Forest Health Conditions in Ontario 2020

Ministry of Northern Development, Mines, Natural Resources and Forestry

Ontario

Forest Health Conditions in Ontario 2020

Compiled by:

- Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry, Science and Research Branch

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Printed in Ontario, Canada

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ISBN 978-1-4868-5253-6 (pdf)
ISSN 1913-617X (online)

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État de santé des forêts 2020

En 2020, l'Ontario a connu peu d'événements météorologiques notables qui ont eu une incidence sur la santé des forêts, mais l'hiver chaud et le printemps sec peuvent avoir influencé les populations d'insectes nuisibles, surtout dans le sud.

Principaux insectes nuisibles et zones où les feuilles et les aiguilles des arbres ont été consommées :

- la tordeuse du pin gris a légèrement diminué dans le nord-ouest et a été détectée dans le nord-est;
- la tordeuse des bourgeons de l'épinette a augmenté par rapport à l'année précédente, principalement dans le nord-est;
- les populations de livrée des forêts ont chuté partout dans la province;
- la spongieuse a continué d'augmenter dans le sud, avec une zone touchée record pour la province;
- la tordeuse du tremble a augmenté, principalement dans le nord-est.

La maladie corticale du hêtre, qui est une combinaison d'un insecte envahissant (cochenille du hêtre) et d'un champignon à tige envahissant, a continué d'être surveillée, avec de nouveaux emplacements enregistrés dans la région du sud.

En 2020, peu de détections de la maladie de la feuille du hêtre ont été effectuées au-delà des emplacements confirmés au cours des années précédentes. À ce jour, les symptômes de la maladie de la feuille du hêtre se sont seulement trouvés dans les districts d'Aylmer et de Guelph, et à un seul endroit dans le district d'Aurora. Les chercheurs s'efforcent de déterminer si le seul agent causal est un nématode ou s'il fait partie d'un ensemble de maladies.

De nouvelles occurrences de coléoptère envahissant de l'agrile du frêne ont été signalées dans le district de Parry Sound, qui se trouve dans la zone en quarantaine. Le longicorne asiatique a été déclaré éradiqué de la région de Toronto/Vaughn par l'Agence canadienne d'inspection des aliments.

En 2020, seuls les perturbations/insectes nuisibles principaux ont été surveillés en raison des limites de travail sur le terrain liées à COVID-19.

In an effort to use inclusive language, the ministry is transitioning away from the use of "gypsy moth" and will be using the term "LDD moth" moving forward.

Introduction

Forest health monitoring in Ontario is conducted by the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF).

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
- Conducting special surveys for pests of interests, particularly invasive species, or pests affecting high value trees, such as plantations or seed orchards
- Conducting or supporting research projects 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 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 2020, insect diagnostics were carried out through a partnership among NDMNRF, the Canadian Forest Service (CFS), and the Invasive Species Centre (ISC). Samples collected by the program were identified by the ISC. The CFS provided laboratory space and access to its historical insect reference collection. Disease samples were identified at the Ontario Forest Research Institute (OFRI). Results of the insect and disease collections were entered into a national database managed by CFS.

As a result of restrictions associated with the global COVID-19 pandemic, monitoring was delayed until mid summer and was limited to major forest disturbances. Maps, tables, and graphs were produced from aerial surveys of major forest disturbances. Results of the annual monitoring program were reported provincially as part of the Science Insights seminar series and nationally at the Forest Pest Management Forum (virtually) and via numerous collaborating agencies and interested organizations and are described in detail in this report.

Weather patterns

Weather affects the growth, phenology (timing of different 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 2020, temperatures were warm initially and then varied widely across the province. For the most part, it was warmer and wetter than normal (based on 30-year averages) in the south, with above normal amounts of precipitation in the form of rain causing flooding in some areas, and thunderstorms in March and April. The warm winter months in the south may have contributed to the fecundity of gypsy moth in 2020. In the northeast and northwest, temperatures started out above normal, then fluctuated, and then were normal to below normal at the end of April. Precipitation in the northwest was below normal while in the northeast precipitation ranged locally from above to below normal.

The next four months were relatively warmer than normal, except for a cold front in May resulting in late spring snowfall across much of the province. By the end of May, maximum temperatures reached 30 °C and higher. May precipitation was below normal across the province. June temperatures were normal to slightly above normal, with some hot days in various areas. It was wetter than normal in the northeast and the far northwest had heavy rainfall in the Kenora/Lake of the Woods area as well as severe winds in Stratton west of Fort Frances. Otherwise it was relatively dry in the northwest. Precipitation in the south was below normal but seven tornados were registered on June 10 in southcentral and southwestern parts of Southern Region. Temperatures continued to be above normal in July, with three heat waves across the province. A new record for mean temperature was recorded in Moosonee in 2020. Precipitation was below normal, but with some weather events in July including a violent storm in the Caribou Lake area (500 km north of Thunder Bay), a hailstorm in the Temiskaming Shores/New Liskeard area, heavy rainfall events in the south, and on July 19 six tornadoes and several downbursts occurred in the south near London, Listowel, Halton, Peel, and Belmount. In early August, rainfall was heavy in the south-central part of the province and three tornadoes were recorded in eastern Ontario. Wet conditions continued in the south, with drier than normal conditions in the northeast.

The last four months of 2020 were uneventful, with warmer than normal temperatures and relatively normal levels of precipitation but some dry periods in the north. In early September, rainfall was heavy in the southwest near London and a storm passed through northern Ontario, resulting in a substantial rainfall in a short period. October temperatures were cooler, particularly towards the end of the month in the Timmins area as a new record low of -19.0 °C was recorded. The province was drier than normal in October, especially in the northwest, except for wetter than normal conditions from Superior east to the Quebec border. November was warmer than normal, and a record-breaking heat wave was recorded from November 4–11, with daily maximum temperatures in the high teens and low twenties. Precipitation varied across the province but overall was near normal. Although the month was warmer than normal, some notable snowfalls events were recorded. One such case was in Toronto on November 22 when 19.4 cm fell at Pearson International Airport. Drier conditions prevailed in the northwest and parts of northeastern Ontario. The warmer than normal temperatures continued into December, particularly in the northwest and northeast. Precipitation was close to normal across the province, except some areas in the

north were drier than normal. Snowfall was more prevalent in the south, but all parts of the province had a white Christmas, except for eastern Ontario that had more rain. By the end of the month, warmer weather had reduced the snow load.

Extreme weather and abiotic events

With warmer temperatures and drier than normal conditions in spring 2020, early season defoliators such as gypsy moth, jack pine budworm, spruce budworm, and large aspen tortrix thrived. The area of moderate to severe defoliation from these four insects totalled 1,964,331 ha.

In 2020, 607 forest fires were recorded, a slight increase from the 537 recorded in 2019 (NDMNRF Aviation, Forest Fire and Emergency Services). Many of the fires in 2020 were in areas where blowdown, snow damage, insect infestations, or disease had killed or damaged trees in recent years.

The area of blowdown decreased from 8,490 ha in 2019 to 1,466 ha in 2020. Most of this blowdown was in Northwest Region with small areas in Northeast Region; none was recorded in Southern Region. Due to COVID-19 operational restrictions, aerial mapping was focused on known major forest disturbances so blowdown in remote areas may not have been detected.

Insect infestations

The area of moderate to severe gypsy moth defoliation increased from 43,158 ha in 2019 to 569,384 ha in 2020, the most ever recorded in Ontario. A total of 17,002 ha of light defoliation were also mapped, all in Southern Region. Most (544,468 ha) of the moderate to severe defoliation was aerially mapped in Southern Region, with the remainder (24,916 ha) mapped in Northeast Region. All but one Southern Region district (Algonquin Park) had some level of gypsy moth defoliation. Three districts — Bancroft Kemptville, and Pembroke — had gypsy moth defoliation for the first time during the current outbreak, which started in 2017. This new area of defoliation (226,102 ha) made up almost half the total area of moderate to severe defoliation in Southern Region. The area in the other districts with moderate to severe defoliation increased in 2020, with Peterborough District having the largest increase from 409 ha in 2019 to 159,578 ha in 2020. Most of the light defoliation was on the edges of moderate to severe defoliation in Southern Region, with Kemptville District having almost half (8,458 ha) the total area of light defoliation. Varying levels of gypsy moth pathogens, such as Entomophaga maimaiga and nuclear polyhedrosis virus (NPV), were noted in Southern Region. Moderate to high levels of egg parasitism were also evident in Aylmer and Guelph districts where gypsy moth defoliation has been recorded for the past four years. Gypsy moth defoliation forecast surveys projected severe defoliation for 2021 in seven districts in Southern Region for all but one location. In Northeast Region, most of the moderate to severe defoliation was recorded in Sudbury District (24,262 ha) in and around the City of Greater Sudbury where the last outbreak of gypsy moth occurred in 2014. North Bay and Sault Ste. Marie districts had small areas of defoliation in 2020.

Moderate to severe defoliation by jack pine budworm decreased from 1,001,269 ha in 2019 to 929,763 ha in 2020. Most of the defoliation was in Northwest Region, with a small area of defoliation in Northeast Region. In Northwest Region, most of the moderate to severe defoliation was in Sioux Lookout, Dryden, Kenora, and Red Lake districts. In Red Lake District, the area of defoliation decreased from 771,404 ha in 2019 to 112,425 ha in 2020, but the area affected in the other three districts increased. Survey data indicated that the jack pine budworm outbreak in Red Lake District is declining. Small increases in the area of defoliation were recorded in Thunder Bay and Fort Frances districts. The Northwest Region also had light defoliation (136,161 ha) in 2020, most of it in Red Lake and Kenora districts. In Northeast Region, 128 ha of moderate to severe jack pine budworm defoliation was recorded in 2020, all in Sudbury District in the Town of Espanola.

In late September 2020, 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. A total of 64 locations were surveyed, 59 in Northwest Region and five in Northeast Region. Most of the locations in Northwest Region were in Dryden and Sioux Lookout districts with the remainder in Kenora and Red Lake districts. Results indicated that in 2021 the infestation is likely to persist in Dryden, Sioux Lookout, and Kenora districts while declining in Red Lake District. In Northeast Region, all but one location had a light defoliation forecast for 2021. The exception was the Town of Espanola where defoliation was aerially mapped in 2020 and the forecast for 2021 is severe defoliation.

The area of moderate to severe spruce budworm defoliation increased from 342,333 ha in 2019 to 442,426 ha in 2020. Most of this increase was in Northeast Region with a minor increase in Southern Region. In Northeast Region, spruce budworm defoliation was aerially mapped in all nine districts in 2020. Areas of moderate to severe defoliation increased substantially in Cochrane and Timmins districts, moderately in North Bay, Sudbury, Sault Ste. Marie, and Hearst districts, and minimally in Kirkland Lake District. Wawa District had a new area of defoliation in 2020 that was 977 ha. Chapleau District was alone in its decrease in the area of moderate to severe defoliation. A total of 9,328 ha of tree mortality caused by spruce budworm was also mapped in Northeast Region in 2020. Most of this mortality was mapped in North Bay and Chapleau districts, with the remainder evenly dispersed amongst Timmins, Hearst, Kirkland Lake, and Cochrane districts. In Southern Region, moderate to severe spruce budworm defoliation was only mapped in Parry Sound District, increasing from 2,753 ha in 2019 to 6,869 ha in 2020. Tree mortality was also mapped in Parry Sound District for the first time, in a 31 ha area.

In October 2020, spruce budworm defoliation was forecast in Northeast Region based on surveys of the number of overwintering larvae on tree branches. A total of 24 locations were surveyed in Cochrane, Timmins, Hearst, Chapleau, and North Bay districts. Results indicated that defoliation will persist in these districts in 2021.

Moderate to severe defoliation by large aspen tortrix increased from 16,548 ha in 2019 to 22,759 ha in 2020. New areas of defoliation popped up in Sudbury, Sault Ste. Marie, Wawa, and North Bay districts and notable increases in defoliation occurred in Cochrane and Kirkland Lake districts. Defoliated area decreased in Timmins District and no defoliation was aerially mapped in Chapleau District.

In 2020, the forest tent caterpillar infestation in Ontario collapsed. It was the first time in more than 70 years that no forest tent caterpillar defoliation was aerially mapped in the province. Some forest tent caterpillar larvae were found in southern areas of Northeast Region, but no defoliation was recorded during aerial surveys.

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 influence overall 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 2020, leaf spot was observed during ground surveys in Northeast and Southern regions in small localized areas. Stillwell's syndrome, a syndrome that causes single balsam fir tree mortality, was observed in Pembroke District, Southern Region. A total of 226 ha of mortality and decline were mapped in this area. Red oak decline was aerially mapped in Northeast Region. This decline was in Sault Ste Marie and Sudbury districts and totalled 570 ha. The decline is attributed to several factors including severe forest tent caterpillar defoliation, drought-like conditions, poor site, and a frost event. As a result, wood borers and armillaria root rot have established, causing whole tree mortality and decline. 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, NDMNRF forest health experts worked with AgCanada and U.S. researchers to describe the nematode found in symptomatic leaves and reproduce 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 2020, beech leaf disease detection surveys and sampling were limited due to COVID-19 operational restrictions.

Invasive species

Emerald ash borer is an invasive insect 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, at the northern end of Sault Ste. Marie District. The city of Thunder Bay in Northwest Region is also regulated for this borer. During ground surveys, new occurrences were found in the quarantined area in Parry Sound District, Southern Region.

On April 5, 2013, the CFIA declared Asian long-horned beetle eradicated from Toronto and Vaughan. The declaration resulted following a program aimed at eliminating the pest after it was initially found in the area in 2003. The program involved cutting and chipping infested trees and all potential host trees within 400 m of an infested tree, followed by surveys to determine if any beetles remained. After five consecutive years in which detection surveys found no beetles or infested trees, the CFIA declared the pest eradicated.

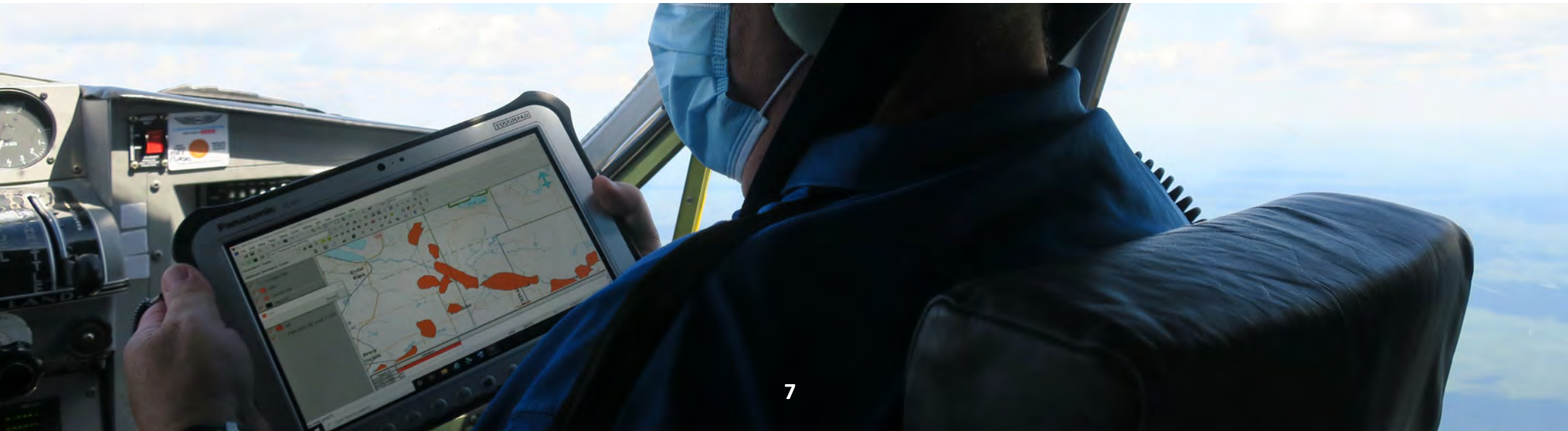
In August 2013, a new infestation of Asian long-horned beetle was found in Mississauga, following the discovery of a beetle on a car. Subsequent surveys by the CFIA; the cities of Toronto, Mississauga, and Brampton; and NDMNRF found approximately 25 infested Norway and Manitoba maple trees. Infested trees were in the area around Lester B. Pearson International Airport, except for one tree found in an adjacent area in the City of Toronto. This infestation has undergone an aggressive eradication program led by the CFIA, the agency that continues to lead the federal detection survey. After five years of surveys with no detection of Asian long-horned beetle, the CFIA deemed the pest eradicated from this area and the infested place order was repealed as of June 9, 2020.

Beech bark disease, which is a combination of an invasive insect (beech scale) and an invasive stem fungus, has continued to spread in Ontario. In 2020, a small area (57 ha) of damage caused by beech bark disease was aerially mapped in Pembroke District, Southern Region. Beech bark disease was also reported by Algonquin Provincial Park staff in the southeast part of the park. Leaf spot was found in various parts of the province but was not aerially mapped in 2020.

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.

Common name	Scientific name	Type	Page
Asian long-horned beetle	*Anoplohora glabripennis Motschulsky*	Insect	19
Basswood leafroller	*Pantographa limata (Grote and Robinson)*	Insect	21
Beech bark disease	*Neonectria faginata*	Disease	24
Beech leaf disease	*Litylenchus crenatae* ssp. *mccannii*	Disease	27
Blowdown	Not applicable	Abiotic	30
Emerald ash borer	*Agrilus planipennis* Fairmaire	Insect	36
Forest tent caterpillar	*Malacosoma disstria* Hubner	Insect	37
Gypsy moth	*Lymantria dispar* (L.)	Insect	41
Jack pine budworm	*Choristoneura pinus pinus* Freeman	Insect	56
Large aspen tortrix	*Choristoneura conflictana* (Wlk.)	Insect	68
Oak decline	Not applicable	Complex	72
Spruce budworm	*Choristoneura fumiferana* Clemens	Insect	75
Still well's syndrome	Not applicable	Syndrome	85
Whitespotted sawyer beetle	*Monochamus s. scutellatus (Say)*	Insect	87



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 2020 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.
Ash species	*Fraxinus spp.*
Balsam fir	*Abies balsamea* (L.) Mill.
Balsam poplar	*Populus balsamifera* L.
Basswood	*Tilia americana* L.
Black ash	*Fraxinus nigra* Marsh.
Black spruce	*Picea mariana* (Mill.) BSP
Choke cherry	*Prunus virginiana* L.
Eastern hemlock	*Tsuga canadensis (L.) Carrière*
Eastern white pine	*Pinus strobus L.*
Hackberry	*Celtis occidentalis*
Horse chestnut	*Aesculus glabra*
Ironwood	*Ostrya virginiana*
Jack pine	*Pinus banksiana Lamb.*
London planetree	*Platanus × acerifolia*
Manitoba maple	*Acer negundo L.*
Mountain ash	*Sorbus americana*
Norway maple	*Acer platanoides*
Pin cherry	*Prunus pensylvanica L. f.*
Red ash	*Fraxinus pennsylvanica*
Red oak	*Quercus rubra L.*
Red pine	*Pinus resinosa Ait.*
Scots pine	*Pinus sylvestris L.*
Silk tree	*Syringa reticulata*
Speckled alder	*Alnus incana spp. rugosa (Du Roi) J. Clausen*
Sugar maple	*Acer saccharum Marsh.*

Host index *(continued)*

Common name	Scientific name
Sycamore	*Platanus occidentalis*
Tamarack/larch	*Larix laricina (Du Roi) K. Koch*
Trembling aspen	*Populus tremuloides Michx.*
White birch	*Betula papyrifera Marsh.*

Major forest disturbances

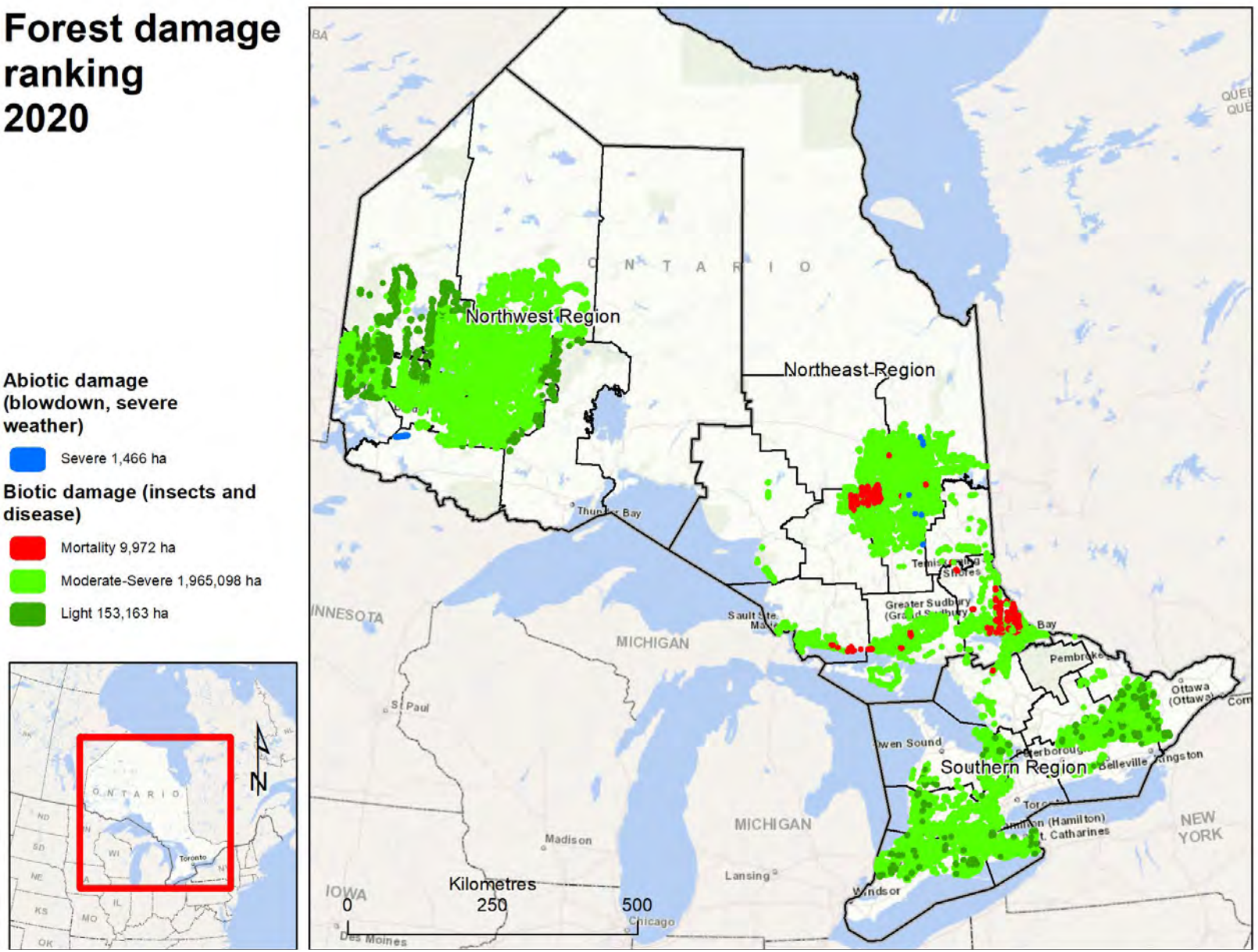
Mapped area

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 2020.

