pest information

Common name:	Fall webworm
Scientific name:	*Hyphantria cunea* (Drury)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	American elm, ash spp., alder spp., cherry spp., poplar spp., black walnut, hickory spp. and white birch
Infestation area:	Localized

Provincial key facts

- Fall webworm is one of the few native North American insects accidently introduced into Europe and Asia.
- Its effect on tree health is usually limited because defoliation occurs late in the growing season, but persistent infestation can cause branch and crown dieback.
- In Canada, only one generation of fall webworm occurs per year, whereas two will occur in warmer climates.
- High populations of this pest often last only two to three years, making associated tree mortality unlikely.
- In 2022, defoliation from fall webworm varied from trace to severe in Northeast and Southern regions.

Regional summary

Northeast

- In North Bay District, moderate to severe fall webworm defoliation was observed along Hwy 17 east of North Bay to Corbeil and west of North Bay to Beaucage Park Road, and along Hwy 11 south of North Bay to Powasssan. Light defoliation was observed along Olrig Road.
- In Sault Ste. Marie District, moderate to severe fall webworm defoliation was recorded along the southern part of Hwy 556 (Ranger Lake Road), along Hwy 556 near Little Garden River Road, and along Hwy 129 north of Hwy 556 in Villeneuve and Rollins townships.

Southern

- In Peterborough District, moderate to severe fall webworm defoliation was observed in Hastings County along Hwy 7 east of Havelock, and throughout Trent Hills in Northumberland County.
- In Aylmer District, trace fall webworm defoliation was observed throughout Norfolk County, in Elgin County around St. Thomas, Talbotville (Southwold Twp) and West Lorne, and in Middlesex County around Thorndale, Strathroy-Caradoc, Delaware West, Mt. Brydges, and Strathroy.
- In Guelph District, trace fall webworm defoliation was observed in Brant County around Harley and Scotland, extending south into Haldimand County.
- In Pembroke District, trace fall webworm defoliation was observed in Renfrew County on West Ross Road, east of Muskrat Lake (Ross Twp), and near Perretton (Westmeath Twp) on Indian Road and Mclaughlin Road.
- In Kemptville District, trace fall webworm defoliation was observed in Lanark County on Ramsay Concession Road 1, Ferguson Falls Road, and Miller Road.
- In Algonquin Park, light fall webworm defoliation was observed on Barron Canyon Road from the Sand Lake gate to Lake Travers.

Hawthorn rust

Pest information

Common name:	Hawthorn rust
Scientific name:	*Gymnosporangium globosum* (Farl.) Farl.
Pest origin:	Native to North America
Pest type:	Rust disease
Host species:	Hawthorn sp.
Infestation area:	Localized

Provincial key facts

- Several *Gymnosporangium* sp. fungi are native to North America and mainly cause disease in juniper species and plants in the rose family.
- On evergreen hosts, they can cause galls, stem swellings, and branch dieback. On broadleaf hosts, these fungi cause leaf spots.
- Leaves severely infected by hawthorn rust will turn yellow and drop prematurely. Hawthorn rust also occasionally occurs on fruit or green stems of hawthorn trees causing deformities.
- In 2022, hawthorn rust was detected in one district in Southern Region.

Regional summary

Southern

- In Aylmer District, severe hawthorn rust symptoms were observed by mid-August and were widespread across Lambton County and parts of Elgin and Middlesex counties. Severe foliar symptoms including leaf spots and premature leaf drop were observed on hawthorn trees throughout all townships in Lambton County. In Elgin County, severe damage was reported north of Campbelltown in Dutton/Dunwich Twp, and throughout West Elgin Twp. In Middlesex County, severe damage was observed on open-grown hawthorn trees in southwest Middlesex between Shields Siding and Glencoe.

