Forest Health Conditions in Ontario, 2018

Ministry of Natural Resources and Forestry

Ontario

Forest Health Conditions in Ontario, 2018

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État de santé des forêts, 2018

En 2018, la principale difficulté météorologique ayant des répercussions sur la vitalité des forêts était l'été chaud et sec. Ces conditions ont débouché une sécheresse dans le sud de la province, les feux au centre et au Nord de l'Ontario, et les tempêtes qui ont mené à une croissance des arbres abattus par le vent.

Les régions où les feuilles ou les aiguilles des arbres ont été dévorées par: la tordeuse du pin gris a augmenté dans le Nord-Ouest; la livrée des forêts a diminué dans le Nord et a augmenté dans le Sud; la tordeuse des bourgeons de l'épinette a diminué par rapport à l'année précédente; et la spongieuse a augmenté dans le Sud. Pour la troisième année consécutive, la région où les feuilles ou les aiguilles des arbres ont été dévorées par la tordeuse du tremble a été documenté dans le Nord-Est, avec une légère diminution de la superficie touchée par rapport à 2017. Dans le Sud, les feuilles du cèdre ont été dévorées par la mineuse du bouleau, avec une augmentation de la région affecté en 2018.

Selon un sondage effectuée tous les deux ans, l'étendue nord du déclin et mortalité des arbres par l'agrile du frêne a été enregistrée pour 2018. Les pièges installés dans le Nord-Ouest pour détecter la propagation de l'agrile du frêne dans les environs de Thunder Bay n'a pas pris aucun coléoptère. Les pièges installés pour le dendroctone du pin ponderosa dans le Nord-Ouest et pour le scolyte des rameaux du noyer (un vecteur pour la maladie des milles chancres), dans le sud, sont également revenus vides. Plusieurs autres insectes et maladies ont affectées les forêts à travers la province, mais les dommages sont restés localisés.

La maladie des feuilles du hêtre, une maladie découverte pour la première fois dans le Sud-Ouest de l'Ontario en 2017, a augmenté en 2018 près de la ville d'Aylmer. Cette découverte a incité une collaboration avec des partenaires, y compris les États-Unis, à rechercher les causes de la maladie.

Introduction

Forest health monitoring in Ontario is conducted as a partnership between the Ontario Ministry of Natural Resources and Forestry (MNRF) and Natural Resources Canada – Canadian Forest Service (CFS).

The annual forest health monitoring program has five components:

- aerial mapping of major forest disturbances to quantify their 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
- special surveys for pests of interests, particularly invasive species, or pests affecting high value trees, such as plantations or seed orchards
- temporary and permanent sample plots to monitor health of select forest ecosystems
- conducting or supporting research projects in forest entomology, pathology, or weather effects

Forest health monitoring in Ontario includes the occurrence of native, non-native, and invasive 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 2018, insect diagnostics were executed through a partnership among MNRF, CFS, and the Invasive Species Centre (ISC). The ISC identified samples collected by the program. The CFS verified insect identification and provided laboratory space and access to its insect collection and fungal herbarium. 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.

Maps, tables, and graphs presented here were produced from aerial surveys of major forest disturbances.

Results of the annual monitoring program were reported provincially at the Ontario Forest Health Review and nationally at the Forest Pest Management Forum and are described in more detail here.

Weather patterns

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

In 2018, January and February temperature extremes were seen across the province. A cold spell that started late December 2017 continued into early January, followed by warmer than normal temperatures and then fluctuated between cold and warm until the end of January. Temperatures in February were higher than normal in the south and lower than normal in the north. Precipitation in January was below normal across most of Ontario except the far northwest, east, and parts of the northeast. All forms of precipitation — rain, freezing rain, and snow — fell in January. In February, above normal precipitation, mostly snow, was seen in the south and areas near Lake Superior to the Quebec border, while precipitation levels were normal to below normal in the northeast and northwest. With mild temperatures and higher than normal precipitation, most of the snow in southern Ontario melted resulting in some flooding, particularly in the southwest.

The first half of March was warm, but it cooled down by month's end. Precipitation was lacking in March, particularly in the northwest in Thunder Bay, Kenora, Fort Frances, and Dryden. The only substantial precipitation fell in southern Ontario in early March when several hours of rainfall switched to snow, with some areas getting 15 to 30 cm.

Below normal temperatures across the province in April made it seem more like winter than spring. For several communities, including Sudbury, Earlton, Barrie, Hamilton, and Windsor, it was the coldest April on record. Towards the end of the month it warmed up, but not enough to reach normal monthly temperatures. Precipitation varied across the province with very little in the north but above normal levels in the Golden Horseshoe and central parts of the province. With the cold weather, record highs for single day snowfall were observed in Wiarton, Sudbury, Sault Ste. Marie, Haliburton, and Barrie. In the south, freezing rain and ice pellets were seen the weekend of April 14, damaging trees and shrubs.

Temperatures started to rise in May, increasing across most of the province except for parts of the northeast and the Far North. Precipitation varied, with drier than normal conditions in parts of the north and above normal precipitation in others. In some areas of the northwest, precipitation brought some relief to areas affected by forest fires. The south also had drier than normal conditions in May as well as damaging winds that went through the Toronto, Hamilton, and Ottawa areas.

June and July were hot and dry for most of Ontario. June saw closer to normal temperatures except for a few days in mid June in the south when daytime highs reached the mid-thirties. Overall, June was a dry month, but some areas of the northeast had above normal precipitation. Severe weather was observed by mid-June, with high winds in the south and parts of the northeast. Two tornadoes were seen, one near Waterford that moved northeast to the shores of Lake Erie, the other near Norwich between London and Hamilton. At the end of June, a severe thunderstorm went through northwestern Ontario and kept rolling across Lake Superior into the northeast causing tree damage. The thunderstorm also produced some hail north of Searchmont. July had two heatwaves, one early and the other mid-month. It was the warmest July on record for Kapuskasing and Cornwall and the second warmest for several other communities. Precipitation varied from very dry in some areas to above normal in others. Dry conditions were seen in most of the north and extreme southwest, while higher rainfall levels were observed in the Far North, northeast, and south. With the extreme heat followed by cooling came severe thunderstorms with damaging winds. In mid-July, severe thunderstorms and hail occurred in the northwest and trees were uprooted in Sudbury. With the drier conditions, lightning strikes were more common in northern Ontario, which led to more forest fires, particularly in North Bay District. Smoke from the fires prompted special air quality advisories. In late July, more forest fires were seen in the province with a large area burning north of Parry Sound. At the end of July, severe thunderstorms in the Ottawa area caused flooding while hail was seen in the London, Toronto, and Haliburton areas.

In August, the hot and dry weather continued in northern and central Ontario while the south received plenty of rain. The hot, dry conditions resulted in the forest fire north of Parry Sound growing to over 11,000 ha. In contrast, areas east of Georgian Bay and Lake Huron had double the normal monthly precipitation and, in the south, thunderstorms flooded areas of Toronto. Flash flooding was also seen in Kingston and Parry Sound. At the end of August, a tornado touched down north of Barrie in the township of Oro-Medonte, damaging trees.

The heat continued in September in south, central, and parts of northeastern Ontario while temperatures in the north were normal. For the first three weeks of September, heat warnings were issued in the south. Precipitation was higher than normal in the north, with heavy rain closing Hwy 17 between Sault Ste. Marie and Wawa in early September. Severe thunderstorms and heavy rainfall were seen in the northwest, particularly around the Upsala area. It was drier in the south but heavy rain occurred in some areas. On September 21, a tornado occurred in the Dunrobin area near Ottawa. In late September, thunderstorms in the southwest part of the province caused flooding.

Temperatures cooled in October with a short-lived heat wave from October 8 to 11. Overall, temperatures were below normal, particularly towards the end of the month. Precipitation was higher than normal in northern Ontario with drier than normal conditions in the Far North and southern Ontario. A short period of heavy rain (October 11-13) east of Lake Superior prompted flood warnings for most of northern Ontario. Strong winds and heavy rains were also recorded at the beginning of the month in the Kapuskasing and Sault Ste. Marie areas. In mid-October, heavy snow fell in the northwest prompting the closures of some schools in Dryden and Kenora, while in the northeast heavy rains washed out parts of some highways north of Sault Ste. Marie near Heyden (Hwy 556), between Thessalon and Chapleau along Hwy 129 near Aubrey Falls and south of Wawa along Hwy 17.

November began with above normal temperatures but soon cooled to below normal and stayed that way for the rest of the month. A cold airmass helped to set new lows in Kingston and Brockville. Dry conditions were observed in northern Ontario, particularly in the northwest, while it was wetter than normal in southern Ontario, especially in areas bordering Lake Ontario. In the second week of November, rain and snow accompanied with strong winds affected southern and central parts of the province, with the hardest hit areas near Parry Sound and Huntsville. In mid-November, heavy snowfall was recorded in Sault Ste. Marie (35 cm) and to a lesser degree (11–14 cm) southern Ontario, including Toronto, Ottawa, Guelph, and Milton. At the end of November, freezing rain started in northwestern Ontario and spread northeast and south.

December was warmer than normal in the north, especially in the northwest close to the Manitoba border where temperatures were 6 °C above normal. Southern Ontario was also warmer than normal but to a lesser degree. Precipitation was below normal across the province, with snow in the north and rain in the southwest and the Greater Toronto area. In early December, thunder and lightning were seen in southern Ontario prompting a severe thunderstorm watch stretching from the southwest to Georgian Bay. Closer to Christmas, a winter storm moved through the province with heavy snow in Timmins, Sudbury, and Espanola and freezing rain in eastern Ontario. At the end of December, the northwest received 30 to 40 cm of snow in Thunder Bay, Geraldton, and Marathon areas while 15 to 25 cm were recorded from Upsala to Kapuskasing. The southern and eastern parts of the province had freezing rain.

Extreme weather and abiotic events

With the higher than normal temperatures and lower than normal precipitation in 2018, almost 25,000 ha of drought were aerially mapped, all in the Southern Region. Most of this damage occurred in Peterborough District.

In 2018, 1,325 forest fires were recorded in the province, with a total of 276,356 ha burned. Many of these fires were in areas where blowdown, snow damage, insect infestations, and disease have killed or damaged trees in the last few years. Lightning strikes caused by fluctuating temperatures resulted in about 71% of the fires in the province.

In late October 2017, snow damage occurred in Northwest Region but was not aerially mapped until 2018. A total of 2,258 ha of damage was mapped, mostly in Dryden and Sioux Lookout districts. Snow damage affected all tree species, causing bent trees, snapped tops, and broken branches.

In 2018, the area of blowdown increased (by 1,400 ha). Each region had some areas of blowdown, with most (2,771 ha) recorded in Northwest Region, followed by Northeast Region (956 ha), and only a small area (112 ha) in Southern Region. In all cases, localized areas of blowdown were small and scattered. In June and July, the extreme heat followed by cooling caused severe thunderstorms, with associated winds resulting in blowdown in the northwest, particularly in Red Lake and Sioux Lookout districts, as well as Chapleau District in Northeast Region. In Southern Region, blowdown was mapped in only two districts, most of it in the southwest corner of Pembroke District. Several late season storms were not mapped in 2018, but these disturbances will be recorded in 2019.

Areas of scorch were recorded during ground surveys in the Northeast and Southern regions in 2018. These areas were too small for aerial mapping and were observed on younger roadside hardwoods as well as deciduous trees in treed swamps that were drying up.

Ice damage was seen in Southern Region from a winter storm in mid April. Most of the damage was along highway corridors.

Insect infestations

Moderate to severe defoliation by jack pine budworm increased from 100,187 ha in 2017 to 627,455 ha in 2018. All the defoliation was in Northwest Region, with 98% in Red Lake District and small areas in Kenora and Dryden districts. Defoliation was concentrated about 90 km north of the town of Red Lake in an area north and northwest of Kirkness Lake and west of Pikangikum First Nation. In Northeast Region, the area of mortality caused by previous jack pine budworm defoliation increased by 870 ha. Damage was in the same general area as in 2017, totalling 1,193 ha. The infestation in Sault Ste. Marie District collapsed in 2017 but jack pine mortality expanded in the infested area from defoliation damage that occurred the previous two years. Combined with moderate to severe defoliation mapped in 2015 and 2016, as well as drought-like conditions on a poor site (shallow soil to bare rock) in 2017 and 2018, jack pine mortality was mapped on the east side of Matinenda Lake. In both regions, jack pine larvae were collected in areas historically infested by jack pine budworm but with very little associated defoliation. In October 2018, defoliation was forecast based on surveys of the number of overwintering jack pine budworm larvae on tree branches. In the northwest, 52 locations were surveyed, mostly in Red Lake District. Results indicate that the infestation is likely to persist in Red Lake District in 2019. Only 12 locations were surveyed in Northeast Region with very few larvae found, indicating that defoliation will be very light in six of the 12 locations.

The area of moderate to severe spruce budworm defoliation decreased from 147,072 ha in 2017 to 137,082 ha in 2018. Most of this decrease was in Northeast Region, but in the south populations pretty much collapsed. In Northeast Region, 137,008 ha of moderate to severe defoliation were mapped, with Cochrane, Timmins, and Hearst districts having less area of moderate to severe defoliation, but North Bay District showing a large increase and smaller increases in Chapleau and Sudbury districts. In 2018, a small area (14 ha) of spruce budworm mortality was mapped in Northeast Region, all of which was balsam fir. Only a small amount of moderate to severe defoliation was mapped in Southern Region: 74 ha in Peterborough District at Balsam Lake Provincial Park for the third consecutive year. Susceptible forests of spruce and balsam fir across much of northern Ontario are beginning to reach age classes preferred by spruce budworm (i.e., >40 years). Spruce budworm pheromone trapping and aerial surveys will be continued to detect any significant increases in populations.

In 2018, the area affected by forest tent caterpillar decreased by 181,362 ha but remains at almost a million hectares of moderate to severe defoliation across the province (992,207 ha). Area affected decreased in Northeast and Northwest

regions but increased significantly in Southern Region. In Northeast Region, after four consecutive years of increases in forest tent caterpillar defoliation in Hearst District, the infestation peaked in 2017 at 590,451 ha and decreased to 237,395 ha in 2018. This was the largest decrease in the Northeast Region with small decreases in Kirkland Lake, North Bay, and Timmins districts. The drop in North Bay District may have been attributed to not being able to fly around forest fires in the district, particularly in the Temagami area where forest tent caterpillar was mapped in previous years. In Sault Ste. Marie, Sudbury, and Cochrane districts the infestation area increased, but parasitized and diseased larvae were common as was the large flesh fly. In Northwest Region the collapse of the infestation is imminent as only 38 ha of moderate to severe defoliation was mapped in two districts, mostly Thunder Bay. In Southern Region, the area of moderate to severe forest tent caterpillar defoliation increased by just over 200,000 ha. Five of the six districts with defoliation saw the area affected increase in 2018. Most of this increase was recorded in Bancroft and Kemptville districts.

Moderate to severe defoliation by large aspen tortrix decreased from 48,297 ha in 2017 to 39,206 ha in 2018. For the third consecutive year, all the defoliation was recorded in Northeast Region, mostly in Chapleau and Timmins districts, although in both districts the area affected decreased in 2018. A new area of large aspen tortrix defoliation was found in the northern part of Sault Ste. Marie District near the Chapleau District boundary near Flame Lake.

Gypsy moth defoliation was mapped only in Southern Region where the area affected increased from 10,856 ha to 14,937 ha in 2018. Most of this defoliation was in Guelph District (11,154 ha) with new areas of infestation in Aurora District (2,764 ha). Gypsy moth defoliation was observed in Peterborough District in 2017 (1,461 ha) but none was mapped in 2018.

After two consecutive years of increases of fall cankerworm defoliation in Southern Region, a substantial decrease was seen in 2018. The total area went from 11,764 ha in 2017 to 831 ha in 2018. Most of the defoliation was in Guelph District with smaller areas in Aurora and Peterborough districts.

Several other insects caused localized defoliation or damage in various parts of Ontario. These occurrences did not develop into large areas but contribute to overall forest health concerns.

Forest pathogens and tree decline

Most tree pathogens do not cause symptoms over areas large enough to be aerially mapped, except when the damage caused by foliar diseases is severe. In 2018, foliar diseases such as brown spot needle blight, spruce needle rust, and armillaria root rot were mapped in all three regions, totalling 2,042 ha. Numerous other foliar diseases were reported during ground surveys including white pine blister rust, septoria leaf spot, and western gall rust. Beech leaf disease was first reported in Ohio in 2012 and in 2017 symptoms of beech leaf disease were confirmed in Aylmer District. In 2018, MNRF partnered with Agriculture and Agri-Food Canada and U.S. scientists to better understand the

cause of beech leaf disease. Viruses, bacteria, fungi, and nematodes are being considered as possible causal agents. Scientists at Agriculture and Agri-Food Canada and the Ontario Forest Research Institute are determining if nematodes found in symptomatic buds and leaves are involved in the development of the disease.

Invasive species

Emerald ash borer is an invasive insect that is regulated by the Canadian Food Inspection Agency (CFIA). As of June 30, 2016, areas regulated to control emerald ash borer in Ontario includes all of Southern Region and the southern part of Northeast Region, south of Montreal River, which is at the northern end of Sault Ste. Marie District as well as the city of Thunder Bay in Northwest Region.

In 2018, MNRF mapped the northern extent of ash decline and mortality and deployed traps in the Northwest Region. In 2018, 4,580 ha of emerald ash borer-related ash decline and mortality was recorded in Southern Region. Most of this damage was in Peterborough District (2,518 ha) and to a lesser extent in Parry Sound, Midhurst, Bancroft, Pembroke, and Kemptville districts. During ground surveys in Northeast Region, emerald ash borer infested trees were found farther north than in 2017, (about 4 km) along the Harmony River north of Sault Ste. Marie. In 2018, 34 baited green prism traps were deployed in Northwest Region in Fort Frances, Kenora, and Dryden districts. No beetles were found. Beetles were found at three trap sites, one in Northeast Region and two in Southern Region, all in regulated areas.

In 2013, as part of a long-term strategy to reduce the effects of emerald ash borer, biocontrol agents were released by the Canadian Forest Service. In total, 20 release sites were established in Ontario and Quebec, where over 127, 000 Tetrastichus planipennisi have been released over the past six years. In addition, over 48,000 Obius agrili have been released at 16 sites over the past four years and 2,700 *Spathius galinae* over the past two years. In 2018, releases were conducted at six sites in Ontario: one in Northeast Region in Sault Ste. Marie District and five in Southern Region, in Peterborough, Kemptville, and Pembroke districts.

On April 5, 2013, 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, Brampton, and MNRF 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. No new finds of Asian long-horned beetle were reported in 2018.

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 2018, new locations of beech bark disease were recorded in Southern Region.

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
Armillaria root rot	*Armillaria* spp.	Disease	22
Asian long-horned beetle	*Anoplohora glabripennis Motschulsky*	Insect	25
Balsam fir sawfly	*Neodiprion abietis* (Harr.)	Insect	27
Beech bark disease	*Neonectria faginata* (M.L. Lohman, A.M.J. Watson & Ayers) Castl. & Rossman	Disease	30
Beech leaf disease	Not available	Disease	32
Blowdown	Not applicable	Abiotic	35
Brown spot needle blight	*Lecanosticta acicula* (Thüm.) Syd.	Disease	43
Cedar leafminer complex	Various species	Insect	49
Eastern larch beetle	*Dendroctonus simplex* LeConte	Insect	56
Emerald ash borer	*Agrilus planipennis* Fairmaire	Insect	58
Fall cankerworm	*Alsophila pometaria* (Harr.)	Insect	63
Forest tent caterpillar	*Malacosoma disstria* Hubner	Insect	67
Gypsy moth	*Lymantria dispar* (L.)	Insect	78
Jack pine budworm	*Choristoneura pinus pinus* Freeman	Insect	83
Larch casebearer	*Coleophora laricella* (Hubner)	Insect	94
Large aspen tortrix	*Choristoneura conflictana* (Wlk.)	Insect	97
Mountain pine beetle	*Dendroctonus ponderosae* Hopkins	Insect	100
Nitidulid beetle	*Nitidulidae* spp	Insect	102
Pine engraver	*Ips pini* (Say)	Insect	105
Satin moth	*Leucoma* (= Stilpnotia) salicis (L.)	Insect	107
Snow damage	Not applicable	Abiotic	110
Spruce budworm	*Choristoneura fumiferana* Clemens	Insect	115
Spruce needle rust	*Chrysomyxa ledicola* Lagerh.	Disease	122
Walnut twig beetle	*Pityophthorus juglandis* (Blackman)	Insect	125

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.

Common name	Scientific name	Type	Page
Shoot blight of aspen	*Venturia macularis* (Fr.:Fr.) E. Mull. & Arx	Disease	156
Twig beetle	*Pityophthorus* spp.	Insect	157
Western gall rust	*Peridermium harknessii*, J.P. Moore	Disease	158
White pine blister rust	*Cronartium ribicola* J.C. Fisch.	Disease	160
White pine weevil	*Pissodes strobe* (Peck)	Insect	161
Whitespotted sawyer beetle	*Monochamus s. scutellatus* (Say)	Insect	162
Willow lace bug	*Corythucha elegans* Drake	Insect	164
Winter browning		Abiotic	165
Yellowheaded spruce sawfly	*Pikonema alaskensis* (Roh.)	Insect	167
Yellownecked caterpillar, Drexel's datana	*Datana ministra* (Drury), *Datana drexelii* Hy. Edw.	Insect	169

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 or surveyed for during forest health monitoring field work in Ontario in 2018 are listed below.

Common name	Scientific name	Type	Page
Asian long-horned beetle	*Anaplophora glabripennis* (Motschulsky)	Insect	30
Beech bark disease	*Neonectria faginata* (Lohman et al.) Castl. & Rossman	Disease	35
Beech scale	*Cryptococcus fagisuga Lindinger*	Insect	134
Butternut canker	*Ophiognomonia clavigignenti-juglandacearum* (V.M.G. Nair, Kostichka & J.E. Kuntz) Broders & G.J. Boland	Disease	137
Emerald ash borer	*Agrilus planipennis* Fairmaire	Insect	63
Gypsy moth	*Lymantria dispar* (L.)	Insect	83
Imported willow leaf beetle	*Plagiodera versicolora* (Laich.)	Insect	147
Introduced pine sawfly	*Diprion similis* (Htg.)	Insect	148
Japanese beetle	*Popillia japonica* Newm.	Insect	149
Larch casebearer	*Coleophora laricella* (Hubner)	Insect	99
Satin moth	*Leucoma salicis* (L.)	Insect	112
White pine blister rust	*Cronartium ribicola* J.C. Fisch.	Disease	165

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.
Balsam fir	*Abies balsamea* (L.) Mill.
Balsam poplar	*Populus balsamifera* L.
Basswood	*Tilia americana* L.
Bitternut hickory	*Carya cordiformis* (Wangenh.) K Koch
Black ash	*Fraxinus nigra* Marsh.
Black cherry	*Prunus serotina* Ehrh.
Black spruce	*Picea mariana* (Mill.) BSP
Black walnut	*Juglans nigra* L.
Bur oak	*Quercus macrocarpa* Michx.
Carolina poplar	*Populus x canadensis* Moench cv. Eugenei
Choke cherry	*Prunus virginiana* L.
Eastern cottonwood	*Populus deltoides* Bartr. ex Marsh.
Eastern hemlock	*Tsuga canadensis* (L.) Carrière
Eastern red cedar	*Juniperus virginiana* L.
Eastern white cedar	*Thuja occidentalis* L.
Eastern white pine	*Pinus strobus* L.
European larch	*Larix decidua* Mill.
European white poplar	*Populus alba* L.
Green ash	*Fraxinus pennsylvanica* Marshall
Jack pine	*Pinus banksiana* Lamb.
Largetooth aspen	*Populus grandidentata* Michx.
Lombardy poplar	*Populus nigra* L.
Manitoba maple	*Acer negundo* L.
Pin cherry	*Prunus pensylvanica* L. f.
Red maple	*Acer rubrum* L.

Common name	Scientific name
Red oak	*Quercus rubra* L.
Red pine	*Pinus resinosa* Ait.
Red spruce	*Picea rubens* Sarg.
Scots pine	*Pinus sylvestris* L.
Silver maple	*Acer saccharinum* L.
Speckled alder	*Alnus incana* spp. rugosa (Du Roi) J. Clausen
Sugar maple	*Acer saccharum* Marsh.
Tamarack/larch	*Larix laricina* (Du Roi) K. Koch
Trembling aspen	*Populus tremuloides* Michx.
White ash	*Fraxinus americana* L.
White birch	*Betula papyrifera* Marsh.
White oak	*Quercus alba* L.
White spruce	*Picea glauca* (Moench) Voss
Willow species	*Salix* spp.

Major forest disturbances

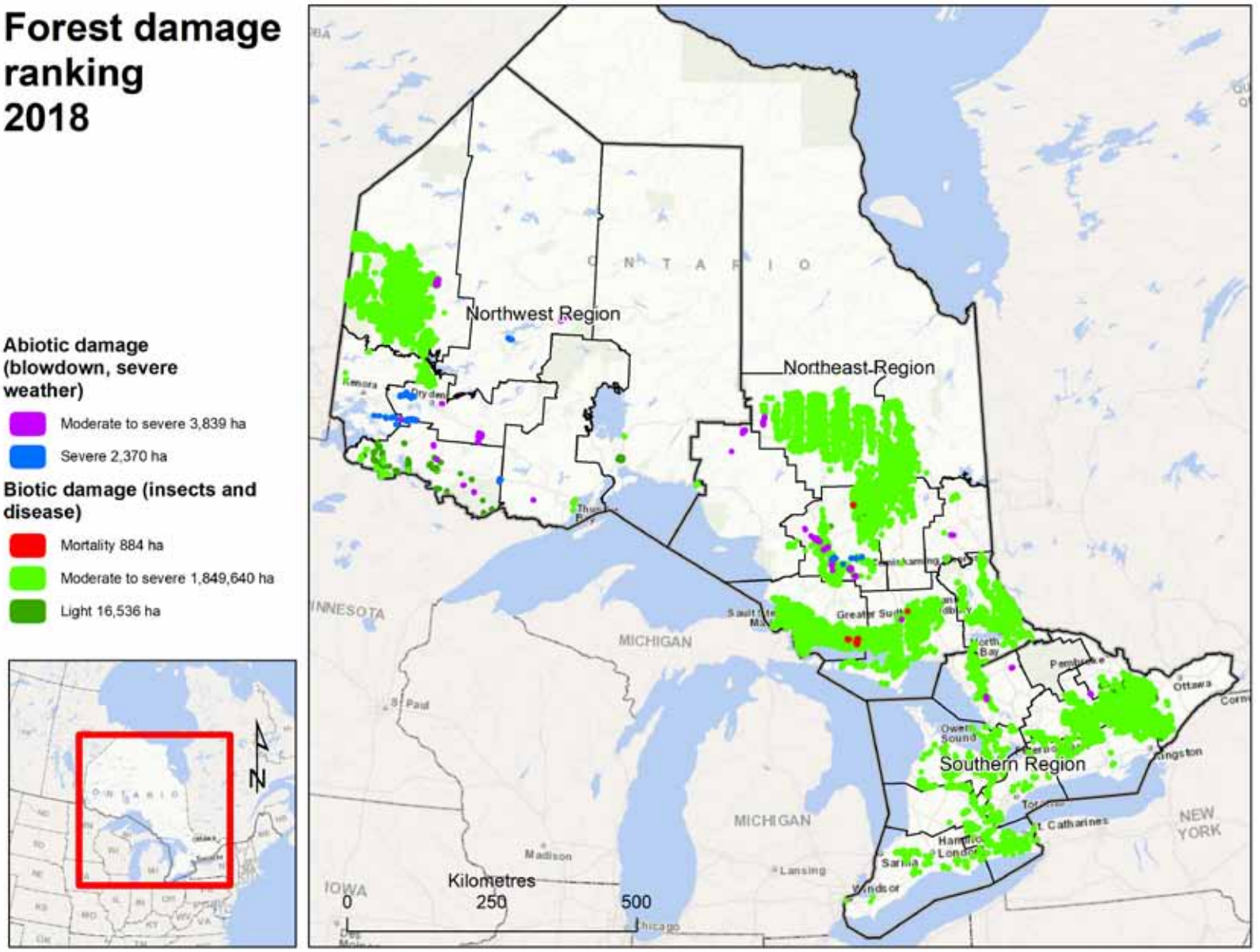
Mapped area of major forest disturbances

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 2018. In this document, major forest disturbances are those that occur over a large contiguous area (patches) and may not be an indicator of number of trees killed by the disturbance agent.

Common name	Light	Moderate to severe	Tree mortality	Total
Armillaria root rot	-	34	-	34
Balsam fir sawfly	31	-	-	31
Blowdown	-	3,839	-	3,839
Cedar leafminer	2,628	26,448	-	29,076
Emerald ash borer	-	4,580	-	4,580
Eastern larch beetle	-	1,125	-	1,125
Fall cankerworm	-	831	-	831
Forest tent caterpillar	13,806	992,207	-	1,006,013
Gypsy moth	-	14,937	-	14,937
Jack pine budworm	-	627,455	870	628,325
Larch casebearer	-	3,853	-	3,853
Large aspen tortrix	64	39,206	-	39,270
Satin moth	-	61	-	61
Septoria leaf spot	-	1,986	-	1,986
Spruce budworm	6	137,082	14	137,102
Snow damage	-	2,370	-	2,370
Spruce needle rust	-	181	-	181

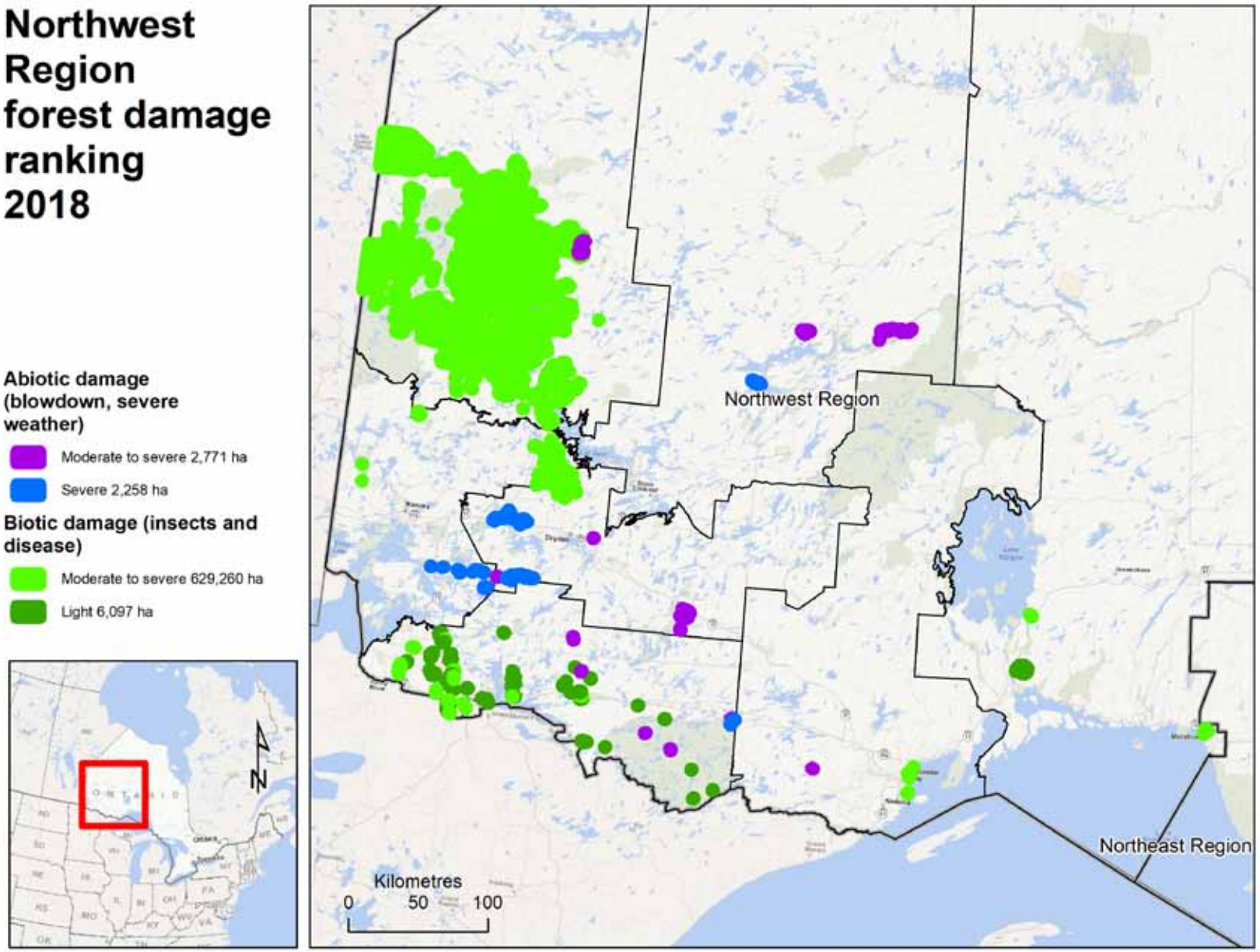
Major forest disturbance maps

Provincial overview



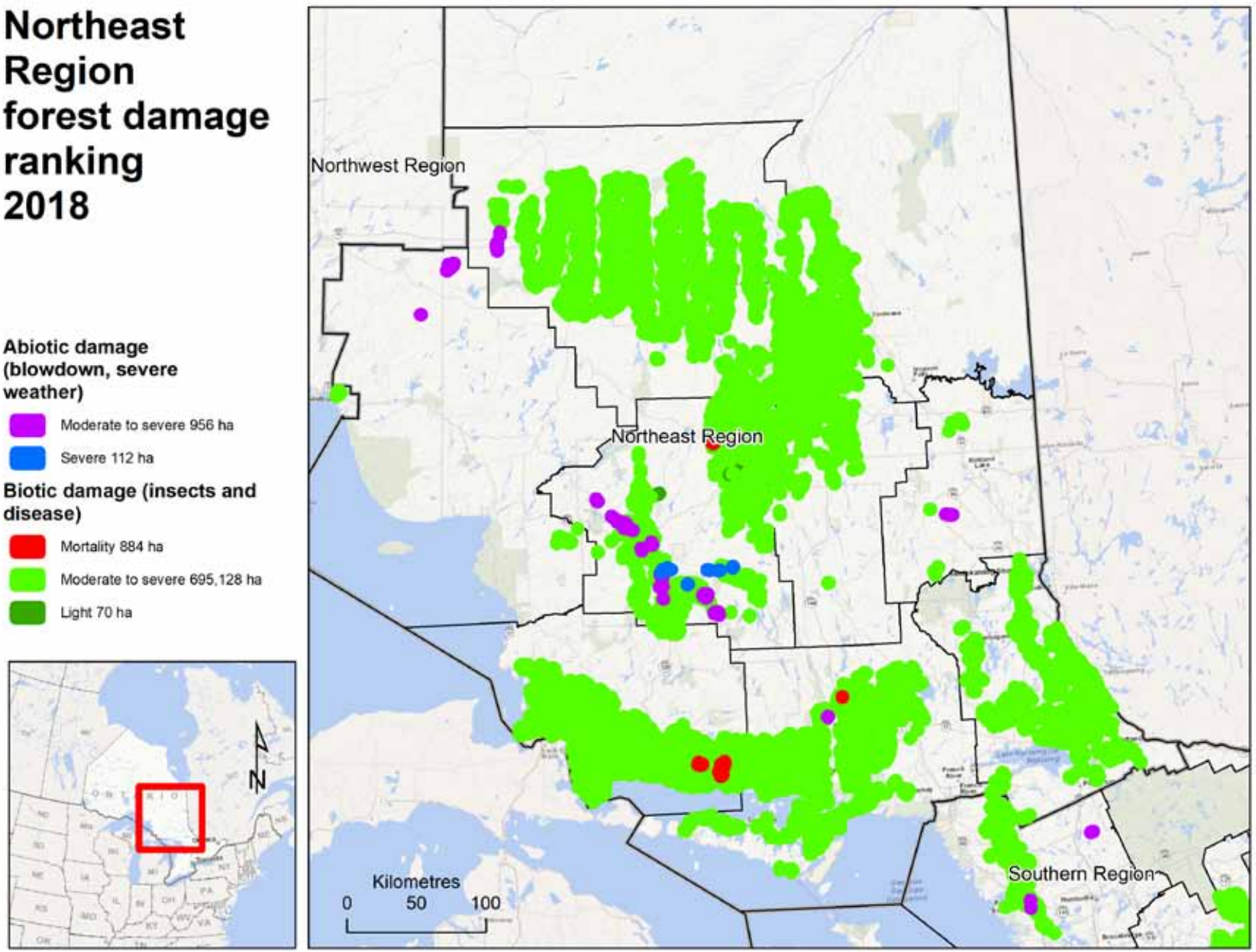
Northwest overview

Northwest Region forest damage ranking 2018

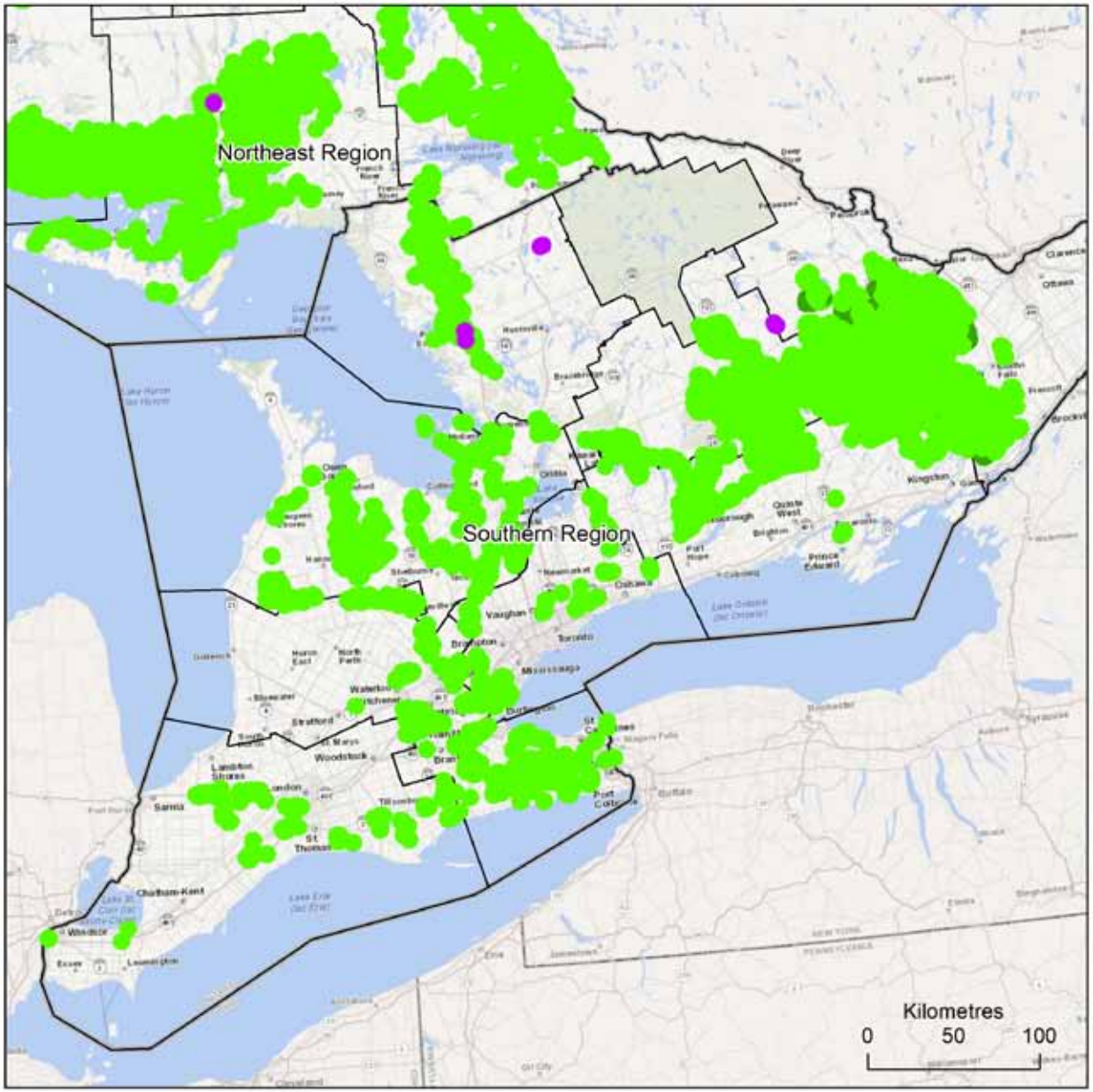


Northeast overview

Northeast Region forest damage ranking 2018



Southern Region forest damage ranking 2018



Abiotic damage (blowdown, severe weather)