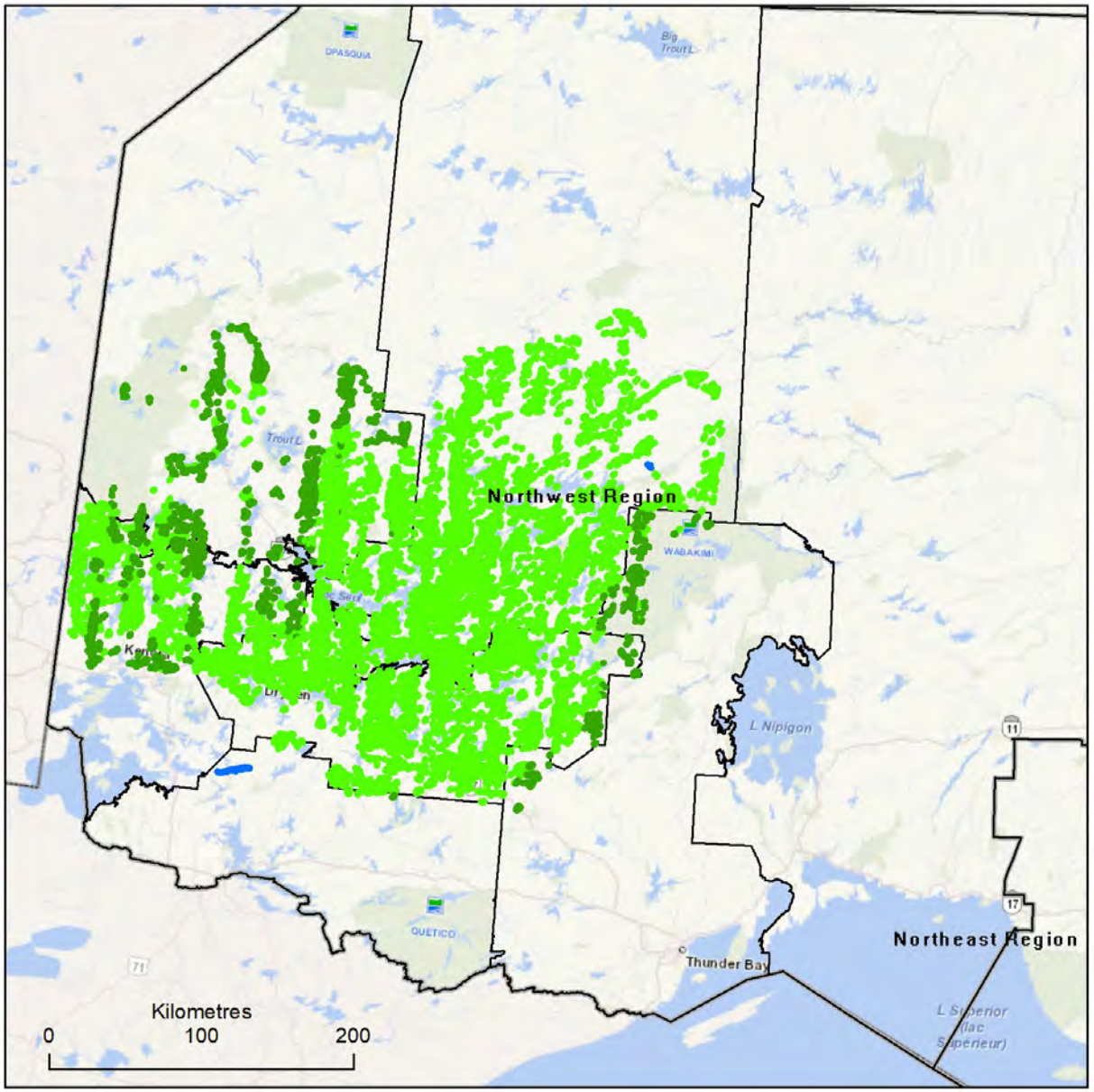
Common name	Light	Moderate to severe	Tree mortality	Total
Basswood leafroller	0	479	0	479
Blowdown	0	1,466	0	1,466
Gypsy moth	17,002	569,384	0	586,386
Jack pine budworm	136,161	929,763	0	1,065,924
Large aspen tortrix	0	22,759	0	22,759
Oak decline	0	0	570	570
Spruce budworm	0	442,426	9,358	451,784
Stillwell's syndrome	0	226	0	226
Whitespotted sawyer beetle	0	4	44	48

Major forest disturbances maps

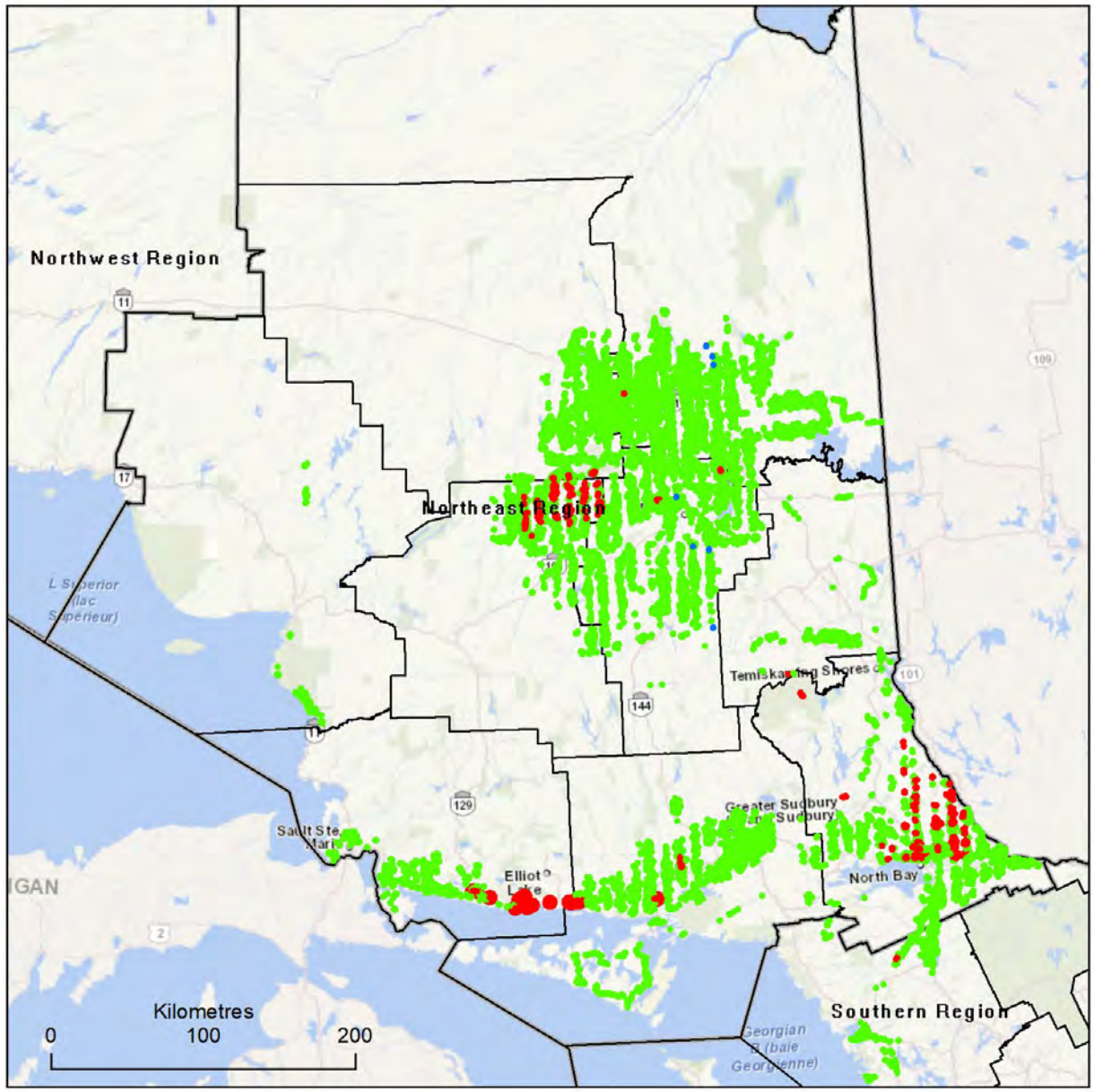
Provincial overview



Northwest Region Forest damage ranking 2020



Northeast Region Forest damage ranking 2020



Abiotic damage (blowdown, severe weather)

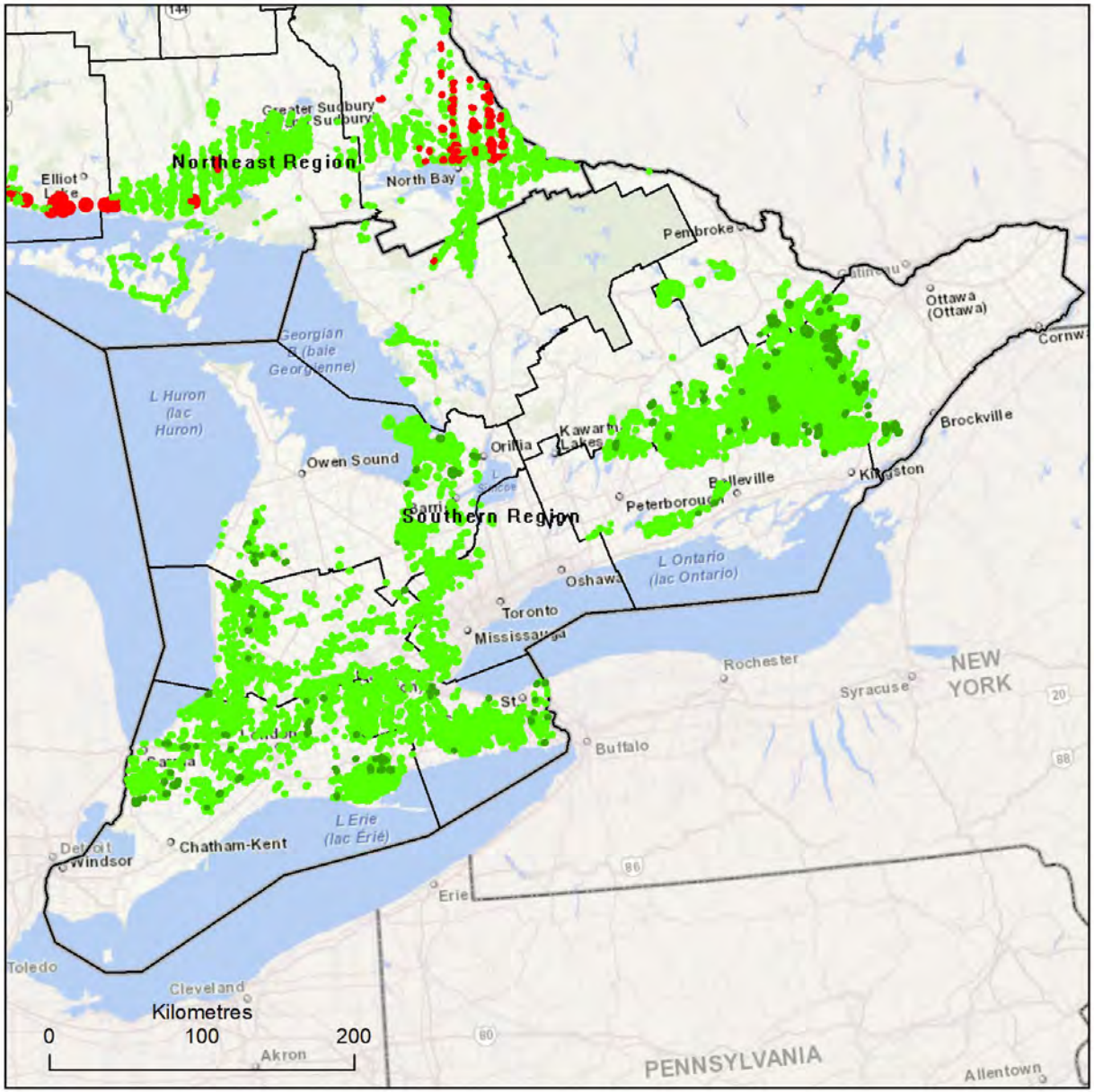
Severe 93 ha

Biotic damage (insects and disease)

Mortality 9,942 ha

Moderate-Severe 483.363 ha

Southern Region Forest damage ranking 2020



Biotic damage (insects and disease)

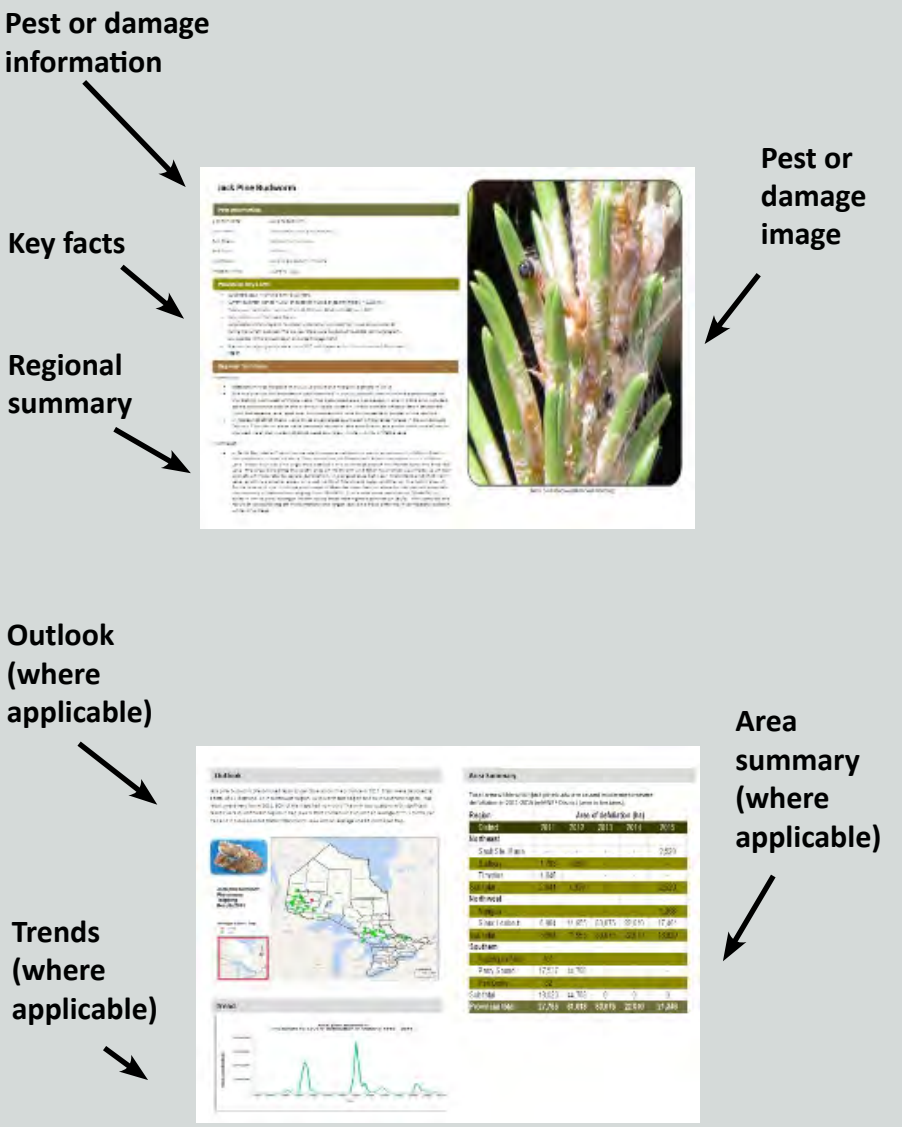
- Mortality 31 ha
- Moderate-Severe 552,100 ha
- Light 17,002 ha

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, including some or all of:

- **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 NDMNRF 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 2016 to 2020 by NDMNRF region and district.

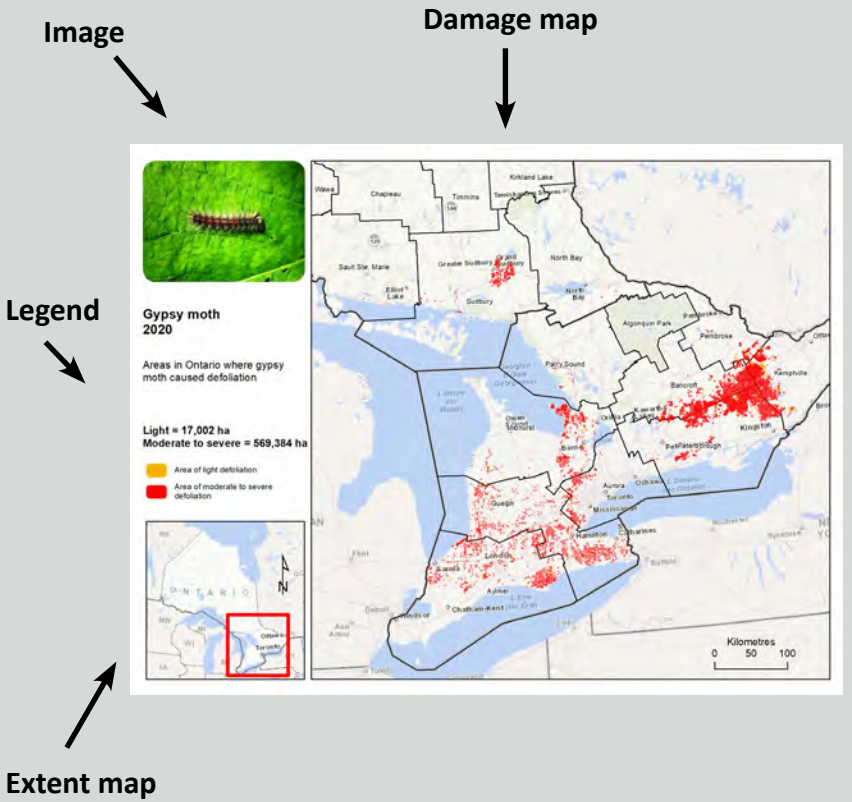


Example map

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



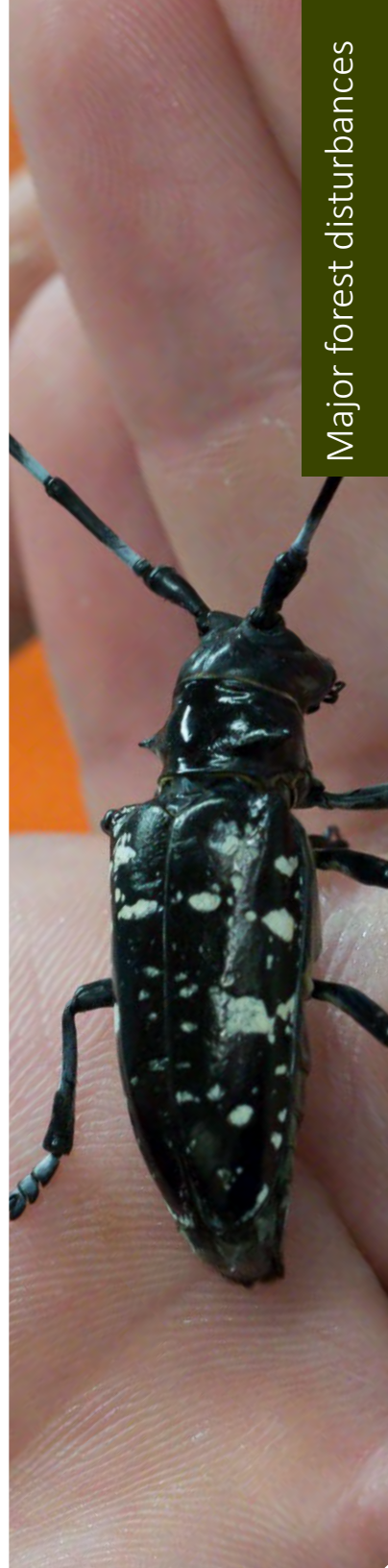
Asian long-horned beetle

Pest information

Common name:	Asian long-horned beetle
Scientific name:	*Anaplophora glabripennis* (Motschulsky)
Pest origin:	Invasive – Native to Asia
Pest type:	Wood borer
Host species:	Birch, elm, hackberry, horse chestnut, Katsura, maple, mountain ash, poplar, silk tree, sycamore or London planetree, and willow
Infestation area:	No new finds, infested place order repealed

Provincial key facts

- The Asian long-horned beetle (ALHB) was first found in 2003 in an industrial park bordering Toronto and the city of Vaughan.
- It was possibly introduced to North America by way of wooden pallets, crates, or packaging materials used in shipping.
- The Canadian Food Inspection Agency (CFIA), which is the lead agency responsible for preventing the entry and spread of invasive insect species, joined with NDMNRF, the Canadian Forest Service (CFS), City of Toronto, City of Vaughan, York Region, Toronto and Region Conservation Authority, and the U.S. Department of Agriculture to create a task force focused on controlling this beetle.
- After several rounds of host tree removals and surveys, the Toronto-Vaughan infestation was thought to be eradicated in 2003.
- On September 20, 2013, the CFIA confirmed the presence of Asian long-horned beetle in an industrial area near Pearson International Airport, Mississauga, with about 25 trees identified as infested and subsequently destroyed.
- In early 2014, host trees within 800 metres of infested trees were removed from parks, ravines, and industrial and residential areas of Mississauga and west Toronto.
- As part of eradication efforts, the CFIA established a regulated area in Mississauga and Toronto to prevent the spread of the insect. This area is about 20 square kilometres, bordered by Finch Avenue (north), Martin Grove Road (east), Hwy 401 (south), and Dixie Road (west).



- After five years of surveys with no detection of Asian long-horned beetle, the CFIA deemed the pest eradicated from this area and the ALHB infested place order was repealed as of June 9, 2020. The movement of firewood and host tree materials is no longer restricted.
- More information is available on the CFIA website at: http://www.inspection.gc.ca/plants/plant-protection/insects/asian-longhorned-beetle/eng/1337792721926/1337792820836.
- New detections of the AHLB in South Carolina and other states underlie the need for continued awareness and monitoring of this pest.

Regional summary

Southern:

- In early 2020, the CFIA carried out surveys in the regulated area in collaboration with partners, including NDMNRF. No new detections of the beetle were reported.

Basswood leafroller

Pest information

Common name:	Basswood leafroller
Scientific name:	*Pantographa limata (Grote and Robinson)*
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Basswood and sugar maple
Infestation area:	479 ha

Provincial key facts

- The basswood leafroller occurs in southeastern Canada and the eastern United States.
- It feeds primarily on basswood leaves from late July to late September but will also feed on oak and elm.
- It feeds by cutting and stitching a leaf to form a roll from within which it consumes the leaf tissue, skeletonizing the leaf.
- In the fall, basswood leafroller forms a cocoon inside a rolled leaf where it takes shelter. It overwinters as a pupa on the ground inside the fallen leaf.
- It is not known to cause serious defoliation in Ontario.
- In 2020, 479 ha of moderate to severe basswood leafroller defoliation were mapped in two locations in Southern Region.

Regional summary

Southern:

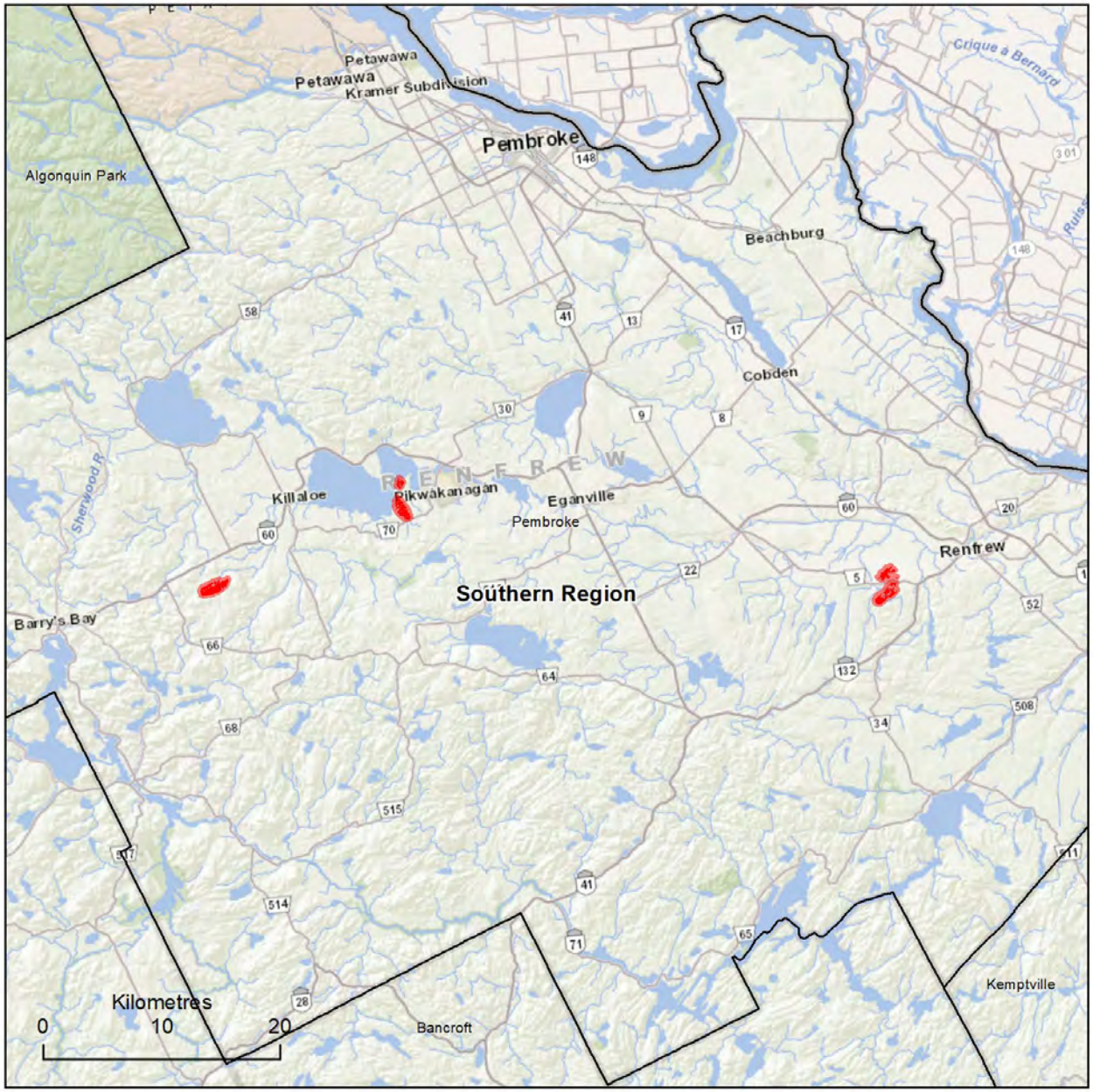
- In Pembroke District, 479 ha of moderate to severe basswood leafroller defoliation were mapped on Mountainview Road west of Killaloe, Hagarty Twp, and south of Golden Lake in Algona Twp. During ground verification surveys, larvae were collected on Mountainview Road, Hagarty Twp, where light (<25%) defoliation of basswood and sugar maple was recorded. Cercospora leaf spot was also observed causing the stand to appear more severely damaged.
- In Kemptville District, basswood leafroller larvae were collected in a young hardwood forest on Larose Bay Road, near Lyndhurst, Lansdowne Twp, Leeds-Grenville County. Suppressed basswood were severely defoliated, however they made up a very small percentage of the hardwood stand (<5%).

Basswood leafroller 2020

Areas in Southern Region where basswood leafroller caused defoliation

Moderate to severe = 479 ha

Area of moderate to severe defoliation



Beech bark disease

Pest information

Common name:	Beech bark disease
Scientific name:	Fungus – *Neonectria faginata* (Lohman et al.) Castl.
	Insect – *Cryptococcus fagisuga* Lind.
Pest origin:	Invasive — native to Europe
Pest type:	Insect-disease complex
Host species:	American Beech
Infestation area:	57 ha

Provincial key facts

- Beech bark disease is the result of an insect-fungal pathogen complex initiated by the infestation of beech scale 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 may cause premature mortality.
- 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: disease has passed through and remains endemic in the beech population. Large remnant trees continue to decline and young trees become infected, disfigured, and gradually decline.
- Forest health staff continue to monitor and collect information on new occurrences of beech bark disease during general surveys. In 2020, new locations were added to an existing database of confirmed infections in Southern Region. A small area of damage was aerially mapped in Pembroke District.

Regional summary

Southern:

- In Pembroke District, a small area (57 ha) of beech bark disease damage was recorded in a mature mixed stand of beech and eastern hemlock on Curtiss Road on the southeast side of Bark Lake southwest of Barry's Bay in Jones Twp, Renfrew County. Cankers were observed on 70% of the beech trees in the stand. Beech scale and beech tree mortality were also observed.
- In Algonquin Provincial Park, severe beech bark disease was reported by park staff in a mature maple-beech mixed forest near Sec Lake in the southeast part of the park. Observations included distinctive cankers, beech tree decline and mortality associated with the disease. High populations of beech scale were also reported at this site.