Hemlock looper

Pest information

Common name:	Hemlock looper
Scientific name:	*Lambdina fiscellaria fiscelleria* (Guenée)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Eastern hemlock
Infestation area:	Localized

Provincial key facts

- Hemlock looper is a native defoliator of eastern hemlock, balsam fir, and white spruce. It is found in Canada from Newfoundland to Alberta and in the United States.
- Repeated periodic outbreaks have occurred over much of eastern Canada, especially in Newfoundland.
- Hemlock looper was reported in Ontario from 2001 to 2005 in Northeast and Southern regions, where it caused moderate to severe defoliation to eastern hemlock and balsam fir. In 2003, defoliation peaked at about 8,500 ha, concentrated in Sudbury and Parry Sound districts. Repeated areas of defoliation resulted in considerable tree mortality totalling 4,000 ha in 2005. It was not reported again until 2019, where it was detected in a few trees in Peterborough District, Southern Region.
- In 2022, hemlock looper was detected in one location in Aurora District, Southern Region.

Regional summary

Southern

- In Aurora District, hemlock looper larvae were collected in a semi-mature sugar maple forest with a small hemlock component at Case Woodlot in Aurora. Light defoliation and discoloured needles were observed. Only eastern hemlock trees were affected at this location.

Hemlock woolly adelgid

Pest information

Common name:	Hemlock woolly adelgid
Scientific name:	*Adelges tsugae* (Annand)
Pest origin:	Invasive — native to Asia
Pest type:	Defoliator
Host species:	Eastern hemlock
Infestation area:	Localized

Provincial key facts

- In Canada, populations of hemlock woolly adelgid are established in British Columbia, Nova Scotia, and Ontario.
- In Ontario, hemlock woolly adelgid was first found in Etobicoke, near Toronto, in 2012 on five ornamental trees. In 2013, the Canadian Food Inspection Agency (CFIA) detected an infestation during pest-specific surveys in the Niagara Gorge near Niagara Falls. The pest was again detected by the CFIA during surveys in 2019 in the Niagara Gorge and in a forested area near Wainfleet, Niagara Region. In 2021, CFIA confirmed the presence of hemlock woolly adelgid in Fort Erie, also in Niagara Region.
- The insect has two generations per year in Canada, and is dispersed naturally by wind, birds, and mammals. It can also be spread by human movement of nursery stock and other wood products such as firewood.
- Feeding damage causes branch, twig, bud, and shoot dieback and leads to premature needle loss and eventual tree mortality.
- In 2022, the CFIA confirmed the presence of hemlock woolly adelgid in two locations outside the regulated area in Southern Region.

Regional summary

Southern

- The CFIA confirmed the presence of hemlock woolly adelgid in the town of Pelham (Niagara Region) in Guelph District. This detection is outside the current regulated area for this invasive pest, which includes the city of Niagara Falls, the town of Fort Erie, and township of Wainfleet.
- In Peterborough District, the presence of hemlock woolly adelgid was confirmed by CFIA staff in several hemlock trees near Grafton in Northumberland County. This infestation is outside the current regulated areas in the Niagara Region.

Trend analysis/outlook/issues

MNRF forest health field staff have been trained in survey protocols and procedures for detecting hemlock woolly adelgid. The ministry will continue to collaborate with federal partners in both the CFIA and Natural Resources Canada-Canadian Forest Service to support related survey and scientific initiatives.

Additional surveys for hemlock woolly adelgid were completed in 2022, with priority on hemlock stands close to the Canada-U.S. border. The objectives were early detection of hemlock woolly adelgid and identifying and inventorying hemlock stands for current and future surveys.

With the recent detection in Grafton, the concern is that hemlock woolly adelgid could spread rapidly through the contiguous hemlock forest in southern and central Ontario faster than it has in the more isolated stands previously identified in Niagara Region.

Imported willow leaf beetle

Pest information

Common name:	Imported willow leaf beetle
Scientific name:	*Plagiodera versicolora (Laich.)*
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	Willow spp.
Infestation area:	Localized

Provincial key facts

- Imported willow leaf beetle was introduced to North America in 1915 and is now widely distributed across the range of willow in Ontario.
- Up to three generations of this insect can occur in a year.
- This pest has the potential to cause severe defoliation; however, damage to trees is not serious unless defoliation occurs for several consecutive years.
- In 2022, localized imported willow leaf beetle defoliation was reported in Southern Region.