- Moderate to severe 112 ha

Biotic damage (insects and disease)

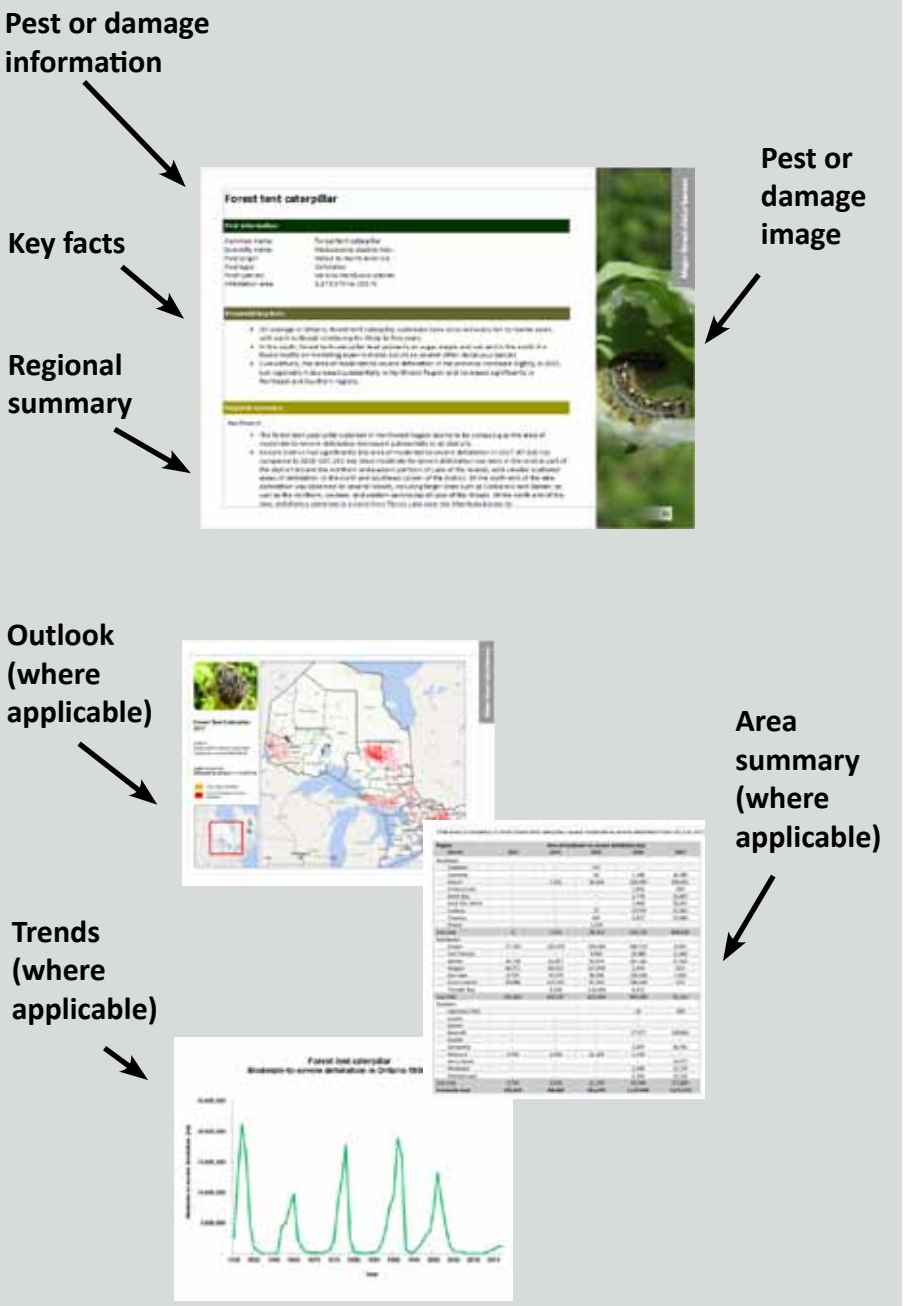
- Moderate to severe 525,251 ha
- Light 10,368 ha

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 MNRF administrative region (Northwest, Northeast, Southern)
- **Image** – a photo of the disturbance or pest
- **Outlook** – where applicable, an overview of potential future implications and developments for the disturbance
- **Trends** – where applicable, additional information about possible trends
- **Area summary** – where applicable, information about the total area in which the disturbance caused moderate to severe damage from 2014 to 2018 by MNRF region and district.

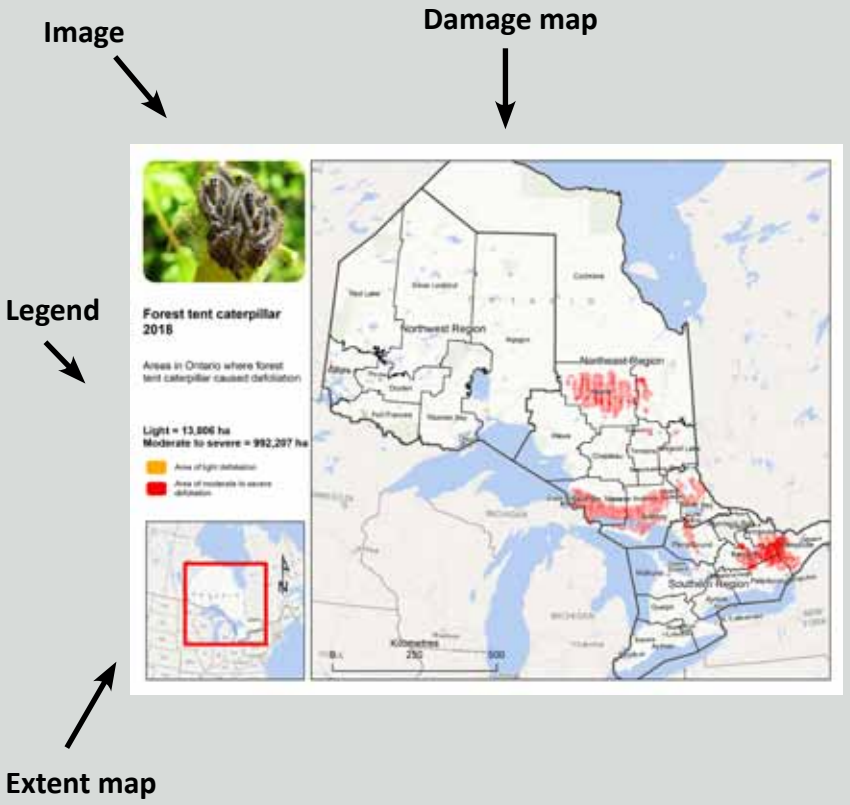


Example map

How to read the maps in this report

For major disturbances, the following spatial information is provided:

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



Armillaria root rot

Pest information

Common name:	Armillaria root rot
Scientific name:	*Armillaria* spp.
Pest origin:	Native to North America
Pest type:	Root disease
Host species:	Pine and spruce species
Infestation area:	34 ha

Provincial key facts

- Found throughout North America, armillaria root rot is a serious fungal disease that causes tree mortality and contributes to significant wood volume losses in both hardwood and softwood stands.
- This fungus is present in the soil and affects trees that are stressed by other biotic and abiotic factors. Trees can be infected for many years before they succumb to the disease.
- In forest stands, individual trees or groups of trees decline and die in a circular pattern. New trees are infected when they root graft with diseased trees or when shoestring-like filaments produced by the fungus reach nearby hosts.
- In 2018, armillaria root rot was reported in the Northwest and Northeast regions, occurring on softwoods. Armillaria infections are causing mortality throughout the province but damaged areas are typically too small to be detected from the air.

Regional summary

Northwest:

- In Nipigon District, 34 ha of moderate to severe armillaria root rot damage was aerially mapped in two areas north of the community of Macdiarmid in Kilkenny Twp. One area was on the west side of Hwy 11 and the other was farther west, in Lake Nipigon Provincial Park. Root rot was also noticed on several dead and declining trees in the Limestone Lake spruce plantation.

- In Dryden District, moderate to severe armillaria root rot affected red and jack pine trees in the town of Vermilion Bay. A small mixed stand of approximately 20 red and jack pine trees had heavy armillaria damage causing mortality.
- In Thunder Bay District, armillaria root rot was causing some mortality to young white spruce saplings in Sleeping Giant Provincial Park.

Northeast:

- In Sault Ste. Marie District, armillaria root rot was detected in a jack pine stand south of Elliot Lake in the northwest corner of Esten Twp. Several stressors, including insect defoliation, drought, and poor site condition, may have contributed to the decline. Of the trees surveyed, 45% were live and healthy, 17% had dead tops, and 38% were dead.

Armillaria root rot 2018

Areas in the Northwest Region where armillaria disease caused damage

Moderate to severe = 34 ha

Area of moderate to severe damage

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, horsechestnut, Katsura, maple, mountain ash, poplar, silk tree, sycamore or London plane tree, and willow
Infestation area:	Not found

Provincial key facts

- The Asian long-horned beetle 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 CFIA, which is the lead agency responsible for preventing the entry and spread of invasive insect species, joined with MNRF, the 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.
- On September 20, 2013, the CFIA confirmed the presence of Asian long-horned beetle in an industrial area near Pearson International Airport, Mississauga, with approximately 25 trees identified as infested, which were 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 approximately 20 square kilometres, bordered by Finch Avenue (north), Martin Grove Road (east), Hwy 401 (south), and Dixie Road (west).

- Restrictions on moving nursery stock, trees, logs, lumber, wood, wood chips, and bark chips from certain deciduous trees identified as hosts of the beetle are in place for the regulated area.
- Agencies currently working collaboratively to eradicate this insect are the CFIA, CFS, MNRF, and cities of Toronto, Mississauga, and Brampton.
- More information is available on the CFIA website at: www.inspection.gc.ca/plants/plant-protection/insects/asian-longhorned-beetle/eng/1337792721926/1337792820836.

Regional summary

Southern:

- In winter 2018, surveys were carried out in the regulated area in partnership with the CFIA. No new detections of the beetle were reported. Surveys are expected to continue until the winter of 2020, and if there are no new detections at that time, the CFIA will be able to consider declaring eradication.

Balsam fir sawfly

Pest information

Common name:	Balsam fir sawfly
Scientific name:	*Neodiprion abietis* (Harr.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Balsam fir
Infestation area:	31 ha

Provincial key facts

- Infestations of balsam fir sawfly are common in eastern Canada (Newfoundland and Labrador) and less frequent in Ontario.
- Outbreaks occurred in southeastern Ontario in the Ottawa Valley in the early 1940s and 50s and again in the late 1960s and early 70s.
- More than five or six consecutive years of defoliation can cause some mortality, but since spruce budworm often occurs simultaneously it is difficult to distinguish which insect is causing the most damage.
- In 2018, moderate to severe defoliation was only detected and aerially mapped in Southern Region.

Regional summary

Southern:

- In Pembroke District, 31 ha of moderate to severe defoliation by balsam fir sawfly was mapped during aerial surveys in a riparian corridor that passed through an agricultural area on south McNaughton Road, west of the town of Renfrew. The semi-mature stand was primarily trembling aspen with white spruce as the secondary species. On average, white spruce trees were 20% defoliated.
- In Kemptville District, moderate to severe defoliation was reported for the second year in a row in a semi-mature white pine/white spruce forest on Regional Road 20 (Waba Road) in Mississippi Mills Twp, Lanark County. Defoliation was noted on scattered individuals in mixed forest between Pakenham and White Lake. Light balsam fir sawfly defoliation was also seen on a 1 kilometre forested stretch of County Road 36 near Elphin, in the Lanark

Highlands. Defoliation of white spruce was observed mainly affecting old foliage in the top third of the trees.

- During ground surveys in Peterborough District, moderate to severe balsam fir sawfly defoliation was observed in a stand of mature balsam fir trees in Lakehurst south of Sandy Lake, Harvey Twp. Most affected were the tops of the crowns, with dieback of second year needles observed.

Total area (in hectares) in which balsam fir sawfly caused moderate to severe defoliation from 2014 to 2018 by MNRF district.

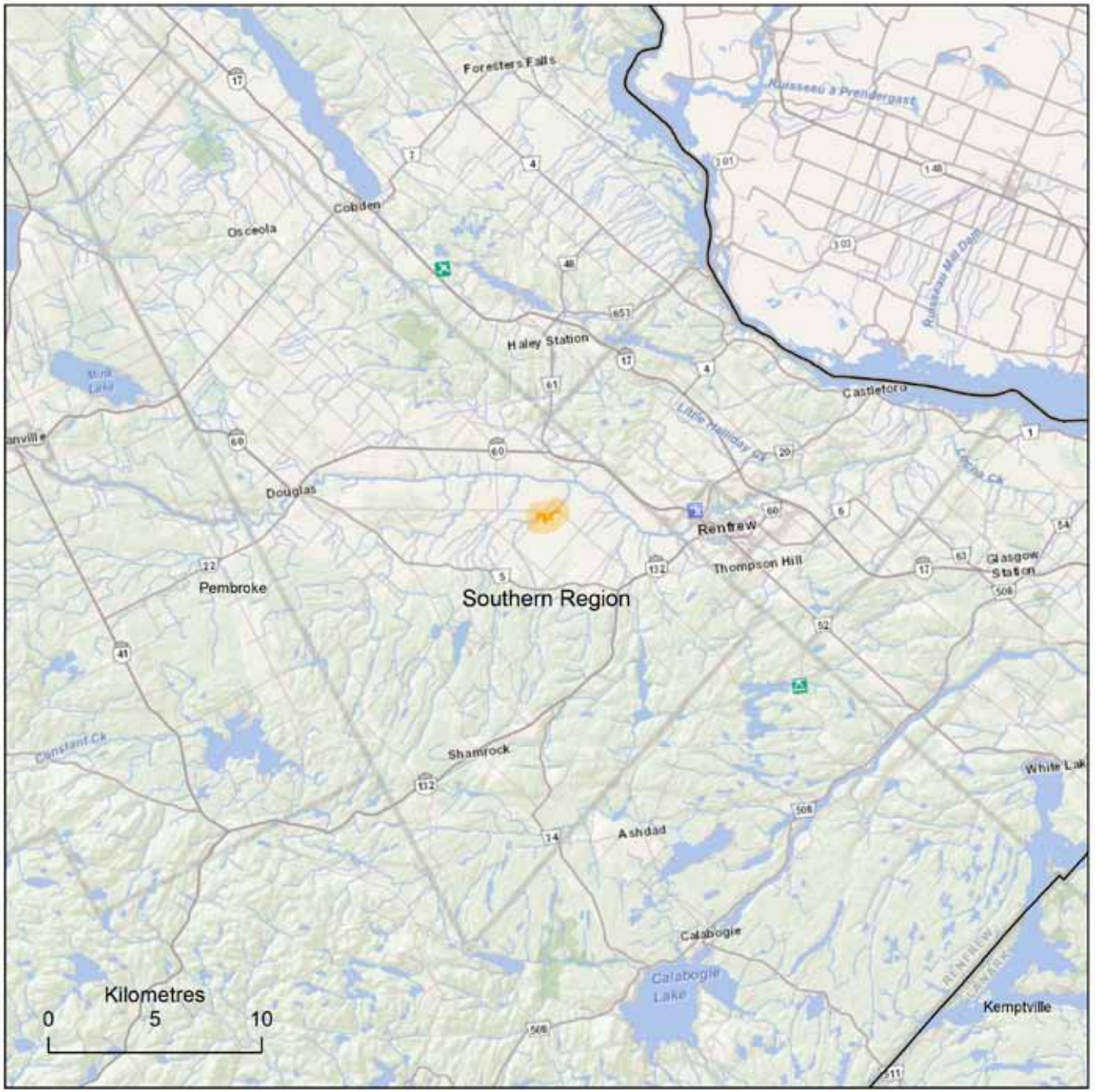
Region	Area of defoliation (ha)				
District	2014	2015	2016	2017	2018
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	-	-	-	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	-
Parry Sound	-	-	-	-	-
Pembroke	-	-	591	135	31
Peterborough	-	-	-	-	-
Sub total	0	0	591	135	31
Provincial total	0	0	591	135	31

Balsam fir sawfly 2018

Areas in the Southern Region where balsam fir sawfly caused defoliation

Light defoliation = 31 ha

Area of light defoliation



Beech bark disease

Pest information

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

Provincial key facts

- Beech bark disease is the result of an insect-fungal pathogen complex initiated by the infestation of beech scale 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. Large remnant trees continue to decline, and young trees become infected, disfigured, and gradually decline.
- In 2018, new beech bark disease locations were added to an existing database of confirmed infections in Southern Region.

Regional summary

Southern:

- In Pembroke District, beech bark disease was collected in a mature beech-ironwood forest along Sunnyhill Road at Bark Lake in the east part of Renfrew County. Damage in the stand was moderate to severe and the yellowing canopy was visible during aerial surveys in early July.
- In Aylmer District, beech bark disease fruiting bodies were collected from semi-mature beech in a private woodlot east of Thorndale in Middlesex County.
- In Parry Sound District, beech bark disease caused moderate damage to beech in a mature sugar maple stand along Doherty Road east of Lake Rosseau, Muskoka Lakes.

Beech bark disease plot assessments

- In 2010 and 2011, permanent plots were established at 11 locations to monitor the development of beech bark disease, and to study interactions among the scale, the pathogen, the host tree, and climate. Most plots were along the advancing front of the disease in southwest and central Ontario, and scale was present at various levels at nine locations.
- The plots are evaluated on a bi-annual basis and are to be re-evaluated in 2019.

Beech leaf disease

Pest information

Common name:	Beech leaf disease
Scientific name:	Causal agent not yet identified
Pest origin:	NA
Pest type:	NA
Host species:	American Beech
Infestation area:	Localized

Provincial key facts

- Beech leaf disease was first identified in Lake County, Ohio in 2012 and now extends into other areas of Ohio, northwestern Pennsylvania, and southwestern New York.
- Symptoms of beech leaf disease were first confirmed in southern Ontario in Aylmer District in 2017.
- To date, no causal agent has been identified.
- Symptoms include the presence of aborted buds and striping/banding caused by the thickening of leaf tissue between veins. As the growing season progresses, foliage of affected trees becomes thin, shrivelled, and discoloured.
- 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.
- In 2018, the Ontario Ministry of Natural Resources and Forestry partnered with Agriculture and Agri-Food Canada and US scientists to better understand the cause of beech leaf disease. Viruses, bacteria, fungi, and nematodes are being considered as possible causal agents. Scientists at Agriculture and Agri-Food Canada and the Ontario Forest Research Institute are testing whether a new species of nematode found in diseased buds and leaves is involved in the infection process.

Regional summary

Southern:

- In Aylmer District, symptoms of beech leaf disease have now been identified in Elgin, Middlesex, Oxford, Norfolk, and Chatham-Kent counties. The condition does not appear to be influenced by age class, canopy class, slope, or soil conditions. Several sampling plots were established in areas of Aylmer District, where regular sampling was carried out during the 2018 growing season. Symptomatic and asymptomatic leaf and bud samples were submitted for laboratory analysis to determine a causal agent.

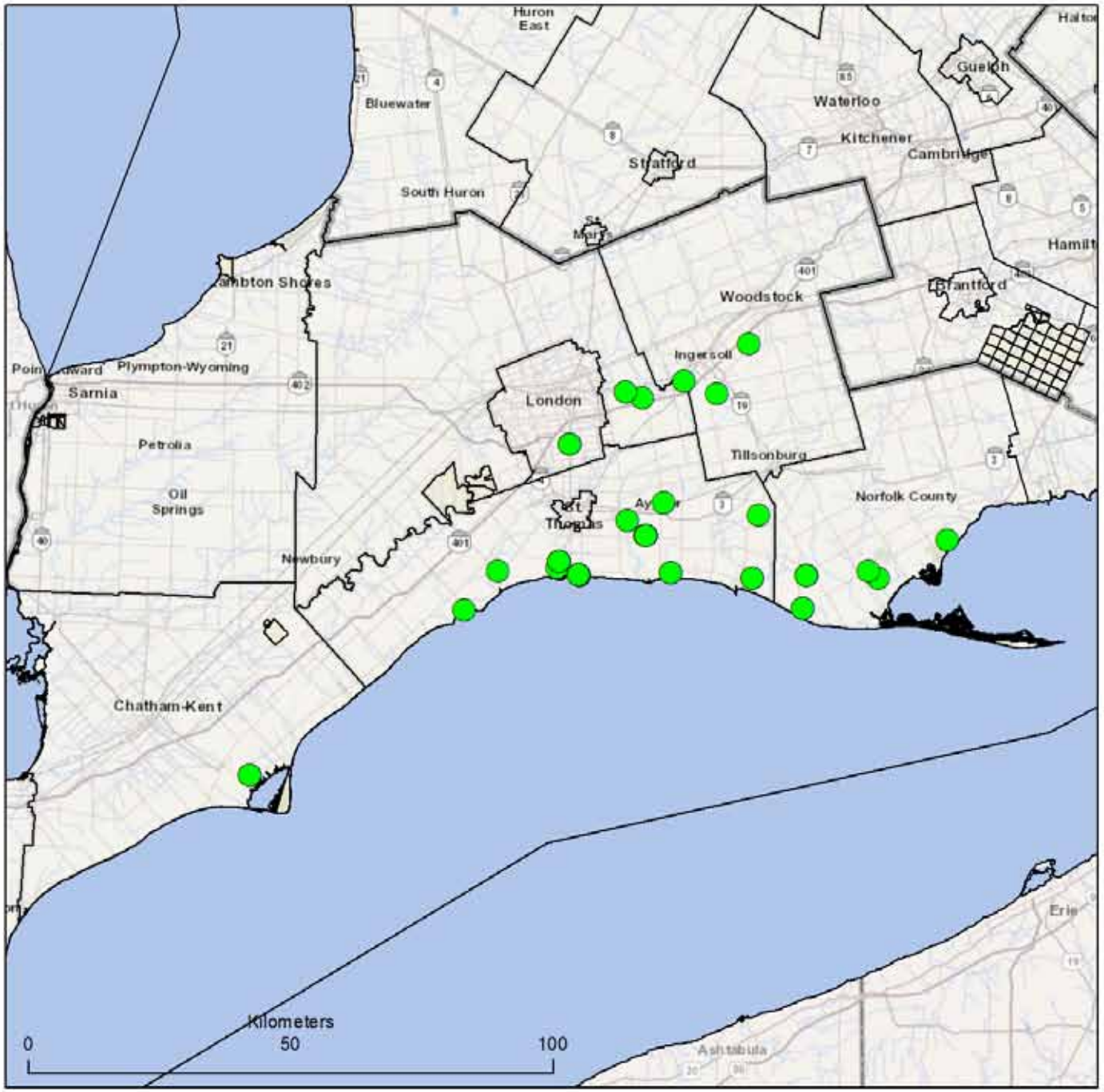
Trend analysis/outlook/issues

Forest Health Program staff will continue to monitor this condition and work with scientists and researchers to identify a causal agent.

Beech leaf disease 2018

Southern Region
Points where beech leaf disease caused damage

Points where beech leaf disease was confirmed



Blowdown

Pest information

Common name:	Blowdown
Scientific name:	NA
Pest origin:	NA
Pest type:	Abiotic
Host species:	Variable
Infestation area:	3,839 ha

Provincial key facts

- Blowdown, damage to trees because of high winds or extreme weather events, is part of the natural processes in forests. The extent and frequency of such damage is sporadic.
- Blowdown increases the incidence of opportunistic insects and diseases such as whitespotted sawyer beetle and armillaria root rot as well as fuel loading for fire.
- More blowdown was recorded in 2018 (3,839 ha) than in 2017 (2,439 ha).
- Scattered areas of blowdown were found in all three regions in 2018, with most in the Northwest Region (2,771 ha).

Regional summary

Northwest:

- On the east side of Red Lake District, two pockets of blowdown totalling 1,120 ha were aerially mapped on the northwest side and south end of Mamakwash Lake.
- On the east side of Sioux Lookout District, 1,032 ha of blowdown was recorded. Three medium sized areas of damage were observed north of Matapesatakum Bay on Lake St. Joseph. A second area of scattered blowdown was noted north of Kagami Island in Albany River Provincial Park.
- In 2018, 497 ha of blowdown was observed in Dryden District. Most of it was in the southeast part of the district with a small area east of the City of Dryden between Thunder and Hartman lakes. The larger area of blowdown was

about 9 kilometres southeast of the town of Ignace near Gulliver River and Hwy 17. A smaller area of blowdown was recorded on the southeast end of Owl Lake.

- Fort Frances District had 113 ha of blowdown in the central and southeast parts of the district in and just north of Quetico Provincial Park. Two small areas were mapped centrally: one east of Entwine Lake and another southeast of Tesup Lake. Blowdown in the southeast was seen in the northern half of Quetico Provincial Park near Quetico Lake and between Sturgeon and Fred lakes and at the south end of Windgoostigwan Lake. The town of Fort Frances had high winds in late August causing damage to many urban trees and blowing down 30 to 40 black ash trees in Pither's Park.
- In the southwest part of Thunder Bay District, a small area (9 ha) of blowdown was mapped between Batwing Lake and Matawin River on the north central side of Matawin River Provincial Park nature reserve.
- During ground surveys, a small area of blowdown was observed in the northeast corner of Kenora District west of Wabaskang Lake along Railbed Road, west of Hwy 105.

Northeast:

- A major storm went through Chapleau District at the end of June, causing the closure of Hwy 129. A total of 653 ha of blowdown was mapped in July northwest and south of the town of Chapleau as well as south of Sultan in Wakami Lake Provincial Park. Northwest of Chapleau, small scattered areas of blowdown were aerially mapped at the south end of Como Lake and farther northwest blowdown was observed along or near the railway line on the south end of Windermere Lake and just south of Delmage Lake in Delmage Twp. South of the town of Chapleau small scattered areas of blowdown were reported in the south end of Galagher Twp near Earl and Kirkpatrick lakes as well as two small areas south of the junction of Hwy 101 and Hwy 129 in the northeast corner of Chappise Twp at the north end of MClennan Lake. Further south, blowdown was mapped south of the junction of Hwy 129 and Hwy 667. Most of the damage in this area was on the west side of Reaney Twp in Wenebegon River Provincial Park (waterway class) and Five Mile Lake Provincial Park (recreational class). A little farther south, small areas of blowdown were reported in the northeast corner of Hutcheon Twp, the northwest corner of Langlois Twp at the north end of Mather Lake, and the northwest corner of Birch Twp, all close to Hwy 129. South of Sultan several areas of blowdown were observed in or near the southeast corner of Wakami Lake Provincial Park in Symington and Bullbrook townships. South of here six more areas of blowdown were mapped at the northern borders of Eaton and Edighoffer townships near Eaton and Rock lakes.
- In 2018, 133 ha of blowdown was recorded in the northern part of Wawa District. Most of it was about 20 km northwest of Nagagami Lake on the north side of Otasawian Lake in Downer and Frances townships. A very small area of blowdown was also mapped south of the railway station of Hillsport on the northwest side of Anna Lee Lake approximately five kilometres north of Herbert Twp.

- On the west side of Hearst District, a total of 36 ha of blowdown was observed on the north and south sides of Hwy 11 in McCoig and Cross townships. Stands of semi mature to mature black spruce were blown over along the Pitopiko River.
- In the southcentral part of Kirkland Lake District, a small patch of blowdown (123 ha) was mapped southeast of Matachewan. The damage was located between Hwy 66 and Hwy 65 east of Montreal River on the north side of Council Creek, in Willison and Davidson townships.
- In the central part of Sudbury District, a small area of blowdown (11 ha) was mapped west of Windy Lake, approximately three kilometres from Fox Lake in Ermatinger Twp. During ground surveys a small area of blowdown was observed, but not mapped, south of kilometre 114 along West Branch Road in Moses Township.

Southern:

- In 2018, 98 ha of blowdown was mapped in the southwest corner of Pembroke District along the Bancroft District boundary in Raglan Twp, south of York River.
- In Parry Sound District only a few scattered areas of blowdown were aerially mapped near Windfall Lake and Capton Lake, south of Parry Sound as well as east of the town of Sundridge along Gibbons Road, in Joly Twp. This area totalled 9 ha. Ground surveys indicated blowdown occurred along Chemical Road by Wendigo Lake, northeast of South River. This area was not aerially mapped.

Total area (in hectares) in which blowdown was recorded from 2014 to 2018 by MNRF district.

Region	Area of damage (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	4	275	697	653
Cochrane	7	-	67	84	-
Hearst	1	-	3	25	36
Kirkland Lake	-	-	-	140	123
North Bay	-	-	-	-	-
Sault Ste. Marie	152	-	-	10	-
Sudbury	7	67	-	326	11
Timmins	-	-	5	83	-
Wawa	-	-	-	-	133
Sub total	168	71	350	1,365	956

District	2014	2015	2016	2017	2018
Northwest					
Dryden	292	31	884	31	497
Fort Frances	792	991	-	319	113
Kenora	106	488	73	30	-
Nipigon	46	277	180	-	-
Red Lake	-	-	6,761	227	1,120
Sioux Lookout	9	72	3,080	468	1,032
Thunder Bay	1,867	117	120	-	9
Sub total	3,111	1,976	11,098	1,075	2,771
Southern					
Algonquin Park	114	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	7	-	-	-	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	-
Parry Sound	-	-	-	-	14
Pembroke	16	-	-	-	98
Peterborough	-	-	-	-	-
Sub total	136	0	0	0	112
Provincial total	3,415	2,047	11,448	2,439	3,839

Blowdown 2018

Areas in Ontario where blowdown caused damage

Moderate to severe = 3,839 ha

Area of moderate to severe damage

Blowdown 2018

Areas in the Northwest Region where blowdown caused damage

Moderate to severe = 2,771 ha

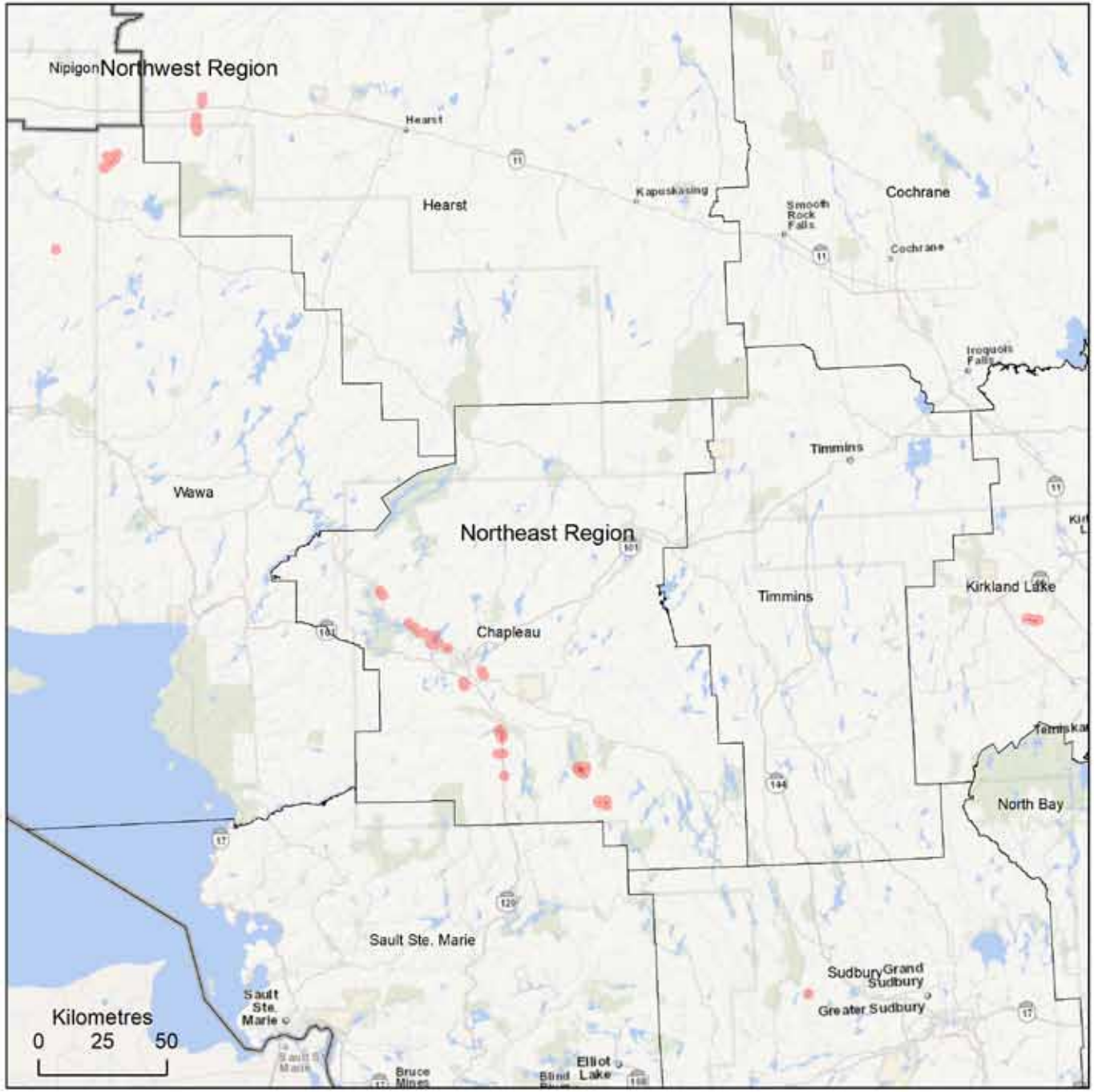
Area of moderate to severe damage

Blowdown 2018

Areas in the Northeast Region where blowdown caused damage

Moderate to severe = 956 ha

Area of moderate to severe damage

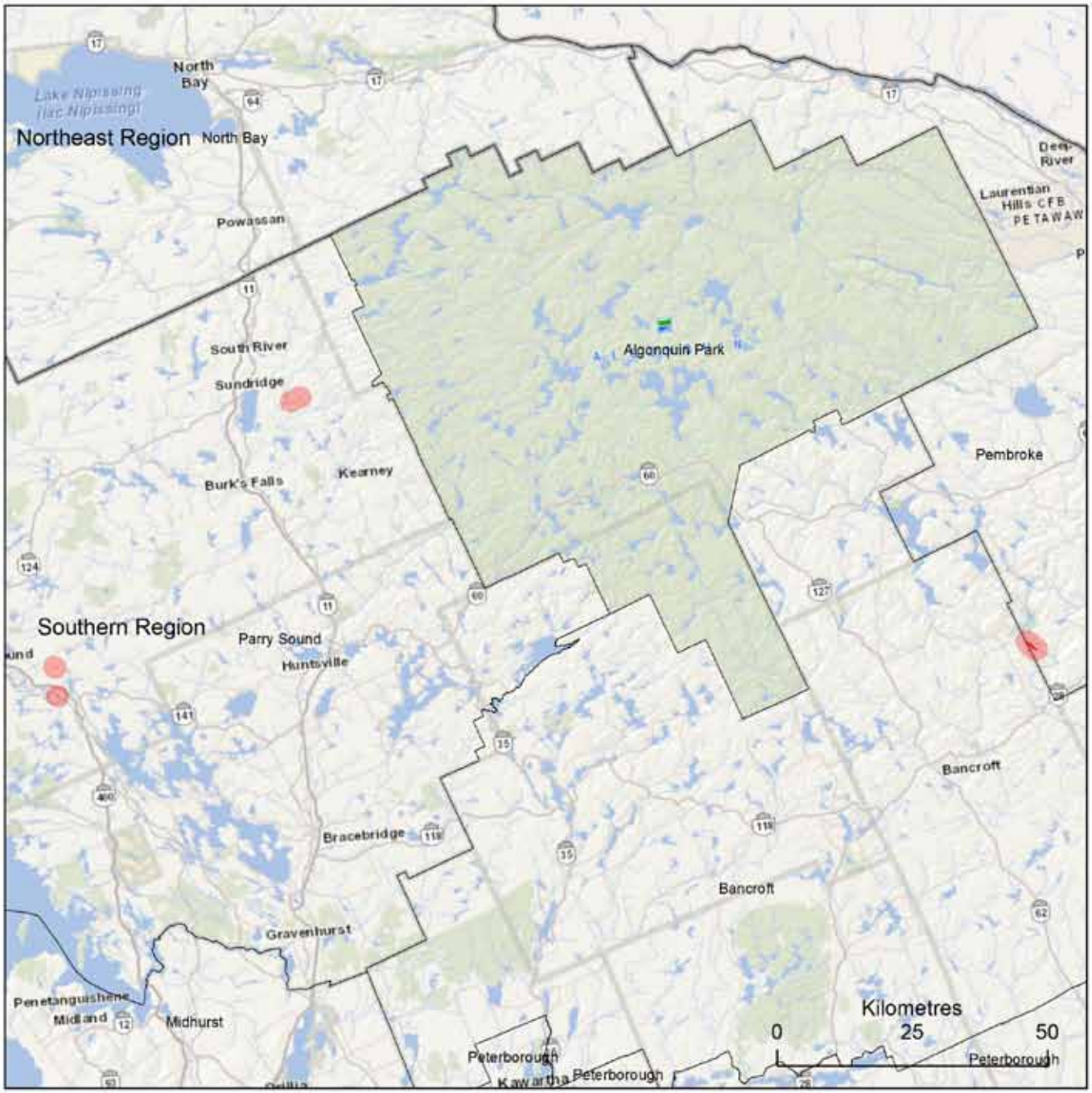


Blowdown 2018

Areas in the Southern Region where blowdown caused damage

Moderate to severe = 112 ha

Area of moderate to severe damage



Brown spot needle blight

Pest information

Common name:	Brown spot needle blight
Scientific name:	*Mycosphaerella dearnessii* M.E. Barr
Pest origin:	Native to North America
Pest type:	Needle blight
Host species:	*Pinus* spp
Infestation area:	1,827 ha

Provincial key facts

- This disease affects many pines including Scots and Austrian pine of all ages but is most damaging to seedlings and smaller trees.
- Several years of infection reduces tree growth. Coupled with other factors, such as drought and secondary insect attack, it may kill branches or trees.
- Defoliation was mapped in small areas of Scots pine in plantations and adjacent fields.
- In some locations previous years' needles were brown and dropping in June, leaving only current years' shoots on trees.
- Total area of damage in 2018 was 1,827 ha, an increase from 2017 when no damage was mapped.