Beech bark disease 2020

Areas in Ontario where beech bark disease caused damage

Severe = 57 ha

Area of moderate to severe damage

Beech leaf disease

Pest information

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

Provincial key facts

- Beech leaf disease was first identified in the United States in Lake County, Ohio, in 2012 and has since been detected from northcentral Ohio to Connecticut. In Ontario, it occurs along the shores of Lake Erie and in the municipality of Toronto.
- Symptoms of beech leaf disease were first confirmed in southern Ontario in 2017 in Aylmer District.
- The primary symptom of beech leaf disease is striping, or banding, caused by the thickening of leaf tissue between veins. Severely affected leaves have yellowed bands, are coarse, and curl. Early leaf drop of severely affected leaves and bud abortion make tree crowns appear thin.
- Symptomatic trees are host to other foliage affecting insects and pathogens including erineum patches caused by eriophyid mites, woolly beech aphids, and foliar fungi such as anthracnose and powdery mildew.
- It is not known if the nematode is the sole causal agent or part of a disease complex.
- In 2020, few detections of beech leaf disease symptoms were made beyond locations confirmed in previous years.
- To date, symptoms of beech leaf disease have only been found in Aylmer and Guelph districts, and at one location in Aurora District.

Regional summary

Southern:

- In Aylmer District, symptoms of beech leaf disease have now been confirmed in Elgin, Middlesex, Oxford, Norfolk, Lambton, and Chatham-Kent counties with a new find in Essex County. Symptoms of beech leaf disease were detected at Maidstone Conservation area near the town of Essex in Essex County. A sample containing the nematode Litylenchus crenatae mccannii (Anguinata) was collected by the Essex Region Conservation Authority and sent to the Ontario Forest Research Institute pathology laboratory for analysis. This sample represents the first confirmed detection of beech leaf disease in Essex County. In Elgin County, symptoms of beech leaf disease were detected on three ornamental European beech trees in Bayham Twp.
- In Guelph District, no new detections were made in 2020. To date, beech leaf disease symptoms have been detected in Haldimand County and Niagara Region.
- In Aurora District, no new detections were made in 2020. To date, beech leaf disease symptoms have been confirmed in Toronto.

Trend analysis/outlook/issues

Beech leaf disease detection surveys and sampling were limited by COVID-19 restrictions in 2020.

Work on beech leaf disease is ongoing and involves numerous partners. Now that a causal agent has been identified, NDMNRF plans to investigate how the nematode is being spread locally and regionally. The ministry is participating in the development of a highly sensitive DNA-based test to improve nematode detection. In 2019, a plot network was established to monitor effect of beech leaf disease on forests with and without beech bark disease. Mortality of understory beech trees is expected as well as changes in plant communities as more light reaches the forest floor.

Future monitoring in Ontario will be focused on determining if 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 the Great Lakes-St. Lawrence 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

Blowdown

Pest information

Common name:	Blowdown
Scientific name:	NA
Pest origin:	NA
Pest type:	Abiotic
Host species:	Variable
Infestation area:	1,466 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.
- Less blowdown was recorded in 2020 (1,466 ha) than in 2019 (8,490 ha). Due to the COVID-19 pandemic, aerial survey time was limited so some blowdown may have been missed as mapping efforts were focused on major forest disturbances such as jack pine budworm, spruce budworm, and gypsy moth.
- In 2020, scattered areas of blowdown were found in Northwest and Northeast regions, with the most area (1,373 ha) in the northwest.

Regional summary

Northwest:

- In 2020, most (1,169 ha) of the blowdown aerially mapped in Northwest Region was in Fort Frances District. All blowdown was in the north central part of the district, just south of the Kenora and Dryden district boundaries. A swath of uprooted trees, about 21.6 km long, was recorded from the east side of Lawrence Lake west to the east side of Brooks Lake. This blowdown event may have occurred June 7-9, when a cold front moved through the Fort Frances area bringing thunderstorms and high winds.
- In Sioux Lookout District, a small area of blowdown was observed about 33 km south east of Pickle Lake. Three small areas of blowdown totalling 204 ha were mapped north of Albany River Provincial Park (Waterway) to the south end of Bowcott Lake.

Northeast:

- In 2020, four small areas of blowdown totalling 55 ha were mapped in localized areas in the central and eastern part of Timmins District. One small area was observed near the northwest end of the Timmins Victor M Power Airport (Jessop Twp), and two others were relatively close to each other in Adams Twp near Mountjoy River and the northeast corner of Douglas Twp between the south end of Nighthawk Lake and McArthur Lake. The fourth area of blowdown was recorded further south near the Timmins/Kirkland Lake district boundary in the middle of Mond Twp southwest of Ferris Lake.
- In Cochrane District, 38 ha of blowdown were mapped in the southern part of the district. This blowdown consisted of three small areas directly north of Cochrane, starting about 31 km north of the town on the east side of the Ontario Northland Railway. Two small areas were in Thorning Twp south of Jawbone Lake and the third larger area was in the southwest corner of Inglis Twp

Total area (in hectares) in which blowdown caused moderate to severe damage from 2016 to 2020 by NDMNRF district.

Region	Area of damage (ha)				
District	2016	2017	2018	2019	2020
Northeast					
Chapleau	275	697	653	1,238	-
Cochrane	67	84	-	-	38
Hearst	3	25	36	24	-
Kirkland Lake	-	140	123	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	-	10	-	25	-
Sudbury	-	326	11	-	-
Timmins	5	83	-	207	55
Wawa	-	-	133	254	-
Sub total	350	1,365	956	1,748	93
Northwest					
Dryden	884	31	497	-	-
Fort Frances	-	319	113	-	1,169
Kenora	73	30	-	-	-

District	2016	2017	2018	2019	2020
Nipigon	180	-	-	-	-
Red Lake	6,761	227	1,120	2,832	-
Sioux Lookout	3,080	468	1,032	3,188	204
Thunder Bay	120	-	9	-	-
Sub total	11,098	1,075	2,771	6,020	1,373
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	-	-	-	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	77	-
Midhurst	-	-	-	-	-
Parry Sound	-	-	14	-	-
Pembroke	-	-	98	645	-
Peterborough	-	-	-	-	-
Sub total	0	0	112	722	0
Provincial total	11,448	2,439	3,839	8,490	1,466

Blowdown 2020

Areas in Ontario where blowdown caused damage

Severe = 1,466 ha

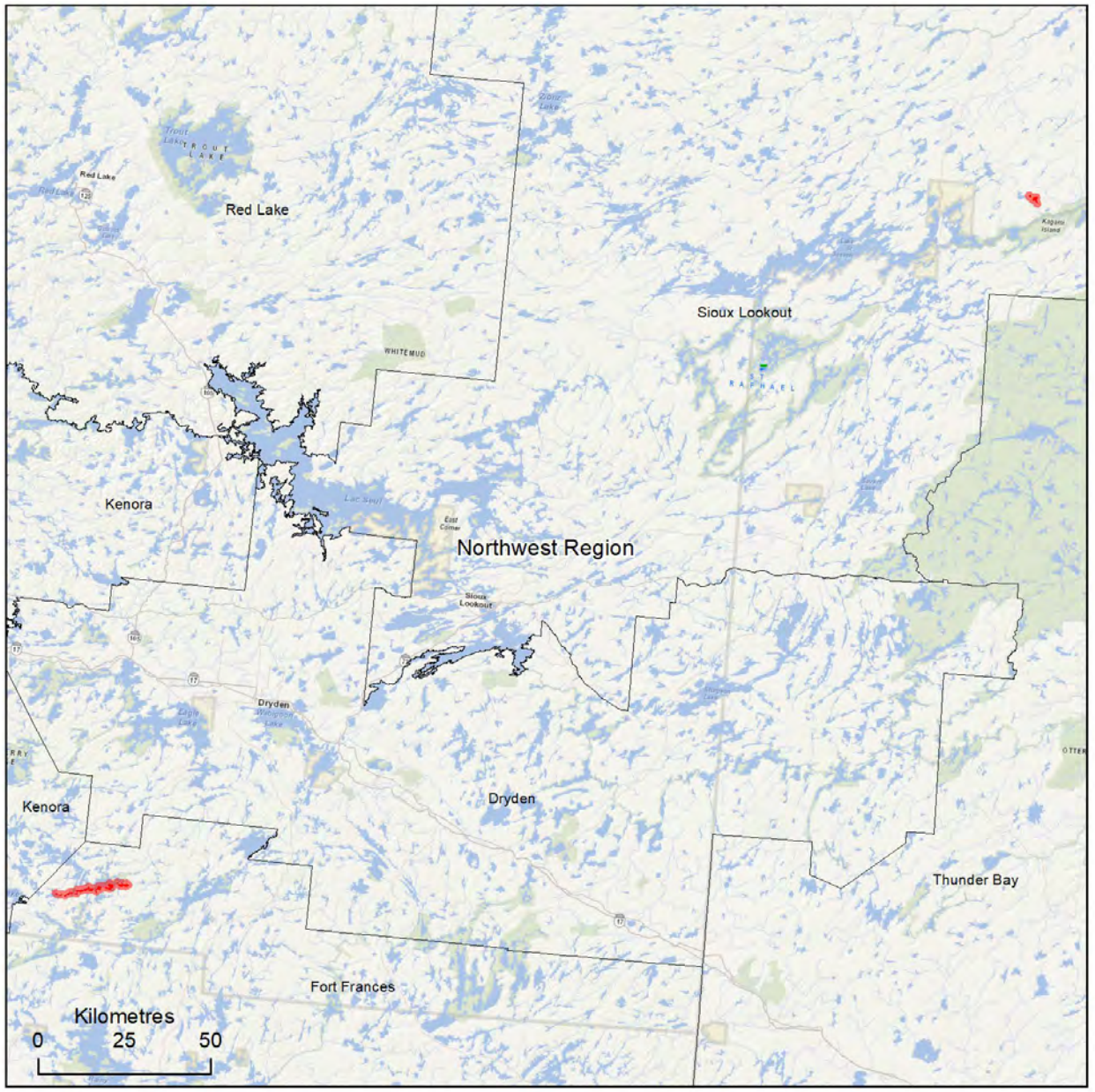
Area of severe damage

Blowdown 2020

Areas in the Northwest Region where blowdown caused damage

Severe = 1,373 ha

Area of severe damage

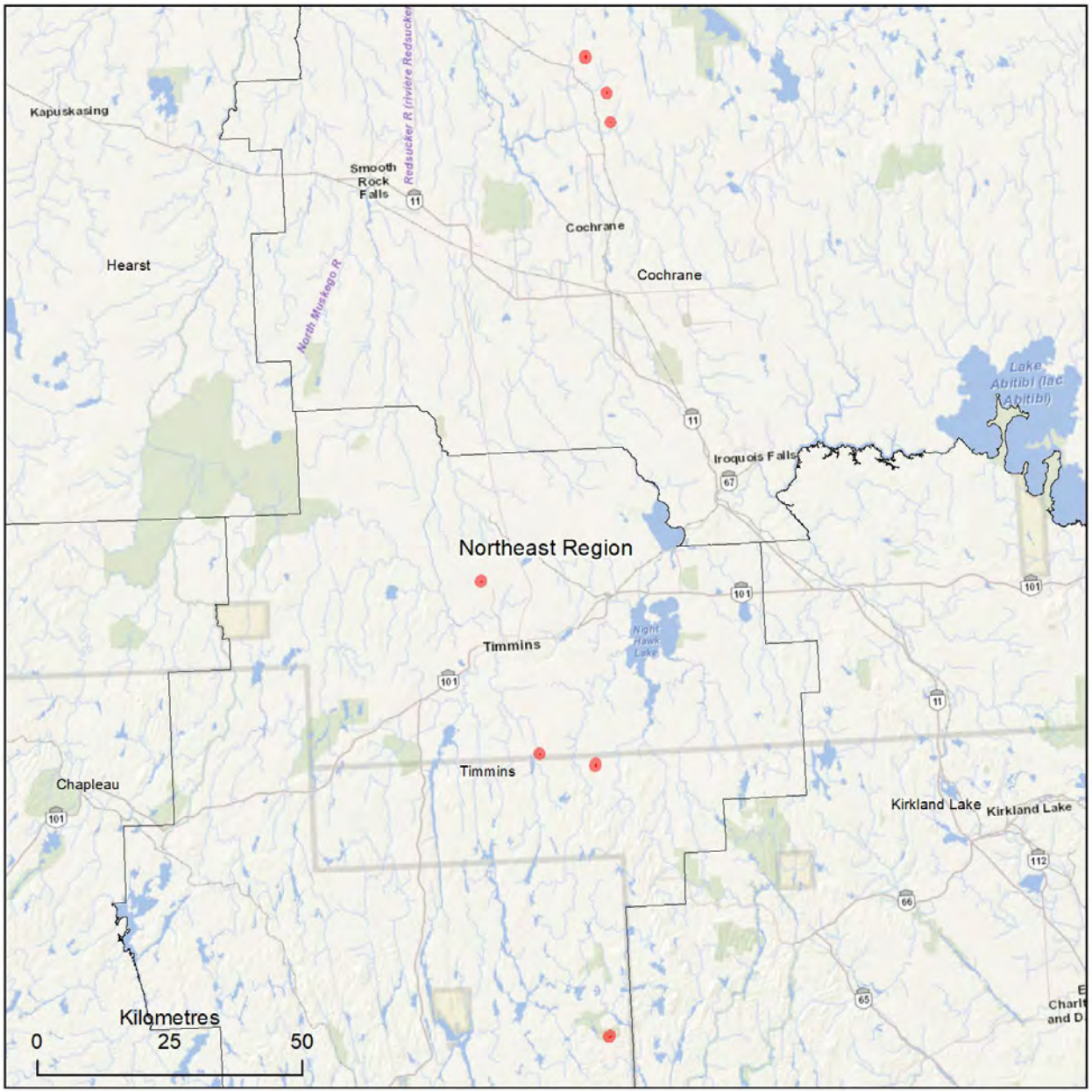


Blowdown 2020

Areas in the Northeast Region where blowdown caused damage

Severe = 93 ha

Area of severe damage



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:	Localized

Provincial key facts

- Since it was discovered in Windsor in 2002, emerald ash borer has been a considerable 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.
- Aerial surveys for emerald ash borer are planned for 2021.
- In 2020, new occurrences of emerald ash borer were found in the quarantined area in Parry Sound District, Southern Region.

Regional summary

Southern:

- In Parry Sound District, emerald ash borer larvae were collected on Golden Beach Road, west of Bracebridge. The ash trees in the area had severe damage with epicormic shoots, crown dieback, D-shaped exit holes and S-shaped galleries under the bark.
- In Pembroke District, emerald ash borer adults were collected on pheromone traps and submitted to NDMNRF by the Renfrew County forester for species confirmation. The traps were set in Shaw Woods on Bulger Road and on Germanicus Road, both in Wilberforce Twp; on McMillan Road in North Algona Twp; and at Veteran's Park in Cobden, Ross Twp. Damage to ash trees from emerald ash borer was not assessed at these locations.

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:	NA

Provincial key facts

- On average in Ontario, forest tent caterpillar outbreaks have occurred every ten to 12 years, with each outbreak continuing for 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 mostly on trembling aspen but also feeds on several other deciduous species.
- In 2020, the infestation collapsed and for the first time in over 70 years forest tent caterpillar defoliation was too minimal to be mapped from the air.

Regional summary

Northeast:

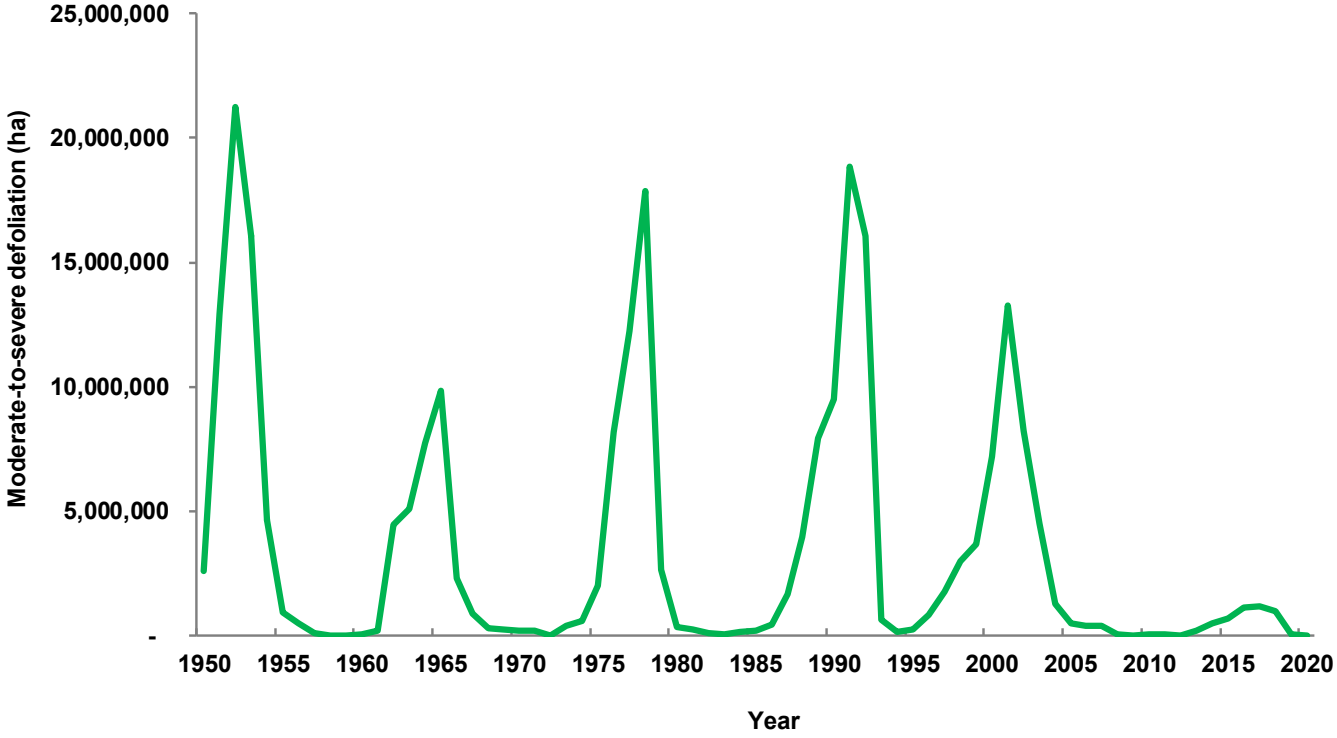
- In 2020, some forest tent caterpillar larvae were detected in the southern part of Sault Ste. Marie District, but no defoliation was recorded in the area.

Total area (in hectares) in which forest tent caterpillar caused moderate to severe defoliation from 2016 to 2020 by NDMNRF District.

Region	Area of defoliation (ha)				
District	2016	2017	2018	2019	2020
Northeast					
Chapleau	-	-	-	-	-
Cochrane	1,188	26,385	33,428	7,732	-
Hearst	100,990	590,451	237,395	22,470	-
Kirkland Lake	5,845	600	521	-	-
North Bay	5,778	33,907	25,724	69	-
Sault Ste. Marie	3,468	95,087	148,442	50	-
Sudbury	10,539	52,063	72,435	3,073	-
Timmins	4,327	10,966	888	-	-
Wawa	-	-	-	-	-
Sub total	132,135	809,459	518,833	33,393	0
Northwest					
Dryden	386,518	9,803	-	-	-
Fort Frances	**20,980**	**11,465**	**-**	**-**	**-**
Kenora	197,292	67,620	9	-	-
Nipigon	1,504	814	-	-	-
Red Lake	139,046	1,003	-	-	-
Sioux Lookout	186,838	513	-	-	-
Thunder Bay	8,221	-	29	-	-
Sub total	940,399	91,218	38	0	0
Southern					
Algonquin Park	18	369	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	37,577	138,664	235,831	-	-
Guelph	-	-	-	-	-
Kemptville	2,007	58,782	126,179	-	-

District	2016	2017	2018	2019	2020
Midhurst	2,150	-	434	-	-
Parry Sound	-	14,472	11,618	95	-
Pembroke	2,560	25,276	27,731	-	-
Peterborough	6,594	35,330	71,543	-	-
Sub total	50,906	272,893	473,337	95	-
Provincial total	1,123,440	1,173,570	992,207	33,488	0

Total area (in hectares) in which forest tent caterpillar caused moderate to severe defoliation in Ontario from 1950 to 2020.



Gypsy moth

Pest information

Common name:	Gypsy moth
Scientific name:	*Lymantria dispar* (L.)
Pest origin:	Invasive — native to Europe
Pest type:	Defoliator
Host species:	Most hardwood species
Infestation area:	569,384 ha moderate to severe; 17,002 ha light

Provincial key facts

- Gypsy moth was discovered in Ontario in 1969, with the first incidence of severe defoliation recorded in Kemptville District in 1981.
- Gypsy moth outbreaks are cyclical, typically occurring every seven to 10 years. In Ontario, major outbreaks have peaked in 1985, 1991, and 2002. The most recent outbreak, which peaked in 2008, was much less severe than previous ones.
- Gypsy moth hosts include oak, birch, and aspen in the north and hardwoods, such as oak, sugar maple, and American beech, and softwoods, such as eastern white pine and Colorado blue spruce, in the south. In 2020, defoliation was severe on many types of trees, including secondary hosts such as eastern white pine.
- Cool, wet conditions provide an ideal environment for the proliferation of Entomophaga maimaiga (E. maimaiga), a fungus known to cause gypsy moth populations to collapse. Nuclear polyhedrosis virus (NPV) is a viral infection that is also known to kill gypsy moth larvae. Both were present at various levels in Peterborough, Bancroft, Kemptville, Guelph, and Midhurst districts in 2020. Other natural enemies of gypsy moth known to affect populations include parasitoids and several types of predators.
- Defoliation caused by gypsy moth increased from 47,203 ha in 2019 to 586,385 ha in 2020, with both light and moderate to severe defoliation mapped during aerial surveys. This outbreak is the largest recorded in Ontario.
- In 2020, defoliation was mapped in all districts in Southern Region, except Algonquin Park, while in Northeast Region three districts had mappable gypsy moth defoliation. In Northwest Region, gypsy moth larvae were intercepted in oak nursery stock shipped from outside the regulated area to Thunder Bay. No defoliation was observed in Northwest Region.

Regional summary

Southern:

- In 2020, the largest area of moderate to severe gypsy moth defoliation was recorded in Peterborough District (159,578 ha). Most of it was in the northeast corner of the district, with less in southcentral and southwest areas. In the northeast, large areas of moderate to severe defoliation were recorded north of Sydenham (Frontenac County) along the Kemptville District boundary to the district junction of Bancroft/Peterborough/Kemptville near Clarendon Station. Defoliation stretched west along the Peterborough/Bancroft district boundary into the northern part of Lennox and Addington County on both sides of Hwy 7. The defoliated area narrowed as it continued west into Hastings and Peterborough counties, predominantly on the south side of the Hwy 7 corridor. Smaller, more fragmented areas of defoliation were recorded at the furthest extent of the northwestern defoliation, along the Bancroft/Peterborough district boundary near White, Clear, Lower Buckhorn, Sandy and Big Bald lakes (Peterborough County).
- In the southern part of the district, moderate to severe defoliation was also mapped in Northumberland, Hastings, Peterborough, and Kawartha Lakes counties. The largest area was in the central part of Northumberland County between Rice Lake and Hwy 401. On the southwest side of Hastings County, moderate to severe defoliation was recorded south of Sterling to Wooler near the western boundary of Hastings County. Small areas of defoliation were also recorded close to the southern boundaries of Peterborough County and Kawartha Lakes, south and southwest of the community of Millbrook near Hwy 115.
- Light defoliation totalling 1,950 ha was also mapped in Peterborough District. Most of it was in the northeast corner of the district in small areas between Frontenac Provincial Park and the community of Parham, north of Arden on the north side of Hwy 7 in Frontenac County, north of Beaver Lake, and scattered northwest of Kaladar in Lennox and Addington County. Small areas of light defoliation were also recorded in the northeast part of Hastings County, northeast of Queensborough, and in the southwest part of the county between Frankford and Stirling and just north of Wooler.
- In Bancroft District, 127,992 ha of moderate to severe defoliation were mapped predominantly on the southeast side of the district and continued into Peterborough, Kemptville, and Pembroke districts. The most concentrated area of defoliation was from the southeast boundary of Bancroft District westward along the south and north sides of Hwy 506 to the east side of Petroglyphs Provincial Park (Frontenac, Lennox and Addington, Hastings and Peterborough counties). Smaller, more scattered areas of moderate to severe defoliation were also observed north of this concentrated defoliation in the northeast corner of Frontenac County in the area of Norman and Long Schooner lakes as well as in Lennox and Addington County near Westemkoon and Otter lakes. Gypsy moth defoliation was also less concentrated west of Petroglyphs Provincial Park between the communities of Apsley and Buckhorn, predominantly in Kawartha Highlands Provincial Park (Peterborough County).