Regional summary

Southern

- In Pembroke District, light to moderate imported willow leaf beetle defoliation was observed from Muskrat Lake to Forester's Falls in Whitewater Region Twp. Overall, defoliation of the willow trees was 30%.
- In Kemptville District, imported willow leaf beetle caused moderate defoliation of mature willows along Charleville Creek and its tributaries in Charleville, Augusta Twp, and around the Village of Lyn in Elizabethtown-Kitley Twp.

Japanese beetle

Pest information

Common name:	Japanese beetle
Scientific name:	*Popillia japonica* (Newm.)
Pest origin:	Invasive — native to Japan
Pest type:	Defoliator
Host species:	Sassafras
Infestation area:	Localized

Provincial key facts

- Populations of this invasive insect have existed in Ontario since its discovery in the Niagara Peninsula, Southern Region, in 1939.
- Commonly encountered as an exotic horticultural pest, the Japanese beetle will also feed on many native tree species. Adults are heavy feeders, known to attack both foliage and fruit of more than 250 host plants. Preferred woody hosts in Ontario include basswood, oak, and white birch.
- In 2022, Japanese beetle was reported during ground surveys in Aylmer District, Southern Region.

Regional summary

Southern

- In Aylmer District, Japanese beetle caused moderate to severe defoliation of sassafras in Elgin, Middlesex, and Norfolk counties by late summer. Notable defoliation of sassafras of all age classes occurred in woodlots along westbound Hwy 401 from Graham Road to Downie Line in Elgin County, and in a forest along the Thames River at Pratt Siding Road south of Wardsville in Middlesex County. Japanese beetle also caused moderate to severe defoliation in a grove of sassafras along St. John's Road East near the intersection of Ryerse Road, and along County Road 45 near Deer Creek Conservation Area in Norfolk County.

Linospora leaf blight

Pest information

Common name:	Linospora leaf blight
Scientific name:	*Linospora tetraspora* (G.E. Thomps.)
Pest origin:	Native to North America
Pest type:	Fungal disease
Host species:	Balsam poplar
Infestation area:	Localized

Provincial key facts

- Linospora leaf blight is a foliar disease that can affect all ages of balsam poplar.
- When severe, infection causes early leaf drop.
- Several consecutive years of severe infection can reduce tree vigour and increase susceptibility to other pathogens.
- In 2022, damage from linospora leaf blight was reported in Southern Region.

Regional summary

Southern

- In Pembroke District, linospora leaf blight and cankers were observed on balsam poplar on Schutt Road (Hwy 514) and adjacent side roads from Schutt to Jewellville in the western parts of Pembroke District. Damage varied from light to severe. Similar damage was also observed along Hwy 17 from the City of Renfrew to Pembroke in the eastern parts of the district.

Marssonina leaf spot

Pest information

Common name:	Marssonina leaf spot
Scientific name:	*Marssonina brunnea* (Ellis & Everh.)
Pest origin:	Native to North America
Pest type:	Foliar disease
Host species:	Balsam poplar, trembling aspen, elm spp.
Infestation area:	Localized

Provincial key facts

- Marssonina leaf spot is a disease that affects poplar species.
- Both a wet spring and late summer can promote leaf spot infection rates.
- Heavy infections of this disease cause early leaf drop.
- Repeated infections can cause branch dieback and increase susceptibility to other damage agents.
- In 2022, marssonina leaf spot was detected in Kemptville and Midhurst districts, Southern Region.

Regional summary

Southern

- In Kemptville District, moderate to severe marssonina leaf spot damage was observed on balsam poplar in Lanark County from the north boundary to Hwy 7. In Leeds and Grenville County, damage was observed intermittently south of Hwy 43 from Oxford Mills to Oxford Station. In Stormont-Glengarry-Dundas County it was observed south of Winchester, in Northfield, west of Cornwall along the Long Sault Parkway, and from Alexandria to Casselman. Damage was particularly severe around Maxville in North Glengarry Twp.
- In Midhurst District, light marssonina leaf spot damage was detected on trembling aspen on Elgin Street in Tobermory (Bruce County), and along Hwy 9, Hwy 109, and Hwy 10 between the towns of Hanover (Grey County) and Brampton (Peel Region). Moderate damage was observed on elm trees at Pefferlaw Conservation Area, York Region.