Regional summary

Southern:

- In Midhurst District, 1,569 ha of brown spot needle blight damage on Scots pine was mapped across the southern part of the district. The area with the most damage was in Simcoe County from Cook's Bay, north to Christian Island and along the east shore of Georgian Bay, north of Wasaga Beach and along Hwy 400 to Midland. Areas of damage were also observed near the Huron-Bruce county border south of Walkerton. Small plantations were affected between Owen Sound and Southampton in Bruce County. In Grey County, small stands with damage were mapped south along Hwy 6 from Owen Sound to Varney.

- In Aurora District, several areas of damage totalling 121 ha were mapped, from Halton Hills in Halton Region to north of Oshawa.
- In Aylmer District, 68 ha of damage were mapped in several areas south of Tillsonburg to Walsingham as well as southeast of the community of Simcoe near Hwy 6, Norfolk County.
- In Peterborough District, 3 ha of damage was mapped north of Rice Lake near Fraserville.

Northeast

- In Sudbury District, brown spot needle blight was observed causing needle drop in a 67 ha stand of Scots pine along Dump Road and Hwy 540, east of Meldrum Bay on Manitoulin Island. New foliage was shorter than older foliage that was beginning to brown in July. Green needles were present only at the tips and top of the tree.

Total area (in hectares) in which brown spot needle blight caused moderate to severe damage from 2014 to 2018 by MNRF district.

Region	Area of damage (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	176	15	-	-	-
Sudbury	150	11	100	-	67
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Sub total	327	26	100	0	67

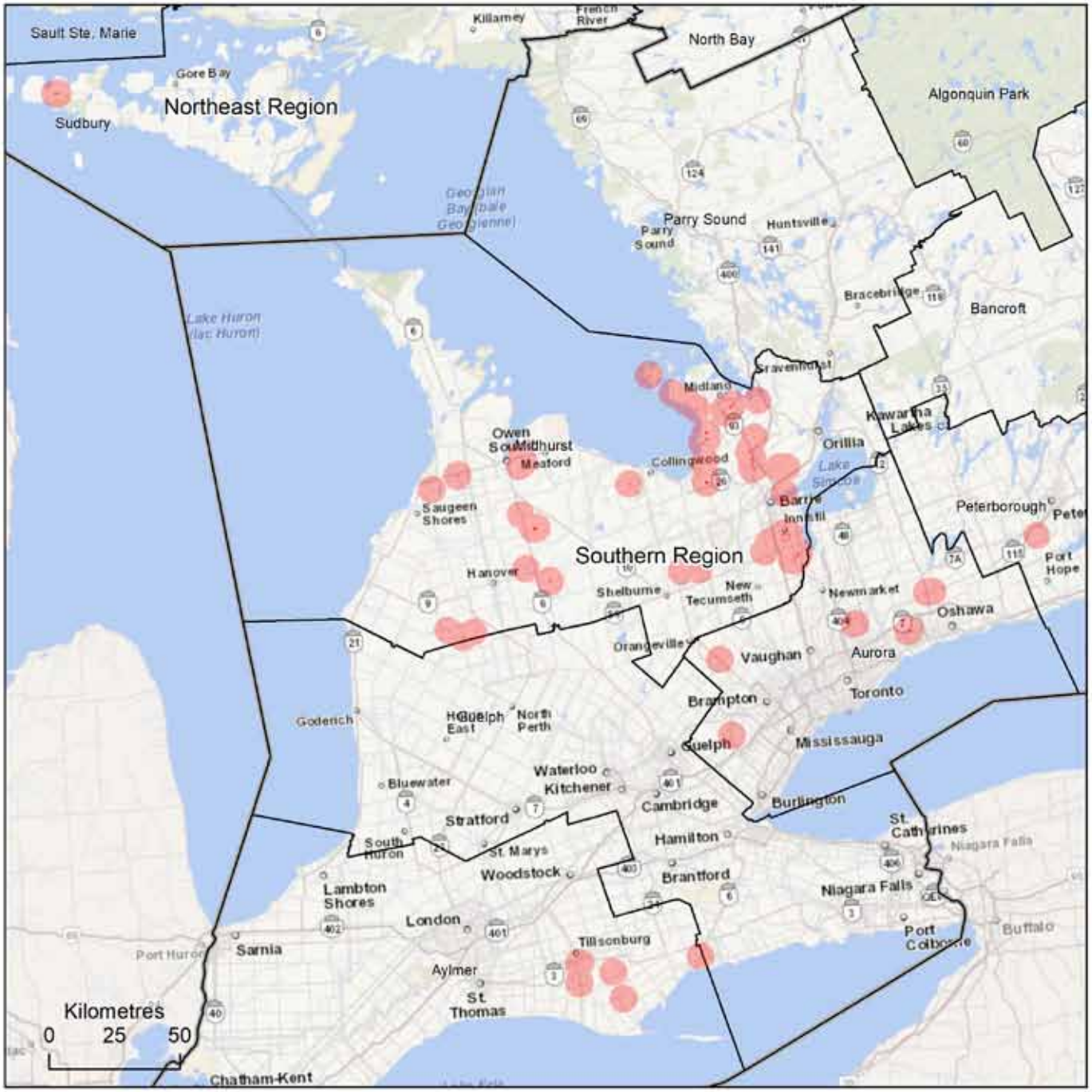
District	2014	2015	2016	2017	2018
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	121
Aylmer	-	-	-	-	68
Bancroft	-	-	-	-	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	1,569
Parry Sound	-	-	-	-	-
Pembroke	-	-	-	-	-
Peterborough	-	-	-	-	3
Sub total	0	0	0	0	1,760
Provincial total	327	26	100	0	1,827

Brown spot needle blight 2018

Areas in Ontario where brown spot needle blight caused defoliation

Moderate to severe = 1,827 ha

Area of moderate to severe defoliation



Brown spot needle blight 2018

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

Moderate to severe = 67 ha

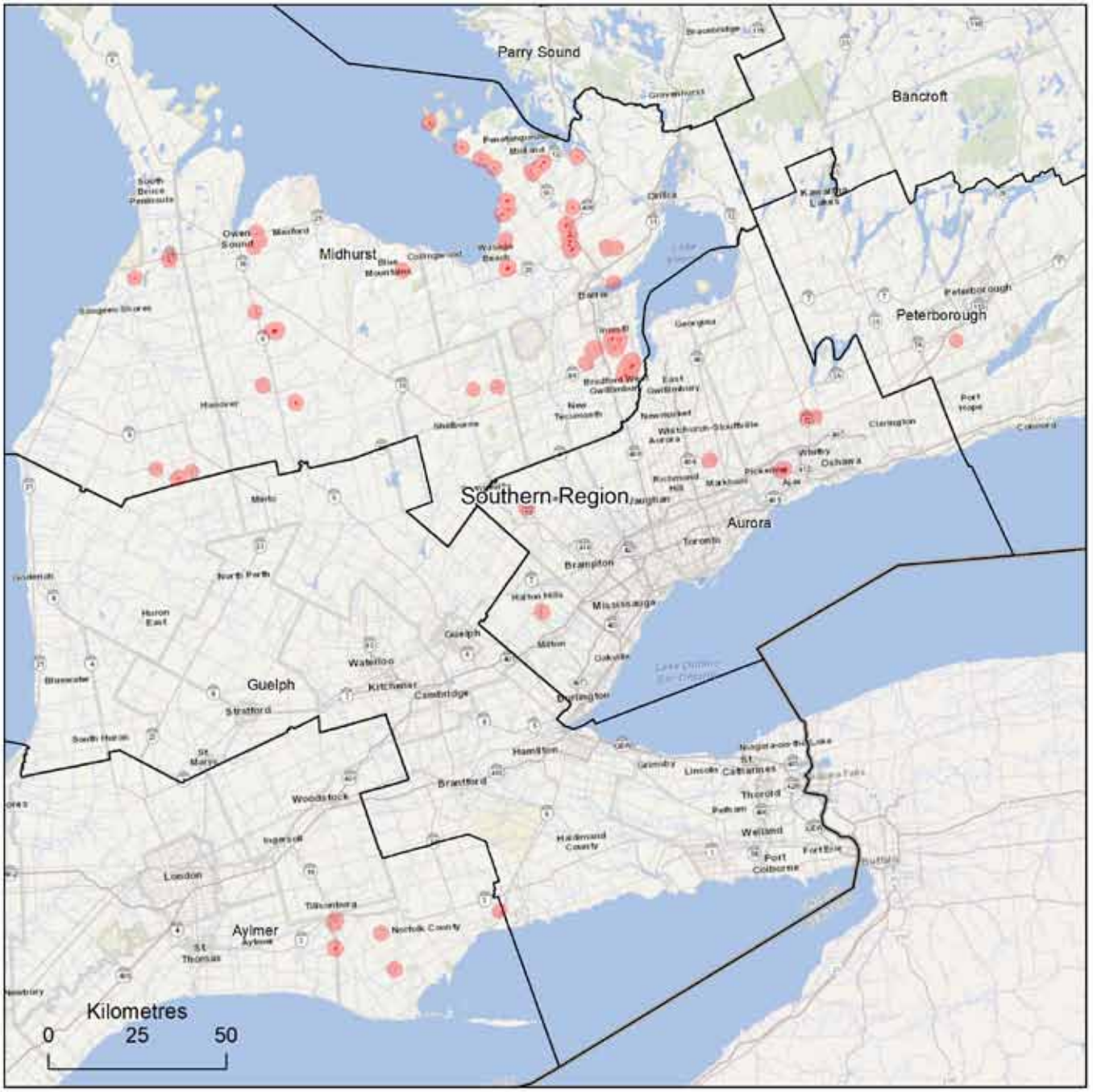
Area of moderate to severe defoliation

Brown spot needle blight 2018

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

Moderate to severe = 1,760 ha

Area of moderate to severe defoliation



Cedar leafminer complex

Pest information

Common name:	Cedar leafminer complex
Scientific name:	*Argyresthia aureoargentella* Brower, *Argyresthia canadensis* Freeman, *Argyresthia thuiella* (Peck), *Coleotechnites thujaella* (kft.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Eastern white cedar
Infestation area:	26,448 ha

Provincial key facts

- Cedar leafminer complex is a group of similar insects that mine cedar foliage, including:
  - *Argyresthia aereoargentella* Brower
  - *Argyresthia canadensis* Freeman
  - *Argyresthia thuiella* (Pack)
  - *Coletechnites thujaella* (Kft.)
- The most recent widespread cedar leafminer outbreak occurred in Kemptville District from 2002 to 2007, resulting in high amounts of top kill and whole tree mortality.
- In Southern Region, detection of cedar leafminer defoliation was hindered by heavy cone retention in many districts.
- In 2018, 26,448 ha of moderate to severe cedar leafminer defoliation was aerially mapped in Northwest and Southern regions as well as 2,628 ha of light defoliation only in Northwest Region. The area of defoliation increased substantially relative to 2017.

Regional summary

Northwest:

- In Fort Frances District, 366 ha of moderate to severe and 2,628 ha of light cedar leafminer defoliation were aerially mapped. The moderate to severe defoliation was observed in five areas: three were between Emo and

Caliper Lake, one was east of Fort Frances near Windy lake, and another was about 9 km east of Mine Centre along Hwy 11. Most of the light defoliation was on the west side of the district with small scattered areas in the central and eastern parts of the district. On the west side of the district, small areas of light defoliation were mapped on the west and east sides of Hwy 71 from the Fort Frances/Kenora district boundary to Fort Frances and the east side of Rainy Lake. In the central part of the district, scattered areas of light defoliation were observed in the Mine Centre area around Little Turtle and Wild Potato lakes as well as on the west end of Namaken Lake near the Minnesota border and east of Flanders near McCaulay Lake. On the east side of the district, one small area of light defoliation was recorded in the southeast corner of Quetico Provincial Park between Bell and Other Man lakes.

- In the northeast corner of Kenora District, areas of light to moderate defoliation were observed, but not aerially mapped, along shorelines in the Perrault Falls area near Perrault and Wabaskang lakes. Light defoliation of mature roadside cedar was also observed along Hwy 71 north of Sioux Narrows.
- In Dryden District, light defoliation was observed during ground surveys on ornamental eastern white cedar on private property in the City of Dryden, and in cedar stands on Thunder Lake Road east of the city. Further light defoliation was observed in cedar stands along Hwy 17, just west of the community of Dinorwic.
- Light defoliation caused by cedar leafminer was seen during ground surveys on fringe cedar along Hwy 72, south of the town of Sioux Lookout in Sioux Lookout District.

Southern:

- In 2018, cedar leafminer defoliation was mapped in six districts in Southern Region.
- In Midhurst District, 17,852 ha of moderate to severe cedar leafminer defoliation were aerially mapped across the district. Large areas of defoliation were mapped in the southwest, central, and eastern parts of the district. In the southwest, large areas of defoliation were mapped south of the community of Kinloss around Clam and Silver lakes to Huron Bruce Road along the Midhurst/Guelph district boundary. In the central part of the district areas of defoliation were mapped north, west, and south of Flesherton. In the eastern part of the district, small scattered areas of defoliation were observed north, south, and west of Barrie to Midland, Bradford West Gwillimbury, and between Collingwood and Shelburne.
- In Guelph District, 4,396 ha of moderate to severe defoliation of eastern white cedar were aerially mapped on the northeast side of the district. Defoliation in the northern extent of the district was along the Midhurst/Guelph district boundary between Mount Forest and Pike Lake following the South Saugeen River. A little farther southeast, smaller scattered areas of defoliation were mapped in Centre Wellington, Wellington County, in and around Luther Marsh Wildlife Management Area and Belwood Lake. In the eastern edge of the district, larger areas of defoliation were mapped north, east, west and southeast of the City of Guelph.

- In Aurora District, 2,709 ha of moderate to severe defoliation were mapped throughout the district. On the west side of the district, areas of defoliation were recorded northwest and north of the Town of Milton in Esquesing and Nassagaweya Townships as well as west of Caledon in and around Fork of the Credit Provincial Park. In the central part of the district, two large pockets of defoliation were mapped southwest on the City of Pickering and east of the City of Markham. On the east side of the district, scattered areas of defoliation were observed north of Lake Scugog along Hwy 2, north of Clarington and north of Whitby.
- In Peterborough District, 527 ha of defoliation were recorded in the western part of the district. Areas of moderate to severe defoliation were mapped in hedgerows northeast of the City of Peterborough, in Douro Twp. On the far west side of the district, small areas of moderate to severe defoliation were mapped along the border of Aurora district on the east side of Hwy 2 north of Lake Scugog. A larger more concentrated area of defoliation was recorded between Sturgeon and Cameron lakes in the Fenlon Falls area.
- In Kemptville District, 500 ha of moderate to severe defoliation were aerially mapped in the western part of the district. Defoliation was mapped in and around Smiths Falls and between the communities of Perth and Almonte.
- In Bancroft district, 98 ha of moderate to severe cedar leafminer defoliation were aerially mapped in the southwest corner of the district. Small stands were defoliated on the northeast end of Balsam Lake along Hwy 35 north of Rosedale, and west of Burnt River in the Four Mile and Silver lakes areas. All areas affected by cedar leaf miner also had brown crowns due to heavy cone retention.
- Moderate to severe cedar leafminer defoliation was recorded, but not aerially mapped in Alymer District during ground surveys. Defoliation was observed ubiquitously in hedgerows and agricultural windbreaks throughout Norfolk, Essex, and Middlesex counties.

Total area (in hectares) in which cedar leafminer caused moderate to severe defoliation from 2014 to 2018 by MNRF district.

Region	Area of damage (ha)				
District	2014	2015	2016	2017	2018
Northwest					
Dryden	-	-	-	-	-
Fort Frances	-	-	-	924	366
Kenora	-	-	-	-	-
Nipigon	-	-	-	-	-
Red Lake	-	-	-	-	-
Sioux Lookout	-	-	-	-	-
Thunder Bay	-	-	-	-	-
Sub total	0	0	0	924	366
Southern					
Algonquin Park	-	44	-	-	-
Aurora	631	-	-	184	2,709
Aylmer	36	-	-	-	-
Bancroft	231	9	-	130	98
Guelph	2,199	-	-	602	4,396
Kemptville	2	82	14	1,822	500
Midhurst	6,567	56	-	1,124	17,852
Parry Sound	-	-	-	44	-
Pembroke	227	200	-	-	-
Peterborough	886	120	-	1,073	527
Sub total	10,780	511	0	4,979	26,082
Provincial total	10,780	511	14	5,903	26,448

Cedar leafminer 2018

Areas in Ontario where cedar leafminer caused defoliation

Light = 2,628 ha
Moderate to severe = 26,448 ha

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

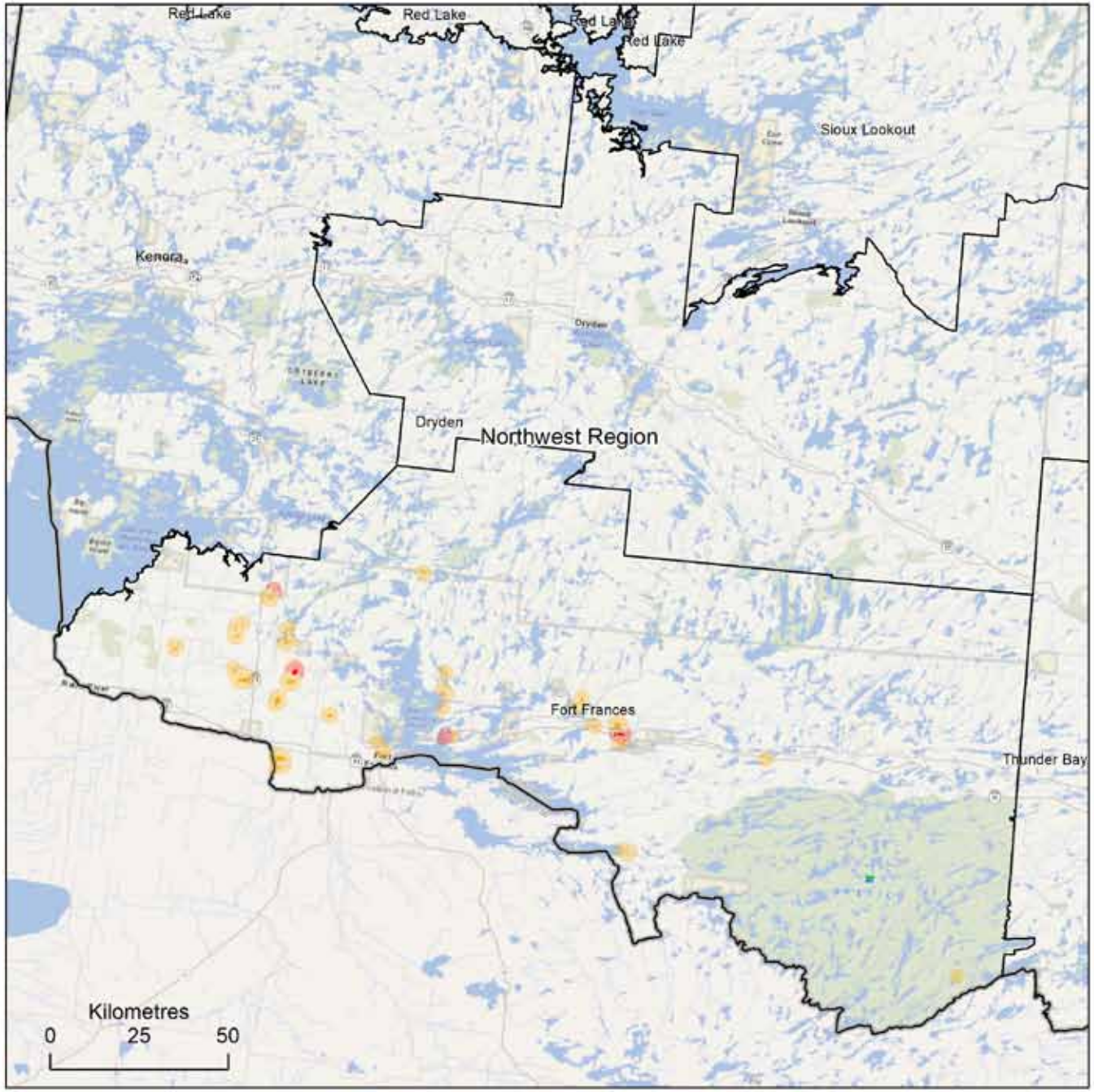
Cedar leafminer 2018

Areas in the Northwest Region where cedar leafminer caused defoliation

Light = 2,628 ha
Moderate to severe = 366 ha

Area of light defoliation

Area of moderate to severe defoliation

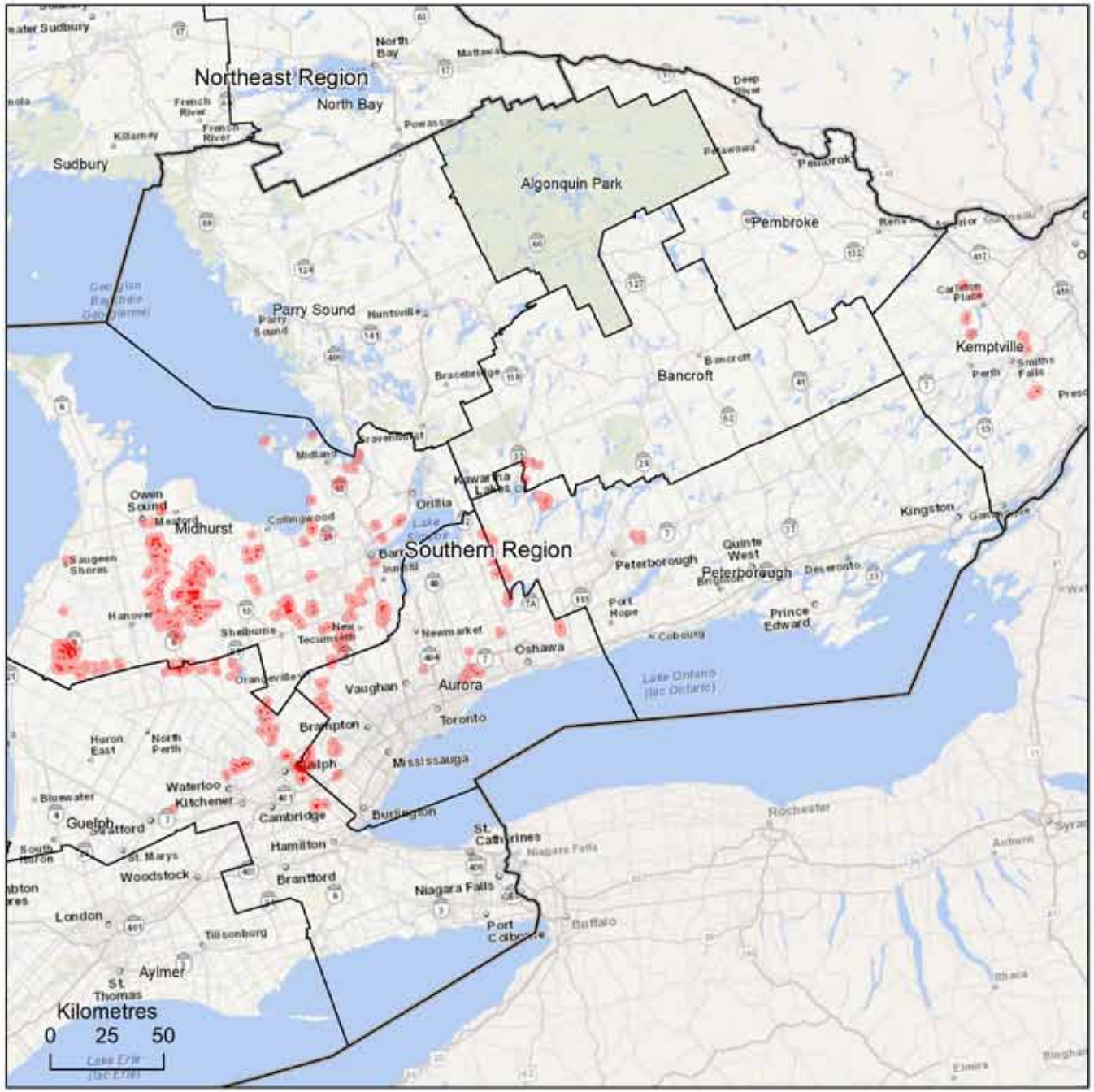


Cedar leafminer 2018

Areas in the Southern Region where cedar leafminer caused defoliation

Moderate to severe = 26,082 ha

Area of moderate to severe defoliation



Eastern larch beetle

Pest information

Common name:	Eastern larch beetle
Scientific name:	*Dendroctonus simplex (LeConte)*
Pest origin:	Native to North America
Pest type:	Bark beetle
Host species:	Larch (tamarack)
Infestation area:	1,125 ha

Provincial key facts

- The beetles bore into and feed on the inner bark and sapwood portions of the larch trunk.
- Eastern larch beetle can produce two complete generations.
- Large portions of a larch stands may die following an eastern larch beetle outbreak.
- Larch beetle damaged is frequently observed in areas stressed from other insect or abiotic disturbances.
- In 2018, some new areas of eastern larch beetle damage were mapped in Northwest Region and some previously infested areas expanded.

Regional summary

Northwest:

- In the southern part of Fort Frances District, 1,125 ha of eastern larch beetle damage were mapped in new areas as well as previously infested areas. Four new areas of eastern larch beetle damage were mapped south of Hwy 11 near the Minnesota border between Emo and Fort Frances. Previously infested areas also had damage; these were near the junction of Hwy 11 and Hwy 71, north of Pinewood along Hwy 619 and near Spruce Islands Provincial Nature Reserve (Nelles Twp), and along Hwy 600 in the south end of Dewart Twp.

Southern:

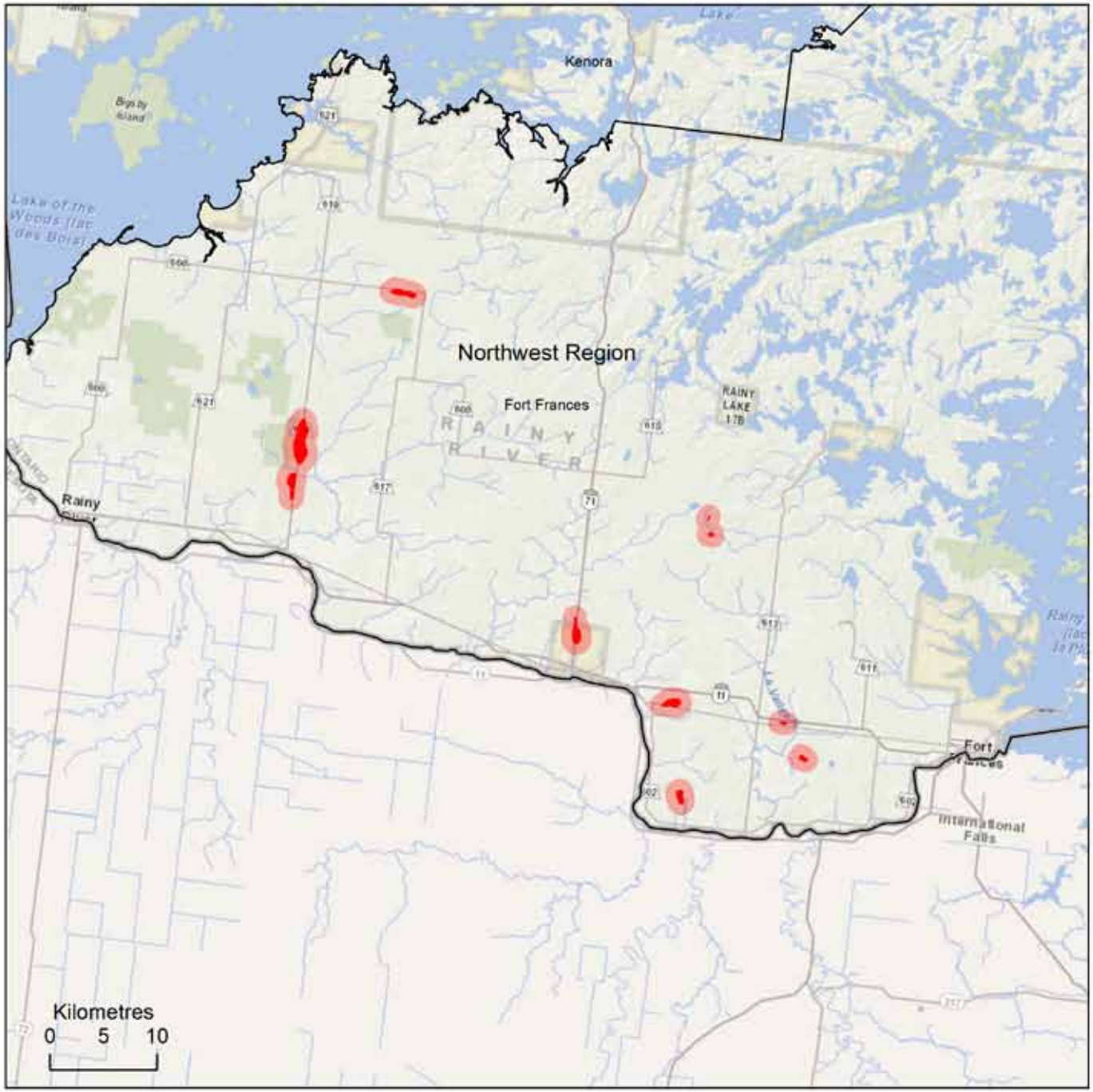
- In Guelph District, eastern larch beetle was causing decline and mortality of more than 20 tamarack trees on private land north of Wingham in the Municipality of Morris-Turnberry, Huron County. This area was not aerially mapped.

Eastern larch beetle 2018

Areas in the Northwest Region where eastern larch beetle caused damage

Moderate to severe = 1,125 ha

Area of moderate to 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:	4,580 ha

Provincial key facts

- Since it was discovered in Windsor in 2002, emerald ash borer has been a significant threat to ash in Ontario.
- Since 2002, emerald ash borer has spread east to Ottawa and north to Sault Ste. Marie and Thunder Bay.
- This beetle is expected to spread across the entire range of ash, causing widespread mortality in Ontario.
- In 2018, MNRF staff monitored 34 locations in Northwest Region for emerald ash borer using baited green prism traps. No beetles were found.
- In Southern Region, areas of ash decline and mortality caused by this beetle were mapped during aerial surveys in early September. The focus was to capture the northern range of its spread, building on data captured in 2016. All 2018 mapping was in the regulated quarantined area.

Regional summary

Northwest:

- In Northwest Region, 34 emerald ash borer pheromone traps were deployed in Dryden, Kenora, and Fort Frances districts. No beetles were found.

Northeast:

- In 2018, emerald ash borer was detected farther north in Sault Ste. Marie District than in 2017 but remained within the quarantined area. Four ash trees in a predominantly red and sugar maple stand were infested with

emerald ash borer. This stand was along the Wolf Lake Road on the south side of the Harmony River in Harmony Twp. The stand was in a wet area and three of the four ash trees were recently dead, but all four trees had emerald ash borer galleries and larvae.

Southern:

- In 2018, ground and aerial surveys were conducted in Southern Region to help delineate the northern expansion of beetle populations and related ash decline and mortality. In all, 4,580 ha were aerially mapped across Southern Region.

- In the northern part of Peterborough District, ground survey collections of beetle larvae confirmed populations (from west to east) in the communities of Woodville, Kirkfield, Point Pleasant, Buckhorn, Burleigh Falls, Marmora, and Eldorado. During aerial surveys, conducted in early September, 2,518 ha of ash decline, and mortality were mapped north of Peterborough to Bobcaygeon in the west to east of Madoc in the Moira Lake area. Ash decline and mortality were recorded in northern areas of Pigeon, Buckhorn, and Stony lakes along the Peterborough/Bancroft district boundary. Scattered areas of damage were recorded east of Peterborough along Hwy 7 to Madoc and north of Madoc in the Bannockburn and Queensborough areas.

- In the southern part of Parry Sound District, 601 ha of ash decline and mortality were aerially mapped in four areas, all close to the Parry Sound/Midhurst district boundary. The largest area was west of Port Severn between Muskoka Road 5 and Hwy 400 right to the shoreline of Georgian Bay. The second largest area was at the north end of Sparrow Lake near Gravenhurst at Sophers Landing, with woodpecker feeding and galleries observed. Two smaller areas of damage were recorded along the Severn River on the east side of Hwy 11.

- In the northeast corner of Midhurst District, 430 ha of ash decline were aerially mapped. The largest area of damage was seen south of Port Severn in Forest Harbour, Robin's Point, and a stretch of damage on Irish Line southwest of the community of Mordolphin near Otter Lake. Two other areas of damage were recorded along the Severn River, one between Sparrow and Grass lakes, the other east of Severn Bridge along Wasdell Falls Road and Cooper Falls Road.