- Light defoliation totalling 1,892 ha was also mapped in a few areas in the southeastern part of Bancroft District. Small areas were recorded on the periphery of the moderate to severe defoliation in northern Frontenac County, north of Plevna near Buckshot and Reid lakes as well as in Lennox and Addington County on the east side of Westemkoon Lake, and a small area farther south at the north end of Skootamatta Lake. Only four small areas of light defoliation were found in southern Hastings County; two areas between the villages of Gunter and Gilmour southeast of Limmerick Lake and the other two farther north near the junction of Hwy 62 and Hwy 620 north of Omsby. Four fair size areas of light defoliation were recorded on the east and south sides of Peterborough County. On the east side, light defoliation was observed at the north end of Chandos Lake along Hwy 620, another area at the northeast end of Jack Lake, and a third area at the south end of West Twin Lake west of Hwy 46. The fourth area of light defoliation was in the southcentral part of the county near the Peterborough District boundary just outside of the southwest tip of Kawartha Highlands Provincial Park near Flynns Turn on Hwy 507.
- In 2020, new areas of the gypsy moth infestation were recorded in Kemptville District, totalling 84,563 ha of moderate to severe defoliation and 8,458 ha of light defoliation. All the moderate to severe defoliation was on the west side of the district along the Bancroft, Peterborough, and Pembroke district boundaries (Lanark and Leeds & Greenville counties). The most contiguous part of the defoliation was mapped north of Westport near Hwy 15 stretching north to the junction of Kemptville/Pembroke/Bancroft district boundaries in the area of Lavant Long and Clyde lakes, almost all in Lanark County. This concentrated area of defoliation ran eastward towards Arnprior along the Pembroke District boundary and petered out south of Carleton Place, Lanark, and Perth. A small, scattered area of moderate to severe defoliation was also recorded in the southwest part of the district on the west side of Charleston Lake and along the Gananoque River (Leeds & Grenville County).
- Most of the light defoliation was mapped on the eastern edge of the moderate to severe defoliation in Kemptville District. The largest areas of light defoliation were in the northwest corner of the district in Lanark County. On the north side of Hwy 7, large areas of light defoliation were recorded north of Lanark and northwest of Carleton Place to the junction of Pembroke/Bancroft/ Kemptville district boundaries. Smaller areas of light defoliation were southwest of Lanark, along Hwy 7 east of Brooke and north of Murphy's Point Provincial Park near Otty, Big Rideau, and Black lakes. In Leeds & Grenville County, light defoliation was mapped predominantly in the Charleston Lake area east of Lyndhurst. Smaller areas of light defoliation were recorded south of Westport, southeast of Rideau Lakes, and on the east side of Hwy 15 southeast of the community of Crosby.
- For the fourth consecutive year, moderate to severe gypsy moth defoliation (52,168 ha) was mapped in Guelph District. This defoliation was scattered throughout the district but was more concentrated on the southeast side in Hamilton-Wentworth, Brant, Niagara, and the eastern part of Haldimand-Norfolk counties. Within these counties, defoliation was mapped between Hamilton, Cambridge, and Brantford on the north side of Hwy 403. On the south side of Hwy 403, moderate to severe defoliation was observed west and south of Branford, stretching southeast to Caledonia, Hagersville, down to Dunneville, and between St. Catherines and Port Colborne. In the northwest part of the district, areas of moderate to severe defoliation were smaller and scattered in Huron, Perth, Waterloo, and Wellington counties. Huron County had the most defoliation, stretching

from Wingham in the north to Grand Bend in the south, with more between Grand Bend and Exeter. In southern Waterloo County, more concentrated defoliation was recorded west of Cambridge and south of Kitchener. In the northern part of the county, defoliation was scattered in small areas north of Waterloo close to the northwest county boundary and to a lesser extent in the northeast corner east of St. Jacobs and near the communities of Floradale and North Woolwich. In Perth County, most of the defoliation was in the south, from south and north of Stratford west to the county boundary near Chiselhurst. Most of this defoliation was in hardwood stands along creeks and rivers. In the northern part of Perth County, small areas of moderate to severe defoliation were mapped northwest of Listowel to County Road 16 and north of Listowel on the east side Hwy 23 near Palmerston. In Wellington County, most of the defoliation was south of Fergus and Brisbane, in and around Guelph Lake Conservation Area, southeast of Guelph near the university, and along Hwy 401 northeast of Punslinch Lake. In the northern part of Wellington County, small areas of defoliation were observed southwest of Harriston close to the county border, in and around Constoga Lake Conservation area south of Drayton, north and south of the town of Arthur, and on the south side of Hwy 89 southwest of the community of Conn near the northern county boundary.

- A small (636 ha) area of light defoliation was also mapped in Guelph District. It was west of Wingham towards Clinton on the west side of the district, west of Hamilton in the central part of the district, and between Colbourne and St. Catherines as well as west of St. Catherines in the southeast part of the district.
- In Aylmer District, 47,219 ha of moderate to severe gypsy moth defoliation were aerially mapped in 2020, the fourth consecutive year of defoliation in the district. Most of the moderate to severe defoliation was in the northern and eastern parts of the district in Halldimand-Norfolk, Oxford, Middlesex, and Lambton counties. Only a small area was recorded in the northeast part of Kent County and the eastern end of Elgin County. In Haldimand-Norfolk County, most of the defoliation was on the south side of Hwy 3 from Delhi and Courtland south to the hamlet Cultus, close to Port Rowan and Turkey Point. In the central and northern parts of the county, defoliation was recorded on the north side of Hwy 3, east of Delhi, and east of Simcoe as well as on the east side of Catfish Creek west of Townsend. Farther north, smaller scattered areas of defoliation were mapped between Windham Centre and the community of Vanessa, north of Waterford to the counties' northern boundary and between Bill's Corners and Hagersville. In Middlesex County, most of the moderate to severe defoliation was west of London and in scattered areas, reaching to the western boundary of the county through Strathroy, southwest to Bothwell and Newbury, and north past Parkhill and close to Thedford and Arkona. Small areas of defoliation were also detected north of London to the community of Lucan near the northern county boundary. South of London, defoliation was mapped on the edge of the city and on the southern side of Hwy 401 between Wilton Grove Road and Glanworth Drive on the east side of Highbury Avenue South. East of London, moderate to severe defoliation was evident on both sides of Hwy 401, with most north from Dorchester to Cobble Hill and farther north to Cherry Grove near the county boundary. Smaller scattered areas were also recorded between Elginfield and Fanshawe Lake east of Ballymote.

- A total of 2,103 ha of light defoliation was mapped in Aylmer District. Most of it was in Haldimand-Norfolk and Lambton counties and to a lesser extent in Middlesex, Oxford, and Elgin counties. In Haldimand-Norfolk County, the light defoliation was west of Port Dover and Simcoe on both sides of Hwy 3. In Lambton County, it was mostly in the central part near Oil Springs, with smaller areas between the communities of Thomyhurst and Terminus in the south, a few small areas on both sides of Hwy 402 farther north along Bear Creek near Warwick, and on the west side of Oil Heritage Road southeast of the community of Camlachie. In Middlesex County, light defoliation was observed on the west side of the county. Small areas were evident in the Strathroy area and on the south side of the Canadian National Railway line near the community of Glencoe. On the west side of Oxford County, light defoliation was mapped in four areas: two northeast and south of the town of Thamesford along Hwy 19, one farther north south of Wildwood Lake near Harrington, and one on the west side of Hwy 59 between Cassel Road and Hwy 8. In the east part of Elgin County, light defoliation was observed in two areas: one along the north side of Big Otter Creek near Eden and another farther south between Port Burwell and Vienna.
- In Midhurst District, 41,743 ha of moderate to severe defoliation were mapped during aerial surveys. Most of it was on the eastern side of the district in Simcoe and Dufferin counties and small scattered areas were recorded on the west side of the district in southern Bruce County. Only a small area of defoliation was observed in the mid-south part of the district in the southern part of Grey County. In Simcoe County, the most concentrated area of defoliation was in the north, stretching from the northwest side of Lake Simcoe to the peninsula at Awenda Provincial Park on the shores of Georgian Bay, including Christian Island and reaching south along the shoreline to Wasaga Beach. Some large areas of moderate to severe defoliation were mapped in the southwest part of Simcoe County along the county border north and northwest of Earl Rowe Provincial Park. South of the park, large areas of defoliation were mapped west and east of Tottenham between and north of County Road 1 and Hwy 9 west to the Dufferin/Simcoe county boundary near Hockley. Smaller, scattered areas of moderate to severe defoliation were observed in and around Midhurst and Springwater Provincial Park, south of Barrie on the west and east side of Hwy 400 near Innisfil, and farther south at Pinkerton and Bond Head. Scattered areas of defoliation were also found south of Wasaga Beach from Stayner south to the county boundary on the west and east sides of County Road 42 near the community of Banda. In the northeast corner of Dufferin County, large areas of moderate to severe defoliation were mapped from Randwick south along the county border to Rosemount and stretched west to Boyne Valley Provincial Park and the communities of Redickville and Conover along County Road 124. South of the larger areas of defoliation scattered moderate sized areas were recorded from the south side of Hwy 89 near the community of Violet Hill, to Mono Cliffs Provincial Park, farther south to Hockley Valley Provincial Park, and east over to the county boundary east of the junction of County Road 18 and County Road 7 near Hockley. Two small areas of moderate to severe defoliation were mapped in the southwest corner of Dufferin County, one east of Grand Valley on both sides of the Grand River and the other west, east, and north of the junction of County Road 24 and County Road 3 near Reading. On the west side of the district in southern Bruce County, moderate to severe defoliation was mapped in small areas south of Snake Creek near the communities of Turners and Paisley, predominantly along the east side of Bruce Road 1 down to Hwy 9 and across to Walkerton. In the mid-south part of the district, only small areas of moderate to severe defoliation were mapped in southern Grey County,

northeast of Mount Forest at the junction of Hwy 9 and Hwy 23 and north of South Saugeen River near the junction of Southgate Sideroad 55 and Southgate Road 8.

- A small (1,102 ha) area of light defoliation was also mapped in Midhurst District. Most of it was in the northern part of Simcoe County on the edge of areas with moderate to severe defoliation. Three areas of light defoliation were mapped between Lake Simcoe and Georgian Bay, one south of Hwy 12 near Victoria Harbour, the second also south of Hwy 12 on the shores of Bass Lake near Orillia, and the third on the east side of Hwy 400 between and south of Craighurst and Horseshoe Valley. A small area was also mapped in Simcoe County at the north and south ends of Wasaga Beach. Light defoliation was also observed in the south-central part of Bruce County, between Walkerton and the community of Kingarf along County Road 1 and County Road 9. Farther north, a small area of light defoliation was also observed southwest of Paisley and, south of Walkerton, light defoliation was noted northeast of Mildmay on both sides of Sideroad 15 N. One small area of light defoliation was mapped in Dufferin County between Boyne Valley Provincial Park and the junction of County Road 124 and County Road 17.
- In Aurora District, the area of moderate to severe gypsy moth defoliation increased from 1,949 ha in 2019 to 15,613 ha in 2020. All defoliation was in the southwest part of the district along the Guelph/Midhurst/Aurora district boundary, from Burlington in the south to Newmarket in the north, distributed among Halton, Peel, and York counties. A small area of moderate to severe defoliation was mapped east of Keswick (Cooks Bay, Lake Simcoe) between Warden Avenue (County Road 65) and Kennedy Road (County Road 3) near Mount Pleasant, York County.
- In Pembroke District, 13,547 ha of moderate to severe defoliation were mapped in the far south of the district, with small areas in central part of the district between Golden Lake and Barry's Bay. Large areas of moderate to severe defoliation were recorded between Glasgow Station and White Lake as well as areas east and west of White lake along the Pembroke/Kemptville district boundary. Large areas of defoliation were also noted between Norway and Calabogie Lake as well as south of Calabogie Lake to the southern Pembroke District boundary at Clyde Lake and west along the Madawaska River to the southeast and southwest sides of Black Donald Lake. At the district boundary, a small area of defoliation was recorded south of Matawatchan Provincial Park (Nature Reserve) south of Hutson Lake near Strong Lake. Southwest of Renfrew, a moderate size area of defoliation was mapped predominantly on the north side of Hwy 132 and to a lesser extent on the south side of the highway in the Shamrock area southeast of Colton Lake, Admaston Twp. A total of 859 ha of light gypsy moth defoliation were mapped in the southern part of Pembroke District on the edge of areas of moderate to severe defoliation. Most of this light defoliation was north of Calabogie Lake and along the northwest and northeast shores of Black Donald Lake. A small area was recorded farther southwest between Wilson and Centennial lakes along Centennial Lake Road.
- In Parry Sound District, gypsy moth caused 2,046 ha of moderate to severe defoliation in 2020, an increase from 177 ha mapped in 2019. All the defoliation was mapped south of Parry Sound except for moderate to severe defoliation north of Parry Sound on the west side of Mill Lake near Badger's Corners, another smaller area

southeast of Noble north of Portage Lake along the east side of Hwy 400, and a two tiny areas in Hagerman Twp between Dunchurch and Fairholme north of Orange Lake and on an island in Whitestone Lake. South of Parry Sound, a large area of moderate to severe defoliation was recorded from Parry Island to Depot Harbour along Wawbawzee Road. Smaller, scattered areas of defoliation continued south along Hwy 400 to Oastler and Horseshoe lakes and east to the start of Hwy 141 (Hayes Corners) as well as the southeast side of Whitefish Lake at the junction of Hwy 141 and Tally Ho Swords Road. More small, scattered areas of moderate to severe defoliation were mapped south along Hwy 400 near Portage and Blackstone lakes and the MacTier area and along the Healey Lake Road. A large area of defoliation was also recorded on the south side of Twelve Mile Bay near the mouth of Georgian Bay in and around O'Donell Point Provincial Park (Nature Reserve). The most southern gypsy moth defoliation in Parry Sound District was aerially mapped along Hwy 400 south of South Gibson Lake Road north of Six Mile Lake. During ground surveys, defoliation and egg masses were observed by Port Carling, Lake Muskoka, Tobin Island, Lake Rosseau, and Go Home Lake.

Northeast:

- In Sudbury District, 24,262 ha of moderate to severe defoliation was recorded in 2020, an increase from 93 ha mapped in 2019. Most of the moderate to severe defoliation was recorded in the Greater Sudbury area and smaller more scattered areas of defoliation were mapped in the southwest part of Sudbury District. In the Greater Sudbury area, gypsy moth defoliation was observed south of Capreol in the Hamner, Val Caron, and Blezard Vally areas as well as south of Wanapitei Lake and continuing south through Falconbridge, Wahnapitae, and to Chief Lake in the north part of Tilton Twp. Large areas of defoliation were also mapped in and around Sudbury to the west near Azilda and southwest to Lively and the Kelly Lake area. On the southwest side of the district, small areas of defoliation were found north of Espanola to Agnew Lake (Shakespeare and Baldwin townships), south to Aspey and Bass lakes (Merritt and Mongowin townships), and southeast to Walker Lake in the southern part of Truman Twp. A larger more concentrated area of defoliation was observed farther south, approaching Manitoulin Island in Lacloche Peninsula along Hwy 6 and smaller areas on the west side of Kilarney Twp on McGregor Point and on some small islands in Kilarney Bay, Rutherford Twp. Three small areas of gypsy moth defoliation were also found on the northern part of Manitoulin Island, one south of Little Current along Hwy 6 near Sheguiandah and the other two farther west and east of Ice Lake and close to Bridal Veil Falls on Kapawong River, both along Hwy 540. The most westerly areas of defoliation in Sudbury District were north of Hwy 17 near Shedden and Black lakes, close to the Sault Ste Marie District boundary, as well as south of Horseshoe Lake (Deagle Twp) and south and north of Denvic and Tube lakes (Victoria Twp). A little farther east, defoliation was recorded west and south of Massey on both sides of Hwy 17 in Salter and May townships.
- In North Bay District, 407 ha of moderate to severe defoliation were mapped in 2020. Small areas were documented on the southeast side of the district mostly south of Hwy 17 east of North Bay, including south of Rutherglen along Sharpes Creek, south of Eau Claire Gorge Conservation Area west of Hwy 630 (Calvin Twp), and on the east side of Wasi Lake near Booth Landing and near Fossmill, both in Chisolm Twp. On the north side of Hwy 17, a small area of moderate to severe defoliation was mapped along Songis Road southeast of Redbridge on

the west side of Phelps Twp.

- In Sault Ste. Marie District, 246 ha of moderate to severe defoliation were recorded in the southwest portion of the district between Thessalon and Blind River. Small scattered areas were recorded on the north side of Basswood and Clear lakes, and on the south side of Bright Lake in Bright and Bright Additional townships. One small strip of defoliation was mapped east of Livingstone Creek between Maple Ridge Road and Hwy 17. A small area of defoliation was also observed between Bright and Dean lakes as well as on the northwest end of Dean Lake. Closer to Blind River, three areas of defoliation were observed in Cobden Twp, two near Village Road, the other at the south end of the Old Landfill Site Road. During ground checks, female gypsy moth were laying large healthy egg masses on the north side of Basswood Lake, and small but numerous gypsy moth egg masses were observed on Melwel Road at Clear Lake.

Northwest:

- In the City of Thunder Bay, nursery stock infested with gypsy moth larvae was detected upon arrival from southern Ontario. This interception was outside the regulated area for gypsy moth in Ontario. Trees and larvae were contained, and follow-up surveys were completed by the Canadian Food Inspection Agency.

- Gypsy moth traps were deployed in various locations in Northwest Region in 2019, but the 2020 trapping program was deferred. No gypsy moth adults were trapped in 2019.

Trend analysis/outlook/issues

Gypsy moth outbreaks typically last two to four years. Potentially severe populations of gypsy moth are forecasted for southern Ontario during 2021. How quickly populations collapse will depend on the abundance of the gypsy moth virus (NPV) and the E. maimaiga fungus. High humidity and frequent rainfall promote the fungus while virus activity depends on population size. The effects of control measures and spray programs led by private landowners and municipalities will also affect the 2021 outcome.

Gypsy moth defoliation forecast survey

In Ontario, gypsy 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 gypsy moths lay eggs in August in brownish tan coloured masses, in which the number of eggs varies from 100 to 1,000. Within 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 are counted in the fixed

area plot and egg masses on the ground 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. 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 to forecast gypsy moth defoliation. More than 6,175 egg masses/ha indicates potential for severe (>75%) defoliation. Estimates of 1,236 to 6,175 egg masses/ha indicate potential for moderate (40–75%) defoliation and 1 to 1,235 egg masses/ha indicate potential light defoliation (1–40%).

During leaf off in November to December 2020, 36 locations in seven Southern Region districts were surveyed for gypsy moth egg masses: Aurora (5), Aylmer (6), Bancroft (2), Guelph (5), Kemptville (4), Midhurst (6), and Peterborough (8). The defoliation forecast for 2021 was severe for all locations, except for one in Guelph District that was moderate.

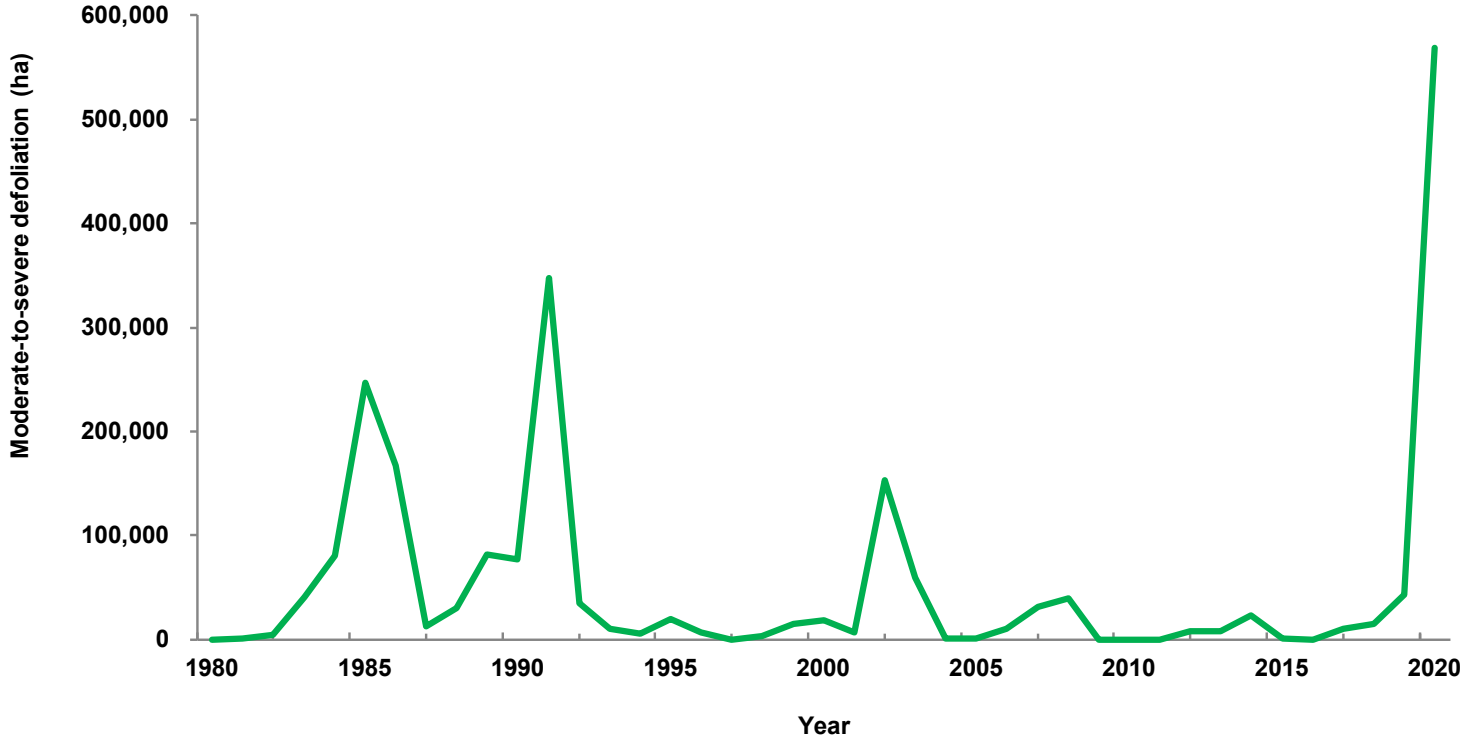
During the survey, a closer investigation of egg masses revealed predation (birds, small mammals) and parasitism at some sites. Small pinholes in egg masses indicated the presence of the tiny parasitic wasp, Ooencyrtus kuvanae. Prevalence of egg parasitism varied and was highest in Aylmer District (88%), intermediate in Guelph (58%), Aurora (47%), and Midhurst (27%) districts, and low in Bancroft (11%), Peterborough (7%), and Kemptville (5%) districts.

Total area (in hectares) in which gypsy moth caused moderate to severe defoliation from 2016 to 2020 by NDMNRF district.

Region	Area of defoliation (ha)				
District	2016	2017	2018	2019	2020
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	407
Sault Ste. Marie	-	-	-	-	246
Sudbury	-	-	-	93	24,262
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Sub total	0	0	0	93	24,916

District	2016	2017	2018	2019	2020
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	2,764	1,949	15,613
Aylmer	-	627	983	19,994	47,219
Bancroft	-	-	-	-	127,992
Guelph	-	8,768	11,154	17,557	52,168
Kemptville	-	-	-	-	84,563
Midhurst	-	-	36	2,978	41,743
Parry Sound	-	-	-	177	2,046
Pembroke	-	-	-	-	13,547
Peterborough	-	1,461	-	409	159,578
Sub total	0	10,856	14,937	43,065	544,468
Provincial total	0	10,856	14,937	43,158	569,384

Total area (in hectares) in which gypsy moth caused moderate to severe defoliation in Ontario from 1980 to 2020.