Oak wilt

Pest information

Common name:	Oak wilt
Scientific name:	*Bretziella fagacearum* (Bretz)
Pest origin:	Unknown
Pest type:	Vascular disease
Host species:	All oak species
Infestation area:	None

Provincial key facts

- Oak wilt is a disease caused by an invasive forest pathogen, newly named *Bretziella fagacearum*. The disease is present in the northern United States, near the Ontario/Canadian border, posing a high risk of introduction. Locally, the disease is spread by insect vectors such as sap beetles (Coleoptera: Nitidulidae) and root grafting. Long distance movement is often the result of people moving oak wilt infected wood.
- Oak wilt poses a risk to all oak species in eastern Canada, especially the red oaks (Quercus section Lobatae). Oak wilt has not been detected in Canada but is present on Belle Island, Michigan, between Detroit and Windsor.
- Sweet smelling, fungal pressure pads develop on stems and large branches of newly killed trees and cause the bark to crack. Nitidulid beetles crawl through the cracks to feed on the fungus. New infections of oak wilt occur when the beetles transfer fungal spores on their bodies from the pressure pads on infected trees to fresh wounds on uninfected oak trees. Oak wilt pockets develop when the fungus spreads through root grafts from infected to nearby uninfected trees.
- Of the hundreds of species of nitidulid beetles, only a subset has behaviours (flight timing, host preference) that result in oak wilt transmission. Current species of interest are *Carpophilus sayi* and *Colopterus truncatus*, since they are known vectors for oak wilt in the United States.
- Current efforts are focused on early detection and prevention of oak wilt establishment by developing best management practices and pruning guidelines.