- On southwest side of Bancroft District, 421 ha of ash decline were aerially mapped. Moderate to severe decline of ash was aerially mapped in areas around Head Lake and west to Uphill along Hwy 45. Areas were also mapped north of Stoney Lake along the Peterborough/Bancroft district border near Big Cedar, Woodview, and Stoneyridge. Emerald ash borer larvae were collected in Head Lake and Norland in Laxton Twp.

- On the southeast side of Pembroke District, ash decline and mortality were mapped west of Pakenham in White Lake area, McNab Twp. Areas of decline continued from Lanark County border north of Burnstown along Waba Road and Burnstown Road. Samples were collected west of Arnprior on Russett Drive and Robinson Road, in Waba and in White Lake. Emerald ash borer populations were high in infested trees. This wood borer was previously detected in and around the Town of Renfrew. In 2018, the infestation did not expand northward but appeared to be moving westward into Admaston Twp. Ash decline was continuous west of Renfrew for 4 km along Hwy 132 to Stone Road and scattered for 10 km along Hwy 60 to Plaunt Road. Ash

decline was also observed during ground surveys in areas along Hwy 60 in Golden Lake, Eganville, Barry's Bay, and in Calabogie, where declining ash trees had thin crowns and some epicormic shoots but emerald ash borer was not found. A total of 312 ha of ash decline and mortality were aerially mapped in Pembroke District.

- On the northwest side of Kemptville District, 298 ha of ash decline were mapped during aerial surveys. The beetle has continued to move westward across Lanark County. From its previous limits in the townships of Mississippi Mills and Drummond/North Elmsley, it now reaches the Lanark Highlands and has moved across Tay Valley Twp. In Tay Valley, ash decline was mapped along Hwy 7 from Perth to Doran Road in the village of Brooke, 12 km east of Frontenac County. Samples were collected at Doran Road where emerald ash borer damage was high. In Lanark Highlands, ash decline was mapped around the village of Lanark. Larvae samples were collected in a stand of semi-mature white ash on Caldwell Road. North of Lanark, ash decline was mapped in and around Clayton at the east township boundary. Samples were collected on ash in a mature trembling aspen/sugar maple forest on Clayton Lake Road. The most westerly mapped occurrence was in Elphin near the west boundaries of Lanark Highlands and Bancroft District. This occurrence was disjunct from other areas mapped in Kemptville District. Both population and host damage levels were high, with some mortality. Emerald ash borer samples were also collected in areas known to be infested and that were mapped in previous years such as Chesterville (North Dundas), Carleton Place (Lanark County), Lyndhurst (Leeds Township), Osgoode (Ottawa), and Blakeney (Lanark County).

Trend analysis/outlook/issues

In 2018, the Canadian Forest Service collaborated with MNRF forest health staff and several other agencies to continue the release of three species of parasitoid wasps to establish populations in the region infested with emerald ash borer. Originally from China and Russia, these wasps are highly specific to emerald ash borer with high parasitism levels in their native range. The first, *Tetrastichus planipennisi* (Hymenoptera: Eulophidae), is a larval parasitoid. Adults emerge in late May and produce multiple generations per year. Females parasitize late instar larvae, with up to 57 wasps produced per larva. This species has been reported to have parasitism rates of up to 50% in China. It has been released since 2013 in Canada. *Oobius agrili* (Hymenoptera: Encyrtidae) is an egg parasitoid, with two generations per year. Up to 80 eggs are attacked per female with one egg laid per emerald ash borer egg. This species has up to 60% parasitism in its native range. It has been released since 2015. The third species, *Spathius galinae* (Hymenoptera: Braconidae), is a larval parasitoid originally found in Russia causing high levels of parasitism to emerald ash borer on green ash.

In total, 20 release sites were established in Ontario and Quebec, where over 127,000 *T. planipennisi* have been released over the past six years. In addition, over 48,000 *O. agrili* have been released at 16 sites over the past four years and 2,700 *S. galinae* over the past two years. In 2018, releases were conducted at six sites in Ontario: 1 in Northeast Region in Sault Ste. Marie District and 5 others in Southern Region, in Peterborough, Kemptville, and Pembroke districts.

Total area (hectares) in which emerald ash borer caused ash decline and mortality from 2014 to 2018 by MNRF district.

Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017*	2018
Northeast	-	-	-	-	-
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	108	-	-	-	-
Sudbury	-	-	-	-	-
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Sub total	108	0	0	0	0
Southern					
Algonquin Park	-	-	-	-	-
Aurora	166	6,092	-	-	-
Aylmer	15,076	2,149	-	-	-
Bancroft	-	-	3	-	421
Guelph	23,347	29,468	-	-	-
Kemptville	4,548	1,021	557	-	298
Midhurst	-	2,336	2,127	-	429
Parry Sound	-	-	-	-	601
Pembroke	-	80	1,942	-	312
Peterborough	93	190	59	-	2,518
Sub total	43,230	41,337	4,688	0	4,580
Provincial total	43,338	41,337	4,688	0	4,580

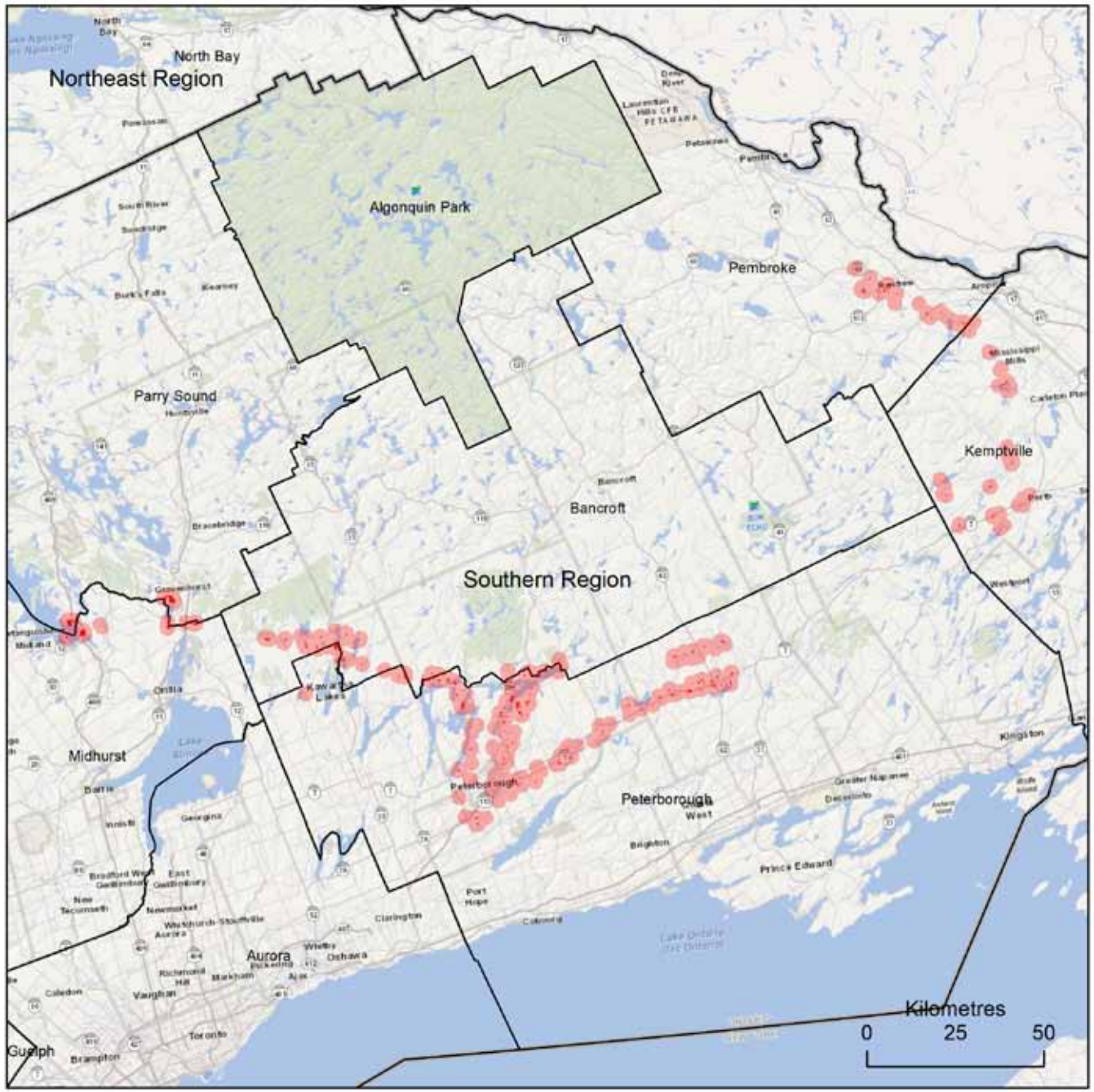
*Not aerially mapped in 2017.

Emerald ash borer 2018

Areas in the Southern Region where emerald ash borer caused damage

Moderate to severe = 4,580 ha

Area of moderate to severe damage



Fall cankerworm

Pest information

Common name:	Fall cankerworm
Scientific name:	*Alsophila pometaria* (Harris)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Various hardwoods, with preference for basswood, maple, ash, elm and oak spp
Infestation area:	831 ha

Provincial key facts

- Fall cankerworm is an early season defoliator of hardwood trees that can reach epidemic levels throughout its range in North America.
- The distribution of this native pest is believed to coincide with the range of basswood in Ontario.
- It has one generation per year.
- In North America, fall cankerworm has an outbreak cycle with large populations present for 2 to 3 years followed by sharp population declines for 5 to 8 years.
- Fall cankerworm was aerially mapped in Southern Region in rural woodlots as well as urban settings in 2016, 2017, and 2018.
- In Ontario, the total area defoliated by fall cankerworm decreased from 11,764 ha in 2017 to 831 ha in 2018. This reduction indicates that populations are collapsing across Southern Region.
- As in 2017, gypsy moth was often found feeding alongside fall cankerworm in 2018.

Regional summary

Southern:

- In 2018, 581 ha of moderate to severe defoliation by fall cankerworm was aerially mapped in four areas of Guelph District. This was a marked decrease from the 8,121 ha mapped in 2017. Populations that had been prevalent along the Niagara Escarpment since 2016 began to collapse in 2018, particularly through Hamilton, Dundas, and Ancaster. Only small areas along the escarpment were mapped between Stoney Creek east

towards Beamsville. In central Guelph District, areas of moderate to severe defoliation were aerially mapped in private woodlots near Roseville in the Township of North Dumfries, Regional Municipality of Waterloo. Smaller populations of gypsy moth were also detected feeding alongside, increasing the level of defoliation. On the southeast side of the district, a small area of moderate to severe defoliation was mapped through parts of Woodend Conservation Area, along Niagara County Rd 70 (Taylor Road) on the south side of the junction of QEW Hwy and Hwy 405, Niagara Region. During ground surveys, small populations of gypsy moth and elm spanworm were observed feeding alongside fall cankerworm at this site. Another small area of moderate to severe defoliation was mapped in a forested area at the northeast corner of Rock Point Provincial Park near Dunneville, Niagara Region. During ground surveys, smaller populations of gypsy moth larvae were observed feeding simultaneously.

- Populations of fall cankerworm began to collapse in 2018 through areas of Aurora District. Only two areas of moderate to severe defoliation were aerially mapped, totalling 131 ha in Halton and York regions. In Halton Region, moderate to severe defoliation was mapped along Hwy 407 north of Oakville as well as on the north side of Hwy 403 just east of Bronte Creek Provincial Park. During ground surveys in Halton Region, severe defoliation of up to 90% of tree crowns was observed at Rattlesnake Point Conservation Area southwest of Milton. In York Region, a small area of moderate to severe defoliation was mapped between Thornhill and Richmond Hill, close to the Don River east branch on the north side of Hwy 407. At these locations gypsy moth was also present feeding alongside populations of fall cankerworm.

- In the southern part of Peterborough District, 119 ha of moderate to severe fall cankerworm defoliation was mapped on Big Island in Prince Edward County. This is the second consecutive year this area has been affected by fall cankerworm but the area of defoliation decreased since 2017.

Total area (in hectares) in which fall cankerworm caused moderate to severe defoliation from 2014 to 2018 by MNRF district.

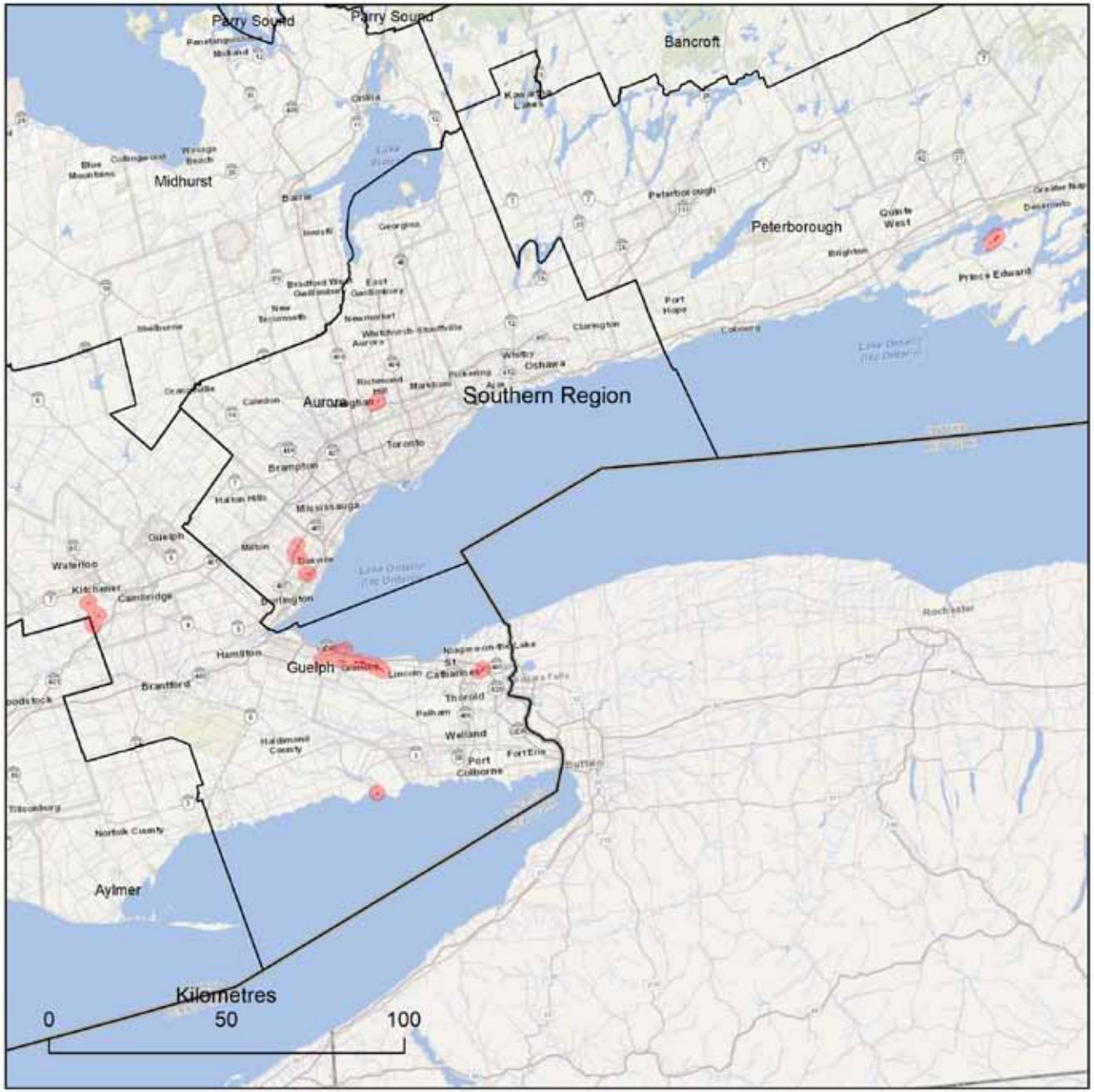
Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	256	2,647	131
Aylmer	-	-	0	675	-
Bancroft	-	-	-	-	-
Guelph	-	-	3,597	8,121	581
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	-
Parry Sound	-	-	-	-	-
Pembroke	-	-	-	-	-
Peterborough	-	-	-	321	119
Sub total	0	0	3,853	11,764	831
Provincial total	0	0	3,853	11,764	831

Fall cankerworm 2018

Areas in the Southern Region where fall cankerworm caused defoliation

Moderate to severe = 831 ha

Area of moderate to severe defoliation



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:	Moderate to severe: 992,207 ha; light: 13,806 ha

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.
- The area of moderate to severe defoliation in the province decreased slightly (181,362 ha) in 2018. The infestation had all but collapsed in Northwest Region, decreased in Northeast Region—particularly in more northerly areas, and increased by over 200,000 ha in Southern Region.

Regional summary

Northwest:

- Only four of the seven northwestern districts had signs of forest tent caterpillar defoliation. Most of the defoliation was light and recorded in two districts while the other two districts had small areas of moderate to severe defoliation.

- In 2018, 2,853 ha of light defoliation were mapped in Nipigon District, all in the Limestone Lake area north of the town of Nipigon. Defoliation was recorded on trembling aspen on the west and east sides of Limestone Lake as well as in a small area between Helen and Limestone lakes, between Ledger and Corrigal townships.

- Small scattered areas of light defoliation were recorded across Fort Frances District totalling 615 ha. On the west side of the district, defoliation was mapped in the Caliper Lake area, northeast of Emo in Carpenter Twp, northeast of the town of Fort Frances and between Hwy 502 and the east side of Rainy Lake near Windy Point, Northeast Bay, and Mainville Lake. In the central part of Fort Frances District, light defoliation was recorded north of Mine Centre near Manion Lake and between Heron and Tesup lakes. Defoliation was also recorded west of Quetico Provincial Park near Threemile Lake and on the east side of Namakan Lake. On the east side of the district, three small areas of light defoliation were mapped in the central part of Quetico Provincial Park: one area south of Atikokan in the park near McAlpine Lake, another farther south at the north end of Agnes Lake, and the third even farther south on the south side of Louisa Lake, near the Minnesota border.

- In 2018, only 29 ha of forest tent caterpillar defoliation were recorded in Thunder Bay District, all of it moderate to severe. This small area of defoliation was southeast of the city of Thunder Bay in the southern part of Fort William First Nation along the coast of Lake Superior.

- In Kenora District, two small areas of moderate to severe defoliation were seen totalling 9 ha, northwest of Kenora near the Manitoba border around Swan Lake. During ground surveys trace defoliation was observed in the City of Kenora as well as along Hwy 71. After six consecutive years of defoliation and drought-like conditions, some aspen decline was observed along Hwy 71, Hwy 17 East, and southeast of the City of Kenora.

Northeast:

- In 2018, seven of the nine districts in Northeast Region had some moderate to severe forest tent caterpillar defoliation. A total of 518,833 ha of defoliation was aerially mapped, most of it in Hearst and Cochrane districts. This is the first year the area of defoliation has declined in the Northeast Region since the infestation began in 2014.

- In 2018, Hearst District had the largest area of moderate to severe defoliation, totalling 237,395 ha, which was down from 556,628 ha in 2017. Most of the defoliation was recorded in the central part of the district, north and south of Hwy 11. Defoliation was mapped as far north as Squirrel River, west of Hwy 631, and extended to the eastern border of the district. The southern limit was the Shanly Creek Drumlins in Shanly and Concobar townships. Moderate to high populations of friendly flies (*Sarcophaga aldrichi*) were observed across the district, contributing to the decline in defoliated areas in 2018. Many parasitized forest tent caterpillar larvae were found while conducting ground surveys.

- In 2018, the area of moderate to severe forest tent caterpillar defoliation in Sault Ste. Marie District increased by over 50,000 ha, reaching 148,442 ha. Most of this increase was seen in the southcentral and southeastern parts of the district. Forest tent caterpillar was mapped from Batchawana Bay in the northwest part of the district stretching southeastward to the Sault Ste. Marie/Sudbury district boundary. New areas of defoliation included south of Ranger Lake in the Devil's and Vixen lakes areas, north of Thessalon in the Wakomata Lake area, and between Iron Bridge and Elliot Lake around Chiblow and Crotch lakes near the Sudbury District boundary. New areas of defoliation were also seen

on the outer edges of St. Joseph Island. In areas that had been defoliated for two consecutive years, larvae were infected with virus and friendly flies were prevalent.

- An increase in moderate to severe defoliation was also seen in Sudbury District, from 52,063 ha in 2017 to 72,435 ha in 2018. Most of the defoliation was mapped west and north of the City of Sudbury. Trembling aspen trees, especially along Hwy 17 west of Sudbury to the western district boundary, were completely defoliated. On Manitoulin Island, the defoliation was concentrated on the north half of the island. Defoliation north of Sudbury continued up Hwy 84, west of Lake Wanapitei. Moderate to severe defoliation was also mapped southwest of Sudbury on Whitefish Lake First Nations and along the north and south edge of Killarney Provincial Park. Friendly flies were found across Sudbury District when the forest tent caterpillar were pupating.

- Cochrane District had 33,428 ha of moderate to severe defoliation, an increase from 26,385 ha in 2017. All defoliation in Cochrane District was along the western boundary. Larger areas of defoliation were mapped north and south of Smooth Rock Falls. The largest area of defoliation was north of Smooth Rock Falls and north of Abitibi Canyon in Pinard, Parliament, Traill, and Sheldon townships. South of Smooth Rock Falls the area of defoliation was less and was concentrated on the east side of Bradburn Twp around East Bradburn Lake.

- In North Bay District, moderate to severe forest tent caterpillar defoliation declined from 33,907 ha in 2017 to 25,724 ha in 2018. Most of the defoliation was north of North Bay and stretched north of Temagami. Areas of defoliation were concentrated between the town of Verner and Martin River, south of Rabbit Lake, in the Temagami area and along the Quebec/Ontario boundary from McLaren's Bay to just north of Buffalo Rock in South Lorrain Twp. Forest fires prevented some of North Bay District from being surveyed so some forest tent caterpillar defoliation may not have been captured northwest of Temagami towards Lady Evelyn Smoothwater Provincial Park. A small area of defoliation was observed in the southwest corner of North Bay District in Dokis First Nations, southwest of Wolseley Bay and west of Port Loring around Toad and Big Caribou lakes.

- In 2018, Timmins District had 888 ha of moderate to severe forest tent caterpillar defoliation, a substantial decrease from 10,966 ha in 2017. All defoliation in Timmins District was confined to the townships of Mountjoy, Jessop, Murphy, and Tisdale at the junction of MacLean Drive and Laforest Road.

- Small scattered areas of moderate to severe forest tent caterpillar defoliation (521 ha) were mapped on the east side of Kirkland Lake District. In the northeast part of the district, defoliation was recorded in the Holtyre and Ramore areas, in the east central part of the district a small area was mapped southeast of Matachewan and in the southeast four small areas of defoliation were noted in Corkill and Brewster townships near Paddle, Shack, and Southbear lakes.

Southern:

- For the fourth consecutive year, the area of moderate to severe defoliation mapped in Southern Region increased: the 473,337 ha recorded in 2018 was almost double the 272,893 ha recorded in 2017. Another 10,337 ha of light defoliation was recorded, primarily in Pembroke District.

- A total of 235,831 ha of defoliation was aerially mapped in Bancroft District, an increase of 97,167 ha from 2017. The most widespread area of defoliation was in the east part of the district, beginning along Hwy 41 and extending to the Kemptville District boundary. Large areas were also mapped around Bon Echo Provincial Park, in Effingham and Anglesea townships. In the north part of Bancroft District, a large swath of moderate to severe defoliation was mapped through McClure and Herschel townships, and extended south through the town of Bancroft. Through Hastings County, scattered areas of moderate to severe defoliation were mapped through Faraday, Dungannon, Wollaston, Limerick, Lake, and Tudor townships. In Cardiff Twp, small areas were mapped along Hwy 118 and Hwy 28, including Silent Lake Provincial Park. Moderate to severe defoliation was also mapped in small areas in the north end of Kawartha Highlands Provincial Park, extending to Monmouth Lake. Defoliation was also reported in Chandos Twp, with areas concentrated north and south of Chandos Lake.

- On the west side of Kemptville District, 126,179 ha of moderate to severe defoliation were mapped in 2018, up considerably from the 58,782 ha recorded in 2017. Lanark County was most severely affected by forest tent caterpillar, particularly in the Lanark Highlands, Mississippi Mills, and Tay Valley townships where moderate to severe defoliation extended uninterrupted over more than 75% of the forest cover. Moderate to severe defoliation continued southward in large pockets through the Township of Rideau Lakes and became intermittent in Leeds Twp where it was concentrated around Charleston Lake, especially at the southwest end. Light defoliation was mapped south of Charleston Lake on Blue Mountain Road, and in small areas around the Kemptville area. Trees in the most severely affected areas were 80% defoliated on average with some trees suffering complete defoliation. Another 1,030 ha of light defoliation were seen south of Carleton Place on the west side of Mississippi Lake. The rest of the light defoliation was in a small area between Gananoque and South lakes.

- In Peterborough District, 71,543 ha of moderate to severe defoliation were mapped during aerial surveys, more than double the area recorded in 2017. The bulk of the defoliation was in the northeast corner of the district. Large areas of moderate to severe forest tent caterpillar defoliation were seen north of Marmora along the Peterborough/Bancroft district boundary in the Cordova and Thompson lakes area and farther west in the Sharbot and Kennebec lakes area to the Bancroft District boundary. Smaller scattered areas of defoliation were mapped to the south along and near the east boundary of Peterborough District. This included the areas of Frontenac Provincial Park, Lake Opinicon and Hart Lake, south of Cole Lake along Hwy 38, and another small area on the east side of Knowlton Lake north of Rosedale.

- In the southern part of Pembroke District, 27,731 ha of moderate to severe forest tent caterpillar defoliation was observed—a slight increase from 2017. Most of this defoliation was south of Renfrew to the Bancroft District boundary,

concentrated between Calabogie and White lakes. Smaller areas of moderate to severe defoliation were mapped west and south of Clear Lake near the junction of Hwy 512 and Hwy 515, south of Constant Lake near the junction of Hwy 41 and Hwy 132 with a small area at the north end of Constant Lake, and north of Black Donald Lake in Broughman Twp. Four small areas of moderate to severe defoliation were also seen in Matawatchan Twp on the west side of Hwy 71 and Centennial Lake. Another 9,307 ha of light defoliation were mapped in Pembroke, most of it northwest of the moderate to severe defoliation. This included larger areas of light defoliation south and north of Black Donald Lake, just south of the town of Renfrew, south of Shamrock in Admaston Twp, and in the northeast corner of Lyndoch Twp on either side of Hwy 515.

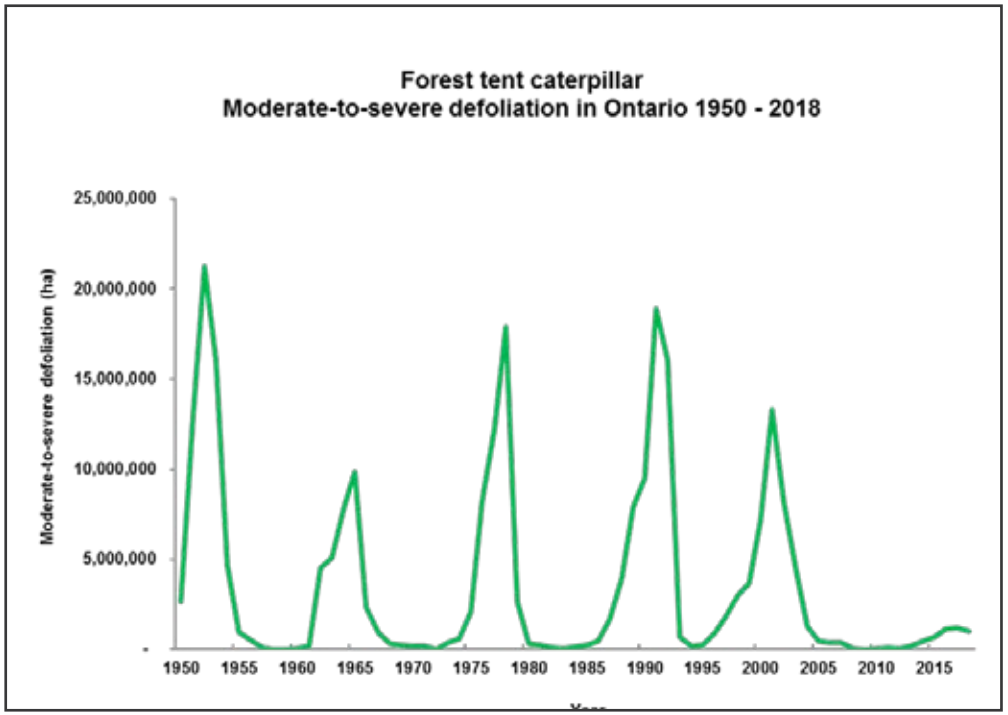
- For the second consecutive year, moderate to severe forest tent caterpillar defoliation was mapped in Parry Sound District. A total of 11,618 ha of defoliation were observed, mostly on trembling aspen, sugar maple, and red oak, down slightly from 14,472 ha in 2017. Most of the defoliation was mapped east of Parry Sound along Hwy 400, west of Lake Joseph along Lake Joseph Road, north of McKellar along Hwy 124, east of Ardberg around Wahwashkesh Lake, and east of Noganosh Lake, south of Hwy 522. Friendly flies were observed when the forest tent caterpillar began to pupate in Parry Sound.

- In 2018, only 434 ha of moderate to severe forest tent caterpillar defoliation was recorded in Midhurst District, all of it between the towns of Midland and Waverly along Hwy 93. Forest tent caterpillar were found feeding on sugar maple, red oak, basswood, poplar, and white birch in several woodlots.

Total area (in hectares) in which forest tent caterpillar caused moderate to severe defoliation from 2014 to 2018, by MNRF district.

Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	132	-	-	-
Cochrane	-	29	1,188	26,385	33,428
Hearst	1,031	36,444	100,990	590,451	237,395
Kirkland Lake	-	-	5,845	600	521
North Bay	-	-	5,778	33,907	25,724
Sault Ste. Marie	-	-	3,468	95,087	148,442
Sudbury	-	25	10,539	52,063	72,435
Timmins	-	443	4,327	10,966	888
Wawa	-	1,239	-	-	-
Sub total	1,031	38,312	132,135	809,459	518,833
Northwest					
Dryden	185,878	169,564	386,518	9,803	-
Fort Frances	-	8,693	20,980	11,465	-
Kenora	61,857	53,974	197,292	67,620	9
Nipigon	64,913	147,945	1,504	814	-
Red Lake	24,079	38,036	139,046	1,003	-
Sioux Lookout	114,242	87,316	186,838	513	-
Thunder Bay	8,228	116,466	8,221	-	29
Sub total	459,197	621,994	940,399	91,218	38

District	2014	2015	2016	2017	2018
Southern					
Algonquin Park	-	-	18	369	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	-	37,577	138,664	235,831
Guelph	-	-	-	-	-
Kemptville	-	-	2,007	58,782	126,179
Midhurst	8,638	21,339	2,150	-	434
Parry Sound	-	-	-	14,472	11,618
Pembroke	-	-	2,560	25,276	27,731
Peterborough	-	-	6,594	35,330	71,543
Sub total	8,638	21,339	50,906	272,893	473,337
Provincial total	468,866	681,645	1,123,440	1,173,570	992,207



Forest tent caterpillar 2018

Areas in Ontario where forest tent caterpillar caused defoliation

Light = 13,806 ha
Moderate to severe = 992,207 ha

Area of light defoliation

Area of moderate to severe defoliation

Forest tent caterpillar 2018

Areas in the Northwest Region where forest tent caterpillar caused defoliation

Light = 3,469 ha
Moderate to severe = 38 ha

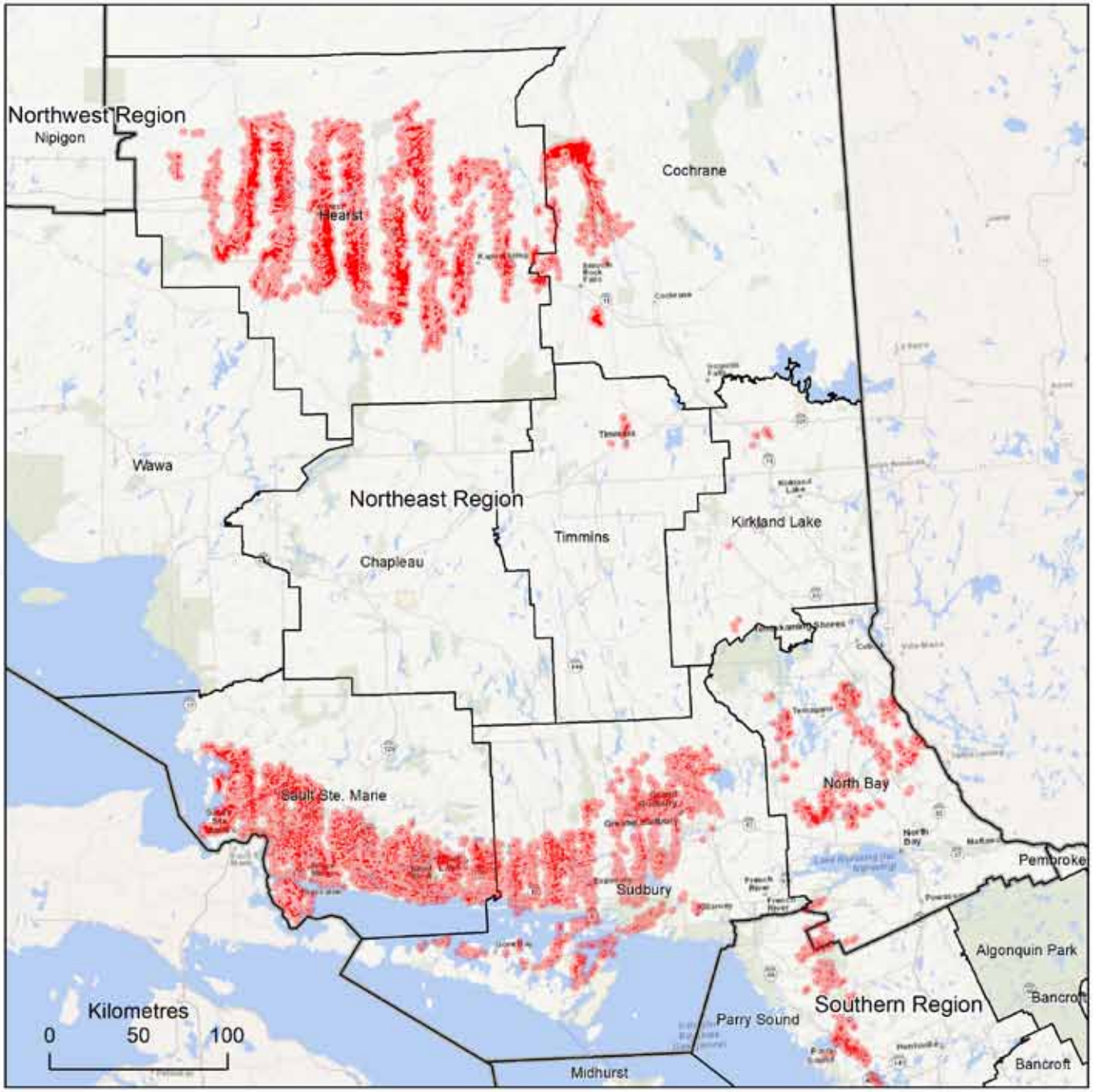
- Area of light defoliation
- Area of moderate to severe defoliation

Forest tent caterpillar 2018

Areas in the Northeast Region where forest tent caterpillar caused defoliation

Moderate to severe = 518,833 ha

Area of moderate to severe defoliation

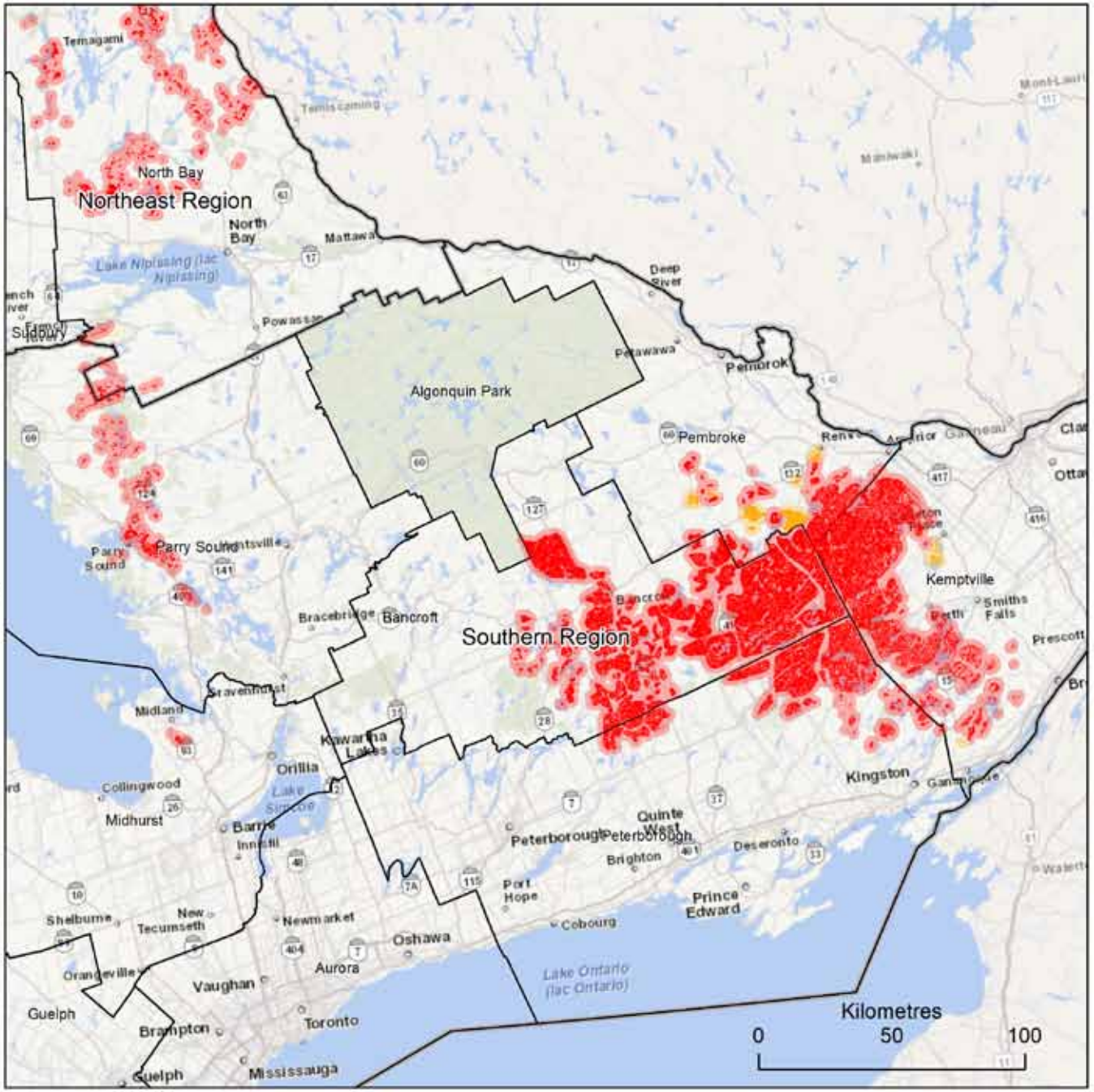


Forest tent caterpillar 2018

Areas in the Southern Region where forest tent caterpillar caused defoliation

Light = 10,337 ha
Moderate to severe = 473,337 ha

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



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:	14,937 ha

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 range from oak, birch, and aspen in the north to hardwoods such as oak, sugar maple, and American beech and softwoods such as eastern white pine and Colorado blue spruce in southern Ontario.
- Cool, wet conditions provide an ideal environment for the proliferation of *Entomophaga 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.
- In 2018, gypsy moth was observed feeding alongside populations of fall cankerworm and forest tent caterpillar throughout Southern Region. In some cases, it was difficult to determine the primary defoliator.
- In 2018, 14,937 ha of moderate to severe defoliation was mapped in Southern Region.