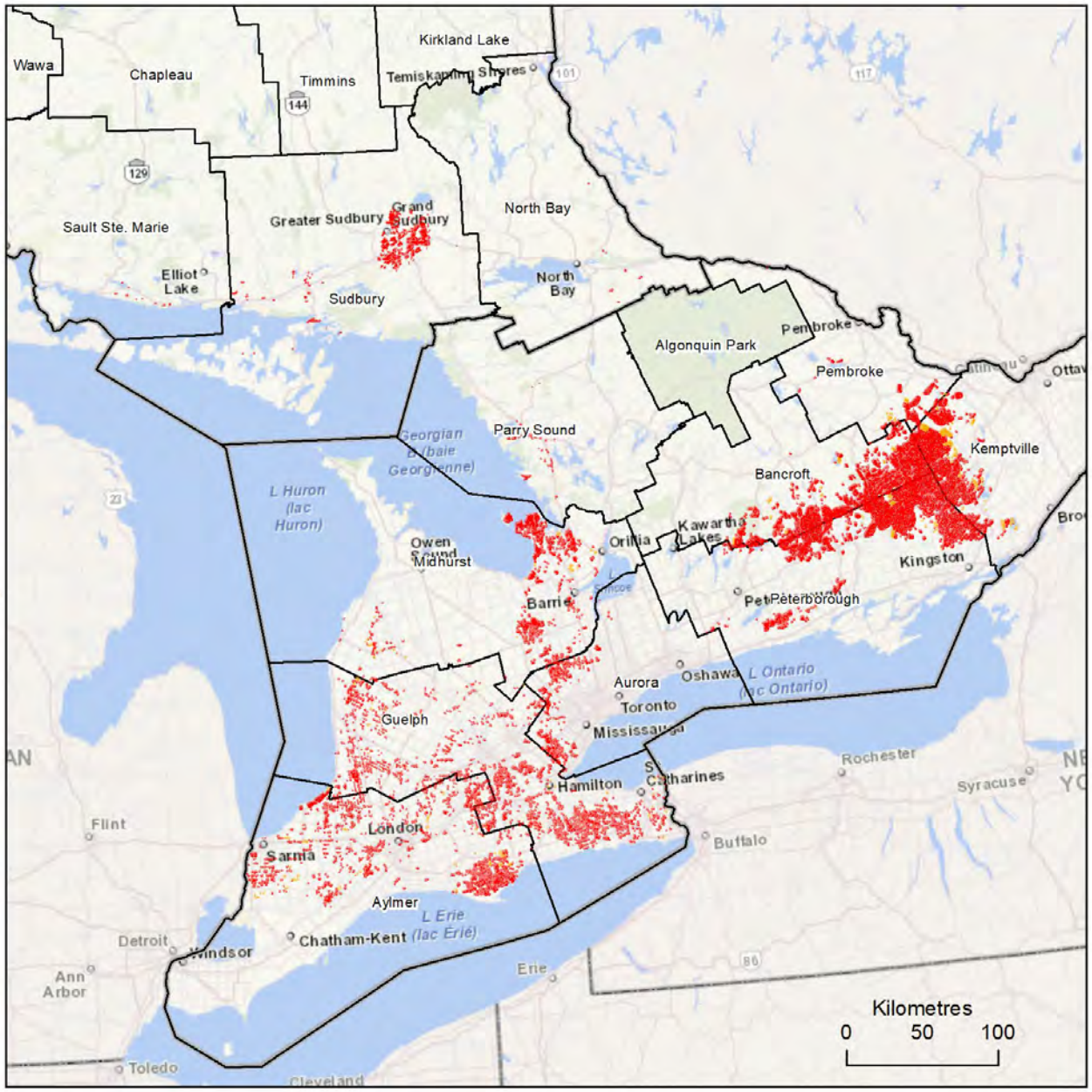
Gypsy moth 2020

Areas in Ontario where gypsy moth caused defoliation

Light = 17,002 ha
Moderate to severe = 569,384 ha

Area of light defoliation

Area of moderate to severe defoliation



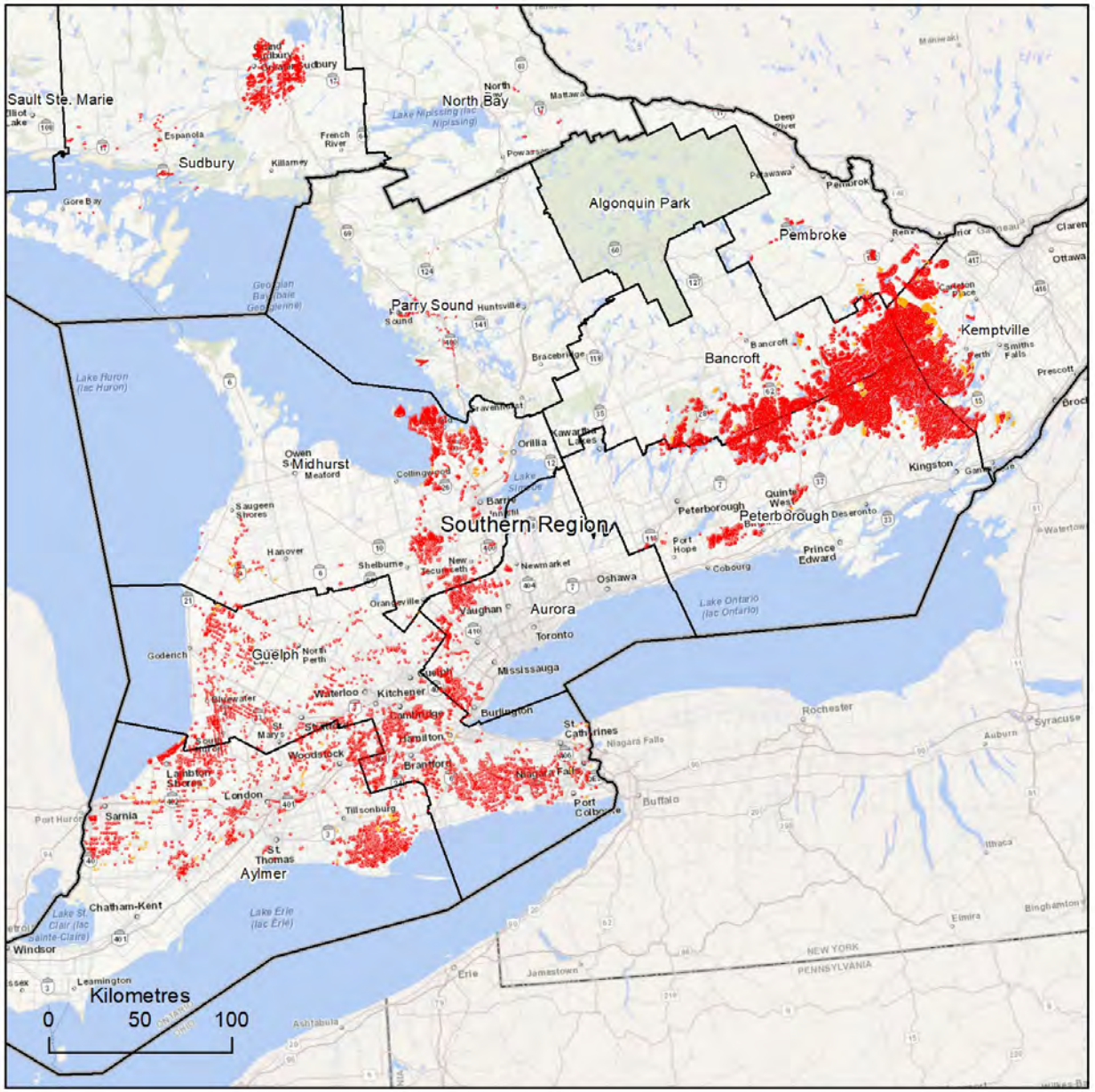
Gypsy moth 2020

Areas in the Southern Region where gypsy moth caused defoliation

Light = 17,002 ha
Moderate to severe = 544,468 ha

Area of light defoliation

Area of moderate to severe defoliation

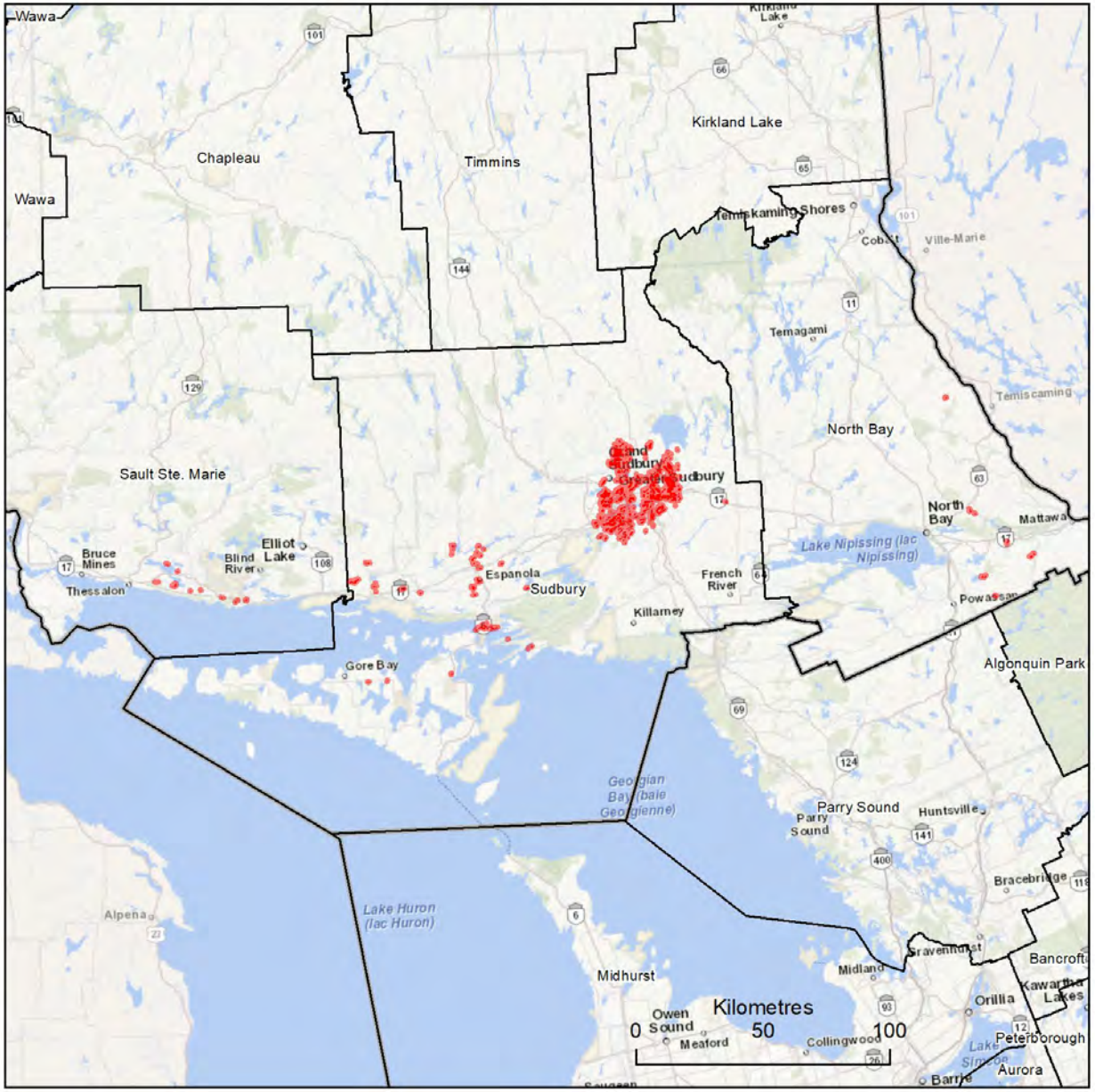


Gypsy moth 2020

Areas in the Northeast Region where gypsy moth caused defoliation

Moderate to severe = 24,916 ha

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



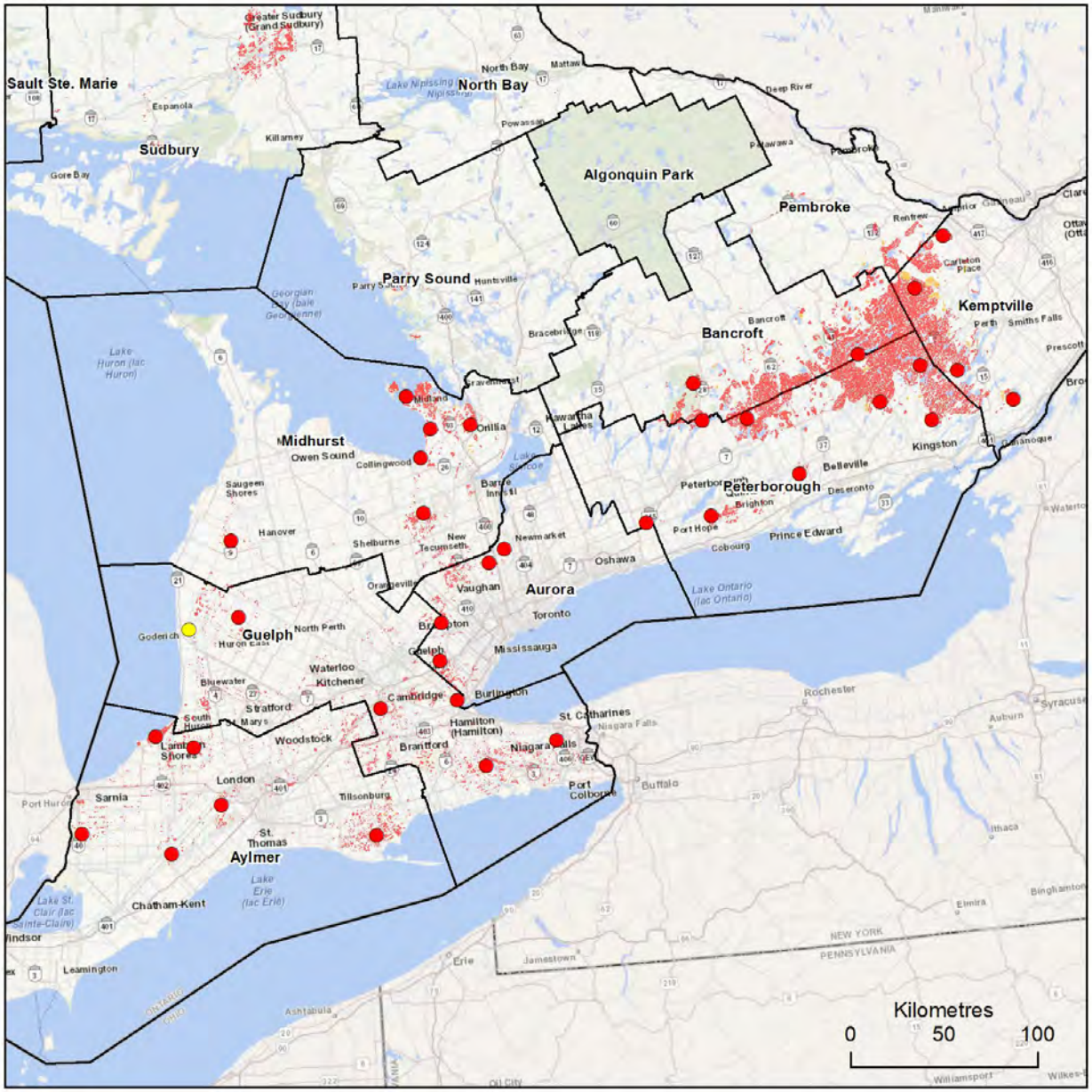
Gypsy moth egg mass survey results

Defoliation forecast 2021

- Severe
- Moderate

Gypsy moth damage 2020

- Area of moderate to severe damage
- Area of light damage



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:	929,763 ha (moderate to severe) 136,161 ha (light)

Provincial key facts

- Jack pine budworm outbreaks occur in Ontario about every eight to 10 years.
- In the past, large-scale control programs have been undertaken to protect high value jack pine stands during an outbreak, with the most recent carried out in 2019 in Northwest Region.
- In 2020, 1,065,796 ha of jack pine budworm defoliation were aerially mapped, primarily in Northwest Region with a small area in Northeast Region. Most (929,763 ha) of the defoliation was moderate to severe.

Regional summary

Northwest:

- Sioux Lookout District had the most area defoliated by jack pine budworm, with 377,043 ha of moderate to severe defoliation. All defoliation was recorded in the southern half of the district from Spruce River in the Menako Lakes area in the north to the Dryden District boundary in the Minnitaki Lake area. And it stretched from the western to the eastern boundary of Sioux Lookout District. The northern part of the infestation involved scattered small areas of moderate to severe defoliation from Menako Lake to Lake St. Joseph, with some larger areas of defoliation on the western side from Slate Falls to the northern tip of Lac Seul. In the southern part of the infestation, large areas of moderate to severe defoliation were observed on the east side of Lac Seul to the Dryden District boundary in the Lake of Bays area. Smaller to more moderate size areas of defoliation were recorded further east towards the Thunder Bay District boundary south of Lake St. Joseph towards the Savant Lake area. Smaller to more moderate size areas of defoliation were also mapped on the southwest side of the district between Lac Seul and Sunlight Lake near the Red Lake District boundary.

- In Dryden District, 326,045 ha of jack pine budworm defoliation were recorded in 2020, with 321,062 ha of moderate to severe and 4,984 ha of light defoliation. Almost no area was unaffected by jack pine budworm except for the southwest corner of Dryden District. Larger areas of contiguous moderate to severe jack pine budworm defoliation were mapped from Lac Seul to the town of Dryden, from the southwest end of Minnitaki Lake to Mennin Lake south of Hwy 17, the east side of Minnitaki Lake to East English River Provincial Park and from Savant Lake to Lake of Bays near the Sioux Lookout boundary. Smaller areas of defoliation were mapped in all directions from these larger areas of moderate to severe defoliation including the east side of the district from Seseganaga Lake to Moberley Lake near the Thunder Bay District boundary, near the town of Ignace on the north and south sides of Hwy 17, between Dryden and Ignace, west of Dryden to Vermillion Bay to the Kenora District boundary, and along the south central part of the district bordering the Fort Frances District in the Turtle River area from Rawlinson Lake to Smirch Lake. Smaller more scattered areas of moderate to severe defoliation were also observed along the Fort Frances District boundary a bit further west between Bunyan Lake (Dryden District) and Upper Manitou Lake (Fort Frances District). All the light defoliation was recorded on the east side of Dryden District along the Thunder Bay District boundary from the northeast corner of the district, east of Brightsand River Provincial Park, to southwest of Kopka River Provincial Park in the Empire Lake area.

- In Red Lake District, 186,320 ha of jack pine budworm defoliation were mapped in 2020, with 112,425 ha of moderate to severe and 73,894 ha of light defoliation. Most of the moderate to severe defoliation was mapped on the southeast side of the district from Shabumeni Lake in the north to Lac Seul (Mackenzie Bay) and east to the Sioux Lookout District boundary from Deaddog Lake to Pilot Lake in the southeast corner of Red Lake District. Moderate to severe defoliation was also recorded in the southcentral part of the district near the Kenora District boundary southeast of Woodland Caribou Provincial Park. Defoliation was observed from the northeast end of Sydney Lake down to Roger Lake at the Kenora District line. Smaller scattered areas of moderate to severe defoliation were mapped in the central part of the Red Lake District from Nungessor Lake to the north and south sides of Red Lake. The light defoliation was mostly in the central part of Red Lake District from Pikangikum to west of the town of Red Lake and on the east side of Trout Lake from the south end of Upper Goose Lake to Lac Seul near the Sioux Lookout District boundary. Smaller areas of light defoliation were in the northern and southern ends of Woodland Caribou Provincial Park and in the south near the Kenora District boundary in the area of Longlegged, Pineneedle, and Confusion lakes. All this light defoliation might reflect the start of the collapse of the infestation in Red Lake District.

- In Kenora District, 157,498 ha of jack pine budworm defoliation were mapped, with 112,902 ha of moderate to severe defoliation and 44,596 ha of light defoliation. Almost all the defoliation was in the north central part of the district on the north side of Hwy 17, with only a small amount of light defoliation on the south side of Hwy 17 near the city of Kenora. Larger areas of moderate to severe defoliation were noted close to the Manitoba border on the northwest side of the district from the Kenora/Red Lake District boundary near Eagle Lake in the north to South Scott and Gun Lake as well as a little east of Big Sand Lake. Defoliation near Hwy 17

was less intense, with light defoliation mapped from Greenwater Lake to Gooseneck Lake. Further east, areas of defoliation were smaller and more scattered from the Red Lake border to Grassy Narrows and continuing south to Hwy 17 near Willard Lake. These areas were almost equally split between light and moderate to severe defoliation. On the northeast side of the district, more moderate to severe defoliation was evident from the Kenora/Red Lake district boundary to the Kenora/Dryden district boundary. A line of defoliation went from Anishinabi Lake reaching south to canyon and Bowden lakes. Closer to the eastern district boundary, defoliation was a mix of moderate to severe with light defoliation from just north of Perrault Falls to Redbuff and Ladysmith lakes in the south.

- On the west side of Thunder Bay District, 16,243 ha of jack pine budworm defoliation were recorded in 2020, much of it (12,482 ha) light. Most of the defoliation was recorded in the northwest corner of Thunder Bay District along the Sioux Lookout and Dryden district boundaries in Wabakimi Provincial Park. A mix of light and moderate to severe defoliation covered the area from Whitewater Lake to Rockcliff Lake and Burntrock Lake. Light defoliation was also recorded between Burntrock and Wabakimi lakes, stretching south to Brightsand River and Osprey Lake. Further south, a mix of light and moderate to severe jack pine budworm defoliation was recorded northwest of Upsala from English River along Hwy 17, north to Selwyn, Wawang and Moberley lakes.

- In the northern part of Fort Frances District, 2,648 ha of jack pine budworm defoliation were mapped along the Fort Frances/Dryden district boundary; an increase from the 139 ha of defoliation observed in 2019. Most of the defoliation mapped in 2020 was moderate to severe (2,442 ha) with a small amount (206 ha) of light recorded. The largest increase of area was an expansion of what was recorded in 2019 between Upper Manitou Lake (Fort Frances District) and Bunyan Lake (Dryden District). New areas of moderate to severe defoliation were recorded further east along the district boundary northwest of Turtle River Provincial Park on the west and east sides of Hwy 622 close to the north end of Pekagoning Lake. The area of light defoliation was a bit further east at the northwest end of Otter Lake.

Northeast:

- In Sudbury District, 128 ha of moderate to severe jack pine budworm defoliation were mapped in the southwest corner of the town of Espanola, around the Espanola Regional Hospital and Health Centre. The defoliation on some trees were so severe that all new foliage was gone and budworm had been feeding on old foliage.

Jack pine forest health plots

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

- In 2020, 98 plots (47 in Northeast Region, 51 in Northwest Region), comprising 4,900 jack pine trees, were assessed. Trees were rated for the presence of any pest, disease, or abiotic factors that affect health/condition. Due to travel restrictions associated with COVID-19, the male flower survey was not done in 2020.

Regional plot summary

- In Northeast Region, 73% of the live jack pine trees were less than 25% defoliated, while in the Northwest Region 21% were less than 25% defoliated, 59% were 25 to 75% defoliated, and 20% were more than 75% defoliated. These numbers reflect the current jack pine budworm outbreak in Northwest Region. In Northeast Region, 98% of live jack pine trees had live tops and in Northwest Region 90% of the trees had live tops, with six per cent having bare tops and four per cent with dead tops.

- In 2020, 44 trees in jack pine plots in Northeast Region died. This mortality was caused mostly by armillaria root rot (61%), abiotic factors such as blowdown (17%), wood borers (7%), but for 18% of the dead trees the cause was unknown.

- In Northwest Region, 43 trees died in jack pine plots. Most (60%) of the mortality was due to consecutive years of moderate to severe defoliation by jack pine budworm. Other causes of mortality included armillaria root rot (25%), abiotic factors such as blowdown, as well as some porcupine damage.

- In Northwest Region, 34 plots had some jack pine budworm defoliation. Most of these plots were in Red Lake, Dryden, and Sioux Lookout districts, only two plots in Kenora District, and none in Fort Frances District. The plots in Red Lake District averaged 35% defoliation, those in Dryden District averaged 49% defoliation, in Sioux Lookout averaged 43%, and in Kenora District averaged 46% defoliation. In Dryden District, a jack pine health plot southeast of Dryden in Hyndman Twp had the highest average jack pine budworm defoliation at 69%. In Northeast Region, jack pine budworm defoliation was not found in the forest health plots.

- In Northeast Region, 74% of the live trees in the forest health plots had no significant pests affecting them. Western gall rust was observed on 25% of the live trees. In Northwest Region, 68% of the live trees were affected by jack pine budworm while most (31%) of the other live trees had no pests.

Trend analysis/outlook/issues

Jack pine budworm outbreaks typically last two to four years. After two years of defoliation in Northwest Ontario, forecasts were for moderate to light defoliation in most areas during 2021. Previous studies have found that severe defoliation by Jack Pine budworm results in fewer pollen cones the following year, an important refuge for larvae during the spring. Parasitism of late larval stages and pupae also contribute to populations declines (McCullough 2019).

Jack pine budworm defoliation forecast survey

In Ontario, jack pine budworm defoliation forecasting is based on surveys of the number of overwintering larvae on tree branches. Jack pine budworm spend the winter as second instar larvae (L2) by encapsulating themselves in silken shelters (hibernacula) under branch scales and bark cracks. These larvae typically spend the winter in shelters from late August until the following spring. This overwintering stage of the lifecycle provides an opportunity 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 and are generally in or near the current defoliation. Areas historically prone to jack pine budworm defoliation were selected as well, as were high value jack pine stands near infestations. 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 that extracts 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 was used to forecast expected jack pine budworm defoliation in 2021. 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.

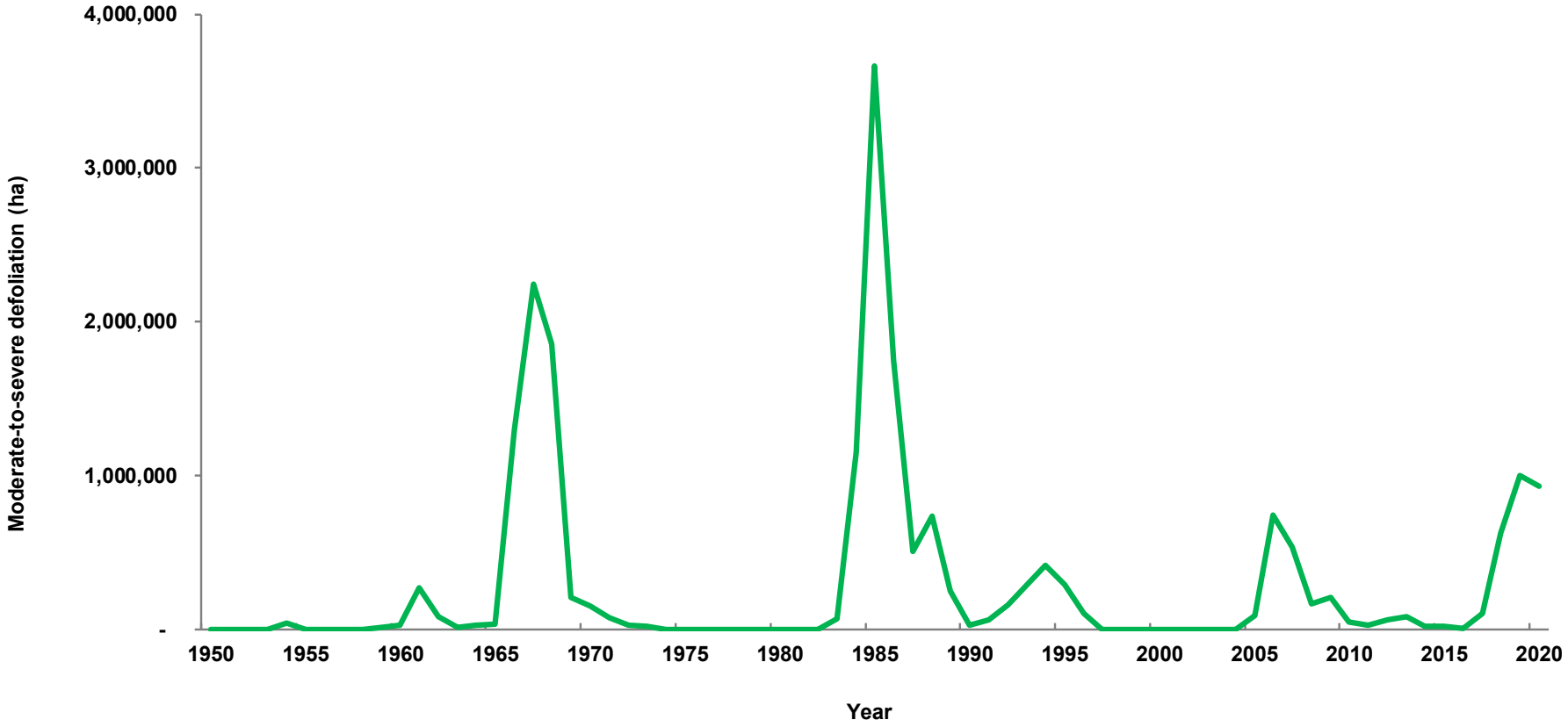
In Northwest Region, 59 locations (590 trees) were sampled in 2020. Over half of these locations were in Dryden District (30), with the remainder divided among Sioux Lookout (14), Kenora (8), and Red Lake (7) districts. Defoliation forecasts for 2021 for Dryden District were severe for two locations sampled, moderate for 16, and light for 12. For Sioux Lookout District, defoliation forecasts were severe for one location sampled, moderated for four, and light for nine. For Kenora District, forecasts were severe for one location, moderate for five, and light for two. For Red Lake District all forecasts were for light defoliation.

In Northeast Region, five locations were sampled in 2020. All locations were in Sudbury District in jack pine stands historically defoliated by jack pine budworm and close to the area of defoliation mapped in 2020. The defoliation forecast for 2021 is light except where defoliation was mapped in 2020 near Espanola where the forecast is severe.