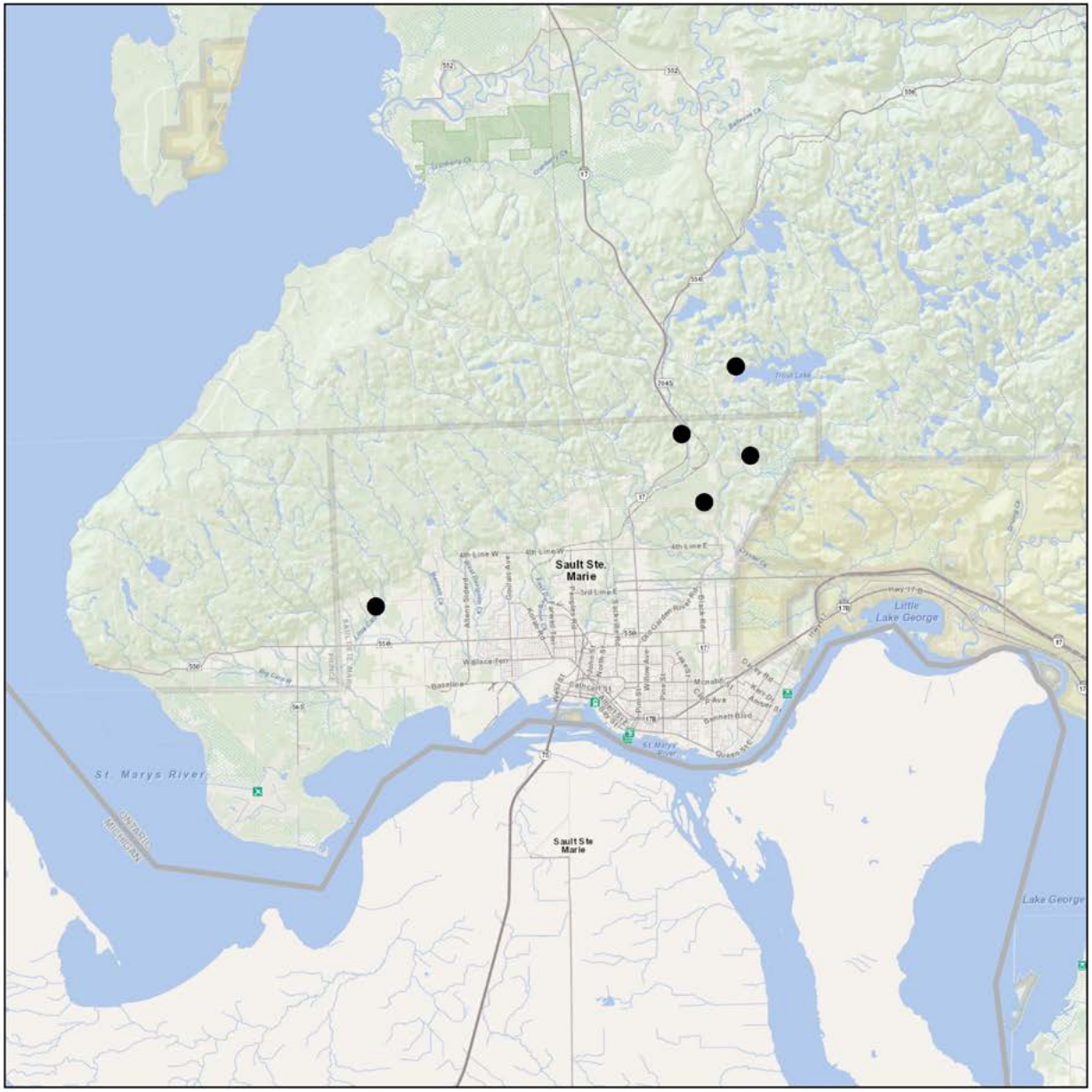
Regional summary

- In 2021, results from a three-year study in Ontario, New Brunswick, and Manitoba showed that oaks in central and eastern Canada were most at risk of oak wilt infection between April and end of July. This determination was made using the flight patterns of the two most common beetle vectors.
- In 2022, oak trees were wounded at five locations in Sault Ste. Marie on a weekly basis between April and August to determine when beetles were attracted to oak wounds. This work will further refine the high-risk period for oak wilt infection and was repeated by collaborators in New Brunswick, Manitoba, and Michigan.
- Flight traps to capture beetles and equipment to monitor temperature were established at five locations in Ontario and maintained from April to late August. This data will be used to determine why nitidulids visit oak wounds.
- Oak wounding yielded 646 beetles representing 12 species. Species that visited wounds most often were *Carpophilus sayi, Epuraea avara,* and *Colopterus truncatus*. Wound visitation started several weeks after beetle flight, which supports further narrowing of the high-risk period. This study will be repeated in southern Ontario in 2023.

Nitidulid beetle flight trap and wounding locations 2022

Nitidulid beetle monitoring locations

● Flight Trap and tree wounding location



Pine false webworm

Pest information

Common name:	Pine false webworm
Scientific name:	*Acantholyda erythrocephala* (L.)
Pest origin:	Invasive — native to Europe and Asia
Pest type:	Defoliator
Host species:	Eastern white pine and red pine
Infestation area:	Localized

Provincial key facts

- First collected in Ontario in 1961, pine false webworm was initially a pest of young pine plantations.
- Starting in 1993, severe defoliation was recorded on semi-mature and mature pine near Peterborough and Simcoe.
- Infestation peaked in 1997, with almost 9,000 ha of moderate to severe defoliation.
- In 2022, pine false webworm defoliation was not aerially mapped but some defoliation was observed during ground surveys in Northeast and Northwest regions.

Regional summary

Northwest

- In Sioux Lookout District, a detection of pine false webworm was made on red pine along Government Row west of Hwy 72 in the town of Sioux Lookout. At this location, larvae populations were low and overall red pine defoliation was less than 10%.

Northeast

- In 2022, pine false webworm defoliation was observed on the east side of Sault Ste. Marie District on lower branches of mature eastern white pine along Little White River Road and Hwy 546 in the southwest corner of Sagard Twp near Poulin Twp. The defoliation on the branches was severe but overall defoliation was less than 10%. The defoliation was limited to eastern white pine at the end of the stand.