Regional summary

Southern:

- In 2018, gypsy moth defoliation increased by 4,081 ha in Southern Region compared to 2017. Extensive defoliation was recorded throughout the golden horseshoe, from St. Thomas to St. Catherine's and up through Cambridge to Mississauga.

- In Guelph District, 11,154 ha of moderate to severe defoliation were aerially mapped from the Cambridge area through to the Niagara region. The largest areas of defoliation were recorded south of Brantford in the eastern part of Six Nations Reserve close to Hwy 6, in Haldimand County near Hwy 3, west of Hamilton in the Lancaster area, and east of Brantford along Hwy 403. Smaller, more scattered areas of defoliation were observed east of Oswego Park to Niagara Falls and south to southwest of Cambridge. Two small areas of moderate to severe defoliation were aerially mapped near Freelton and Carlisle in Flamborough, near the eastern district boundary.

- In Aurora District, 2,764 ha of gypsy moth defoliation were aerially mapped from the southwest edge of the district at Burlington north to Hwy 401 and east to Trafalgar Road (Regional Road 3) between Milton and Oakville. Areas of infestation included Bronte Provincial Park as well as Halton Region and Conservation Halton lands.

- In 2018, 983 ha of small areas of sporadic defoliation were mapped in the southwest and southeast parts of Aylmer District. In the southeast, small areas of moderate to severe defoliation were aerially mapped in woodlots from south of Aylmer through parts of Norfolk County in the areas surrounding Tillsonburg, the town of Simcoe, and Port Dover to the east side of Waterford close to the Guelph District boundary. In the southwest, several small areas of moderate to severe defoliation were recorded south of Lake St. Clair near an airstrip at Stoney Pointe-aux-Roches, along Hwy 401 northwest of the community of Comber and on the west side of the City of Windsor near the U.S. border.

- In Midhurst District, 36 ha of moderate to severe gypsy moth defoliation were aerially mapped in north Simcoe County between the communities of Fesserton and Coldwater amid Hwy 400 and County Road 16. During ground surveys, a small poplar stand in south Bruce County was found with moderate defoliation. This area was not aerially mapped.

- In Kemptville District, low levels of gypsy moth larvae were observed in Lanark County near Bennett Lake northeast of Maberly. Forest tent caterpillar defoliation was also seen in this area, with gypsy moth causing only trace defoliation.

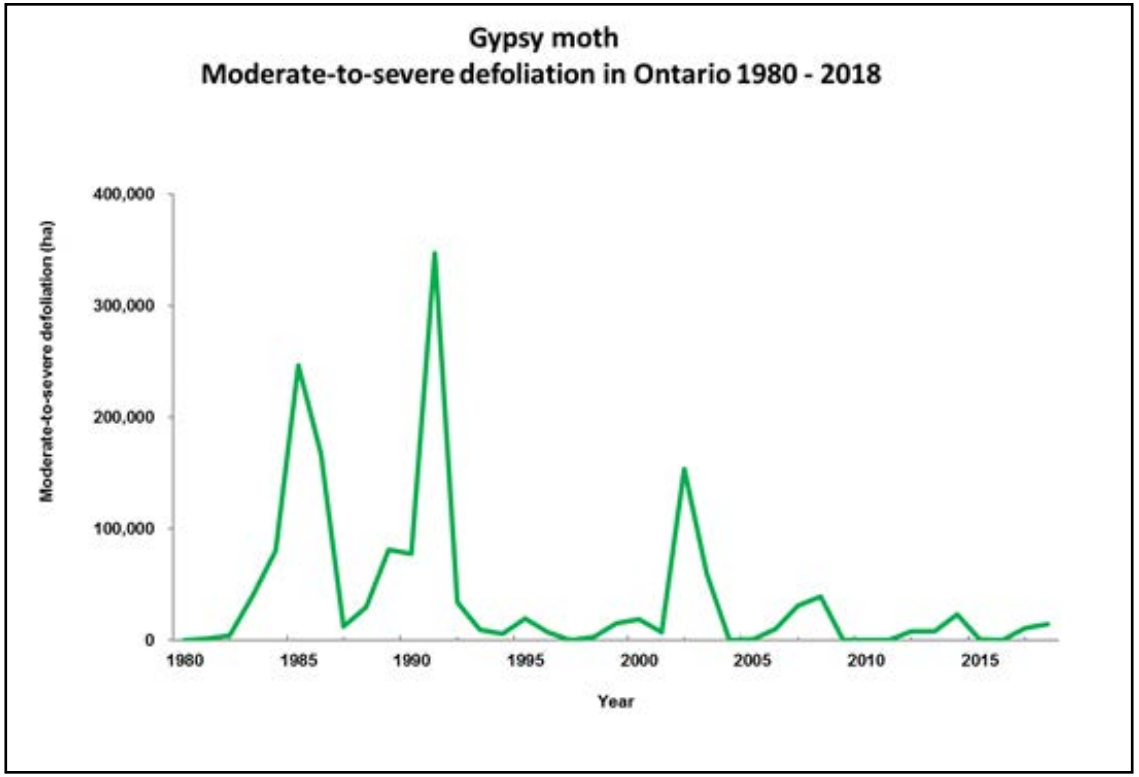
- In the southwest part of Pembroke District, low levels of gypsy moth larvae causing trace defoliation were seen in a mixedwood stand of young white spruce and sugar maple west of Quadeville in Renfrew County.

Northeast

- In the southwest part of Sudbury District, gypsy moth egg masses were collected north and southeast of Massey at Chutes Provincial Park and along Cutler Lake Road at the north end of Cutler Lake. Egg masses were also seen south of Espanola along Whitefish Falls and Bay of Islands roads. In the north central part of the district, egg masses were detected at a rest stop between Onaping Falls and the community of Dowling. At all locations, forest tent caterpillar was the predominant defoliator with trace defoliation by gypsy moth.

Total area (hectares) in which gypsy moth caused moderate to severe defoliation from 2014 to 2018 by MNRF district.

Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	-	-	-	-	-
Sudbury	22,098	-	-	-	-
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Sub total	22,098	0	0	0	0
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	2,764
Aylmer	1,077	757	-	627	983
Bancroft	-	-	-	-	-
Guelph	-	-	-	8,768	11,154
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	36
Parry Sound	160	-	-	-	-
Pembroke	-	-	-	-	-
Peterborough	-	-	-	1,461	-
Sub total	1,237	757	0	10,856	14,937
Provincial total	23,335	757	0	10,856	14,937

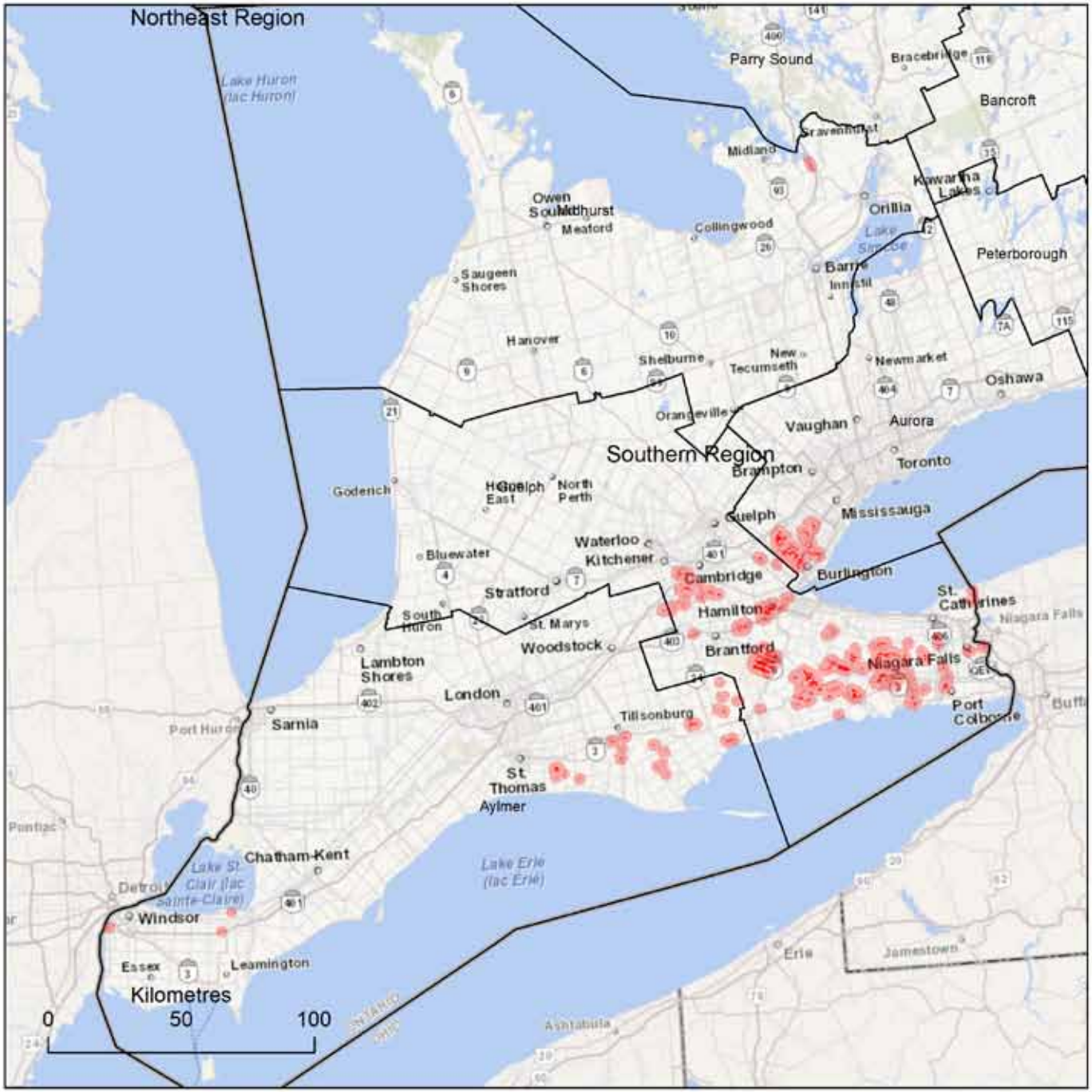

Gypsy moth
Moderate-to-severe defoliation in Ontario 1980 - 2018
Moderate-to-severe defoliation (ha)
400,000
300,000
200,000
100,000
0
1980
1985
1990
1995
2000
2005
2010
2015
Year

Gypsy moth 2018

Areas in the Southern Region where gypsy moth caused defoliation

Moderate to severe = 14,937 ha

Area of moderate to severe defoliation



Jack pine budworm

Pest information

Common name:	Jack pine budworm
Scientific name:	*Choristoneura pinus pinus* Freeman
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Jack pine
Infestation area:	627,455 ha

Provincial key facts

- Jack pine budworm outbreaks occur in Ontario about every 8 to 10 years.
- In the past, large-scale control programs have been undertaken to protect high value jack pine stands during an outbreak. The most recent control program was in 2009, as reported in that year's Annual Report on Forest Management.
- In 2018, 627,455 ha of moderate to severe jack pine budworm defoliation were aerially mapped in three districts in the Northwest Region.
- A total of 870 ha of jack pine budworm-caused tree mortality was mapped in Northeast Region in 2018.
- During ground surveys, larvae were collected from historically infested areas in Northwest and Northeast regions.

Regional summary

Northwest:

- In Red Lake District, jack pine budworm defoliation was mapped for the second consecutive year. A total of 613,574 ha of moderate to severe defoliation was mapped in all but the eastern part of the district. Notable areas of damage included large pockets around the perimeter of Red Lake stretching west and north to Woodland Caribou Provincial Park. Large areas of damage were also mapped north and west of Pakwash Lake and south and east of Gullrock Lake. Scattered smaller areas of damage were mapped east of Trout Lake. Mapped areas of moderate to severe jack pine budworm defoliation were smaller and more scattered

in the southern part of the district. During ground surveys west of Ear Falls along Hwy 804, light to moderate defoliation was observed in several semi-mature jack pine stands outside areas of aerially mapped defoliation.

- In the northeast corner of Kenora District, 10,278 ha of moderate to severe jack pine budworm defoliation were mapped in 2018. Areas of defoliation were east and southeast of Perrault Lake and southeast of Cedar Lake. Trace to light feeding was observed in several other locations throughout the district. Larvae were collected north of Sioux Narrows and around the City of Kenora. New areas of light to moderate defoliation were noted along April Lake Road, west of aerially mapped defoliation.

- In Dryden District, jack pine budworm defoliation was mapped for the first time since 2010. The northwest corner of the district, near Thaddeus and Fawcett lakes, had 3,603 ha of moderate to severe defoliation. Light to moderate defoliation was observed during ground surveys south of Williams Bay and north of the City of Dryden around Banana and Blueberry lakes. Northwest of the town of Vermillion Bay, north of the intersection of Hwy 647 and Hwy 609, trace defoliation was observed in the upper crown of semi-mature to mature jack pine trees.

Northeast:

- Jack pine budworm mortality totalling 870 ha was mapped in the southeast part of Sault Ste. Marie District. Moderate to severe jack pine budworm defoliation was recorded between Blind River and Elliot Lake in 2015 and 2016 and with drought-like conditions in September 2016 and 2017 as well as summer 2018, tree mortality was seen in this area. Most of the mortality was mapped south of Esten Lake along the boundary of McGiverin and Esten townships, with small areas of mortality in two neighboring townships (Long and Spragge). Further mortality was observed in Mack Twp east of Matinenda Lake. During regular surveys, larvae were observed in Sagard Twp, north of Elliot Lake, with trace defoliation (<5%) recorded in the area.

- In Sudbury District, light defoliation was observed close to Espanola in Merritt Twp along Jacklin Road where jack pine budworm has historically been found.

Jack pine forest health plots

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

A total of 107 plots (50 in Northeast Region, 57 in Northwest Region), comprising 5,350 jack pine trees, were assessed in 2018. The trees were rated for the presence of any pest, disease, or abiotic factors that affect health/ condition as well as the abundance of male flowers.

Regional plot summary:

In Northeast Region, 72% of the live jack pine trees were less than 25% defoliated, while in the Northwest Region 56% were less than 25% defoliated, a decrease from 73% in 2017. Over 94% of the tops of live jack pine trees were healthy in both regions.

In 2018, 48 trees in jack pine plots in Northeast Region died. This mortality was caused mostly by armillaria root rot (67%); western gall rust, wood borers, and abiotic factors such as blowdown also contributed.

In Northwest Region, 88 trees died in jack pine plots. Most (55%) of the mortality was due to a wet snow and ice event in late October 2017 that caused trees to snap or fall. Over a quarter of the dead trees succumbed to armillaria root; bark beetles and blowdown accounted for most of the remaining mortality.

Surveys revealed many male flowers in Northeast Region, with 78% of the live jack pine trees having moderate to high numbers of flowers. In Northwest Region, 44% of the trees assessed had nil to few male flowers, possibly due to the jack pine budworm outbreak.

Two plots in Northeast Region, both in Sault Ste. Marie District, had signs of jack pine budworm defoliation. The jack pine forest health plot north of Elliot Lake in Sagard Twp averaged 10% jack pine budworm defoliation; the plot in Vance Twp just northeast of the Sagard plot had less defoliation. In Northwest Region, 24 plots had some jack pine budworm defoliation. Most (18) of these plots were in Red Lake District, three in Dryden District, two in Kenora District, and one in Sioux Lookout District. The plots in Red Lake District averaged 24% defoliation, with the highest defoliation levels, averaging over 50%, north of the town of Red Lake. In Dryden District, trees in plots with defoliation averaged 8% defoliated. The highest average defoliation (15%) was seen in a plot relatively close to the Red Lake District boundary on the south side of Lac Seul. In Kenora District, the two plots with jack pine budworm defoliation averaged 7% defoliated. The plot with the most defoliation (8%) is along Hwy 105 south of Camp Robinson in the northeast corner of the district. Only one plot in Sioux Lookout showed signs of jack pine budworm defoliation. This plot was in the southcentral part of the district along Stanzikimi Lake Road and had trace defoliation (average 1%).

A total of 885 jack pine trees were affected by forest health factors other than budworm, including western gall rust, shoot and bark beetles, animal damage (birds, bears, porcupine), and abiotic factors such as drought, blowdown, and snow damage.

The most damaging agent in Northeast Region was western gall rust. Some level of gall rust was seen on 549 trees but damage was minimal. In Northwest Region, 77 trees had been affected by snow damage and 73 trees by western gall rust. Other forest health factors recorded were stem insects, armillaria root rot, blowdown, animal damage, and drought.

Trend analysis/outlook/issues

Jack pine budworm pheromone trapping

Jack pine budworm pheromone trapping was carried out across the province in 2018. Traps were deployed at 81 locations: 35 in Northwest Region, 37 in Northeast Region, and nine in Southern Region. Trap catches increased dramatically in 2018. The biggest change was recorded in the Northwest Region, increasing from an average of 3.6 moths to 49.4 moths per trap. The highest average numbers of moths per plot were in Dryden and Kenora districts with an average of 133 male moth captures. In Dryden, the jack pine plot was relatively close to the Red Lake District boundary on the south side of Lac Seul and had light defoliation in 2018. The plot in Kenora was northeast of the town of Kenora along Hwy 17 in Coyle Twp.

Southern Region also had a significant change in the average number of moth catches from 5.6 in 2017 to 43.9 in 2018. The highest average number of moths per plot (76) was in Algonquin Park near Lake Travers in the northeast corner of the park.

In Northeast Region, the increase of the average number of moths per trap was not as substantial as in the other two regions. Catches went from 1.5 moths per trap in 2017 to 22.7 in 2018. The area with the highest average number of moths per plot (76.5) was in Nairn Twp, Sudbury District.

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, 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 too determine the average number of larvae per branch for each sample location. This average was used to forecast the expected jack pine budworm defoliation in 2019. An average of more than 54 larvae per branch indicates potential for severe defoliation. Moderate defoliation is forecasted when 16 to 54 larvae are found per branch. Light defoliation can be expected when 15 or fewer larvae are found on each branch.

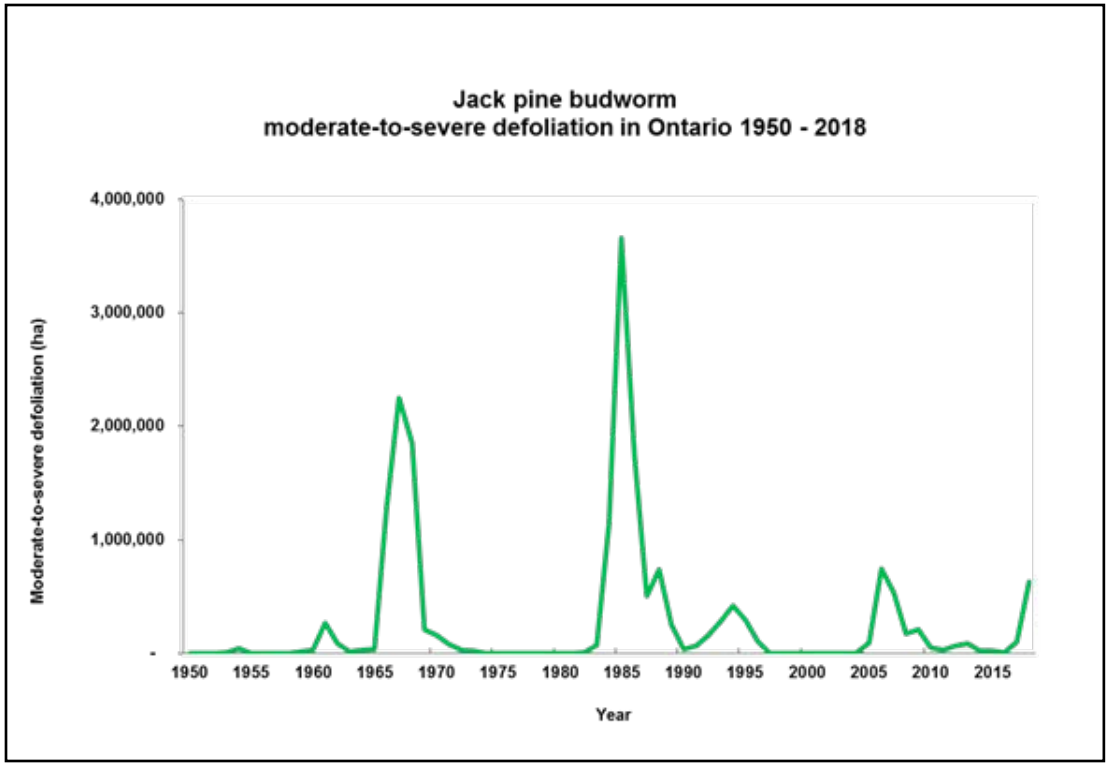
In Northwest Region, a total of 52 locations (520 trees) were sampled in 2018. Most of these locations were in Red Lake District (31), with samples from 11 locations indicating potential for severe defoliation, 13 indicating moderate, and seven

indicating light for 2019. All 10 samples from Sioux Lookout District forecast light defoliation for 2019. In Kenora District, seven samples forecast light defoliation and one forecast moderate defoliation. All three samples from Dryden District indicated light defoliation.

In Northeast Region, 12 locations were sampled in 2018: ten in Sudbury District and two in Sault Ste. Marie District. In Sudbury District, defoliation forecast was nil for four locations and light for the remaining six. The 2019 forecast for both locations in Sault Ste. Marie District was for light defoliation.

Total area (in hectares) in which jack pine budworm caused moderate to severe defoliation from 2014 to 2018, by MNRF district.

Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	-	-	-	-
Cochrane	-	-	-	-	-
Hearst	-	-	-	-	-
Kirkland Lake	-	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	-	2,520	2,403	-	-
Sudbury	-	-	-	-	-
Timmins	-	-	-	-	-
Wawa	-	-	-	-	-
Sub total	0	2,520	2,403	0	0
Northwest					
Dryden	-	-	-	-	3,603
Fort Frances	-	-	-	-	-
Kenora	-	-	-	-	10,278
Nipigon	-	1,368	2,020	-	-
Red Lake	-	-	-	100,187	613,574
Sioux Lookout	22,010	17,461	662	-	-
Thunder Bay	-	-	-	-	-
Sub total	22,010	18,829	2,682	100,187	627,455
Provincial total	22,010	21,349	5,085	100,187	627,455

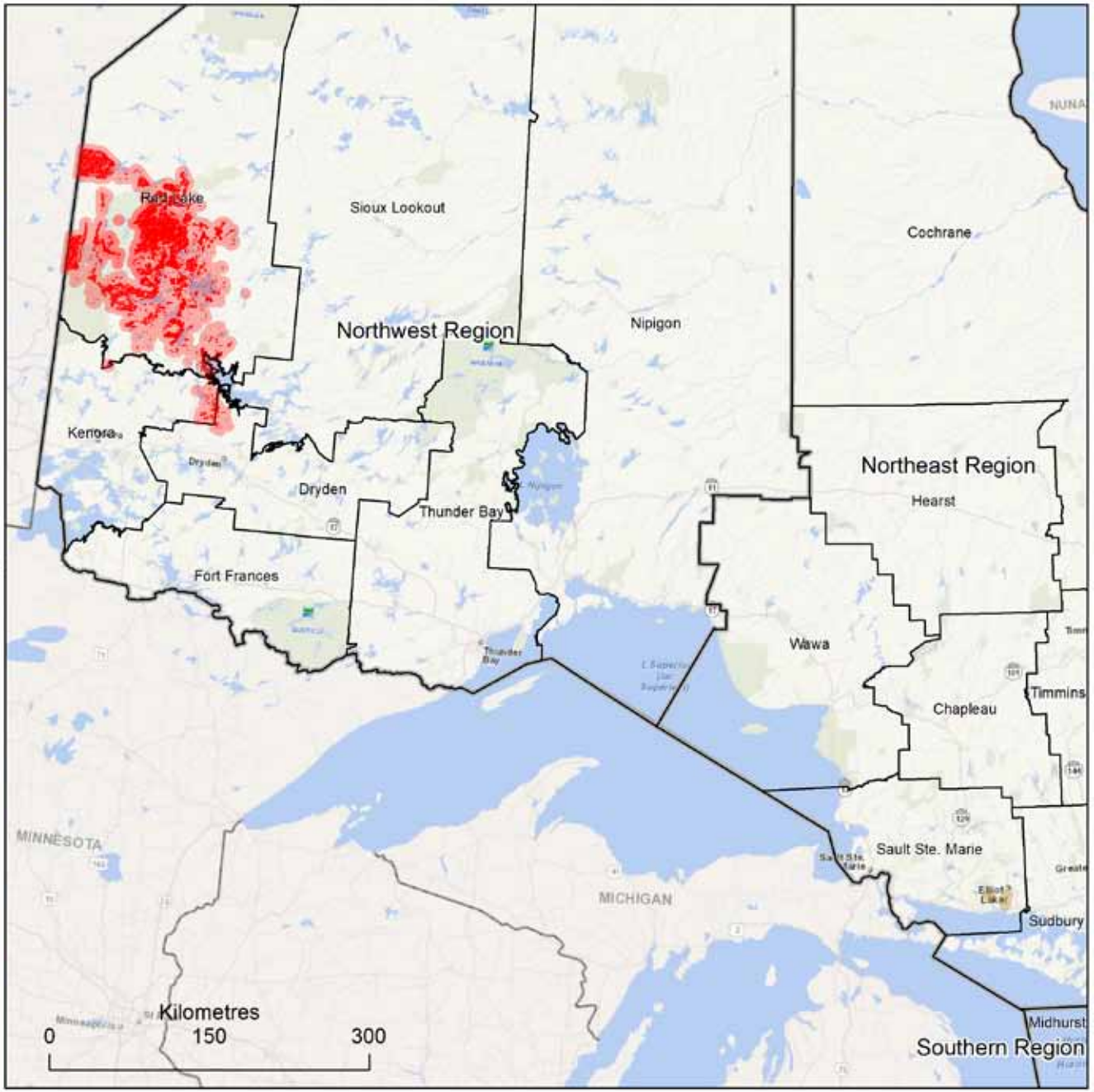

Jack pine budworm
moderate-to-severe defoliation in Ontario 1950 - 2018
Moderate-to-severe defoliation (ha)
4,000,000
3,000,000
2,000,000
1,000,000
-
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year

Jack pine budworm 2018

Areas in Ontario where jack pine budworm caused defoliation

Moderate to severe = 627,455 ha
Mortality = 870 ha

- Area of moderate to severe defoliation
- Area of mortality

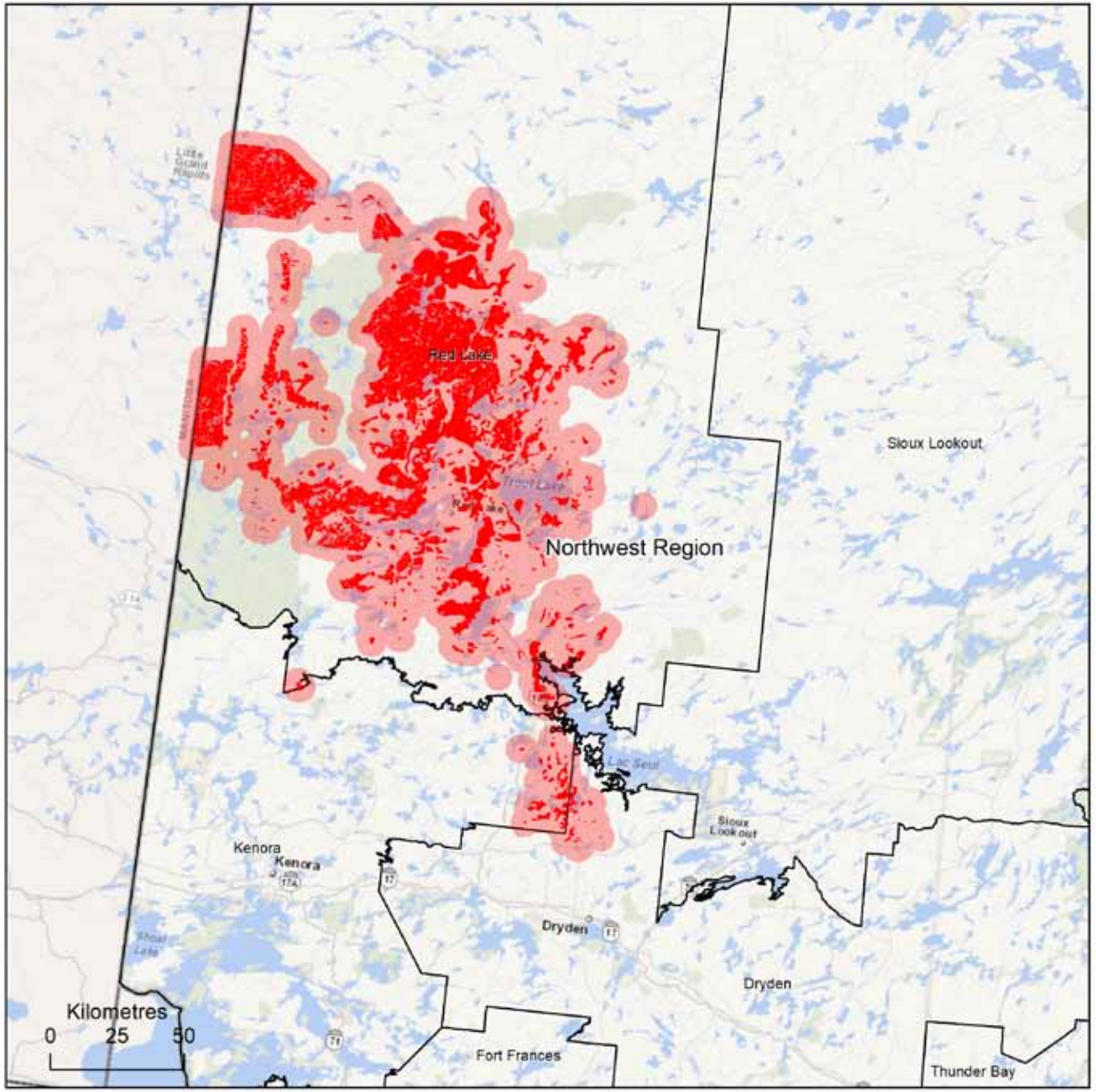


Jack pine budworm 2018

Areas in the Northwest Region where jack pine budworm caused defoliation

Moderate to severe = 627,455 ha

Area of moderate to severe defoliation



Jack pine budworm 2018

Areas in the Northeast Region where jack pine budworm caused mortality

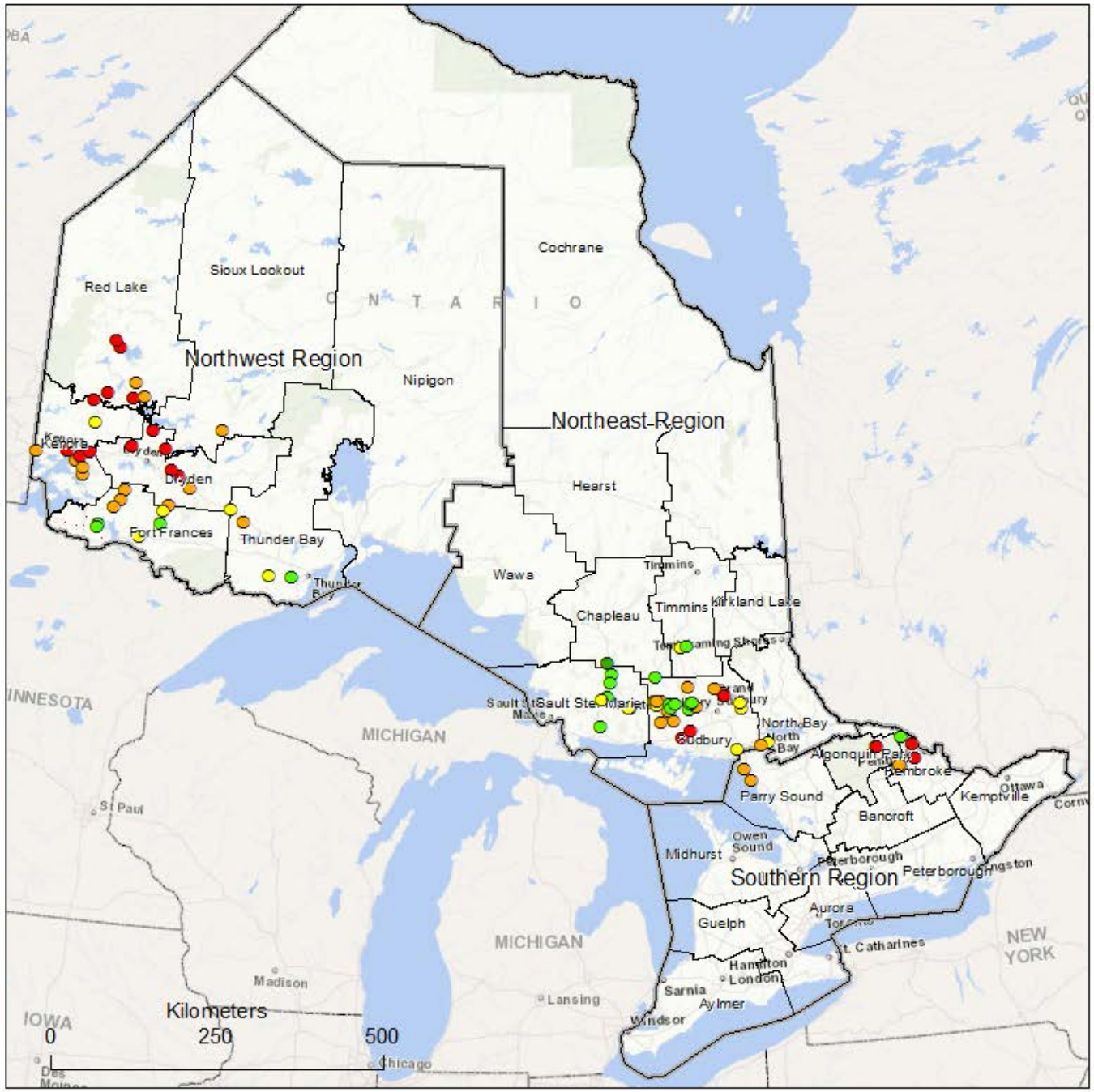
Mortality = 870 ha

Area of mortality

Jack pine budworm Pheromone Trapping Results 2018

Average Number of Moths per Trap

- 0
- < 10
- 10 - 25
- 25 - 50
- > 50



Jack pine budworm second instar larvae survey

- Trap location

Larch casebearer

Pest information

Common name:	Larch casebearer
Scientific name:	*Coleophora laricella (Hubner)*
Pest origin:	Invasive - native to Europe
Pest type:	Defoliator
Host species:	Larch species
Infestation area:	1,986 ha

Provincial key facts

- Larch casebearer was introduced to North America in Massachusetts in 1886 and was detected in Ontario in 1905. This pest is now found across the range of tamarack and throughout European larch plantations in Ontario.
- Larch casebearer is a serious defoliator of tamarack. In Southern Region defoliation has been mapped annually since 2001.
- Larch casebearer occurrence was infrequent in 2018, with 1,986 ha of moderate to severe defoliation mapped in small scattered areas across Southern Region. This area is less than the 3,853 ha documented in 2017.