Total area (in hectares) in which jack pine budworm caused moderate to severe defoliation from 2016 to 2020, by NDMNRF district.

Region	Area of defoliation (ha)				
District	2016	2017	2018	2019	2020
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	2,403	-	-	-	-
Sudbury	-	-	-	-	128
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Sub total	2,403	0	0	0	128
Northwest					
Dryden	-	-	3,603	105,209	321,062
Fort Frances	-	-	-	139	2,442
Kenora	-	-	10,278	51,126	112,902
Nipigon	2,020	-	-	-	-
Red Lake	-	100,187	613,574	771,404	112,425
Sioux Lookout	662	-	-	73,381	377,043
Thunder Bay	-	-	-	10	3,761
Sub total	2,682	100,187	627,455	1,001,269	929,635
Provincial total	5,085	100,187	627,455	1,001,269	929,763

Area (in hectares) of moderate to severe defoliation caused by jack pine budworm in Ontario, 1950–2020.



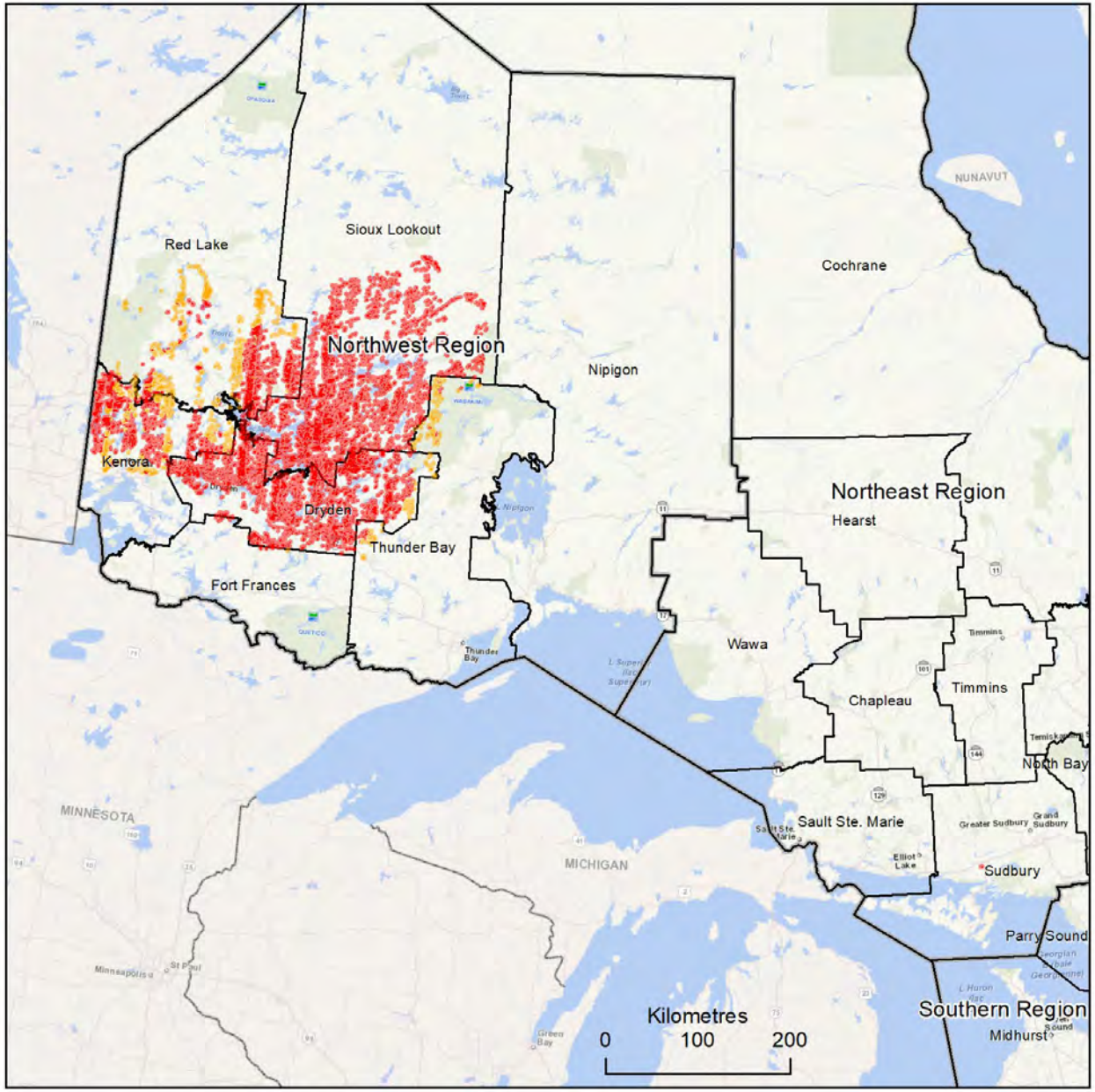
Jack pine budworm 2020

Areas in Ontario where jack pine budworm caused defoliation

Light = 136,161 ha
Moderate to severe = 929,763 ha

Area of light defoliation

Area of moderate to severe defoliation



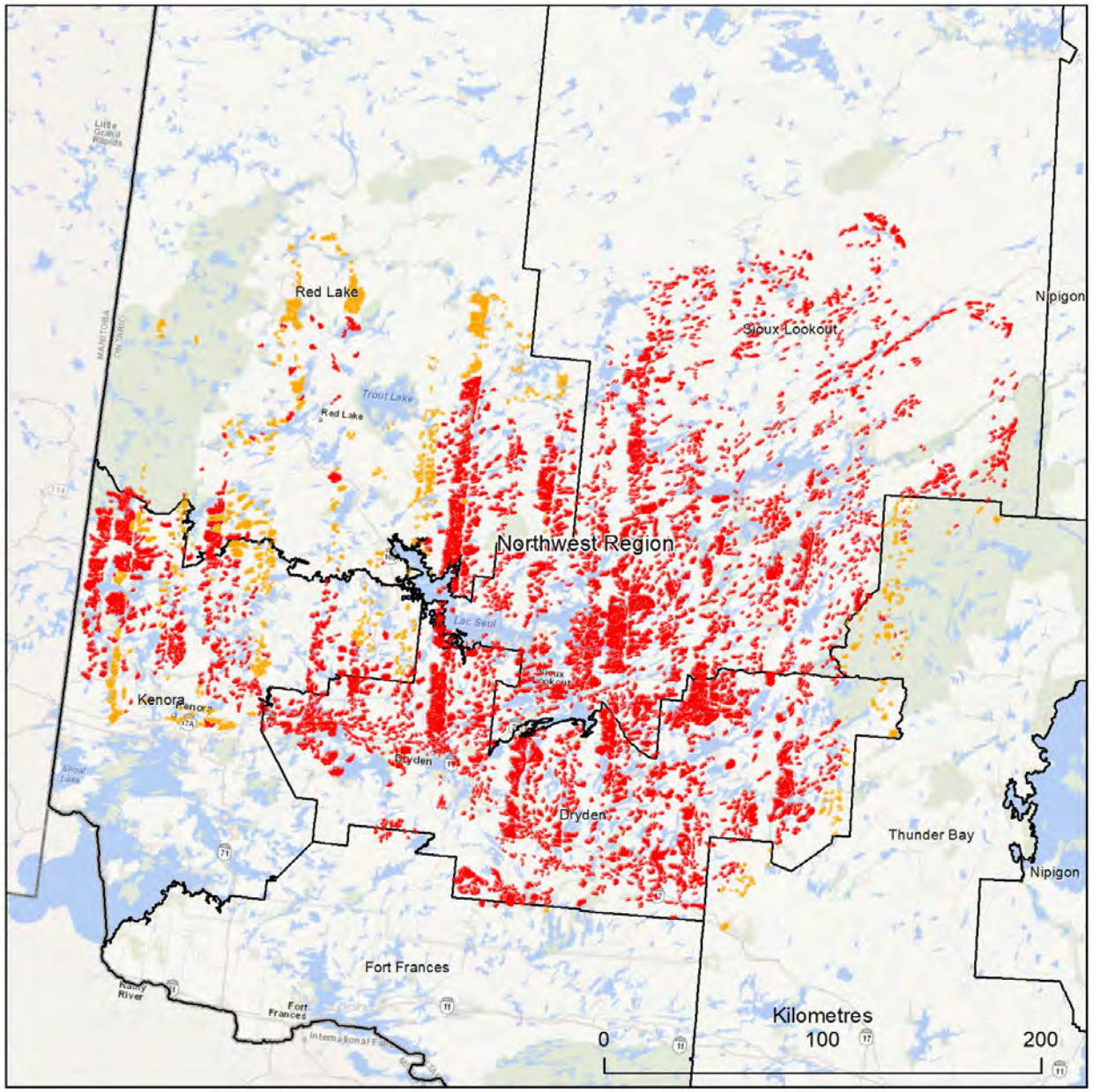
Jack pine budworm 2020

Areas in Northwest Region where jack pine budworm caused defoliation

Light = 136,161 ha
Moderate to severe = 929,635 ha

Area of light defoliation

Area of moderate to severe defoliation

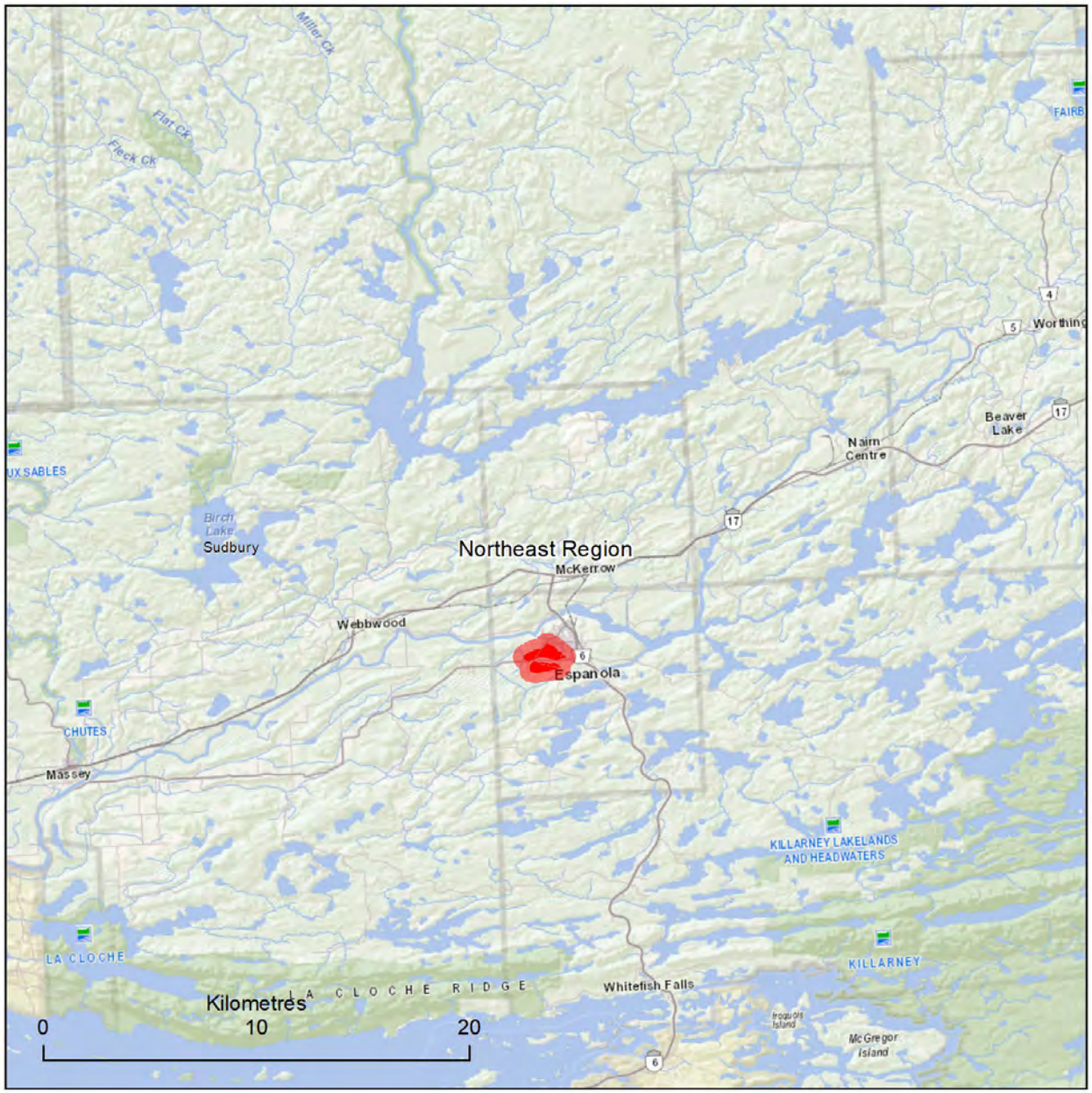


Jack pine budworm 2020

Areas in Northeast Region where jack pine budworm caused defoliation

Moderate to severe = 128 ha

Area of moderate to severe defoliation



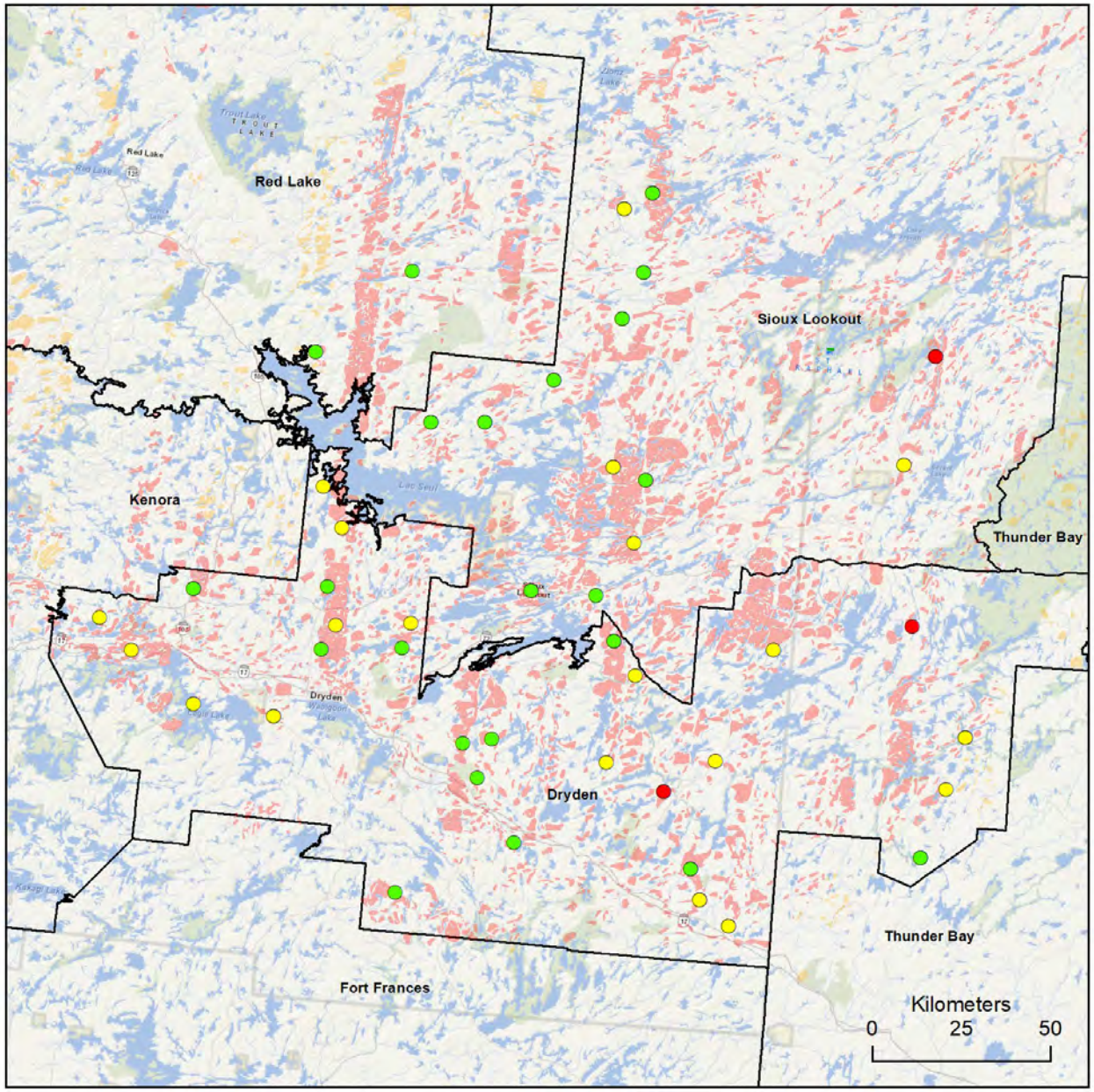
Jack pine budworm second instar larvae survey results

Defoliation Forecast 2021

- Severe
- Moderate
- Light

Jack Pine Budworm Defoliation 2020

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



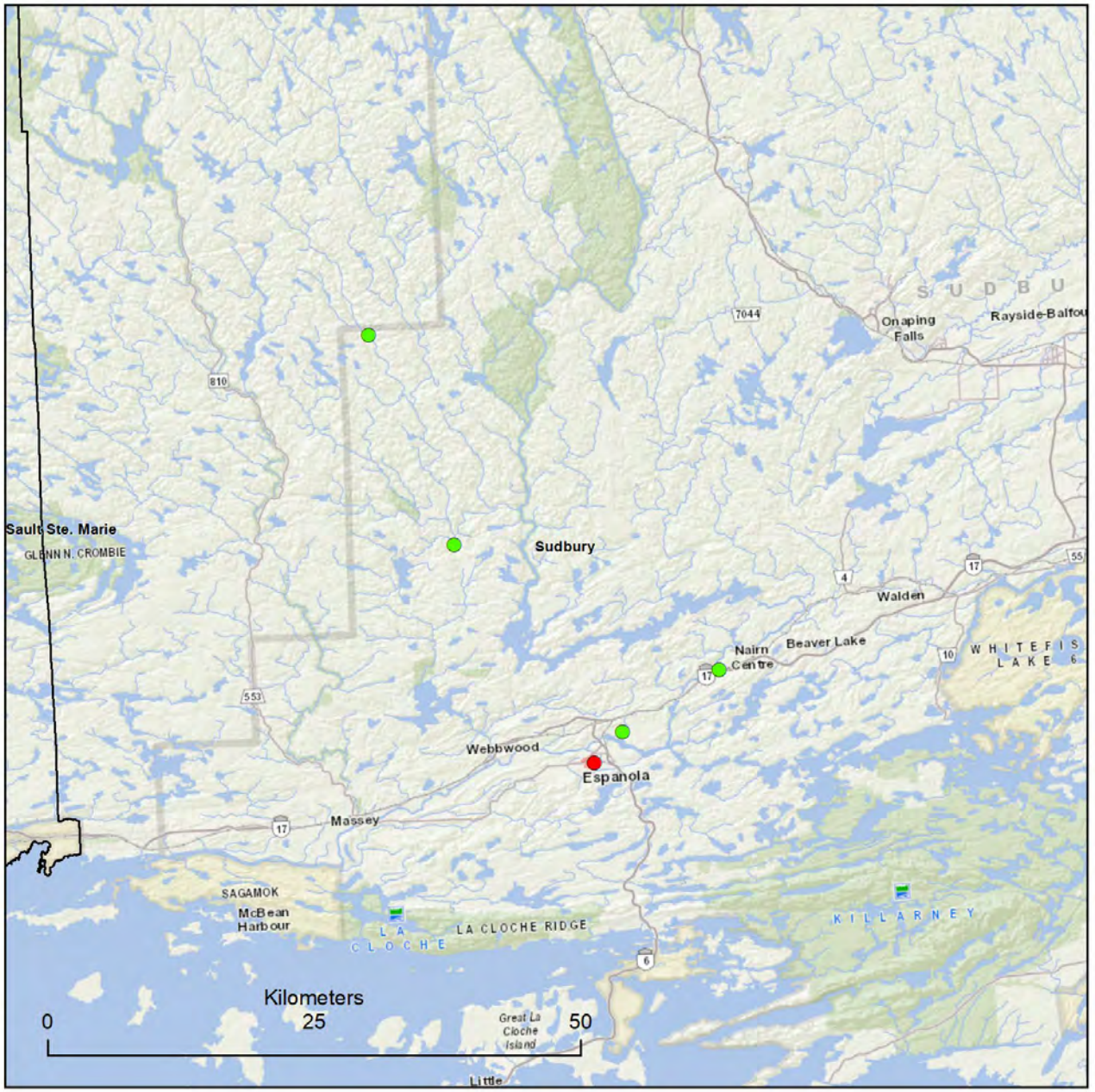
Jack pine budworm second instar larvae survey results Northeast Region

Defoliation Forecast 2021

- Severe
- Light

Jack Pine Budworm Defoliation 2020

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



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:	22,759 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 2020, large aspen tortrix defoliation was mapped across the Northeast Region

Regional summary

Northeast:

- In Cochrane District, 13,651 ha of moderate to severe large aspen tortrix defoliation were mapped. The heaviest areas of defoliation were observed northwest of Lake Abitibi, around the Town of Iroquois Falls, north of the Town of Cochrane, and south of Little Abitibi Lake. Ground checks confirmed defoliation all the way to the Ontario/Quebec border along Translimit Road.
- In Kirkland Lake District, 4,143 ha of moderate to severe defoliation from large aspen tortrix were mapped west of Earlton on the north side of Hwy 65, along Hwy 101 heading west from Hwy 672, and south of Matheson along Hwy 11 to Ramore. During ground surveys moderate defoliation from large aspen tortrix was observed south of Larder Lake along Hwy 624. This area was not aerially mapped.
- In Timmins District, 2,737 ha of moderate to severe defoliation were mapped in the northeast corner of the Timmins District. One small area in the southern part of the district was mapped north of Hwy 560 in Kelvin

Twp. The heaviest areas of defoliation were observed north, northeast, and southwest of Night Hawk Lake and south of Moose Lake.

- In Sudbury District, 1,524 ha of moderate to severe defoliation from large aspen tortrix were mapped on Manitoulin Island, along Hwy 6, north and south of Lake Kagawong and a small area north of Providence Bay. A small area of defoliation was also mapped on the mainland south of Vermillion Lake, northeast of Fairbank Provincial Park
- In Wawa District, 313 ha of moderate to severe large aspen tortrix defoliation were mapped east of Hwy 631, between Hornepayne and White River, at the south end of Breckenridge Twp, and the north end of Doucette Twp.
- In Sault Ste. Marie District, 266 ha of moderate to severe large aspen tortrix defoliation were mapped in the southern part of the district. Most of the defoliation was recorded northwest of Bruce Mines towards Lake George. Four small areas were seen on the east side of Hwy 17 in Laird and Macdonald townships, three south of Bar River, and one north of Bar River. Several small areas of defoliation were also observed in the Gordon Lake area in Aberdeen Additional, Johnson, and Plummer townships as well as another small area at the southeast end of Desbarats Lake, also in Johnson Twp. A small area of large aspen tortrix defoliation was also detected east of Bruce Mines on the north side of Hwy 17 close to the Huron Central Railway line on the southeast side of Plummer Additional Twp. Closer to Sault Ste Marie, a small strip of defoliation on young aspen trees was recorded along Hwy 17 west of Garden River.
- In North Bay District, 124 ha of moderate to severe defoliation from large aspen tortrix were mapped north of the City of North Bay on the east side of Hwy 11 in Widdifield Twp and between Latchford and Temagami on the west side of Hwy 11 south of Three Sisters Lake, Best Twp .
- In the southern part of Chapleau District, trace defoliation from large aspen tortrix was observed during ground surveys around Flame Lake Road off Hwy 129.

Total area (hectares) in which large aspen tortrix caused moderate to severe defoliation from 2016–2020 by NDMNRF district.