Septoria leaf spot

Pest information

Common name:	Septoria leaf spot
Scientific name:	*Sphaerulina betulae* (Pass.) Quaedvl., Verkley & Crous
Pest origins:	Native to North America
Pest type:	Foliar disease
Host species:	White birch
Infestation area:	Localized

Provincial key facts

- Septoria leaf spot is a common fungal disease of white birch.
- This disease commonly infects leaves but can also cause branch and main stem cankers, particularly on hybrid poplar.
- Leaf diseases are normally more prevalent in wet and humid weather. Spores from fallen leaves infect new leaves the following year.
- After repeated severe infections, trees may lose vigour and become more susceptible to other pests and pathogens.
- In 2022, septoria leaf spot of white birch was reported in Northeast and Southern regions.

Regional summary

Northeast

- In 2022, septoria leaf spot of white birch was not as common and not as severe as in 2021 but was found in the same area in the southcentral part of Sault Ste. Marie District. Moderate levels of infection were observed in late August along Hwy 546 (Little White River Road) and north of Elliot Lake along Hwy 639/Hwy 108.

Southern

- In Bancroft District, moderate to severe septoria leaf spot damage was reported on white birch on Hwy 127 north of Lake St. Peter, Hastings County. Damage also extended from South Baptiste Road to Hwy 118, northwest of Bancroft.
- In Algonquin Provincial Park, light septoria leaf spot damage was observed along Baron Canyon Road from Sand Lake gate to Lake Travers at the end of August. Two species of birch leafminer were also found contributing to early leaf discolouration.

Shoot blight of aspen

Pest information

Common name:	Shoot blight of aspen
Scientific name:	*Venturia macularis* (Fr.:Fr.) E. Müller & Arx
Pest origin:	Native to North America
Pest type:	Fungal wilt
Host species:	Trembling aspen
Infestation area:	Localized

Provincial key facts

- Shoot blight of aspen kills terminal and lateral shoots, reducing growth and causing stem deformation. Small trees can die from repeated infections.
- Tips of infected shoots turn black and wither, resembling a shepherd's crook.
- The disease can be serious in plantations but is of little economic importance in natural stands.
- Trees older than five years are often not affected.
- It was last reported in Northeast Region in 2017. In 2022, shoot blight of aspen was reported in Southern Region.

Regional summary

Southern

- In Peterborough District, shoot blight of aspen caused moderate to severe damage at Peter's Woods Provincial Nature Reserve, Northumberland County. More than 80% of understory trembling aspen saplings were affected. Symptomatic "hooking" of infected shoots was observed.

White pine blister rust

Pest information

Common name:	White pine blister rust
Scientific name:	*Cronartium ribicola* J. C. Fisch.
Pest origin:	Invasive — native to Asia and Europe
Pest type:	Rust disease
Host species:	White pine
Infestation area:	Localized

Provincial key facts

- This disease is relatively common throughout Ontario where Ribes spp. (the alternate host) occur near five needle pine.
- It causes branch dieback, reduces growth, and, if infection reaches the stem, eventually kills the tree.
- Porcupine damage can be present on trees with white pine blister rust since they are attracted to the sweet sap at the canker.
- In 2022, white pine blister rust surveys were completed in four eastern white pine plantations in Northeast Region.

Regional summary

Northeast

- In Kirkland Lake District, annual white pine blister rust surveys were completed at eastern white pine plantations in Evanturel, Eby, and Ingram townships. Evanturel had the highest occurrence of white pine blister rust (23% of trees affected) compared to Ingram (17%) and Eby (0%). Most of the infections (60%) in Evantural were severe (main stem), while severe infections in Ingram were evident on only 20% of the trees. Evanturel also had the most porcupine damage (9%) compared to Ingram (5%), with none recorded at Eby. Pine scale was also common in these plantations with 75% of the trees in Evantural affected, 68% in Ingram, and 39% in Eby Twp.
- In North Bay District, an annual white pine blister rust survey was completed at a white pine plantation in Gurd Twp. White pine blister rust had affected 6% of the trees, most (89%) were non-severe infections (branches). Other pests included pine scale, which was found on 69% of the trees surveyed, and porcupine damage found on 4% of the trees.