Regional summary

Southern:

- In Midhurst District, 1,525 ha of defoliation occurred in 2018. The largest area of moderate to severe defoliation was in Minesing Wetland between Angus and Midhurst in Springwater Twp, Simcoe County, an area commonly affected by this pest. In Grey County, a substantial stand of tamarack was mapped northwest of Owen Sound, west of Durham, and a small number of scattered areas throughout Grey, Bruce, and Dufferin counties. Small stands of larch were also defoliated in north Simcoe County at Awenda Provincial Park and Christian Island.
- In Guelph District, 419 ha of severe defoliation were aerially mapped east of the town of Mount Forest at Luther Marsh as well as in a small larch stand west of Mount Forest, in Wellington County. Farther south a small area of defoliation was mapped on the west side of Hwy 11 south of the community of Freelton, West Flamborough Twp.
- In Peterborough District, one small stand of 42 ha of moderate to severe defoliation was aerially mapped along

Shannonville Road north of Belleville. During ground surveys small areas of defoliation were seen along Hwy 7, east of Havelock as well as light defoliation in a semi-mature larch stand in Fenella, Northumberland County.

- In Kemptville District, moderate to severe defoliation was observed along County Road 43, in a mixed aged stand southwest of Kemptville. This area was not aerially mapped.

Total area (in hectares) in which larch casebearer caused moderate to severe defoliation from 2014 to 2018, by MNRF district.

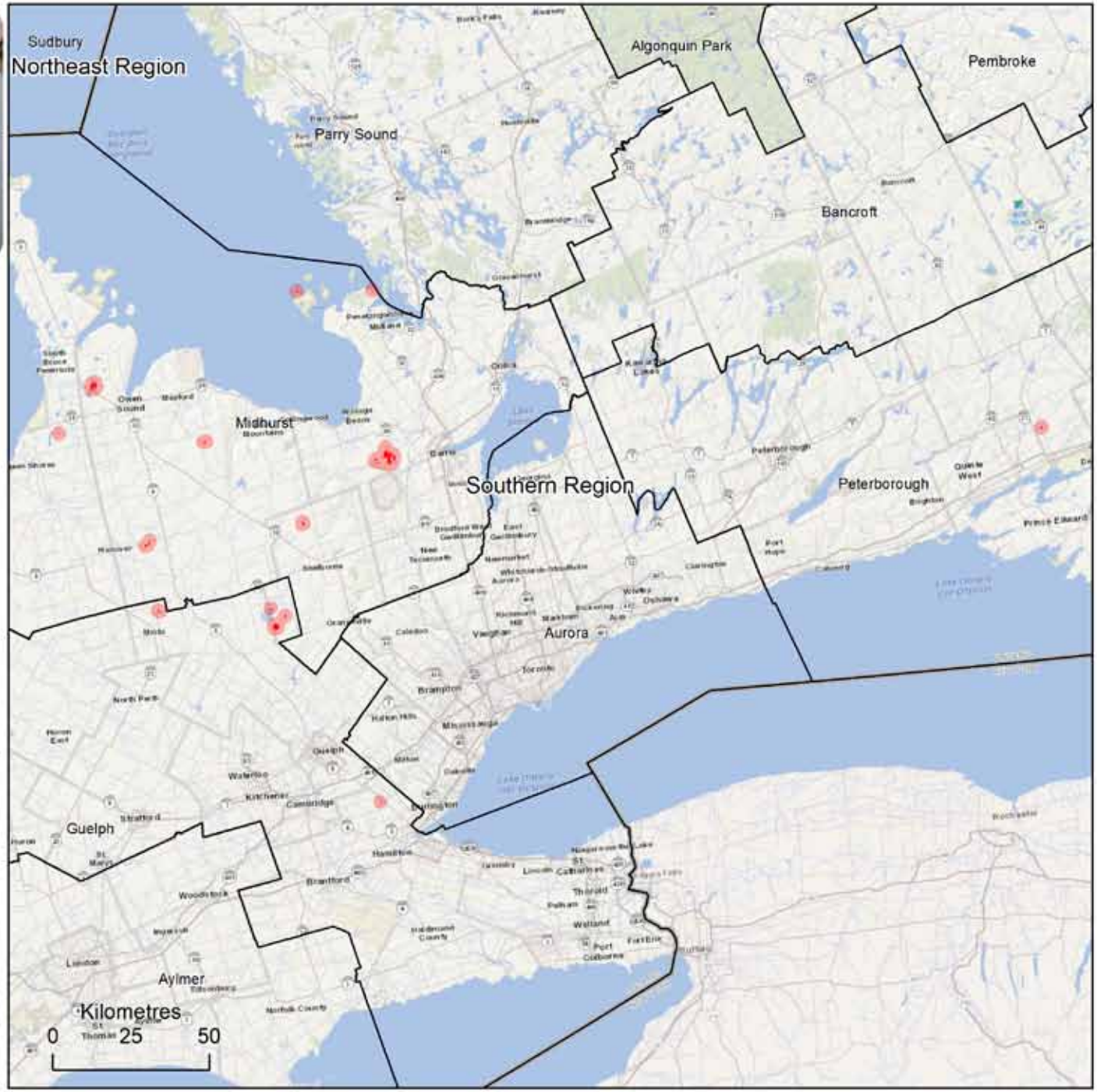
Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	-	-	-	-
Cochrane	3	-	-	-	-
Hearst	1,008	-	-	-	-
Kirkland Lake	15	-	-	-	-
North Bay	-	-	-	-	-
Sault Ste. Marie	34	-	-	-	-
Sudbury	-	-	-	-	-
Timmins	296	-	-	-	-
Wawa	-	-	-	-	-
Sub total	1,355	0	0	0	0
Southern					
Algonquin Park	57	63	-	-	-
Aurora	445	-	-	-	-
Aylmer	47	3	-	-	-
Bancroft	105	811	80	275	-
Guelph	1,369	19	1056	776	419
Kemptville	1,463	86	196	231	-
Midhurst	2,666	661	-	1,437	1,525
Parry Sound	51	42	-	5	-
Pembroke	929	4	52	26	-
Peterborough	1,154	179	126	1,103	42
Sub total	8,287	1,869	1,510	3,853	1,986
Provincial total	9,643	1,869	1,510	3,853	1,986

Larch casebearer 2018

Areas in the Southern Region where larch casebearer caused defoliation

Moderate to severe = 1,986 ha

Area of moderate to severe 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:	39,206 ha

Provincial key facts

- Large aspen tortrix is second in importance 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 they will feed on other trees and shrubs (e.g., birches, alder, and choke cherry).
- Outbreaks of this pest has sharp increases and quick decreases after two to three years of moderate to severe defoliation.
- In 2018, 39,206 ha of moderate to severe defoliation were aerially mapped in Northeast Region.

Regional summary

Northeast:

- Most moderate to severe defoliation from large aspen tortrix was detected in Chapleau District, with over 27,000 ha aerially mapped in 2018. On the west side of the district, large areas of defoliation were mapped east of Missinaibi Lake in Busby Township that continued south to the town of Chapleau, south of the town of Chapleau to Sideburned Lake in Caverley Twp, north of Algoma Headwaters Provincial Park, west of Hwy 129, and southwest of the community of Sultan between Wakami Lake and Hwy 129. On the east side of Chapleau District, large areas of defoliation occurred along the Timmins District border, in and around the town of Foleyet, south of Ivanhoe Lake Provincial Park to the northern part of Dore Twp near Crossley Lake, and northwest of Ramsey Lake towards the community of Sultan.

- In Timmins District, 9,716 ha of moderate to severe defoliation were aerially mapped north and south of Hwy 101 between the City of Timmins to the west district boundary. The heaviest areas of defoliation followed a northeast arc from Horwood Lake to Dana-Jowsey Provincial Park. Areas of defoliation were also mapped south of the junction of Hwy 101 and Hwy 129 in the Kenogamissi Lake area. Large aspen tortrix was detected and sampled in the central part of the district but defoliation was not aerially mapped due to smoke from forest fires in the area.
- In 2018, 1,375 ha of large aspen tortrix defoliation were mapped in the northern part of Sault Ste. Marie District, south of the Chapleau District boundary along Hwy 129. On the east side of Hwy 129, defoliation was mapped along the northern boundaries of Gaunt and Gilbertson townships, south of Glade Lake. On the west side of Hwy 129, defoliation was recorded along the northern boundaries of Foulds and Gaunt townships, near Pluto Lake.
- On the east side of Wawa District, 379 ha of moderate to severe defoliation was mapped southwest of The Shoals Provincial Park in Saunders, Shawkence, and Recollet townships, east of Gould Lake.
- In the southeast corner of Hearst District, 36 ha of moderate to severe defoliation were mapped west of Groundhog River Waterway Provincial Park in the north end of Watson Twp, near Kapik Lake.

Total area (in hectares) in which large aspen tortrix caused moderate to severe defoliation from 2014 to 2018 by MNRF district.

Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	-	-	19,521	34,084	27,701
Hearst	-	-	86	-	36
Sault Ste. Marie	-	-	-	-	1,375
Timmins	-	-	2,980	12,355	9,716
Wawa	-	-	-	1,858	379
Sub total	0	0	22,587	48,297	39,206
Provincial total	0	0	22,587	48,297	39,206

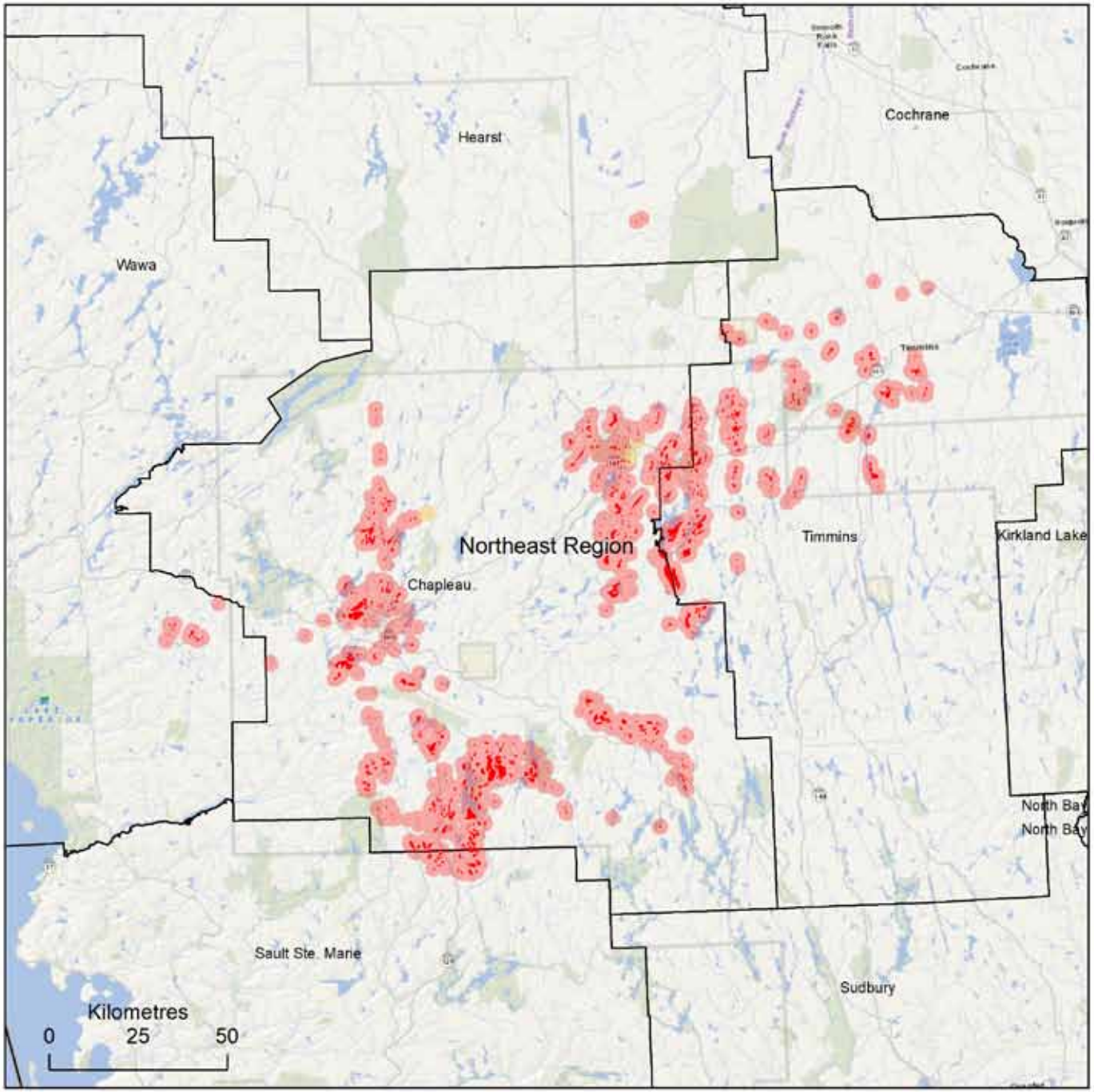
Large aspen tortrix 2018

Areas in the Northeast Region where large aspen tortrix caused defoliation

Light = 64 ha
Moderate to severe = 39,206 ha

Area of light defoliation

Area of moderate to severe defoliation



Mountain pine beetle

Pest information

Common name:	Mountain pine beetle
Scientific name:	*Dendroctonus ponderosae* Hopkins
Pest origin:	Native to North America (western Canada and United States)
Pest type:	Bark beetle
Host species:	Lodgepole pine; jack pine
Infestation area:	None found in 2018

Provincial key facts

- Mountain pine beetle is native to western North America. In Canada, the native range of mountain pine beetle is northern British Columbia, an isolated area in Cypress Hills, Saskatchewan, and more recently to northern Alberta.
- The host of mountain pine beetle is lodgepole pine, but with the recent expansion it has been found in jack pine in the boreal forest in north eastern Alberta. Jack pine is the dominant species in the boreal forest that stretches across northern Ontario, making this pest a potential concern.
- Infestations of mountain pine beetle can cause widespread pine mortality.
- In 2018, 12 pairs of mountain pine beetle pheromone baited Lindgren funnel traps were installed throughout Northwest Region. All traps were negative for mountain pine beetle.

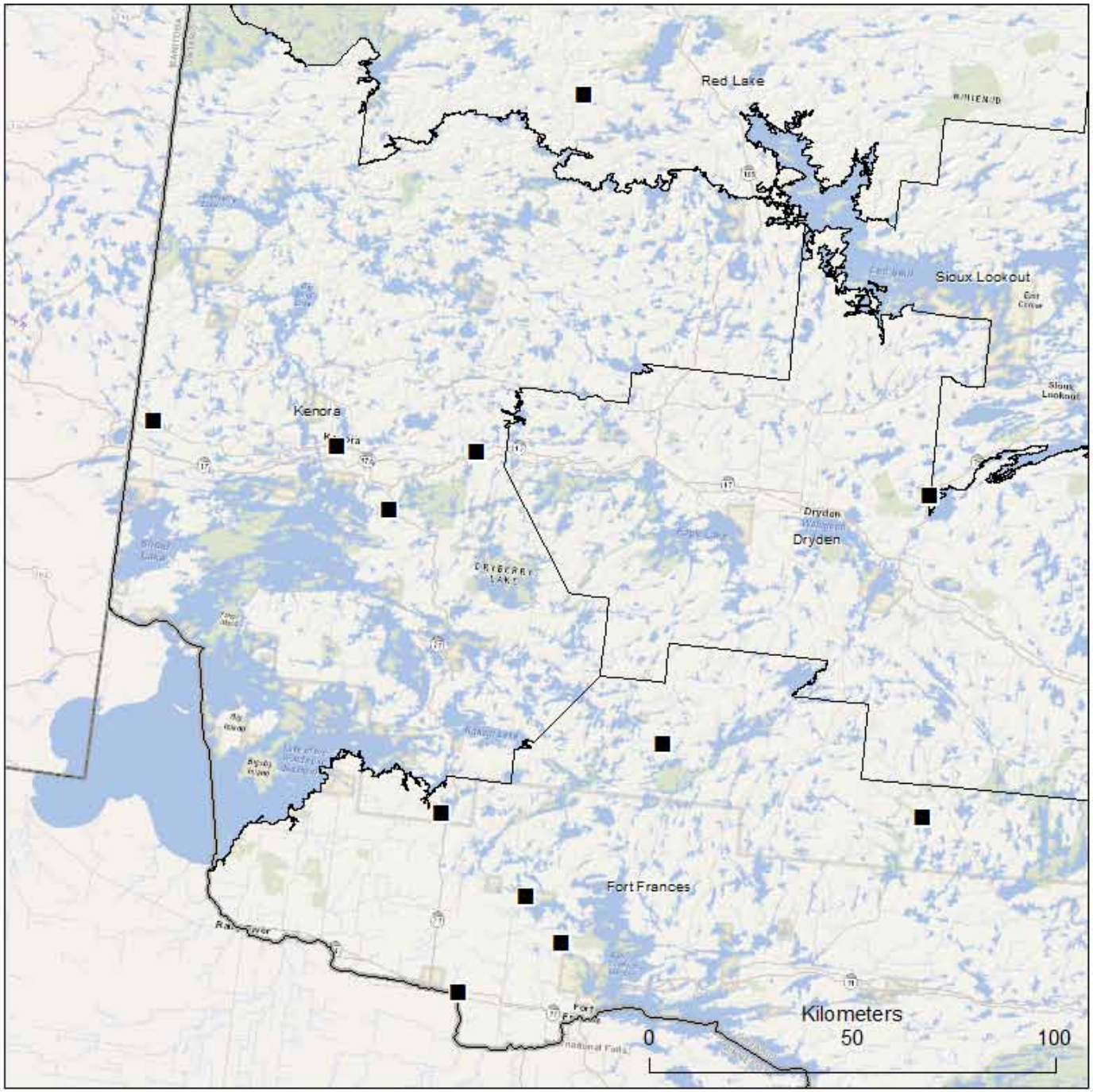
Regional summary

Northwest:

- Traps were installed in jack pine health plots and other mature or stressed jack pine stands. Two traps were deployed at each location, a minimum of 50 m apart. Traps were retrieved in August and all contents were sent to diagnostics. Mountain pine beetle pheromone baited traps were deployed on the west side of Northwest Region. Six sites were in Fort Frances District, four in Kenora District, and one each in Red Lake and Sioux Lookout districts. Most of these sites were in jack pine forest health plots, and the rest were in jack pine stands stressed by hail or snow damage. No mountain pine beetle specimens were caught in these traps.

Mountain pine beetle trap locations 2018

■ Trap location



Nitidulid beetle

Pest information

Common name:	Nitidulid beetle
Scientific name:	*Nitidulidae spp*
Pest origin:	Native to North America
Pest type:	Sap beetle
Host species:	Oak spp
Infestation area:	NA

Provincial key facts

- Nitidulid beetles are sap beetles that are attracted to the fungal mats on the main stem of oak trees that are caused by the oak wilt fungus, *Bretziella fagacearum* (formerly *Ceratocystis fagacearum*). These mats produce a sweet fruity odour that attracts beetles.
- Nitidulid beetles are known to spread oak wilt disease the same way that elm bark beetles transmit Dutch elm disease. During feeding, sticky oak wilt spores adhere to the beetles, which disperse to recently wounded trees spreading the infection.
- In 2018, Ontario Ministry of Natural Resources and Forestry researchers led a pilot program at three Ontario locations to test attractants and trap styles. This program will determine which nitidulid beetle species are most abundant and active during different seasons and temperatures and will determine if collected beetles contain spores from the oak wilt fungus. Local conservation authorities assisted with the weekly trap maintenance and collection of trapped specimens.

Regional summary

Northeast:

- In the Sault Ste. Marie District traps were deployed off Maki Road in Sault Ste. Marie near Wattswood Park and in the Sault Ste. Marie Conservation Area in late April and were maintained by ministry staff until late August. Flight activity of two species known to spread the oak wilt fungus in the United States started in mid May.

Southern:

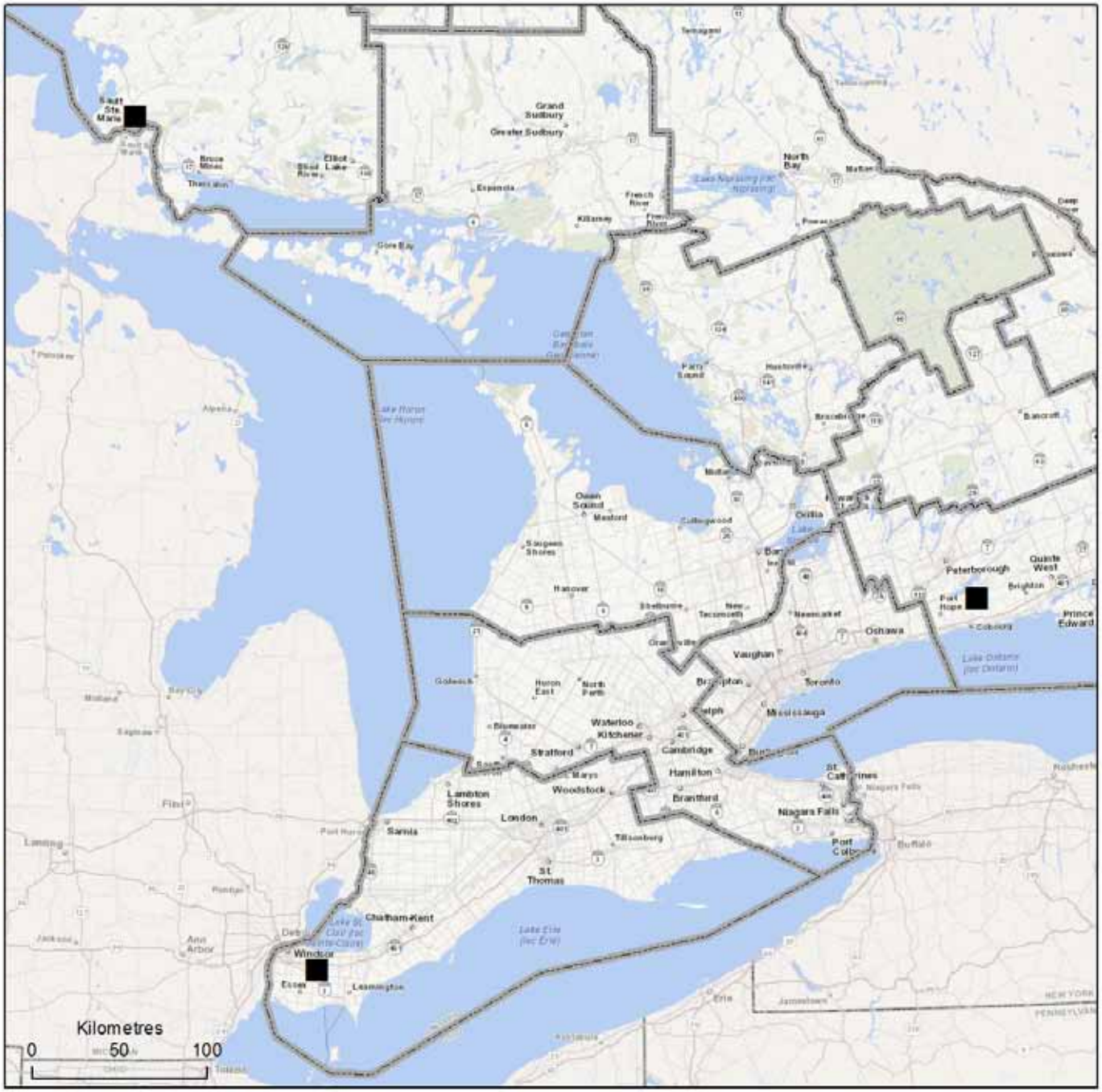
- In Peterborough District, traps were deployed in Northumberland County Forest in mid-April and maintained regularly until late August. Nitidulid species known to spread the oak wilt fungus in the United States were first collected May 3.
- In Aylmer District, traps were deployed at Maidstone Conservation Area in Essex County in mid-April and maintained by the Essex Region Conservation Authority until mid-July.
- Nitidulid species known to spread the oak wilt fungus in the United States were already active by April 17.

Trend analysis/outlook/issues

- Oak wilt is a vascular disease of oak trees caused by the fungus *Bretziella fagacearum* (formerly *Ceratocystis fagacearum*). The disease is present in the northern United States near the Canadian border, posing a high risk of introduction to Canada. Locally, the disease is spread by insect vectors such as sap beetles (Coleoptera: Nitidulidae) and root grafting. Long distance movement is often the result of people moving oak wilt infected logs.
- Thousands of nitidulid beetles were collected in aerial flight traps. Identification of these beetles is ongoing. To date, 24 species have been identified. Both trap and lure styles were very effective.
- Beetles were collected from oak wounds but far fewer beetles were collected from wounds than aerial flight traps. Three species of nitidulids were attracted to oak wounds. Two of these species are known to spread the oak wilt fungus in Wisconsin and Minnesota. A third species collected is not commonly considered a vector of the pathogen but could be so should be investigated. This is an important finding because different nitidulid species have been associated with oak wilt infection in different regions of the United States.

Nitidulid Trap Locations

■ Trap location



Pine engraver

Pest information

Common name:	Pine engraver
Scientific name:	*Ips pini* (Say)
Pest origin:	Native to North America
Pest type:	Bark beetle
Host species:	Jack pine
Infestation area:	15 ha

Provincial key facts

- All pine species attacked.
- Adults are attracted to recently dead or dying trees, particularly smaller diameter pine.
- Beetles spend most of their life cycle under the bark, causing branch dieback or tree death.
- Evidence of pine engraver damage includes wood dust in bark crevices or around the base of the tree, as well as numerous small round holes in the bark.
- Two generations can occur in one year.
- In 2018, pine engraver damage was only mapped in the Northeast Region.

Regional summary

Northeast:

- In Timmins District, 15 ha of severe damage were mapped along Hwy 560 in a semi-mature jack pine plantation. Trees with up to 100% damage were observed mid-August. Symptoms included red needles, needle drop, and numerous exit holes in bark.

Pine engraver beetle 2018

Areas in the Northeast Region where pine engraver beetle caused damage

Moderate to severe = 15 ha

Area of moderate to severe damage

Satin moth

Pest information

Common name:	Satin moth
Scientific name:	*Leucoma salicis (L.)*
Pest origin:	Invasive – native to Europe and Asia
Pest type:	Defoliator
Host species:	*Populus* spp.
Infestation area:	61 ha

Provincial key facts

- Satin moth can be found across North America, including most of southern Ontario. This pest continues to expand its range in Ontario, spreading from the south and reaching Sault Ste. Marie in 2011 and Thunder Bay in 2016.
- Satin moth normally infests individual or small groups of ornamental poplar trees, especially European white and Carolina poplar, but will occasionally defoliate poplar stands.
- In 2018, satin moth defoliation was aerially mapped in Northwest Region (61 ha). In Southern Region, localized defoliation was recorded during ground surveys but not aerially mapped.

Regional summary

Northwest:

- In Thunder Bay District, isolated areas of severe satin moth defoliation were aerially mapped in the City of Thunder Bay for the third consecutive year. European white poplar near the north end of Memorial Avenue, three large cottonwood trees at Court Street N., and balsam poplar on Carrick, Dunlop, and Frederica streets were up to 90% defoliated. Smaller and scattered poplar stands along the waterfront from Marina Park south to Pacific Ave. were also severely defoliated and were aerially mapped. In total, 61 ha of defoliation were mapped.

Southern:

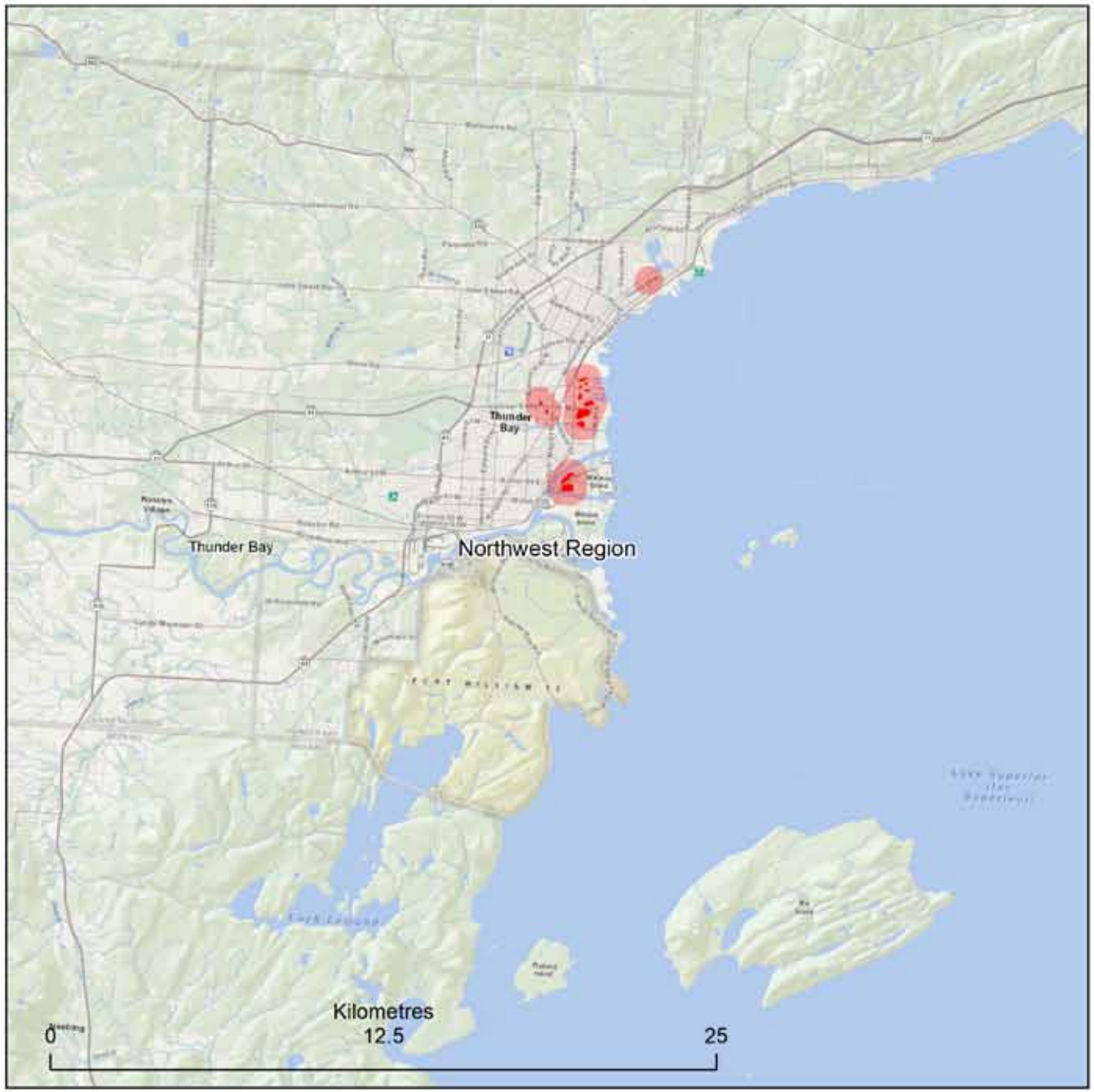
- In Midhurst District through central Grey County, six mature cottonwoods were 90% defoliated along Highway 4, west of Durham. At this site, larvae were migrating down the tree boles to spin cocoons. Severe defoliation was present on several clumps of mature cottonwood and white poplar along Hwy 6, north of Mount Forest. Samples were collected at the north end of Markdale in West Grey, Grey County, from a small stand of mature and regenerating trees. Along Hwy 24 north of Hillsborough in Dufferin County, eight eastern cottonwoods averaged 90% defoliation. At Hwy 11 and 169 at Washago in Simcoe County, several eastern cottonwoods had top dieback after years of repeated defoliation, but actual feeding was reduced to light to moderate.
- In Aylmer District, five young eastern cottonwoods along Hwy 401, in Thames Centre, Middlesex County, were 100% defoliated. South of Tavistock, two mature eastern cottonwood trees at the intersection of Hwy 59 at Oxford County Rd 34, in East Zorra-Tavistock, Oxford County, were 80% defoliated.
- In Guelph District, five mature eastern cottonwood trees were severely defoliated along Perth Road 119, just east of Brunner in Perth County. Several mature eastern cottonwood trees were severely defoliated at Hwy 7 and Heritage Road southwest of the Town of St. Mary's on the Perth-Middlesex county border.
- In Aurora District, one large eastern cottonwood west of Orangeville was 50% defoliated and several mature eastern cottonwoods south of Orangeville, along Hwy 10 near Caledon in Peel Region, were severely defoliated.
- In Pembroke District, severe defoliation was observed on six mature eastern cottonwoods at the municipal beach in White Lake, southeast of the town of Renfrew. Large numbers of satin moth larvae were scaling the main boles after feeding.

Satin moth
2018

Areas in the Northwest Region where satin moth caused defoliation

Moderate to severe = 61 ha

Area of moderate to severe defoliation



Snow

Pest information

Common name:	Snow
Scientific name:	
Pest origin:	
Pest type:	Abiotic
Host species:	All conifer and deciduous
Infestation area:	2,370 ha

Provincial key facts

- Damage consists of trees of all ages and sizes being uprooted, snapped off, bent over, or suffering various amounts of crown damage.
- Snow damage in Ontario can be significant but events are sporadic and effects vary considerably.
- In 2018, snow damage was mapped in both the Northwest and Northeast regions.

Regional summary

Northwest:

- In mid- to late October 2017, a cold snap and early snow resulted in areas of damage throughout the Northwest, totalling 2,258 ha.
- During aerial surveys in Dryden District, 1,187 ha of moderate to severe snow damage was mapped. The largest area of snow damage surrounded the town of Vermilion Bay. Damage was mapped across Docker, Langton, and Mutrie townships, and a small area mapped on the south end of Wabigoon Twp. Small areas of snow damage were mapped in the southwest corner of Dryden District along the shores of Tadpole, Gryphon, Walleye, and Bunyan lakes. During ground surveys broken leaders from snow damage were observed in Blue Lake Provincial Park, along Hwy 647, and in jack pine health plot 106, on Turtle River near the southern boundary of Dryden District.
- In the central part of Sioux Lookout District, 611 ha of snow damage were mapped on the west side of St. Raphael Lake Provincial Park (waterway class) at the north end of Churchill Lake. Low levels of snow and ice

damage were also recorded on individual trees in forest health plots. Damage consisted of broken branches in the upper crown and did not kill trees.

- In Kenora District, 385 ha of moderate to severe snow damage were aerially mapped in 2018. Most of the damage was mapped south of Dryberry Lake in the southeastern section of the district. A large area of damage was mapped directly south of Atikwa Lake and several smaller areas west of the lake. Snow damage affected all tree species, causing bent trees, snapped tops, and broken branches. Smaller areas of snow damage were observed during ground surveys along Hwy 17 to Hwy 71, continuing south to Sioux Narrows. Large trees and shrubs in lowland and rock outcrop areas were damaged between Black Lake and Mac Lake. Scattered areas of snapped tops and bent trees were observed along the Hwy 17 corridor, east of Kenora to the Dryden District border.
- In Fort Frances District, 75 ha of moderate to severe snow damage were mapped in and outside the northeast corner of Quetico Provincial Park. The area just outside the park was east of Windigoostigwan Lake, north of Hwy 11, near Thunder Bay District border and in the park was southeast of Hop Lake.

Northeast:

- In southern Chapleau District, 112 ha of snow damage were mapped in 2018. Damage occurred starting at the Hwy 129 and Hwy 667 junction and continued along Hwy 667 and Sultan Industrial Road to Hong Kong Road in Fawn Twp. Damage was localized to road corridors.