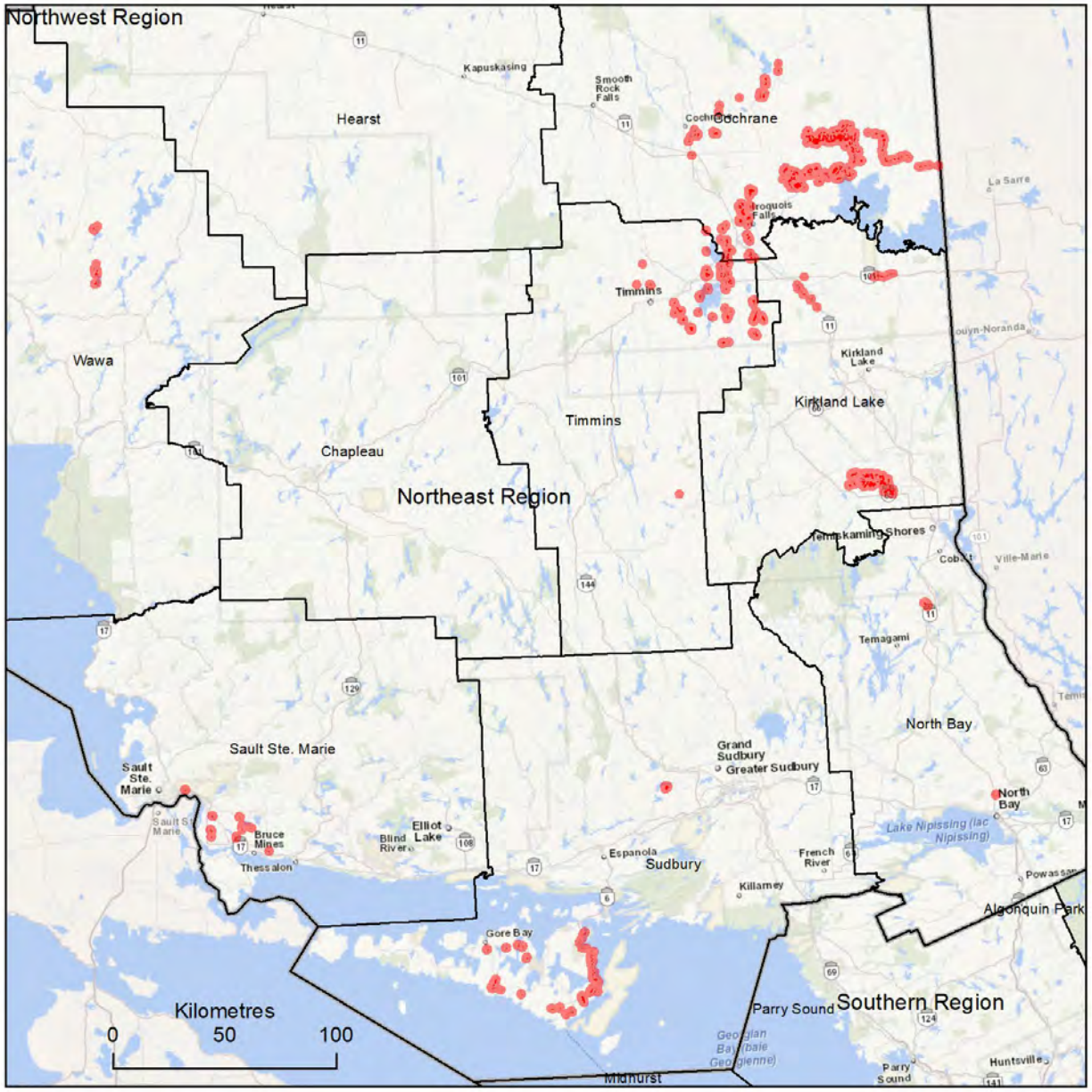
Region	Area of defoliation (ha)				
District	2016	2017	2018	2019	2020
Northeast					
Chapleau	19,521	34,084	27,701	357	-
Cochrane	-	-	-	6,171	13,651
Hearst	86	-	36	-	-
Kirkland Lake	-	-	-	379	4,143
North Bay	-	-	-	-	124
Sault Ste. Marie	-	-	1,375	-	266
Sudbury	-	-	-	-	1,524
Timmins	2,980	12,355	9,716	9,641	2,737
Wawa	-	1,858	379	-	313
Sub total	22,587	48,297	39,206	16,548	22,759
Provincial total	22,587	48,297	39,206	16,548	22,759

Large aspen tortrix 2020

Areas in the Northeast Region where large aspen tortrix caused defoliation

Moderate to severe = 22,759 ha

Area of moderate to severe defoliation



Oak decline and mortality

Pest information

Common name:	Oak decline and mortality
Scientific name:	*NA*
Pest origin:	NA
Pest type:	Complex
Host species:	Red oak
Infestation area:	570 ha

Provincial key facts

- The red oak mortality and decline in Northeast Region is attributable to a combination of several events over the past five years.
- In 2017 and 2018, severe forest tent caterpillar defoliation was recorded in the Northeast.
- Drought-like conditions preceded and coincided with this defoliation event.
- In May 2015, a frost event occurred across the southern part of Northeast Region. Four consecutive days of below freezing temperatures caused red oak leaves to later flush with stunted or damaged leaves.
- Red oaks are also commonly found on rocky sites with shallow soil.
- The combination of these stressors has predisposed the red oak to secondary factors including armillaria root rot, two-lined chestnut borer, and other wood borers.
- In 2020, red oak decline and mortality were mapped and reported in Northeast Region.

Regional summary

Northeast:

- In 2019, 135 ha of red oak mortality were recorded on the southwest side of Sault Ste. Marie District. In 2020, the affected area expanded another 387 ha west of Iron Bridge and eastward into Sudbury District. Larger areas of mortality were recorded between lakes Duborne and Lauzon, north of Blind River. Another large area of mortality was evident across the boundary of the Sault Ste. Marie and Sudbury districts, between Hwy 17 and Serpent Lake. Small areas of mortality were also recorded along the Hwy 17 corridor, west of Iron Bridge to Cutler.
- In 2020, 183 ha of red oak decline and mortality were recorded in southwest Sudbury District. The largest area of mortality was observed along the Sault Ste. Marie District border bounded by Hwy 17, Serpent Lake, and Kenabigoons Lake in Shedden Twp. Two smaller areas of mortality were recorded south of Espanola on Hwy 6 on the west side of Loon Lake in southern Merritt Twp.

Oak decline 2020

Areas in the Northeast Region where oak decline was observed

Mortality = 570 ha

Area of mortality

Spruce budworm

Pest information

Common name:	Spruce budworm
Scientific name:	*Choristoneura fumiferana* Clemens
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	White spruce, balsam fir, tamarack, black spruce, white pine
Infestation area:	442,426 ha moderate to severe defoliation; 9,358 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 extensive mortality to balsam fir and spruce.
- In 2020, most of the defoliation was mapped in Northeast Region, with some in Southern Region.
- The area of moderate to severe spruce budworm defoliation in the province increased to 442,426 ha from 342,333 ha in 2019. A total of 9,358 ha of mortality were mapped in 2020 compared with 2,427 ha in 2019. Most of this mortality was in Northeast Region.

Regional summary

Northeast:

- In Cochrane District, 139,451 ha of moderate to severe defoliation were mapped in 2020, an increase from 109,026 ha in 2019, and representing almost a third of all spruce budworm defoliation in Northeast Region. Most of the defoliation was mapped in the southwest corner of the district as it was in 2019, but in 2020 the infestation expanded further north, east, and south. In the northern part of the district, spruce budworm spread to the Fraserdale Wetland Complex in Homuth and Tolmie townships and was found northwest of Pierre Lake just north of Little Abitibi Provincial Park. In the eastern part of the district, defoliation was recorded northwest of Lake Abitibi along Hwy 652 approaching the Quebec border. In the southern part of the district, defoliation increased northeast of Frederick House Lake towards Iroquois Falls. On the western side of the district, areas of defoliation coalesced with defoliation recorded in 2019 along the Hearst District boundary. In areas heavily

infested with spruce budworm, defoliation was widespread on less common hosts such as tamarack and black spruce. In addition, 19 ha of mortality were mapped southwest of Departure Lake close to the Hearst District boundary.

- In Timmins District, 97,342 ha of moderate to severe defoliation were mapped, an increase from 60,175 ha in 2019. After five years of spruce budworm defoliation in this district, 244 ha of mortality were mapped in three small areas; along the shorelines of the Groundhog River, east of Kamiskotia Lake, and northwest of Frederick House Lake. Before 2020, spruce budworm defoliation occurred in the northern portion of the district above Hwy 101. In 2020, significant defoliation was also detected south of Hwy 101. Most of the moderate to severe defoliation south of Hwy 101 was found between Timmins and Gogama extending to the Chapleau and Kirkland Lake District boundaries. In heavily infested areas, light populations were found on less common hosts such as tamarack and white pine.
- In Hearst District, 77,840 ha of moderate to severe defoliation were mapped, a slight increase from 72,338 ha in 2019. Moderate to severe spruce budworm defoliation continued in the southeast corner of the district, with some expansion northeast of Kapuskasing towards Gurney Lake and southwest of Moonbeam. Host tree mortality was mapped on the southern border of Hearst District (262 ha) in three adjacent townships. Small areas of mortality occurred in Poulett Twp south of the junction of the Ground and Nat rivers, two small areas in the southern end of Watson Twp, and one larger area of mortality near the Trans Limit Road in the southern part of Lisgar Twp.
- In Chapleau District, moderate to severe spruce budworm defoliation decreased from 67,918 ha in 2019 to 52,654 ha in 2020. The largest area of moderate to severe defoliation was recorded in the northeast corner of the district, east of Kapuskasing Lake and north of Hwy 101. In addition, moderate to severe defoliation in the district extended further south and west in 2020; defoliation was recorded south of Foleyet in the Ivanhoe Lake area and further south to Satterly, Opeepeesway, and Rice lakes and the westward expansion was concentrated around and north and south of Kapuskasing Lake. Tree mortality (3,362 ha) was mapped in the northeast corner of the district, east of Kapuskasing Lake, bordering Hearst and Timmins districts.
- A total of 29,431 ha of moderate to severe defoliation were mapped in North Bay District, almost double the area recorded in 2019. Moderate to severe defoliation was mapped north of New Liskeard along Hwy 11, south of Haileybury along Hwy 567, north and south of Temagami, south of North Bay along Hwy 11 to Trout Lake, east of North Bay along Hwy 17 to Klock, and across the centre of the district from the Quebec border to the Sudbury District border. In addition, scattered moderate to severe defoliation was observed along the central portion Dokis Reserve Road, west of French River Provincial Park, and one small area between Hardy and Sandy bays along the French River, Lake Nipissing. Most (5,318 ha) of the mortality was mapped north and northeast from the City of North Bay towards the Quebec Border.
- In Sudbury District, 23,421 ha of moderate to severe spruce budworm defoliation were mapped predominantly in the central part of the district. Defoliation was mapped northwest of Sudbury along Hwy 144 to Heiss Twp by Geneva Lake; in the Greater Sudbury area as far north as Morgan, Lumsden, and Hamner townships; west

of Sudbury along Hwy 17 to Spanish, as far north as Fox Lake in Venturi Twp, and stopping just north of the La Cloche Ridge south of Hwy 17. Small areas of defoliation were found along Hwy 637 to Killarney Provincial Park. On Manitoulin Island, small areas of defoliation were recorded along most highways. Mortality (123 ha) was mapped northwest of Worthington in Drury Twp.

- In Sault Ste. Marie District, moderate to severe spruce budworm defoliation increased substantially, from 4,363 ha in 2019 to 10,826 ha in 2020. In 2020, moderate to severe spruce budworm defoliation was aerially mapped in the south central and southwest part of the district. Most of the defoliation was in the southcentral part of the district, between Lake George near Neebish and Iron Bridge. Large areas of defoliation were recorded from Thessalon to Bruce Mines in Plummer Additional, Lefroy, Thessalon, and Rose townships, stretching north to the Dunns Valley area. Other areas of defoliation were recorded west of Iron Bridge to Bright Lake and north of Iron Bridge along the west side of the Mississaugi River to just south of Tunnel Lake and north along the Little White River to Constance Lake. Smaller areas of defoliation were mapped on St. Joseph Island, north of Sault Ste. Marie to Heyden and west to the Sault Ste. Marie airport. Smaller areas of moderate to severe defoliation were found west of Bruce Mines to Desbarats and north in the areas of Rock, Gordon, and Ottertail lakes. West of Desbarats, areas of defoliation were observed from Desbarats Lake to Lake George and north to Bar River. On the north end of St. Joseph Island small scattered areas of defoliation were mapped between Hilton Beach and Richards Landing with two small areas farther south in the Kentvale area. North of Sault Ste. Marie, small scattered areas of defoliation were found in the Odena area (Tarentorus and Korah townships) and, farther north, larger areas of defoliation were mapped in the Heyden area in Aweres and Pennefather townships. West of Sault Ste. Marie areas of defoliation were concentrated between Gros Cap and Carpin Beach on the way to the airport in Prince, Parke, and Awenge townships.
- In Kirkland Lake District, 3,614 ha of spruce budworm defoliation were mapped, mostly in the southern part of the district. Moderate to severe defoliation was mapped north of Hwy 65 from Elk Lake to Earlton, north of Hwy 560 from Elk Lake to Gowganda, and from Marter to Larder Lake on Hwy 624. Small areas of defoliation were also mapped along Hwy 11 southwest of Round Lake and east of Kirkland Lake along Hwy 66 north of Gull Lake.
- In the southern part of Wawa District, 977 ha of moderate to severe defoliation were mapped in Lake Superior Provincial Park. In the southern end of the park, spruce budworm defoliation was mapped along Hwy 17 from Coldwater River (Giles Twp) to Montreal River (Peever Twp). Four small areas of defoliation were mapped north of Gargantua in Alarie Twp and two other areas were recorded northeast of Old Woman Bay in the northwest corner of Peterson Twp.

Southern:

- In Parry Sound District, 6,869 ha of moderate to severe spruce budworm defoliation were mapped, more than double the area recorded in 2019. Most of the defoliation was concentrated in the northeast corner of the district, along Hwy 11 from Trout Creek to the southwest side of Bernard Lake near Sundridge. The defoliation

stretched west in small scattered areas from Hwy 522 south to the southern boundary of Ferrie and Lount townships near Lake of Many Islands. Smaller areas of defoliation were also recorded in the northwest corner of the district, north of Hwy 522 in the Dollars Lake area to the Sudbury District boundary (Blair Twp). A small area (31 ha) of tree mortality was mapped on the southeast side of Ferrie Twp, southeast of Big Deer Lake.

Trend analysis/outlook/issues

Spruce budworm defoliation forecast survey

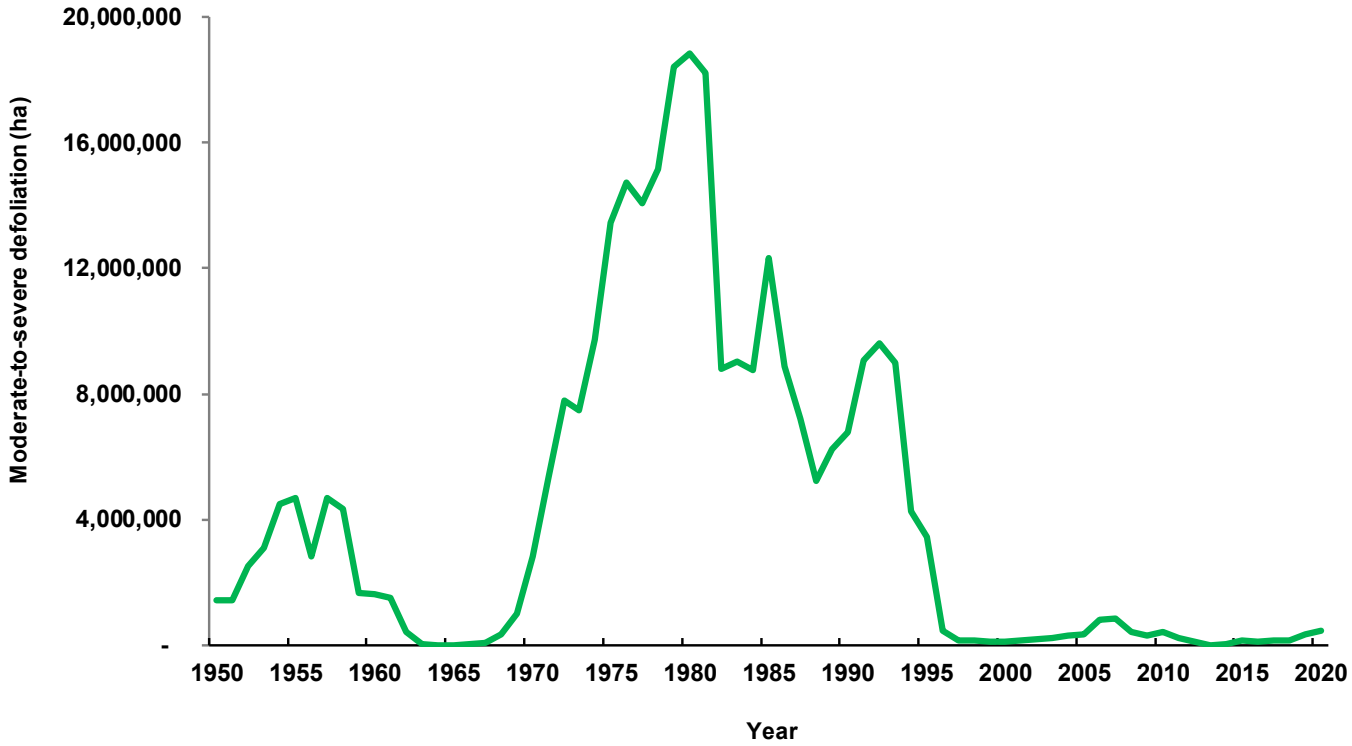
In Ontario, spruce budworm defoliation forecasting is based on surveys of the number of overwintering larvae on tree branches. Spruce budworm spend the winter as second instar larvae (L2) by encapsulating themselves in silken shelters (hibernacula) under branch scales and bark cracks. These larvae typically shelter from late August until the following spring. This overwintering stage of the lifecycle provides an opportunity 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 and are generally in or near areas of current defoliation. 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 that extracts 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 was used to forecast spruce budworm defoliation expected in 2021. 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, 24 locations (240 trees) were sampled for larvae in 2020. These locations were divided among districts: Cochrane (7), Timmins (6), Hearst (5), Chapleau (5), and North Bay (1). In Cochrane District, the defoliation forecast for 2021 was moderate for two locations, severe for three, and light for two. In Timmins District, the forecast for 2021 was moderate for three of six locations, with two forecasted as potentially severe and one light. In Hearst District, forecasts for three of the five locations were for moderate defoliation, one for severe, and one for light. In Chapleau District, forecasts were moderate for three, severe for one, and light for one location. In North Bay District, the defoliation forecast for the one location sampled was light.

Total area (hectares) in which spruce budworm caused moderate to severe defoliation from 2016–2020, by NDMNRF district.

Region	Area of defoliation (ha)				
District	2016	2017	2018	2019	2020
Northeast					
Chapleau	78,629	22,429	30,680	67,918	52,654
Cochrane	3,025	53,967	31,841	109,026	139,451
Hearst	15,761	22,168	16,522	72,338	77,840
Kirkland Lake	-	132	-	972	3,614
North Bay	8,995	4,058	33,933	15,154	29,431
Sault Ste. Marie	-	-	-	4,363	10,826
Sudbury	549	-	803	9,635	23,421
Timmins	8,918	43,772	23,230	60,175	97,342
Wawa	-	-	-	-	977
Sub total	115,877	146,525	137,008	339,580	435,557
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	55	-	-	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	-
Parry Sound	-	-	-	2,753	6,869
Pembroke	-	-	-	-	-
Peterborough	146	492	74	-	-
Sub total	146	547	74	2,753	6,869
Provincial total	116,023	147,072	137,082	342,333	442,426

Total area (in hectares) in which spruce budworm caused moderate to severe defoliation in Ontario from 1950 to 2020.