Snow
2018

Areas in Ontario where snow caused damage

Severe = 2,370 ha

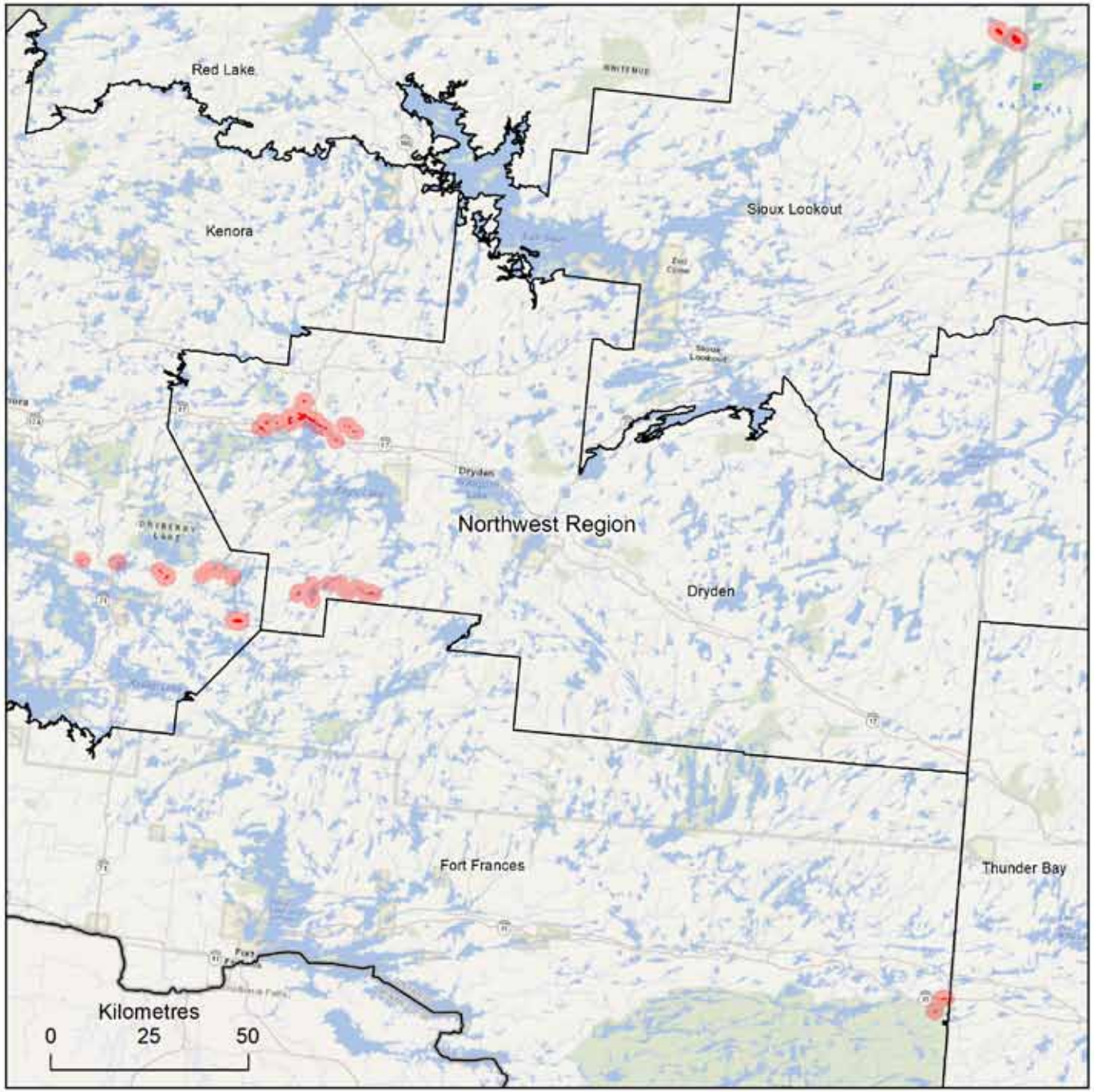
Area of severe damage

Snow
2018

Areas in the Northwest Region where snow caused damage

Severe = 2,258 ha

Area of severe damage

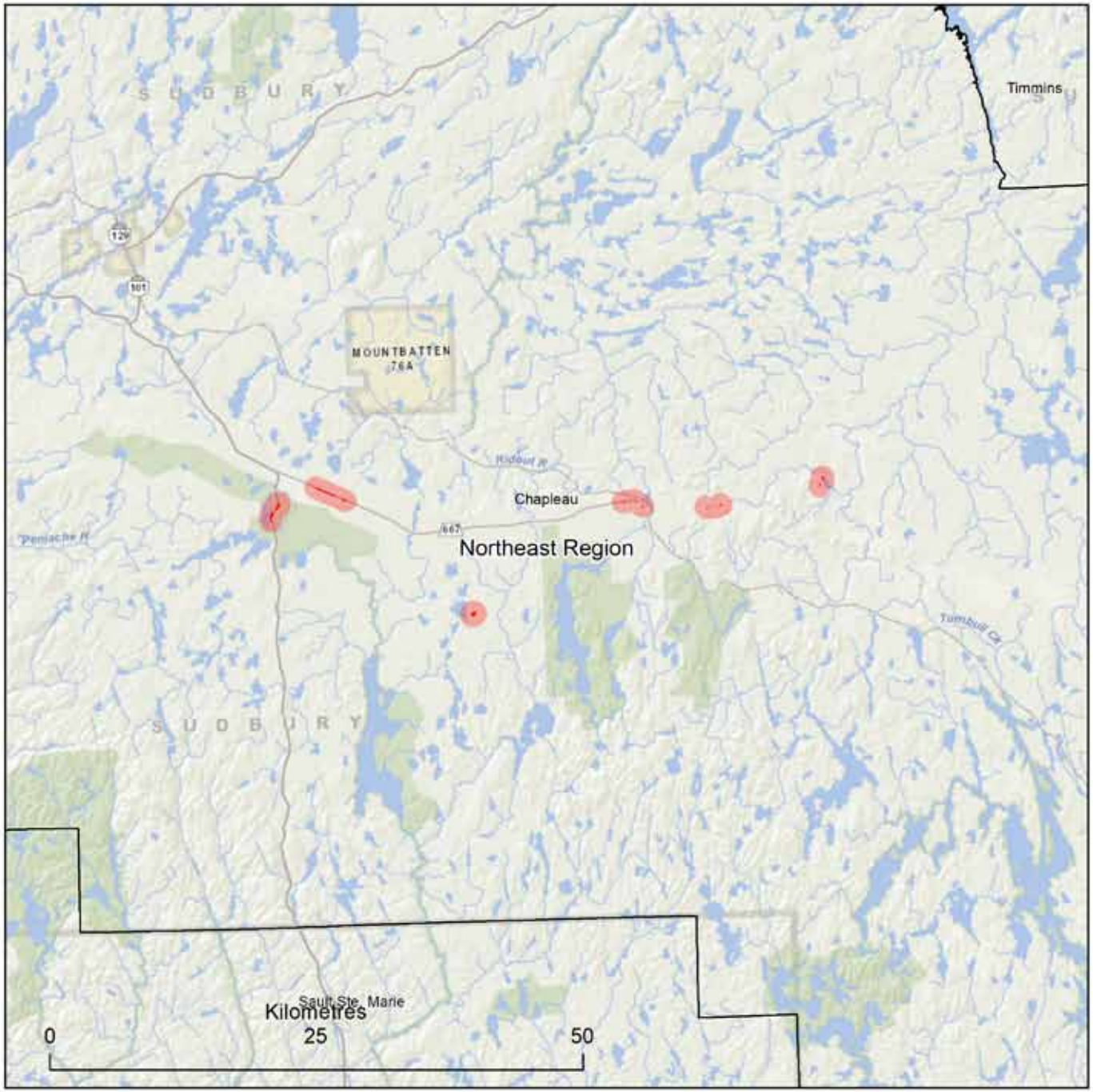


Snow
2018

Areas in the Northeast Region where snow caused damage

Severe = 112 ha

Area of severe damage



Spruce budworm

Pest information

Common name:	Spruce budworm
Scientific name:	*Choristoneura fumiferana* (Clem.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Balsam fir, spruce spp
Infestation area:	137,082 ha moderate to severe, 6 ha light, 14 ha mortality

Provincial key facts

- Spruce budworm is one of the most damaging native insects affecting fir and spruce in Ontario.
- Outbreaks can last several decades and can result in extensive mortality to balsam fir and spruce.
- In 2018, total area of moderate to severe spruce budworm defoliation decreased to 137,082 ha from 147,072 ha in 2017. A total of 14 ha of mortality was mapped in Northeast Region.
- Most defoliation was mapped in Northeast Region, with just under 100 ha in Southern Region.

Regional summary

Northeast:

- In 2018, 33,933 ha of moderate to severe defoliation were mapped in North Bay District, up from 4,058 ha in 2017. The largest areas of defoliation were mapped northwest of the city of North Bay along Hwy 11 to Beaucage as well as in a northeast direction from the city to Buffalo Rock along the Quebec border, about 33 km southeast of Temagami. In the northern part of the district, smaller scattered areas of moderate to severe defoliation were recorded from Rib Lake, just south of Latchford, to Hudson Twp northeast of the town of New Liskeard near the Kirkland Lake District boundary. East of North Bay, smaller areas of moderate to severe defoliation were seen between Bonfield and Mattawa. Most of this defoliation was on the south side of Hwy 17 in Bonfield and Calvin townships. Small scattered areas of defoliation were also aerially mapped south of North Bay between Callander and Corbeil in Ferris Twp, and south of Wasi Lake in and around the community of Chiswick. Three small areas of defoliation were recorded northeast of Powassan in Himsworth Twp. On the

southwest side of North Bay District, a small area of moderate to severe defoliation was observed southwest of Lake Nipissing around French River Provincial Park.

- In 2018, Cochrane District had 31,841 ha of moderate to severe defoliation, a decrease of 22,126 ha relative to 2017. This defoliation was south and north of Smooth Rock Falls in the southwest corner of the district. Mapped defoliation stretched from the Hearst/Cochrane district boundary to the town of Cochrane. New areas of defoliation were detected during ground surveys approximately 50 km east of the town of Cochrane in Freele Twp on the north end of Bingle Lake Road, and southwest of Iroquois Falls in Dundonald Twp, east of Frederick House Lake.
- In Chapleau District, most of the moderate to severe defoliation was mapped in the northeast corner of the district bordering the Timmins and Hearst districts. Farther south, a smaller isolated area of defoliation was recorded west of Gogama, with both areas totalling 30,680 ha. The larger area of defoliation stretched from the community of Shawmere in Oates Twp north to the Hearst District boundary in Wadsworth Twp across to the Timmins District boundary. The smaller isolated area of defoliation was mapped near Rush Lake in the townships of Genoa, Marion, and Mallard. A total of 12 ha of balsam fir mortality caused by spruce budworm defoliation was recorded northwest of Foleyet in the northeast corner of Shenango Twp, north of Shenango Lake.
- In the northwest corner of Timmins District, 23,230 ha of moderate to severe defoliation was mapped bordering the Chapleau, Hearst, and Cochrane districts. Much of the defoliation was observed along waterways including the Mattagami and Nat Rivers. Small areas of light defoliation were detected during ground surveys along Hwy 101 between the community of Schumacher and Hwy 67, east of Night Hawk Centre.
- In the southeast corner of Hearst District, 16,522 ha of moderate to severe defoliation were recorded in 2018, down from the 22,168 ha recorded in 2017. This was a continuation of the infestation in Timmins, Cochrane, and Chapleau districts. Most of the defoliation was south of Hwy 11 from the town of Fauquier to the Timmins/Chapleau district boundary in Northern Claybelt Forest Complex Conservation Reserve.
- In Sudbury District, small scattered areas of moderate to severe defoliation were mapped in the central part of the district and on Manitoulin Island, totalling 803 ha. Most of the defoliation was northeast of Nairn Centre, near the community of Dowling, and south of the town of Lively. On the southern part of Manitoulin Island, small areas of moderate to severe defoliation were recorded between Providence Bay and South Baymouth. Ground surveys detected moderate defoliation northeast of Nairn Centre on Spanish River Road, Drury Twp. A small area (2 ha) of spruce budworm mortality was recorded on a small island in Clear Lake northeast of the community of Cartier. All the balsam fir on the island were dead.
- In 2018, spruce budworm was detected in Sault Ste. Marie District, but only light defoliation (<10%) was evident during ground surveys. Areas with light defoliation included a small white spruce stand on the eastern edge of the City of Sault Ste. Marie, along Hwy 17 west of the town of Desbarats, and north of Hwy 17 in Tarbutt Additional Twp. In addition, numerous moths were seen on several white spruce trees at a rest area just west of Bruce Mines, but very little defoliation was observed.

Southern:

- For the third consecutive year, moderate to severe defoliation was aerially mapped in and around Balsam Lake Provincial Park in Peterborough District. Only 74 ha of moderate to severe defoliation were recorded in and around the park, compared to 547 ha in

2017. Most of the defoliation in the park was on mature white spruce, with a small area of defoliation just north of the park but still in Bexley Twp. This localized population is likely to persist in 2019 as spruce budworm pheromone traps in the park averaged 634 male moths per trap.

- In Kemptville District, defoliation was not mapped in 2018, but larvae were found during ground surveys on Lanark County Road 36, north of the town of Maberly in Tay Valley Twp. Defoliation was light on white spruce.
- In Parry Sound District, moderate to severe defoliation was observed on white spruce on Hwy 124 near the junction of Hwy 520, north of Magnetawan for several kilometres.

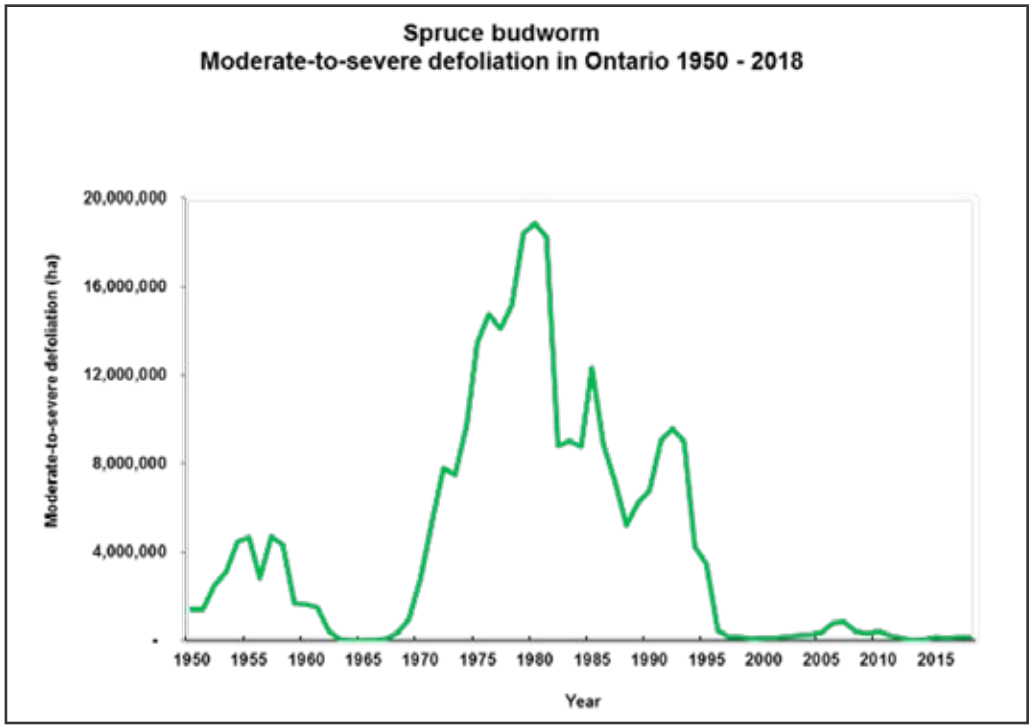
Trend analysis/outlook/issues

- In 2018, spruce budworm pheromone traps were deployed in 64 locations across the province. Overall male moth catches were higher in 2018 than in 2017. Traps in Northeast Region averaged 192 moths per trap compared to 11 moths per trap in Northwest Region. In Southern Region, traps were deployed in 20 locations, with average catches of 218 moths per trap.

Total area (hectares) in which spruce budworm caused moderate to severe defoliation from 2014 to 2018, by MNRF district.

Region	Area of decline and mortality (ha)				
District	2014	2015	2016	2017	2018
Northeast					
Chapleau	20,158	21,167	78,629	22,429	30,680
Cochrane	-	-	3,025	53,967	31,841
Hearst	9	1,134	15,761	22,168	16,522
Kirkland Lake	-	-	-	132	-
North Bay	9,240	119,184	8,995	4,058	33,933
Sault Ste. Marie	-	3,952	-	-	-
Sudbury	911	2,368	549	-	803
Timmins	-	736	8,918	43,772	23,230
Wawa	-	-	-	-	-
Sub total	30,317	148,542	115,877	146,525	137,008

District	2014	2015	2016	2017	2018
Southern					
Algonquin Park	-	-	-	-	-
Aurora	-	-	-	-	-
Aylmer	-	-	-	-	-
Bancroft	-	-	-	55	-
Guelph	-	-	-	-	-
Kemptville	-	-	-	-	-
Midhurst	-	-	-	-	-
Parry Sound	-	-	-	-	-
Pembroke	-	-	-	-	-
Peterborough	-	-	146	492	74
Sub total	0	0	146	547	74
Provincial total	30,317	148,542	116,023	147,072	137,082

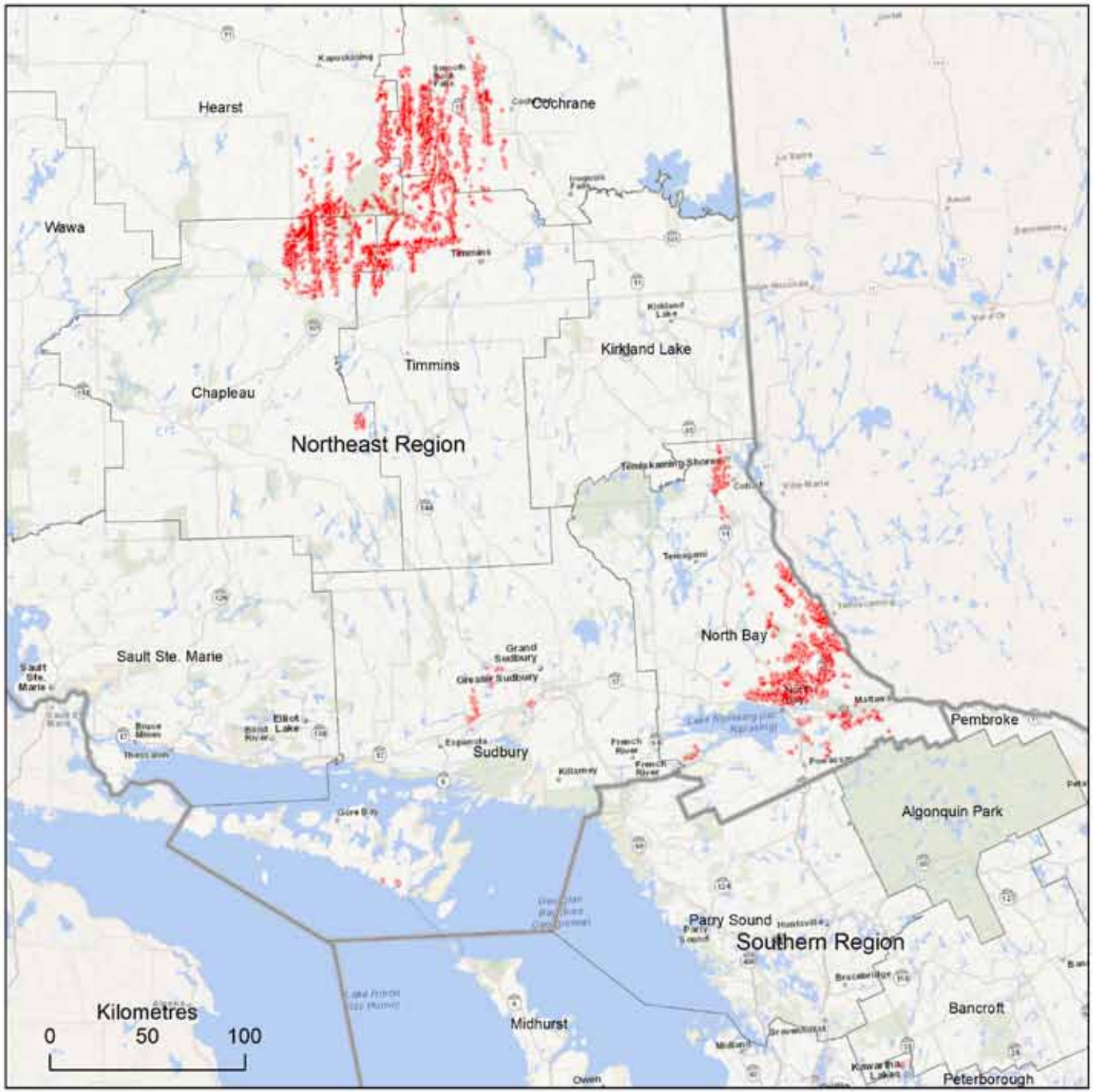


Spruce budworm 2018

Areas in Ontario where spruce budworm caused defoliation

Light = 6 ha
Moderate to severe = 137,082 ha
Mortality = 14 ha

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

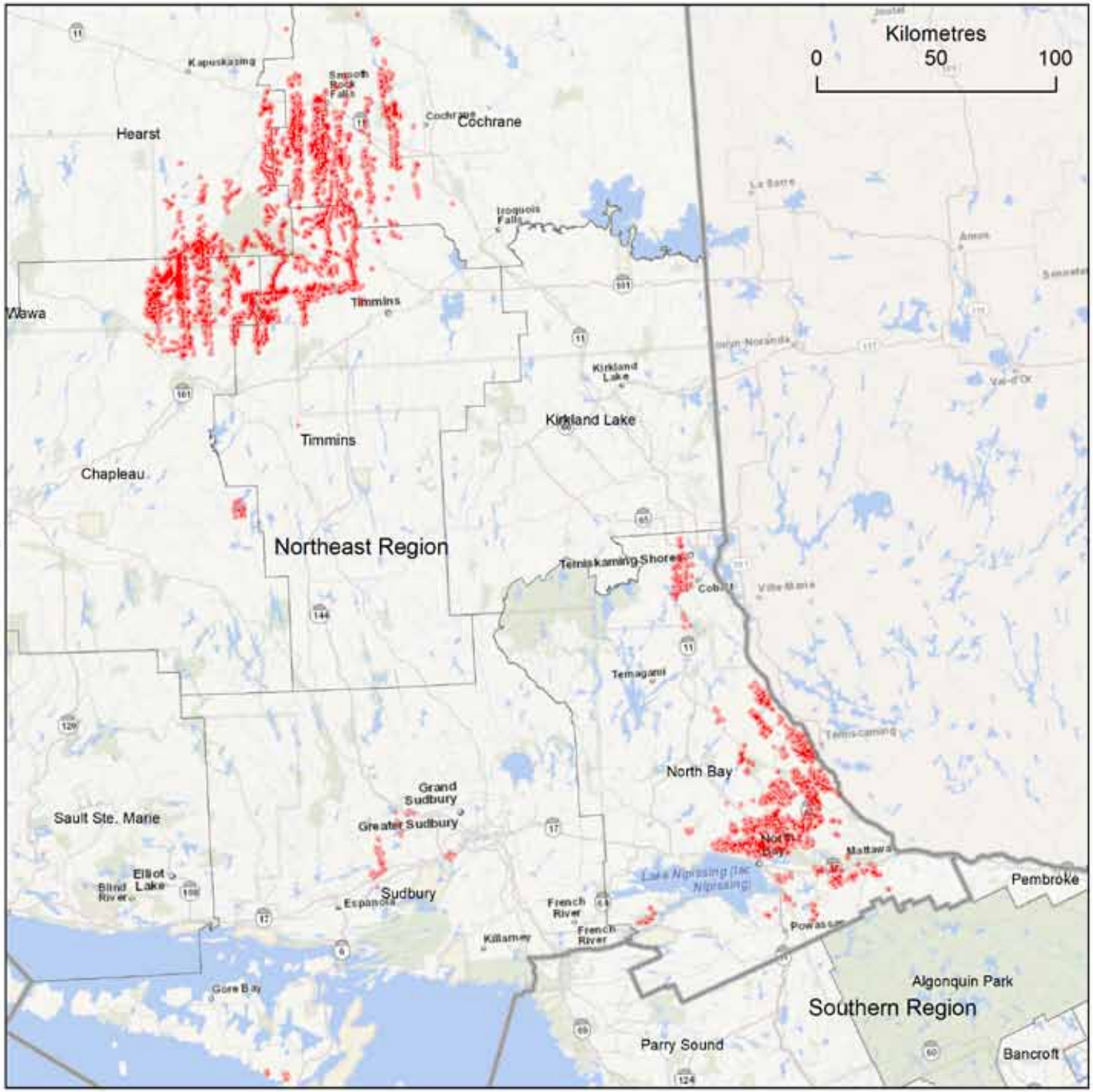


Spruce budworm 2018

Areas in the Northeast Region where spruce budworm caused defoliation

Light = 6 ha
Moderate to severe = 137,008 ha
Mortality = 14 ha

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



Spruce budworm Pheromone Trapping Results 2018

Average Number of Moths per Trap

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

Spruce needle rust

Pest information

Common name:	Spruce needle rust
Scientific name:	*Chrysomyxa nagodhii* P.E. Crane and *Chrysomyxa ledicola* Lagerh
Pest origin:	Native to North America
Pest type:	Needle rust
Host species:	Black spruce and white spruce
Infestation area:	181 ha

Provincial key facts

- Spruce needle rust is a fungus that causes current year needles to dry out, turn red, and drop off.
- It can be identified by the presence of white blisters with bright orange spores.
- Alternate hosts of spruce needle rust are Labrador tea and leatherleaf.
- This rust is most common along bog edges where the alternate hosts reside.
- Normally spruce needle rust is not a serious problem and more than two consecutive years of infection rarely occur.
- Consecutive years of severe infection can kill younger trees and reduce growth of older trees.
- In 2018, damage from spruce needle rust occurred in the Northeast and Northwest regions but was only mapped in the northwest.

Regional summary

Northwest:

- In Nipigon District, 181 ha of moderate to severe spruce needle rust were mapped at the southeast border. Damage was mapped from the town of Marathon, northeast to Marathon airport.

Northeast:

- In Hearst District, light damage was found on white spruce south of Kapuskasing in Lisgar Twp. Fewer than 5% of trees were affected and tree damage averaged 15%. Only small-spored spruce-lab tea rust, *Chrysomyxa nagodhii*, was found in Hearst District.

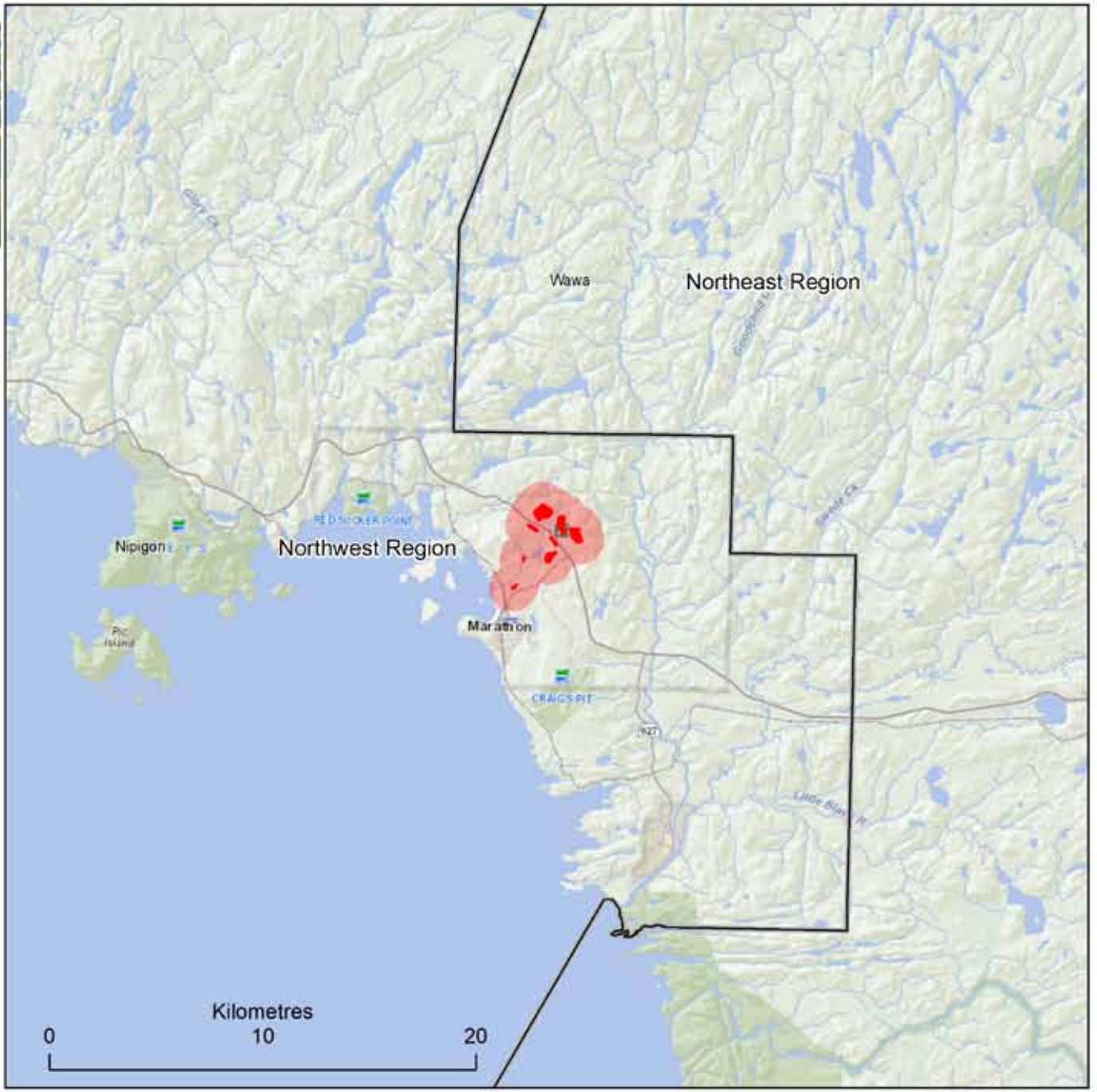
- In Timmins District, light damage was found on white spruce in Zavitz Twp. Damage averaged 20% with 25 to 50% of spruce in this township affected. Only large-spored spruce-lab tea rust, *Chrysomyxa ledicola*, was found in Timmins District.
- In Cochrane District, black spruce had light to moderate damage in Crawford and Stimson Twps. In Stimson Twp, 100% of black spruce in a treed swamp were affected, averaging 30 to 70% tree damage. In Crawford Twp, 25% of black spruce were affected, averaging 20% tree damage. Only small-spored spruce-lab tea rust, *Chrysomyxa nagodhii*, was found in Cochrane District.
- In 2018, severe damage from small-spored spruce-lab tea rust, *Chrysomyxa nagodhii* was observed on trees on the west and northeast sides of Wawa District. On the west side, moderate to severe damage of white spruce was identified along Hwy 614, south of Manitouwadge, south of Leslie Twp. Severe damage was also noted up the Industrial Road, northwest and southeast of the community of Caramat. The area of damage southeast of Caramat was approximately 1 km2. Light to moderate damage was also seen north of Mapledoram Twp, along the Industrial Road, between Caramat and Manitouwadge. Tops of a few larger white spruce were 90% affected. On the northeast side of the district, light to moderate damage was found north of the town of Hornepayne, in Wicksteed Twp, west of Hwy 631. In an approximately 100 m2 area, young black spruce were 90% affected and older spruce were 30 to 40% affected. In the northeast corner of Lessard Twp, trees in a replanted cut block had moderate to severe damage. Young black spruce trees in patches throughout the cut block were about 90% affected.

Spruce needle rust 2018

Areas in the Northwest Region where spruce needle rust caused defoliation

Moderate to severe = 181 ha

Area of moderate to severe defoliation



Walnut twig beetle

Pest information

Common name:	Walnut twig beetle
Scientific name:	*Pityophthorus juglandis* (Blackman)
Pest origin:	Native to North America
Pest type:	Bark beetle
Host species:	Walnut spp
Infestation area:	Not found

Provincial key facts

- Thousands canker disease (TCD) occurs when the walnut twig beetle, native to the southwestern United States, transmits and infects trees with the fungus, *Geosmithia morbida*. The fungus is now known to be widespread in the United States but apparently does not cause disease unless the walnut twig beetle is present.
- The TCD has been identified in the United States as a causal agent in the decline and mortality of walnut.
- The disease is widespread in the western United States and has been detected in eastern states—including Tennessee, Virginia, Ohio and Pennsylvania—threatening the highly valuable native timber stands of eastern black walnut.
- Neither the insect vector nor the fungus are currently known to occur in Canada.
- In 2018, walnut twig beetle traps were deployed across Southern Region. Lindgren funnel traps baited with pheromone lures were used as an early detection tool for the insect.

Regional summary

Southern:

- Walnut twig beetle traps were deployed in targeted black walnut stands across Southern Region. A total of 20 traps were deployed: 5 in Kemptville District, 4 in Aurora District, 3 in Aylmer District, 3 in Guelph District, 3 in Peterborough District, and 1 each in Midhurst and Bancroft districts. No walnut twig beetles were detected in 2018.

Walnut twig beetle trap locations 2018

■ Trap location

Minor forest disturbances

Aspen leafblotch miner

Pest information

Common name:	Aspen leafblotch miner
Scientific name:	*Phyllonorycter ontario* (Free.) on aspen, *Phyllonorycter nipigon* (Free.) on balsam poplar
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Trembling aspen, balsam poplar
Infestation area:	Localized

Provincial key facts

- Aspen leafblotch miner is the most common leafminer in Ontario.
- It prefers young trembling and largetooth aspen.
- Larvae mine between the upper and lower surface of leaves giving them a blotched appearance.
- When larvae first develop, blotches are not always visible on the top side of the leaf.
- Tree mortality is rare, but repeated infestations may reduce tree health and growth rate.
- In 2018, this insect occurred throughout the Northwest and Northeast regions.
- The damage from this insect is generally more severe on young growth, but in 2018 many mature trees in both regions were heavily defoliated.

Regional summary

Northwest:

- Aspen leafblotch miner was reported in most districts in Northwest Region in July and August. Defoliation was observed on young to mature trembling aspen and balsam poplar. Light to moderate defoliation was spread across the region with areas of heavier defoliation recorded at several locations.
- In Fort Frances District, defoliation was heaviest along Cedar Narrows Road, east of Kaiashkons Lake. Populations were high with up to 90% of leaves affected.

- In Thunder Bay District, defoliation from this insect was a common occurrence in the city of Thunder Bay and surrounding area.
- In Dryden District, defoliation was observed in trembling aspen stands. High levels of aspen leafblotch miner were detected in the City of Dryden and surrounding area, as well as east of Dryden in and around the settlement of Dinorwic.
- In Sioux Lookout District, defoliation was found north and south of the town of Sioux Lookout along Hwy 72 and Hwy 516.
- In the northeast corner of Kenora District, aspen leafblotch miner was found south of Perrault Falls, along Hwy 105.
- In Red Lake District, defoliation was recorded on the western shoreline of Red Lake near Bow Narrows camp.

Northeast:

- Aspen leafblotch miner was reported in most districts in Northeast Region from late July to the end of August. Defoliation was found on young to mature trembling aspen and balsam poplar. Light to severe defoliation was found throughout the region as well as localized areas of heavier defoliation. By mid- to late August, severe defoliation gave trembling aspen stands a silvery grey appearance.
- In Hearst District, defoliation from this insect started to appear mid- to late August throughout the district. Young trembling aspen along Pitopiko Road, at the western edge of the district, were 80% defoliated.
- Aspen leafblotch miner was found in many areas of Timmins District. By late summer aspen stands appeared silvery grey. Overall, 45% of young to semi-mature aspen were affected ranging from 45-75% defoliation.
- In Cochrane District, light to moderate areas of defoliation were detected along Hwy 652 northeast of Cochrane to Detour Lake Mine.
- In Kirkland Lake District, the highest presence of aspen leafblotch miner was found north of Sesekinika along Hwy 11, Hwy 66, and Hwy 560 towards Gowganda.
- In North Bay District, defoliation was observed in the northern area of the district along Hwy 11.
- In Sault Ste. Marie District, defoliation varied from light in the north to light to moderate in the southeast areas to severe in the southwest, particularly in the Searchmont area.
- In Chapleau District, moderate defoliation from aspen leafblotch miner was found near Five Mile Lake Provincial Park along Hwy 129, on Hwy 101 in Hellyer and Evans townships, and west of Racine Lake. Severe defoliation was found on young to mature trembling aspen in Racine Twp.

Beech scale

Pest information

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

Provincial key facts

- Beech scale was first found in Canada in the 1890s in Halifax, Nova Scotia.
- In Ontario it was first found in 1966 in Elgin County along the north shore of Lake Erie.
- This insect is now found across the range of beech in Ontario.
- Infestation with scale predisposes beech trees to beech bark disease, which significantly reduces beech tree vigour and causes mortality.
- In 2018, beech scale was collected in Northeast and Southern regions.

Regional summary

Northeast:

- In Sudbury District, high populations of beech scale were observed on beech trees of all sizes along Hwy 540, east of Meldrum Bay on Manitoulin Island. This is a new confirmed location for beech scale in Ontario.
- Beech monitoring plots established in 2017 across southern North Bay District were revisited in 2018. Neither beech scale nor beech bark disease were found at any of the plots this season.

Southern:

- In Pembroke District, beech scale and beech bark disease samples were collected in a mature beech/ironwood forest east of Bark Lake on Sunnyhill Road in Madawaska Valley Twp.