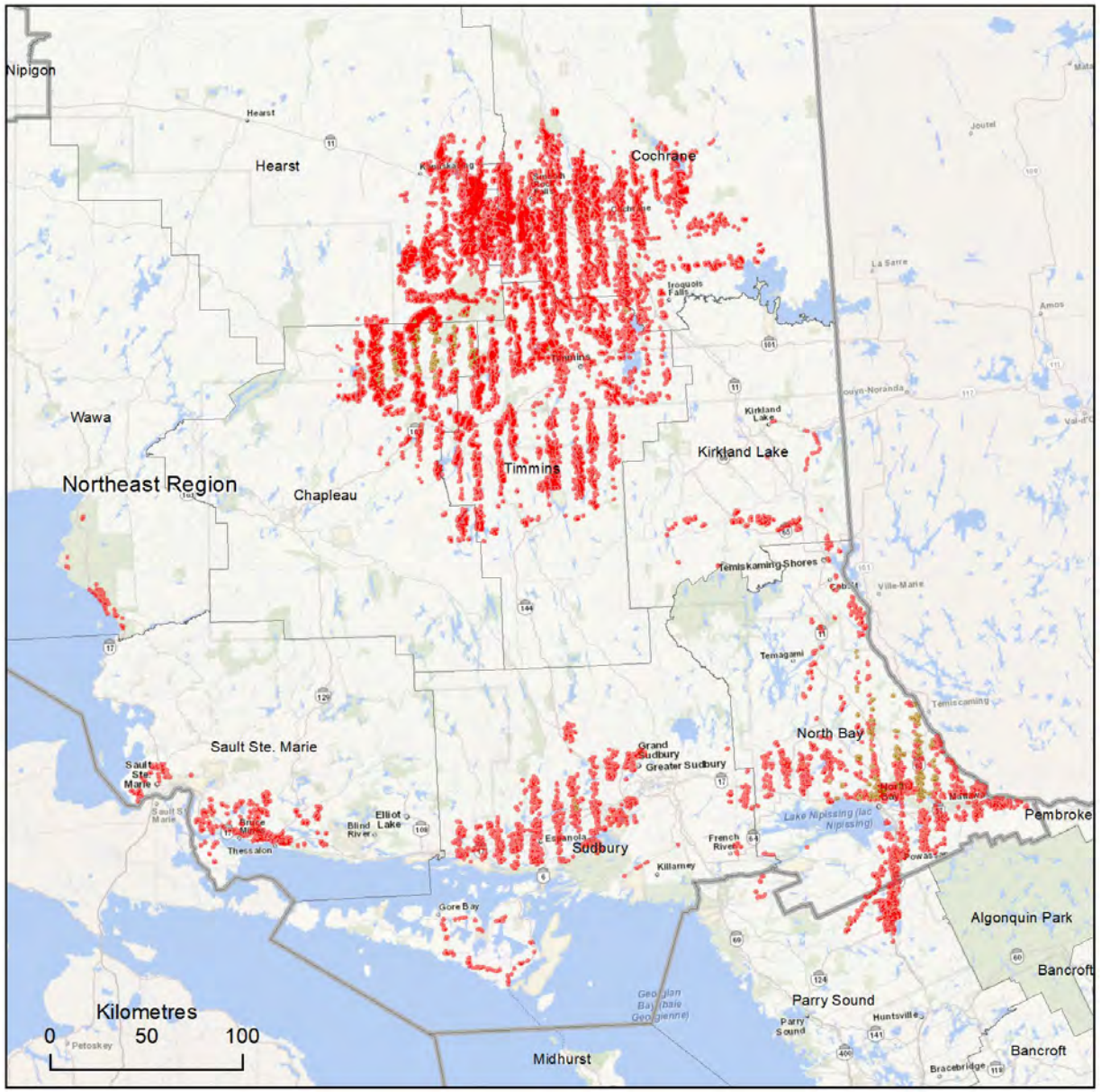
Spruce budworm 2020

Areas in Ontario where spruce budworm caused defoliation

Moderate-to-severe = 442,426 ha
Mortality = 9,358 ha

Area of moderate to severe defoliation

Area of mortality



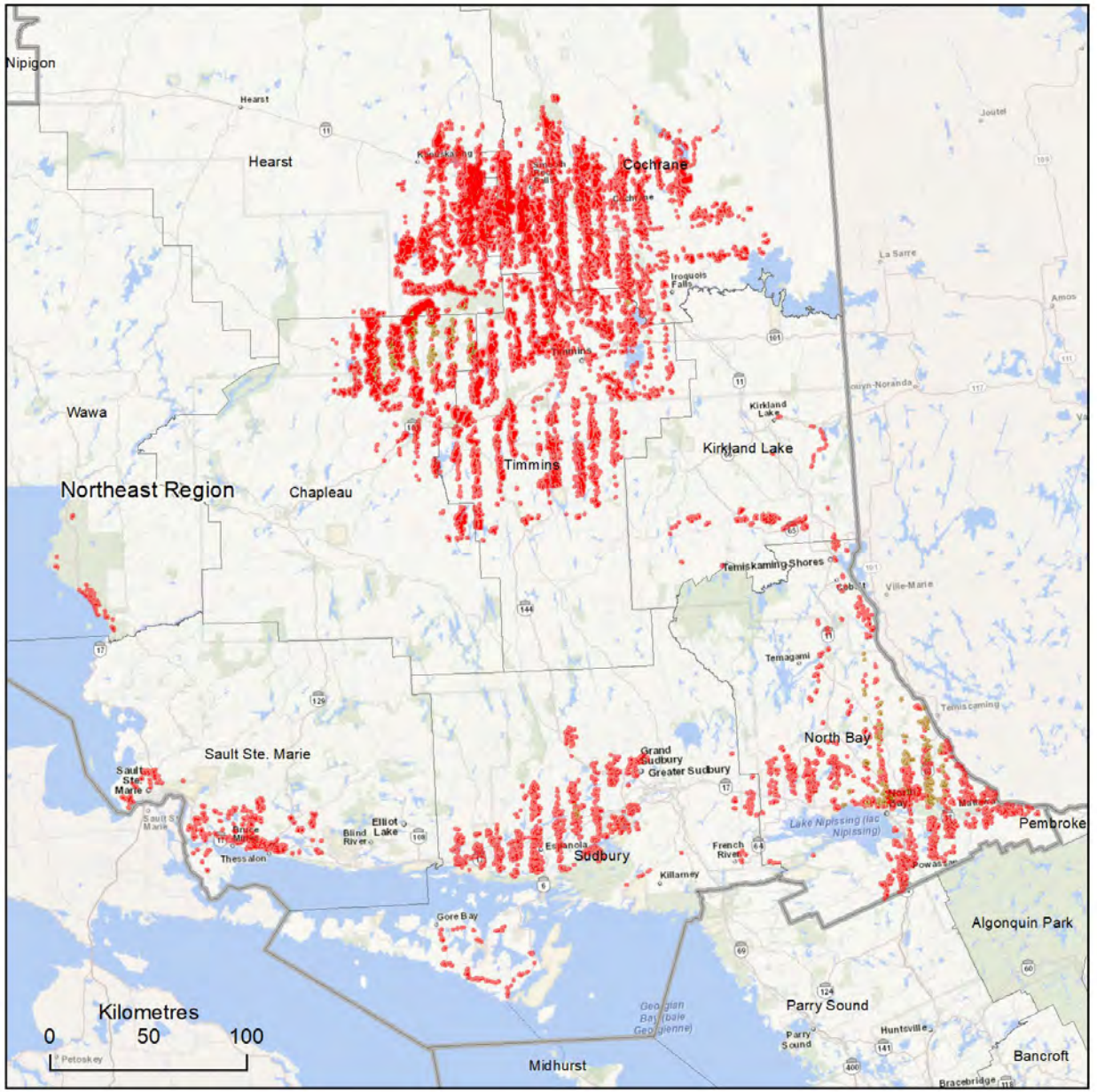
Spruce budworm 2020

Areas in the Northeast Region where spruce budworm caused defoliation

Moderate-to-severe = 435,557 ha
Mortality = 9,328 ha

Area of moderate to severe defoliation

Area of mortality



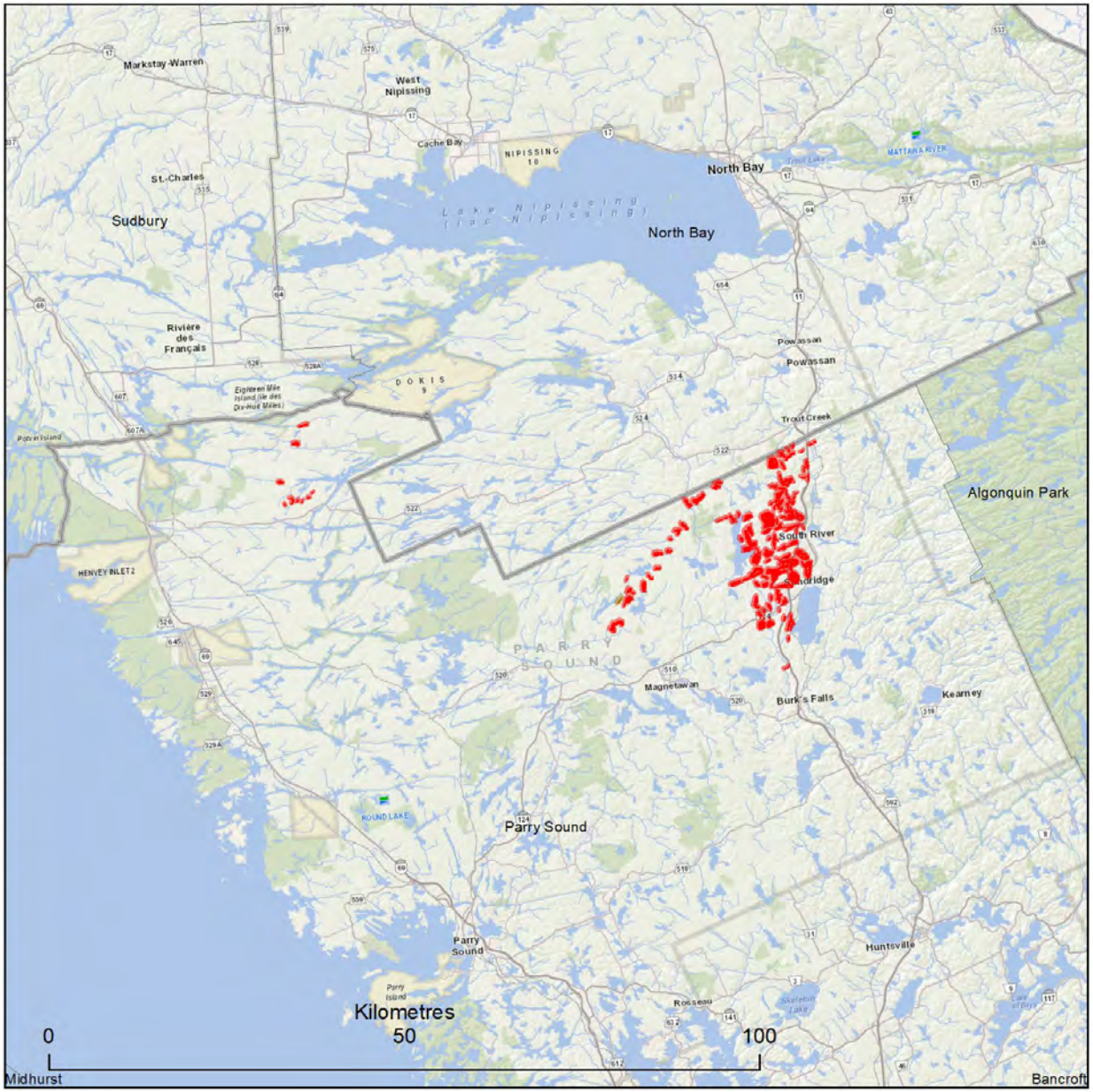
Spruce budworm 2020

Areas in the Southern Region where spruce budworm caused defoliation

Moderate-to-severe = 6,869 ha
Mortality = 31 ha

Area of moderate to severe defoliation

Area of mortality



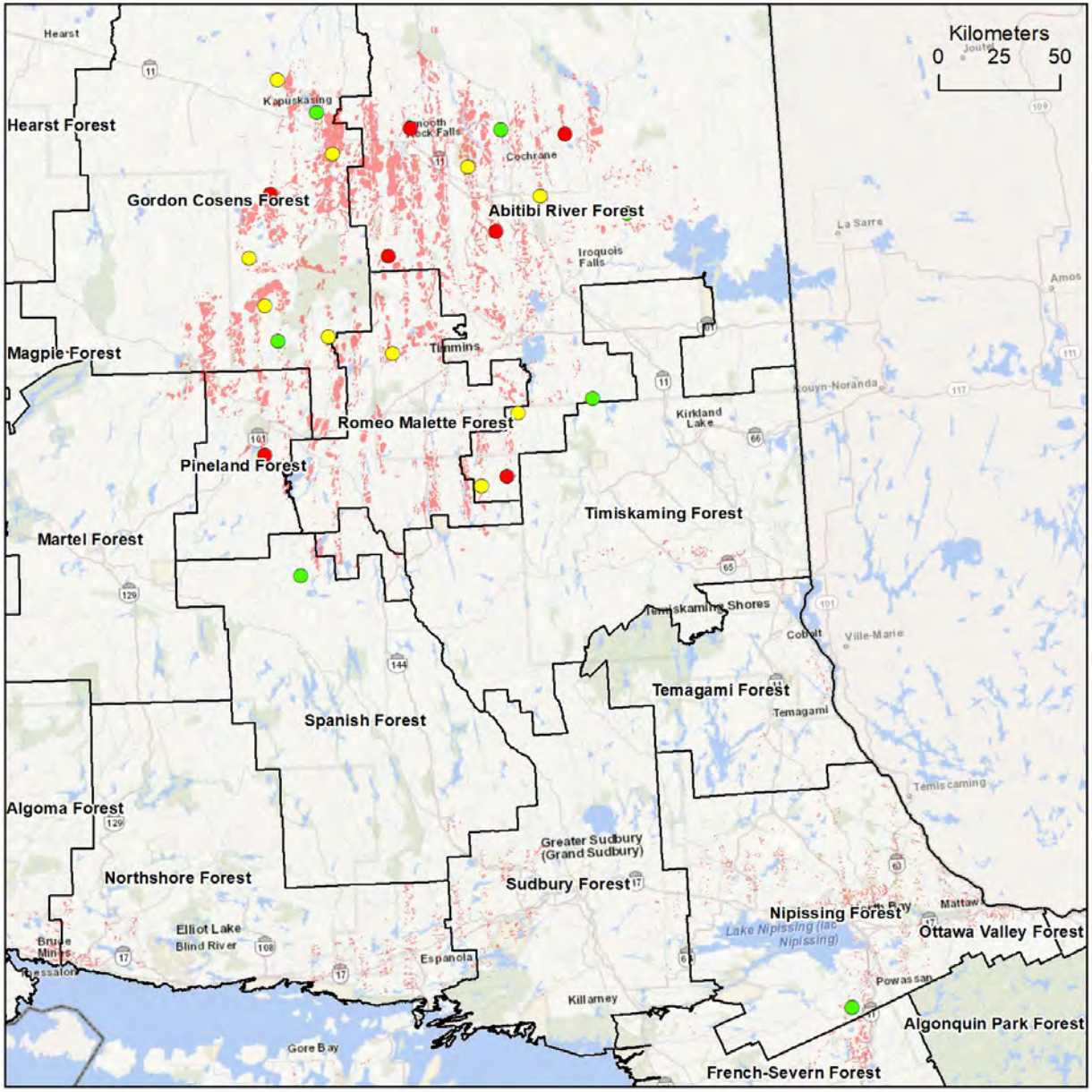
Spruce budworm second instar larvae survey results

Defoliation Forecast 2021

- Severe
- Moderate
- Light

Spruce Budworm Defoliation 2020

- Area of moderate to severe defoliation
- Area of mortality



Stillwell's syndrome

Pest information

Common name:	Stillwell's syndrome
Scientific name:	*NA*
Pest origin:	NA
Pest type:	Syndrome
Host species:	Balsam fir
Infestation area:	226 ha

Provincial key facts

- Also referred to as sudden fir mortality, Stillwell's syndrome causes sudden death of balsam fir trees within a single growing season.
- The mechanism leading to sudden balsam fir mortality is not well understood.
- This syndrome has been associated with spruce budworm outbreaks, armillaria root rot infection, drought, and other stressors, some or all of which may contribute.
- Stillwell's syndrome was most recently mapped in Ontario in 1998 when balsam firs died singly or in groups after recovering from a spruce budworm outbreak around Lac Seul in the Sioux Lookout, Dryden, Kenora, and Red Lake districts.
- In 2020, Stillwell's syndrome was reported in Pembroke District in Southern Region.

Regional summary

Southern:

- In Pembroke District, Stillwell's syndrome was mapped west of Barry's Bay, in the Carson Lake area, Madawaska Valley Twp, Renfrew County. A small area was also mapped on the southeast side of Golden Lake in Algona Twp, also in Renfrew County. Many other single tree occurrences were observed from the air, but the area was too small to be mapped. Samples were collected on Hwy 60 between Barry's Bay and Carson Lake; on Opeongo Road on the west side of Carson Lake; and slightly further west on Skead Road near Bark Lake. About 20% of the balsam firs were symptomatic and overall damage was high with mortality observed at each of the sampling locations. Symptoms included red flagging (red needles on branches), dropping of innermost needles, top down

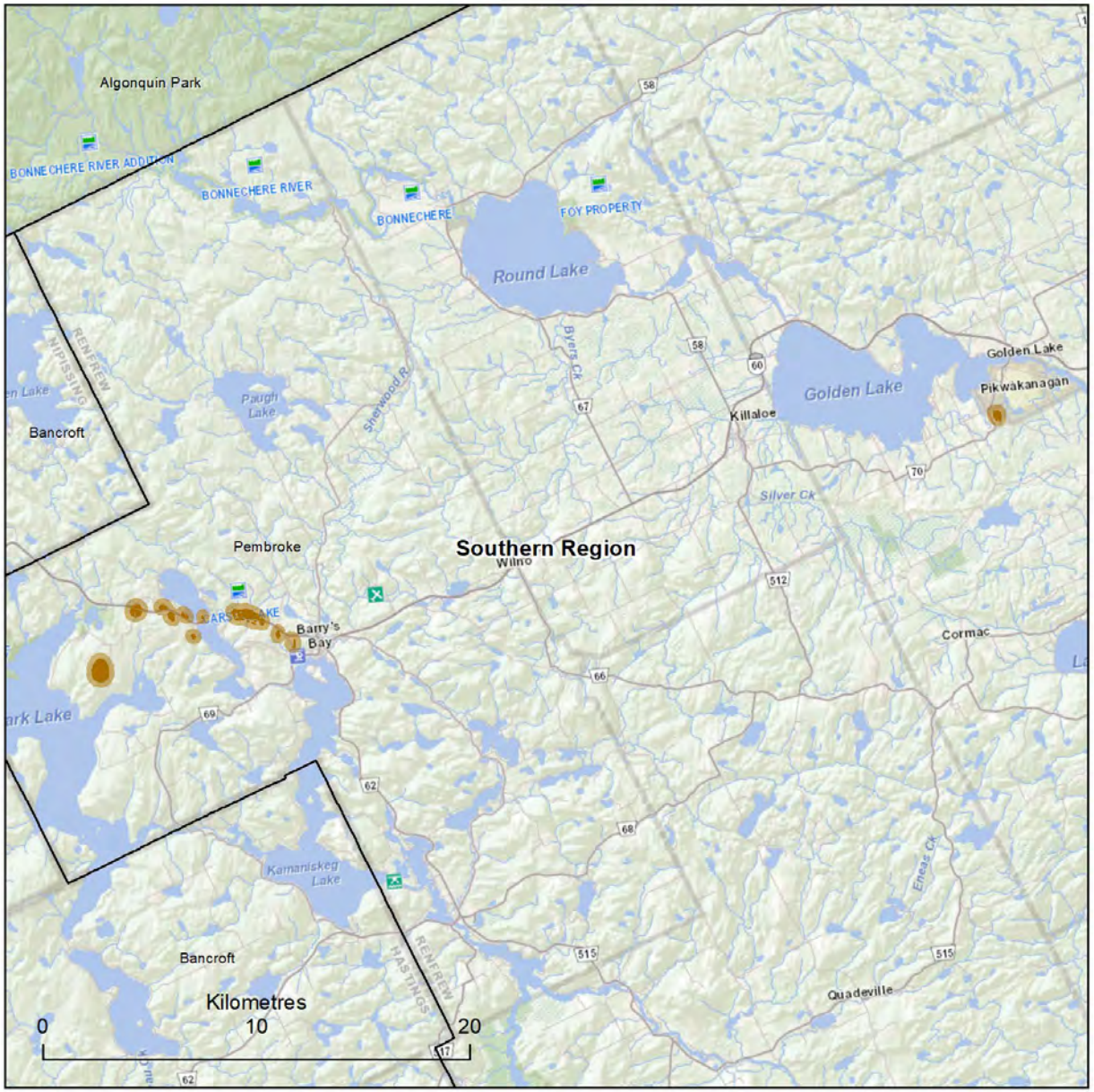
discoloration, and mortality. Various pathogens were detected during laboratory analysis, which could account for the variety of symptoms observed on different trees. Pathogens detected included: Rhizosphaera needle blight (Rhizosphaera pini), which was detected at all three sampling locations; Isthmiella faulii needle cast, which was detected on balsam fir along Opeongo Road and Hwy 60; and an unknown brown rot decay fungus in the Basidiomycetes, which was detected on Skead Road.

Stillwell's syndrome 2020

Areas in Ontario where Stillwell's syndrome caused balsam fir mortality

Mortality = 226 ha

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:	White pine, balsam fir, red pine, white spruce, jack pine
Infestation area:	44 ha mortality; 4 ha moderate to severe damage (2020)

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.
- Larva 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 2020, 48 ha of whitespotted sawyer beetle mortality and damage were mapped in Northeast Region. Localized damage was also observed on small groups of trees in Southern Region.

Regional summary

Northeast:

- In North Bay District, 39 ha of mortality caused by whitespotted sawyer beetle were mapped on the east side of Lady Evelyn-Smoothwater Provincial Park. Four small areas of mortality were observed northeast of Bercole Lake along the boundary of McGiffin and Rorke townships in the park. Trees with severe whitespotted sawyer beetle damage and mortality were also observed around Sturgeon Falls and Temagami, but not aerially mapped. A large fire in 2018 in Lady Evelyn-Smoothwater Provincial Park and near the town of Temagami likely accounts for the increased presence of whitespotted sawyer beetle.

- In the southern part of Kirkland Lake District, a small area of whitespotted sawyer beetle mortality (5 ha) was mapped at the north end of Wolfskin Lake in the southwest corner of Wallis Twp. This area was also just north of Lady Evelyn-Smoothwater Provincial Park and relatively close to the 2018 fire.
- In Timmins District, 4 ha of moderate to severe damage were mapped along Hwy 560 near Olmstrom in Westbrook Twp. Since a 2011 local fire, whitespotted sawyer beetle and pine engraver caused damage in 2014, and 2018 and 2019, respectively. In 2020, the damage spread eastward. Evidence of egg niches, red needles, sawdust at the base of trees, and entrance and exit holes were observed on jack pine in the affected areas.

Southern:

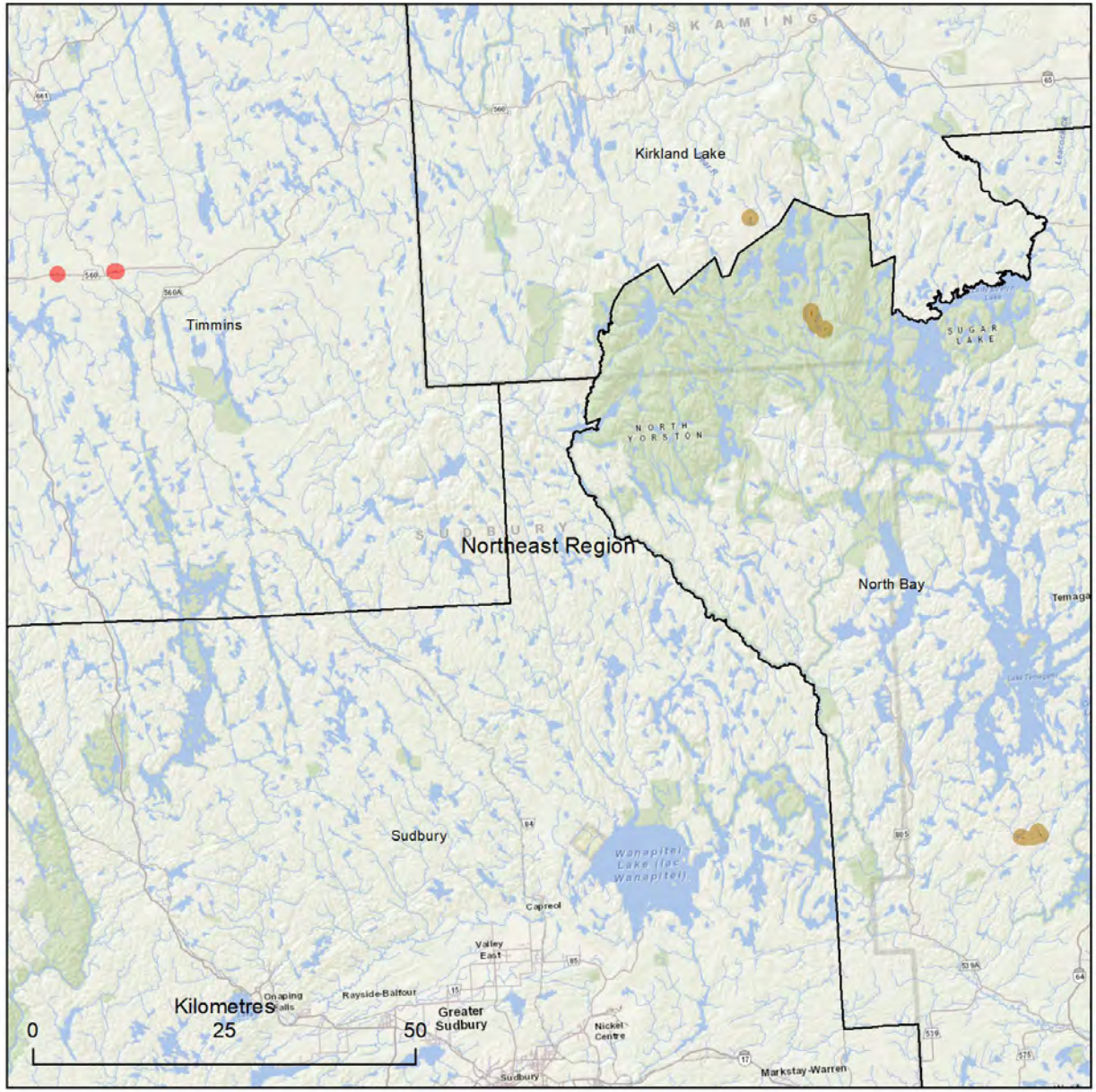
- In Parry Sound District, localized damage and mortality due to whitespotted sawyer beetle were reported in Port Severn, Go Home Bay, Kahshe Lake, Sans Souci, and Parry Sound. Drought-like conditions in previous years may have contributed to this increase in beetle activity.

Whitespotted sawyer beetle 2020

Areas in Ontario where whitespotted sawyer beetle caused damage

Moderate to severe = 4 ha
Mortality = 44 ha

- Area of moderate to severe damage
- Area of mortality



Minor forest disturbances

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, black ash, speckled alder, pin cherry, 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 will occur 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 2020, fall webworm was reported in Northeast and Southern regions.

Regional summary

Northeast:

- In Chapleau District, trace amounts of fall webworm were observed along major highway corridors. One to two branches of webbed foliage were observed on Hwy 101, between the municipalities of Wawa and Chapleau and on Hwy 129 in the northwest corner of Reaney Twp.
- In Wawa District, trace amounts of fall webworm were collected on speckled alder along the Tremblay Flats Road, just outside the municipality of Wawa.
- In North Bay District, severe fall webworm defoliation of mature trees was observed west of the municipality of North Bay, along Hwy 17.

Southern:

- In Parry Sound District, fall webworm defoliation was observed on shrubs and trees along Hwy 400 from south of the municipality of Parry Sound to the municipality of Port Severn. Defoliation was severe in areas with 20 or more nests along this highway corridor.
- In Pembroke District, moderate to severe fall webworm defoliation was observed on Fraser Road west of the village of Burnstown, Bagot Twp, Renfrew County. Some trees were fully defoliated and, in some locations, up to 45% of young black ash trees were affected at the forest fringe. Intermittent light defoliation occurred on Calabogie Road, from the village of Burnstown to Ferguson Lake Road, and on White Lake Road in McNabb Twp, Renfrew County.
- In Kemptville District, fall webworm larvae were collected on ash species and white elm in a young mixed forest on Lanark Conssession 12c, Lanark Twp, Lanark County. About 75% of ash and elm trees had some level of defoliation. Some trees were severely defoliated but overall defoliation was light (<25%).

Leaf spot

Pest information

Common name:	Leaf spot
Scientific name:	*Sphaerulina betulae (Pass.) Quaedvl., Verkley & Crous,* *Sphaerulina populicola (Peck) Quaedvlieg, Verkley & Crous and* *Mycosphaerella effigurata (Schwein.) House* *Paracercosporidium tiliae (Peck) U. Braun, C. Nakash., Videira & Crous*
Pest origin:	Native to North America
Pest type:	Foliar disease
Host species:	Ash, basswood, white birch, and balsam poplar
Infestation area:	Localized

Provincial key facts

- Leaf spot is a common fungal disease of poplar and birch.
- It 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. Fallen leaves re-infect new leaves the following year.
- After repeated severe infections, trees may lose vigour and become more susceptible to other pests and pathogens.
- In 2020, forms of leaf spot were reported in Northeast and Southern regions.

Regional summary

Northeast:

- In Wawa District, moderate to severe damage from septoria leaf spot was found on white birch trees across the old fume kill area, north of the municipality of Wawa, in Chabanel, Musquash, and Corbiere townships. About 70% of the trees across this area were affected.
- In Kirkland Lake District, severe septoria leaf spot was observed on balsam poplar along Hwy 11 from New Liskeard to Engleton.

Southern:

- Light septoria leaf spot damage was observed on 80% of red ash trees along Doran Road and Fagan Lake Road near Maberly in Tay Valley Twp, Lanark County. Similar damage was observed on ash trees nearby on Iron Mine Road, and on Hwy 7 from Maberly to Perth.
- Moderate cercospora leaf spot damage was observed on basswoods in a mature mixed forest on Mountainview Road, near Killaloe, Hagarty Twp., Renfrew County. Infection rate was high, affecting all basswood trees investigated.

Maple webworm

Pest information

Common name:	Maple webworm
Scientific name:	*Pococera asperatella (Clem.)*
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Basswood, sugar maple, ironwood
Infestation area:	Localized

Provincial key facts

- Provincial distribution of maple webworm is from southern Ontario to North Bay.
- Since many parasites and predators attack this pest, populations seldom reach outbreak levels.
- Maple webworm was not considered important until the 1950s when it was found to contribute to the development of maple blight, which killed thousands of sugar maples in Wisconsin. This has not been the case in Ontario.
- In Southern Region, maple webworm occurrences were reported in increasing numbers from 2016 to 2018 in Aylmer and Guelph districts; and widespread defoliation was reported from 2011 to 2013 in Midhurst District.
- In 2020, maple webworm was reported in Pembroke District, Southern Region.

Regional summary

Southern:

- In Pembroke District, maple webworm larvae were collected in a semi-mature sugar maple mixed forest on Oscar Boehme Road in Palmer Rapids, Raglan Twp, Renfrew County. Moderate defoliation of basswood and light defoliation of sugar maple and ironwood were observed in the hardwood stand.

Redhumped oakworm

Pest information

Common name:	Redhumped oakworm
Scientific name:	*Symmerista canicosta Franc.*
Pest origins:	Native to North America
Pest type:	Defoliator
Host species:	Red oak
Infestation area:	Localized

Provincial key facts

- Last reported in Ontario in 2016, redhumped oakworm populations are generally short-lived due to parasitoids, diseases, and predators such as birds.
- Redhumped oakworm is a late season defoliator, with the larvae observed feeding from August to September.
- Its effects are minimal but, if preceded by an early season defoliator, affected trees may lose vigour and be more susceptible to other forest pests.
- In 2020, light to moderate defoliation was observed in Southern Region.

Regional summary

Southern:

- In Parry Sound District, light to moderate defoliation by redhumped oakworm was observed along Twelve Mile Bay Road, east of Moose Deer Point, on red oak that had been severely defoliated by gypsy moth earlier in the season. Larvae were feeding gregariously and found resting on the undersides of oak leaves.

Snow damage

Pest information

Common name:	Snow damage
Scientific name:	NA
Pest origin:	Abiotic
Pest type:	Abiotic
Host species:	All species
Infestation area:	Localized

Provincial key facts

- Damage consists of trees of all ages and sizes being uprooted, snapped off, bent over, or showing various amounts of crown damage.
- Snow damage in Ontario can be significant but events are sporadic, and effects vary considerably.
- In late December 2019, snow damage occurred in Northeast Region, but it was not recorded until January 2020.

Regional summary

Northeast:

- In Sault Ste. Marie District, snow damage from 2019 was recorded on St. Joseph Island in 2020. Heavy wet snow combined with freezing evening temperatures created excess weight on trees and other vegetation. Most of the damage was on the southwest side of the island, with scattered areas on the east side and less at the north end. Species most affected were ash and poplar and smaller maples and birches. Branch snap was common on dominant trees but appeared limited to smaller branches and the occasional major limb. Top snap was more frequent on balsam fir, white spruce, and Scots pine on the southwest side of the island. Smaller trees, particularly white birch, close to the roadside or along trails, were bent over from the snow load.

Striped alder sawfly

Pest information

Common name:	Striped alder sawfly
Scientific name:	*Hemichroa crocea* (Geoff.)
Pest origin:	Invasive – Native to Europe
Pest type:	Defoliator
Host species:	White birch, speckled alder
Infestation area:	Localized

Provincial key facts

- Striped alder sawfly feed gregariously (as a group) on soft leaf tissue, leaving the leaf margins and midribs, until they drop to the ground to overwinter as pre-pupae in the soil.
- In Ontario, alder is the main host but they occasionally feed on birch and willow.
- In 2020, moderate populations of striped alder sawfly were observed affecting white birch and alder trees in Northeast Region.

Regional summary

Northeast:

- In North Bay District, moderate to severe defoliation from striped alder sawfly was observed on white birch and speckled alder in the City of North Bay, particularly in Laurier Woods.