- In western Kemptville District, beech scale was identified in a mature sugar maple/beech woodlot near Clayton in the Township of Mississippi Mills, Lanark County. Nearly half of all beech trees surveyed were infested with beech scale but laboratory analysis did not indicate presence of beech bark disease.
- Beech scale was collected at two new locations in Aylmer District in 2018. Trace-level beech scale was observed north of Hwy 401 at Slo-Pitch City and at Dorchester Mill Pond in Dorchester, Thames Centre, Middlesex County. Low populations of beech scale were also observed and collected at three locations in the City of London at Fanshawe Conservation Area, Westminster Ponds Conservation Area, and Kirk Cousins Management Area. Beech bark disease was not detected during ground surveys at any of these locations.
- In Guelph District, beech scale was observed at four new locations in Huron County. Trace-level scale populations were collected at Bannockburn Conservation Area, near Exeter in Bluewater. Low level populations were collected along Nicholl Lane, near Brussels, and heavy scale was collected on mature beech trees at Sunshine Conservation Area in Morris-Turnberry. Low-level scale populations were also detected along Nature Centre Road near Marnoch in North Huron. No beech bark disease was observed at any of these locations.
- In Parry Sound District, high levels of beech scale were observed on large diameter trees along Island Lake Road, north of Kearney. High scale populations were also identified along Harris Lake Road, north of Pointe au Baril. Both are locations where beech scale has previously been confirmed and where beech bark disease has not yet been found.

Birch leafminer

Pest information

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

Provincial key facts

- Birch leafminer was first found in Quebec in 1929.
- First outbreak of birch leafminer in Ontario occurred in 1939.
- Damage is more severe on open grown white birch.
- This pest has two to four generations per year.
- In Canada, it is found from Newfoundland to Alberta.
- In 2018, defoliation in Ontario was limited to parts of Northeast Region.

Regional summary

Northeast:

- Birch leafminer was more prevalent in Sault Ste. Marie District in 2018 than in 2017. Areas with young understory white birch had moderate to severe defoliation. Most defoliation occurred along Hwy 129 between Aubrey Falls and Flame Lake, and along the west part of Black Creek Road in Wardle and Winkler townships.

Butternut canker

Pest information

Common name:	Butternut canker
Scientific name:	*Ophiognomonia clavigignenti-juglandacearum* (V.M.G. Nair, Kostichka & J.E. Kuntz) Broders & G.J. Boland
Pest origin:	Invasive - native to Europe
Pest type:	Disease
Host species:	Butternut
Infestation area:	Throughout range of butternut in Ontario

Provincial key facts

- Butternut canker is a fatal disease found throughout the range of butternut in Ontario causing decline and mortality of butternut across North America.
- Butternut was officially listed as endangered under Canada's Species at Risk Act in 2005 and listed as endangered under the Ontario Endangered Species Act in 2007.
- Fungal spores initially infect trees through buds, leaf scars, and other openings in the bark. Infections will cause sap to darken and ooze from the tree. Dark, sunken cankers will appear as the tree succumbs to the disease. Spores then spread through rainfall and wind infecting surrounding butternuts. Cankers will eventually girdle the tree, interrupting nutrient movement and causing decline and mortality.
- In 2018, butternut canker was reported in Kemptville District.

Regional summary

Southern:

- In 2018, butternut canker was reported in Kemptville District, where it damaged two open grown semi-mature hybrid butternut x walnut trees in a rural residential neighbourhood on Rideau Valley Drive in the community of Manotick, in the southern part of the city of Ottawa. One tree had dead and dying limbs and was heavily cankered. Cankers were found on branches, twigs, main stem, and root collar, with the root collar being severely affected. A second tree was affected but to a lesser extent.

Cedar apple rust

Pest information

Common name:	Cedar apple rust
Scientific name:	*Gymnosporangium juniper-virginianae* Schwein.
Pest origin:	Native to North America
Pest type:	Foliar rust
Host species:	Eastern redcedar, apple spp., hawthorn spp.
Infestation area:	Sporadic

Provincial key facts

- The causal pathogen of this disease requires two hosts to complete its two-year lifecycle.
- Symptoms differ on each host; on apple the disease appears as lesions on the leaves and on cedar it forms as a gall on the stem.
- As with other foliar fungal diseases, cedar apple rust is often more prevalent in years with a wet spring.
- In 2018, localized infections of this rust were observed in Southern Region in early spring.

Regional summary

Southern:

- In Midhurst District, cedar apple rust infected clumps of young redcedar trees along Sunny Valley Road, south of Owen Sound and south of Hanover in Grey County. Trees had 10 to 50 galls growing on lateral and terminal branches.
- In Kemptville District, semi-mature redcedar trees in Rapid Valley, Leeds-Grenville, had moderate damage to branches from the number of galls.
- In Aylmer District, open grown mature redcedar were affected by cedar apple rust at the Southold Earthworks site near St Thomas.

Dooks needle blight

Pest information

Common name:	Dooks needle blight
Scientific name:	*Lophophacidium dooksii* Corlett & Shoemaker
Pest origin:	Native to North America
Pest type:	Needle blight
Host species:	Eastern white pine
Infestation area:	Sporadic

Provincial key facts

- The first report of Dooks needle blight in Ontario was from a collection in 1979 near McCreight's Dam, north of Thessalon, Sault Ste. Marie District.
- Since then, reports of this disease have been periodic, causing widespread browning of eastern white pine in Ontario, Quebec, and New Brunswick.
- Consecutive years of infection may weaken or stress the tree and increase its susceptibility to secondary pests and disease.
- In 2018, low levels of Dooks needle blight were recorded only in the Sudbury district.

Regional summary

Northeast:

- In the southern part of Sudbury District, along Hwy 69, north of Bigwood, light to moderate damage by Dooks needle blight was observed for several kilometres. This damage included browning and discolouration of foliage on mature white pine. Symptoms were concentrated on edge trees and old foliage.

Dothistroma needle blight

Pest information

Common name:	Dothistroma needle blight
Scientific name:	*Dothistroma septosporum* (Dorogin) M. Morelet
Pest origin:	Native to North America
Pest type:	Needle blight
Host species:	Austrian pine, Scots pine
Infestation area:	Sporadic

Provincial key facts

- This disease affects Austrian and Scots pine of all ages but is most damaging to seedlings and smaller trees.
- Several years of infection reduces tree growth. Coupled with other factors, such as drought and secondary insect attack, it may kill branches or trees.
- In some locations, previous years' needles were brown and dropping in June, leaving only current year's shoots on trees.

Regional summary

Southern:

- In early spring samples of *Dothistroma septosporum* or red band needle blight were requested to support a research project at Laval University in Quebec.
- In 2018, areas in Midhurst District had abundant evidence of this needle blight. in groups of Austrian pine planted along property lines as well as ornamentals in gardens.
- Research collections consisted of a sample bag of needles per tree, from 5 trees at each site.
- Collections were made throughout Midhurst, Aurora, and Peterborough districts.

Drought

Pest information

Common name:	Drought
Scientific name:	NA
Pest origin:	NA
Pest type:	Abiotic
Host species:	Various coniferous and deciduous species
Infestation area:	Localized

Provincial key facts

- Drought is a prolonged period of dryness which can cause extensive damage and significant effects on forests.
- Symptoms can include wilted foliage, sparse canopy, leaf scorch, yellowing, leaf drop, and premature fall colouration.
- Trees weakened by drought have reduced capacity to defend against insects and disease.
- Drought was not aerially mapped in 2018, but below average precipitation and high temperatures caused drought symptoms in Northwest and Southern regions.

Regional summary

Northwest:

- Drought was reported in most districts in Northwest Region. Severe symptoms were observed in areas with shallow soils or bedrock, and along major roadways.
- In Dryden District, the areas most affected by drought were reported in Laura Howe Marsh in the City of Dryden, south of Godson Lake along Hwy 502, south of Wabigoon River along Hwy 105, and south of Snake Bay Road along Hwy 622. Species affected included trembling aspen, tamarack, poplar, maple, ash, birch, and oak.
- In Sioux Lookout District, drought conditions were found on roadside trembling aspen along Hwy 516 and Hwy 72.
- In Kenora District, large areas of damage on deciduous species were observed in and around the town of Kenora, along Hwy 71, and west of Rushing River Provincial Park. Symptoms included scorched leaves and premature leaf drop.
- In Red Lake District, drought conditions appeared in late July in rocky areas with shallow soils in the town of Red Lake and east along Hwy 125.

Southern:

- In Parry Sound District, drought conditions were observed on shallow soils and rock outcrops on jack and eastern white pine north of Britt to French River along Hwy 69.

Eastern tent caterpillar

Pest information

Common name:	Eastern tent caterpillar
Scientific name:	*Malacosoma americanum* (F.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Cherry species and service berry
Infestation area:	Localized

Provincial key facts

- Larvae usually defoliate roadside cherry and apple trees and occasionally mature black cherry.
- It is not considered a major pest, though nests can be unsightly.
- It causes little permanent damage to the host tree.
- In 2018, localized eastern tent caterpillar defoliation was reported in Northeast and Southern regions.

Regional summary

Northeast:

- In Sudbury District, high populations of eastern tent caterpillar were causing severe defoliation on roadside cherry along Hwy 6 from Little Current to South Baymouth and along Government Road, just west of Tehkummah, on Manitoulin Island. Scattered defoliation was also reported along Hwy 17 from Sudbury to Espanola, and along the west end of River Road in Spanish.

Southern:

- In Peterborough District, scattered nests formed by eastern tent caterpillar larvae were observed during early season ground surveys. Abundant nests resulted in moderate to severe defoliation on roadside serviceberry shrubs near Keller Bridge along Hwy 62 in Madoc Twp.
- Similarly, in Bancroft District, moderate to severe eastern tent caterpillar defoliation was observed on serviceberry shrubs along Hwy 6, north and south of Kirkfield, in Carden Twp.

Fall webworm

Pest information

Common name:	Fall webworm
Scientific name:	*Hyphantria cunea* (Drury)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Variety of deciduous trees and shrubs
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, compared to two in warmer climates.
- High populations of this pest often last only two to three years, making associated tree mortality unlikely.
- In 2018, fall webworm was reported in Northeast and Southern regions.

Regional summary

Northeast:

- In Sudbury District, fall webworm caused low levels of defoliation. Large areas of defoliation were found along Bay of Islands Road on Birch Island, on Penage Lake Road east of Espanola, and along Hwy 533 north of Chutes Provincial Park.
- In North Bay District, fall webworm was observed causing low to moderate defoliation on black ash along Hwy 17 between North Bay and Sturgeon Falls, and between North Bay and Mattawa along Hwy 17. Light defoliation was also detected along Hwy 534 east of Restoule.
- In 2018, fall webworm populations were down dramatically in Sault Ste. Marie District. Only a few nests were observed where it has been found in the past. These areas included the south end of Hwy 556 (Ranger Lake Road) and the Hwy 129 corridor near Aubrey Falls.

Southern:

- In Aylmer District, fall webworm caused moderate to severe defoliation on various tree species including black walnut, black cherry, and bitternut hickory. Heavier areas of defoliation occurred in Norfolk County and in Bayham Township in Elgin County, with upwards of 90 to 100% defoliation on black walnut.
- In Midhurst District, fall webworm was collected from chokecherry at Bruce County bike park, South Bruce Peninsula. Observations were made on Concession 5 north of Ballycroy, Adjala-Tosorontio and Irish Line in Severn Township, and Simcoe County on mature walnut trees with many large nests. Small nests were found on ash species east of Lake Couchiching near the community of Rathburn.
- In Parry Sound District, fall webworm was more prevalent in the Muskoka area compared to last year. Large areas of low to moderate defoliation occurred along Muskoka Road 3 southwest of Huntsville, on Peninsula Road and Muskoka Road 7 south of Rosseau, Muskoka Road 6, Doe Lake Road to Barkway Road, Seehaver Road east of Gravenhurst, and west of Gravenhurst along Hwy 118 to Hewlitt Road. One area of severe defoliation was detected between Hwy 11 and Dorset along Hwy 117.
- In Aurora District, fall webworm was present at Kelso Conservation Area in Halton Region on walnut in mid-July.
- In Guelph District, defoliation was observed in Brant County and Waterloo Region on roadside and woodlot black walnut and white ash.
- In Peterborough District, moderate to severe defoliation from fall webworm was found in Ennismore Waterfront Park. Defoliation was observed on the edge of a woodlot, affecting white ash and black walnut.
- In Bancroft District, moderate to severe defoliation was found affecting white ash and black walnut along the east side of Dalrymple Lake near the Midhurst/Bancroft district boundaries, Carden Twp.

Greenstriped mapleworm

Pest information

Common name:	Greenstriped mapleworm
Scientific name:	*Dryocampa rubicunda* (F.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Sugar maple

Provincial key facts

- Greenstriped mapleworm feeds primarily on red maple and sometimes on sugar maple.
- Early stage larvae feed in groups, whereas late instar larvae feed independently.
- Both early and late instars feed on the underside of leaves and consume most of the leaf tissue other than the mid rib and larger veins.
- Severe infestations may reduce growth and cause crown dieback.
- Severe defoliation can significantly reduce sap quality affecting sugar maple production.
- Localized populations have been observed in Northeast Region for several years with minimal effects on trees.

Regional summary

Northeast:

- In Sault Ste. Marie District, greenstriped mapleworm moths were seen on St. Joseph Island on a small building in a maple stand on Hilton Road, St Joseph Twp. About 20 moths were resting on the side wall of the building in a maple syrup producing area. Greenstriped mapleworm larvae and defoliation were not seen during a visit later in the summer.

Ice damage

Pest information

Common name:	Ice damage
Scientific name:	NA
Pest origin:	NA
Pest type:	Abiotic
Host species:	Variety of species
Infestation area:	NA

Provincial key facts

- Ice damage, which is any damage to trees from freezing rain or extreme cold weather events, is part of natural processes in forests. The frequency of these events continues to be sporadic, and extent of damage is highly variable.
- On April 14 and 15, 2018, a late winter storm affected the Kawartha Lakes region and Peterborough County bringing wet snow followed by freezing rain. Some areas of damage were observed early in the growing season; however, the affected area was not extensively surveyed.

Regional summary

Southern:

- In Peterborough District, minor ice storm damage was observed along Hwy 7, south of Lindsay, and along Hwy 115 south of Peterborough. In these areas, most of the damage was concentrated along the highway corridors with some urban trees affected including sugar maple, Scots pine, Norway maple, and white ash.

Imported willow leaf beetle

Pest information

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

Provincial key facts

- Imported willow leaf beetle was introduced to North America in 1915 and is now widely distributed across the range of willow in Ontario.
- Up to three generations of this insect can occur in a year.
- This pest has the potential to cause severe defoliation; however, damage to trees is not serious unless defoliation occurs in several consecutive years.
- In 2018, imported willow leaf beetle was reported during ground surveys in Southern Region.

Regional summary

Southern:

- In Peterborough District, imported willow leaf beetle caused moderate to severe defoliation to dominant willow trees in the town of Kirkfield, at a municipal woodlot and school property along Hwy 6, Eldon Twp. Defoliation extended east to scattered willow trees along Hwy 48 around Mitchell Lake, Eldon Twp. Similarly, in Northumberland County, moderate to severe defoliation was observed in Warkworth, Percy Twp, along Hwy 25, in a ravine area where a large population of adult beetles were present. In the south part of the Peterborough District, moderate to severe defoliation was observed in a ravine along Hwy 33 east of Adolphustown in Greater Napanee Region.

Introduced pine sawfly

Pest information

Common name:	Introduced pine sawfly
Scientific name:	*Diprion similis* (Htg.)
Pest origin:	Invasive – native to Europe
Pest type:	Defoliator
Host species:	White pine, Scots pine
Infestation area:	Localized

Provincial key facts

- First found in Ontario, near Oakville, in 1931.
- This sawfly causes severe defoliation that has often resulted in widespread tree mortality in affected areas.
- Natural control factors help keep populations low.
- Introduced pine sawfly has two generations per year, with the second generation usually more abundant in August and September.
- In 2018, low levels of introduced pine sawfly caused minimal defoliation in Southern Region.

Regional summary

Southern:

- In Aurora district, larvae were found at Rattlesnake Point Conservation Area in Halton Region, causing 20% defoliation on several 4 metre tall white pine trees planted along the trail. A semi-mature tree on the north side of the park had moderate defoliation to the top of the crown, but most first-generation larvae had finished feeding by June 20, 2018.

Japanese beetle

Pest information

Common name:	Japanese beetle
Scientific name:	*Popillia japonica* Newm.
Pest origin:	Invasive — native to Japan
Pest type:	Defoliator
Host species:	Basswood, buckthorn, linden, oak, sassafras, sumac, willow, elm
Infestation area:	Localized

Provincial key facts

- Populations of this invasive insect have existed in Ontario since its discovery in the Niagara Peninsula, Southern Region, in 1939.
- Commonly encountered as an exotic horticultural pest, the Japanese beetle will also feed on many native tree species. Adults are heavy feeders, known to attack both foliage and fruit of more than 250 host plants. Preferred woody hosts in Ontario include basswood, oak, and white birch.
- In 2018, Japanese beetle was recorded in Southern Region defoliating hardwoods in Midhurst, Aurora, and Aylmer districts.

Regional summary

Southern:

- In Midhurst District, Japanese beetle was found feeding on elm, birch, and basswood, resulting in light to moderate defoliation south of Angus and along Quarry Road near Waubaushene in Simcoe County.
- In Halton Region of Aurora District, light to moderate defoliation of basswood was observed near Kelso Conservation Area, west of Milton. Moderate to severe defoliation was also reported on historically infested ornamental linden trees at Rattlesnake Conservation Area southwest of Milton.
- In Aylmer District, moderate to severe defoliation of several sassafras trees occurred at the edge of a woodlot along Essex Road 37 near Leamington in Essex County.

Maple webworm

Pest information

Common name:	Maple webworm
Scientific name:	*Pococera asperatella* (Clem.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	American beech and various maples
Infestation area:	Localized

Provincial key facts

- Provincial distribution of maple webworm is from southern Ontario north 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 maple in Wisconsin. This has not been the case in Ontario.
- In 2018, maple webworm was only reported in Aylmer and Guelph districts.

Regional summary

Southern:

- In Aylmer District, new areas of maple webworm were detected during ground surveys in 2018. Areas were confirmed where populations have persisted for consecutive years in Elgin County and London. In eastern Aylmer District, moderate to severe defoliation of sugar maples of all age and canopy classes were observed in the community of Fishers Glen, Norfolk County. Crowns of infested sugar maples turned brown in late August due to a combination of defoliation and leaf scorch. Light to moderate defoliation of sugar maple and American beech was recorded for the second consecutive year in areas of Elgin County, including Springwater Forest in Malahide Twp and at Hawk Cliff, near Port Stanley in Central Elgin. Light to moderate defoliation of sugar maple and understory American beech was observed in 2018 at Meadowlily Woods in the City of London, and

in various locations in western Elgin County including EM Warwick Conservation Area, near Eagle in West Elgin, and John E. Pearce Provincial Park, near Wallacetown. In western Aylmer District, light defoliation was observed on understory sugar maple and American beech at Kopegaron Woods Conservation Area near Wheatley in Essex County, and also at Sinclair Conservation Trail, southeast of Blenheim in Chatham-Kent County.

- During ground surveys in Guelph District, small populations of maple webworm caused light defoliation in two locations in Huron County. Defoliation of understory maples was detected at a Crown Agreement Forest, in Auburn on Pinery Line in Ashfield-Colborne-Wawanosh Twp. Defoliation of understory and intermediate sugar maples was also observed at Morris Tract Provincial Nature Reserve, near Benmiller, Central Huron Twp.

Northern pitch twig moth

Pest information

Common name:	Northern pitch twig moth
Scientific name:	*Retinia albicapitana* (Bsk.)
Pest origins:	Native to North America
Pest type:	Shoot borer
Host species:	Jack pine
Infestation area:	Localized

Provincial key facts

- The range of northern pitch twig moth extends from Nova Scotia to British Columbia, north into the Northwest Territories, and south into Montana.
- Young pines less than two metres tall are most heavily infested.
- Often confused with pitch nodule maker, *Petrova albicapitana*.
- This pest can cause twig or branch mortality. Repeated attacks can result in deformed and multi-stemmed trees, decreasing wood volume and quality.
- In 2018, this pest was reported in Northwest and Northeast regions.

Regional summary

Northwest:

- In Kenora District, northern pitch twig moth was observed in a mixed pine plantation along Ena Road, affecting lateral branches of young jack pine.
- In Red Lake District, small numbers of northern pitch twig moths were noted along Coli Road on a small number of open growing semi-mature jack pine trees. Low levels of new and old damage were also observed in a jack pine plantation on Golden Road, affecting lateral branches of young jack pine trees.
- Sioux Lookout District had sporadic northern pitch twig moth damage observed on semi-mature roadside jack pine along Hwy 516. Light damage spanned a few kilometres resulting in branch tip mortality of host trees.

- In Fort Frances District, specimens were collected in an area affected by snow damage on jack pine along Cedar Narrows Road.
- In Thunder Bay District, insect samples were submitted from young jack pine on the Resolute seed orchard property near Kakabeka Falls. Northern pitch twig moth samples were also collected from the Lakehead Forest Management Unit where damage was observed on young jack pine trees.

Northeast:

- In Hearst District a small number of resinous blisters were found on jack pine seedlings in a young conifer plantation in Bradley Twp, north of Kapuskasing. Less than 1% of the trees were affected with less than 5% damage.
- In Timmins District, a moderate number of resinous blisters were found in a young jack pine plantation north of the City of Timmins. Less than 15% of the trees were affected with less than 5% damage. Light to moderate branch flagging was observed at this location.

Oak leafshredder

Pest information

Common name:	Oak leafshredder
Scientific name:	*Acleris semipurpurana* (Rob.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Red oak
Infestation area:	Localized

Provincial key facts

- Outbreaks of this pest occur occasionally throughout the range of red oak in eastern North America.
- This leafshredder is primarily a pest of mature oak stands.
- This pest is an early season defoliator.
- Oak leafshredder was first recorded in eastern Canada in 1944, and between 1957 and 1975 caused severe defoliation in red oak stands in Ontario. The pest was last mapped causing moderate to severe defoliation in Southern Region from 1998 to 2000.
- Consecutive years of severe defoliation by this pest may significantly reduce growth and can lead to tree mortality.
- In 2018, this pest was found only in Aylmer District in Southern Region.

Regional summary

Southern:

- In western Aylmer District, oak leafshredder caused defoliation in areas of Middlesex and Lambton counties. Moderate to severe defoliation of red oak of all age and canopy classes was observed in woodlots along Kerwood Road at Melwood Drive in Adelaide Metcalf, Middlesex County. Defoliation ranged from 70 to 90% in several woodlots in this area. Moderate to severe defoliation was reported during ground surveys in woodlots west of Melbourne Road, near Middlemiss, in Southwest Middlesex, Middlesex County. Defoliation of understory and semi-mature red oaks by oak leafshredder was also reported in woodlots located around Seckerton in St. Clair Twp, Lambton County in an area where gypsy moth defoliation has occurred for several consecutive years. No gyspy moth larva or signs of gypsy moth were observed at the time of ground surveys.

Oak skeletonizer

Pest information

Common name:	Oak skeletonizer
Scientific name:	*Bucculatrix ainsliella* Murt.
Pest origins:	Native to North America
Pest type:	Defoliator
Host species:	Oak
Infestation area:	Localized

Provincial key facts

- Oak skeletonizer is a perennial pest of oak across southern areas of Ontario and Quebec.
- Two generations occur per year and preferred host is red oak. First generation moths are seen in early spring, second generation in July to early August.
- Outbreaks have been recorded in Ontario since 1961.
- Consecutive years of severe defoliation reduces growth and causes some crown dieback.
- In 2018, oak skeletonizer was only reported in Southern Region.

Regional summary

Southern:

- In Midhurst District, oak skeletonizer was present on red oaks in central Dufferin County near Mansfield and the Main Tract of Dufferin County Forests. Defoliation was light, remaining below levels found in 2017. Light defoliation was also present in Simcoe County near Waverly in oak-sugar maple stands. In Grey County, light defoliation was observed on leaves of mature roadside oaks south of Collingwood. First generation defoliation was complete by August, and pupae numbers were low.

Phyllosticta leaf spot

Pest information

Common name:	Phyllosticta leaf spot
Scientific name:	*Phyllosticta minima* (Berk. & M.A. Curtis) Underw. & Earle
Pest origins:	Native to North America
Pest type:	Foliar disease
Host species:	Maple species
Infestation area:	Localized

Provincial key facts

- This leaf disease is not known to cause serious damage to trees, however severely infected trees have a poor aesthetic appearance and may drop foliage prematurely.
- Host vigour may be reduced if heavy infection persists for several years.
- This leaf disease was last reported in 2016 in southern region. In 2018, phyllosticta leaf spot was reported in Kemptville and Pembroke districts.

Regional summary

Southern:

- In Kemptville District, phyllosticta leaf spot caused trace damage to red maples in a semi-mature stand of trembling aspen and red maples on Ridge Road at Mer Bleue Conservation Area, in Gloucester (south Ottawa).
- In Pembroke District, phyllosticta leaf spot caused moderate to severe damage to a semi-mature stand of red maples on Siberia Road in the riparian zone of Madawaska River, in Madawaska Valley Twp. About 70% of the trees in this area were damaged. Symptoms consisted of numerous small red spots peppering the leaves.

Scorch

Pest information

Common name:	Scorch
Scientific name:	
Pest origin:	
Pest type:	Abiotic
Host species:	Hardwood spp.
Infestation area:	Minor/localized

Provincial key facts

- Scorch kills the leaf tissue on the edges and between the main veins and can eventually cause entire leaf to turn brown.
- Fringe trees along roads or trees growing in other areas where they are exposed to reflected heat and light are most likely to be scorched.
- A late season scorch event does not pose a serious threat to healthy trees.
- In 2018, leaf scorch in the Northeast and Southern regions was due to high temperatures and little precipitation over the summer.

Regional summary

Northeast:

- In Sudbury District, moderate levels of scorch were recorded on young roadside trembling aspen east of Sudbury, along Hwy 17 to Hagar, and along Hwy 637, west of Hwy 400/69, to Killarney Provincial Park. The scorch damage gave an overall brown tinge to the trees.

Southern:

- In Parry Sound District, young roadside red oak and red maple trees had moderate to severe scorch damage. Damage was observed in rocky areas along Muskoka Road 3, from Huntsville to Rosseau, Muskoka Road 7, from Rosseau to Port Carling, Old Nipissing Road, North of Hwy 124, by Magnetawan, and Hwy 522, from Hwy 69 to Port Loring.

- Signs of June's extreme dry and hot conditions were observed in Aylmer District in the form of leaf yellowing and browning, and in some cases was followed by early leaf drop by late summer. Symptoms observed on affected broad-leaf trees included irregular leaf yellowing and browning of leaf tissues between the veins and along leaf margins. Leaf scorch was observed in treed swamps, that consisted of elm, maple, and aspen, along Hwy 401 between the City of London and Hwy 6 North in Wellington County. Leaf scorch was also observed on several young, open-grown red oaks in Stoney Point, Essex County, as well as in Malden Park, Windsor. Leaf scorch was observed on understory American beech trees along the Elgin Hiking Trail near Port Stanley, Elgin County, and young, open-grown American beech trees were observed with leaf scorch at West Elgin Nature Reserve (Aldborough Memorial Forest) near the community of West Lorne, Elgin County.

Septoria leaf spot

Pest information

Common name:	Septoria leaf spot
Scientific name:	*Sphaerulina populicola* (Peck) Quaedvlieg, Verkley & Crous, on balsam poplar and *Sphaerulina musiva* (Peck) Quaedvlieg, Verkley & Crous trembling aspen and *Septoria betulae* Pass. on white birch
Pest origin:	Native to North America
Pest type:	Foliar disease
Host species:	Balsam poplar, trembling aspen, white birch
Infestation area:	Minor, localized

Provincial key facts

- Common fungal disease of poplar and birch.
- Commonly infects leaves, but can also cause branch and main stem cankers, particularly on hybrid poplar.
- Normally prevalent in wet and humid weather conditions. Fallen leaves re-infect new leaves the following year.
- Trees may lose vigour after repeated severe infections, causing them to be more susceptible to other pests and pathogens.
- In 2018, scattered areas with leaf spot were reported in Northwest and Southern regions.

Regional summary

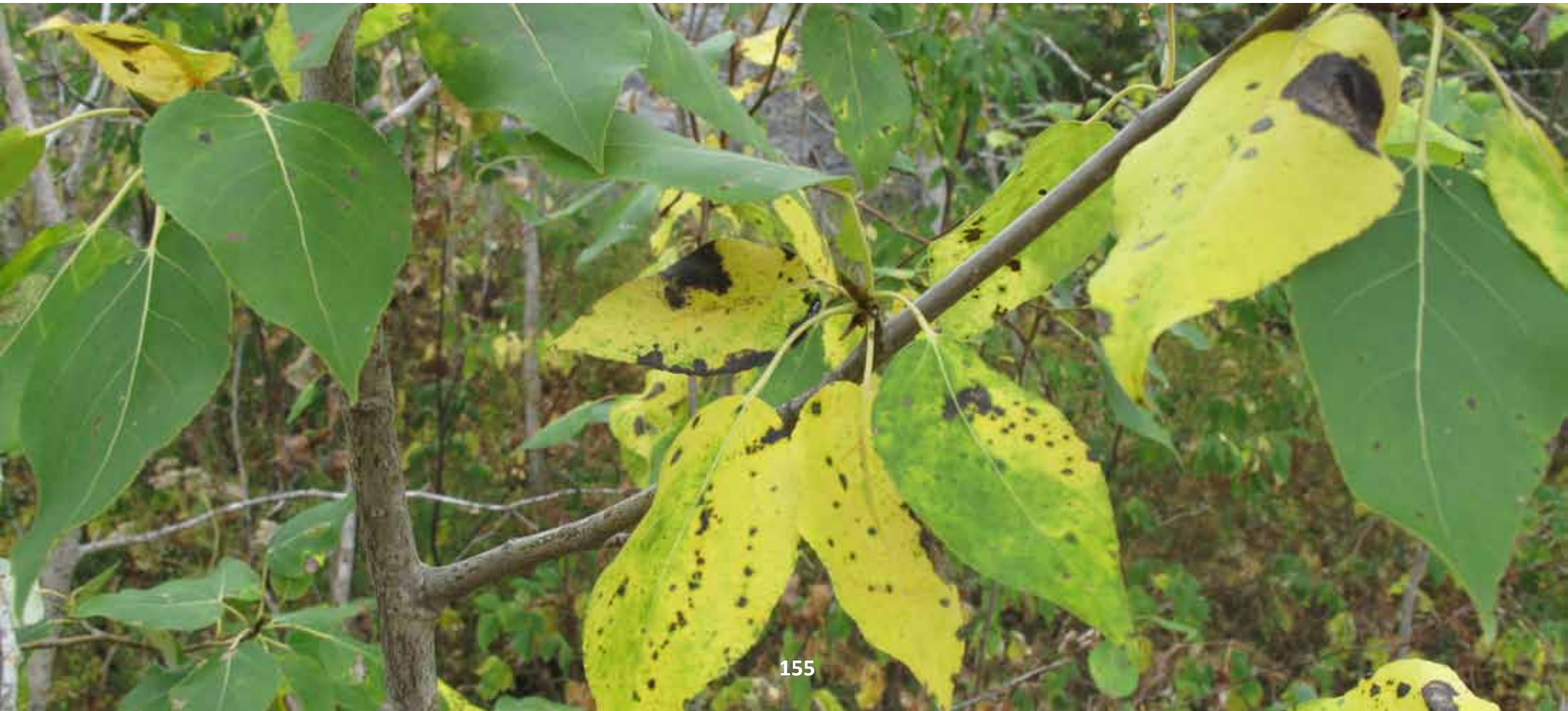
Northwest:

- In Kenora District, septoria leaf spot was observed affecting white birch, trembling aspen, and balsam poplar in many areas around the district, particularly along Hwy 71 where it was observed on white birch of all age classes with higher infection rates on young open grown birch. North of the town of Kenora, septoria leaf spot was observed on young white birch and poplar in a plantation along Ena Road. Sixty per cent of the trees were affected, with individual tree damage ranging from 10 to 60%. Drought damage was also evident in these areas.
- Along Hwy 105 in Red Lake District, septoria leaf spot infected mature white birch and poplar trees. Light to moderate damage was commonly seen in small stands. Infected leaves of mature white birch were also recorded south of Red Lake along Dixie Road North near Stone Lake. Premature leaf drop was observed with up to 40% of the trees affected.

- In Dryden District, deciduous trees infected by septoria leaf spot were observed north of Dryden on North Road, Ghost Lake Road, Goodie Lake Road, and west along Hwy 17 between Dryden and Vermilion Bay.
- In Sioux Lookout District, scattered areas of septoria leaf spot were recorded south of Sioux Lookout along Hwy 72 and north of Sioux Lookout along Hwy 516.

Southern:

- In Algonquin Park and Pembroke districts, septoria leaf spot of birch caused moderate damage to most white birch in a mature trembling aspen and eastern white pine stand in Algonquin Park on Barron Canyon Road. Septoria leaf spot of birch was also observed along Barron Canyon Road throughout Laurentian Valley Township and the Pembroke area.



Shoot blight of aspen

Pest information

Common name:	Shoot blight of aspen
Scientific name:	*Venturia populina* (Vuill.) Fabric
Pest origin:	Native to North America
Pest type:	Fungus
Host species:	Balsam poplar
Infestation area:	Minor/localized

Provincial key facts

- This shoot blight kills terminal and lateral shoots, reducing growth and deforming the stem. Small trees can die from repeated infection.
- Tips of infected shoots turn black and wither, resembling a shepherd's crook.
- The disease can be a serious in plantations but is of little economic importance in natural stands.
- Trees older than five years are often not affected.
- In 2018, a localized severe area of shoot blight was reported in Northeast Region.

Regional summary

Northeast:

- In Chapleau District, a stand of balsam poplar approximately 225 m² was severely affected by shoot blight of aspen on the way to Racine Lake, east of Chartrand Lake, Panet Twp. At a distance, the leaves appeared brown due to the severity of the infection.

Twig beetle

Pest information

Common name:	Twig beetle
Scientific name:	*Pityophthorus* spp.
Pest origin:	Native to North America
Pest type:	Wood borer
Host species:	Eastern white pine
Infestation area:	Minor/localized

Provincial key facts

- Twig beetles are typically found in young or stressed trees.
- Adults bore into new shoots in early spring and lay eggs in the hollowed-out twig and the new adults emerge in late summer.
- Twig beetles on their own rarely cause full tree mortality but can cause branch dieback due to damage to the shoots.
- In 2018, twig beetles were reported on islands and along the coast of Georgian Bay.

Regional summary

Southern:

- In Parry Sound District, moderate defoliation was observed on white pine, mainly on islands in Township of The Archipelago. Damage to trees included flagging of foliage and hollowed out twigs.

Western gall rust

Pest information

Common name:	Western gall rust
Scientific name:	*Peridermium harknessli* J.P. Moore
Pest origin:	Native to North America
Pest type:	Gall rust disease
Host species:	Jack pine
Infestation area:	Localized

Provincial key facts

- This rust disease is common across Ontario.
- It typically causes malformations, stunting, and aesthetic degradation of infected trees.
- It can be a significant pest in nurseries and plantations.
- Branch galls can kill branches, and galls on the main stem of trees less than 10 years old can kill the tree.
- This rust can infect pine to pine and does not require an alternate host to complete its life cycle.
- In 2018, western gall rust was found in both Northwest and Northeast regions, with light damage to jack pine plots in the northwest and moderate damage in the northeast, particularly in Sudbury District.

Regional summary

Northwest:

- In Dryden District, western gall rust caused light to moderate damage in small areas of jack pine. Semi-mature jack pine on Hwy 647, and young jack pine along Sandy Beach Road in the City of Dryden were affected. Most galls were on branches, causing die-back and flagging. Some young jack pine on Sandy Beach Road had galls on the main stem and showed signs of decline. During jack pine health plot surveys in Dryden District, light damage by western gall rust was recorded. Galls caused flagging on affected branches but did not appear to be causing decline in stands.
- In Kenora District, new infections of western gall rust were observed north of Rushing River Provincial Park at the Isabel Lake turn off. Damage was concentrated to lateral branches of young jack pine trees and resulted in stunted growth and branch dieback.

- In Red Lake District, western gall rust was observed along Dixie Road. Light damage was noted in a small stand of semi-mature jack pine trees in the northern section of the road network. Damage from galls was concentrated on branches and resulted in dieback and flagging.
- In Sioux Lookout District, light damage by western gall rust was recorded during jack pine health plots. Galls caused flagging on affected branches but did not appear to be causing decline in stands.

Northeast:

- In Timmins District, low levels of western gall rust were recorded in several locations. One collection was made north of Hwy 560 in Kemp Twp. This location had both new and old galls. Many galls were observed on main stems and large branches. Some large branches had snapped off where old galls were present.
- In Sudbury, an increase of western gall rust was noted during jack pine health plot surveys. Galls were found causing light to moderate branch dieback and thought to be part of the combined cause of mortality in several trees due to the high density of galls.

White pine blister rust

Pest information

Common name:	White pine blister rust
Scientific name:	*Cronartium ribicola* J. C. Fisch.
Pest origin:	Invasive – Native to Asia, Europe
Pest type:	Stem rust disease
Host species:	White pine
Infestation area:	Localized

Provincial key facts

- This disease is relatively common throughout Ontario where *Ribes* spp. (the alternate host) occur near five needle pine.
- It causes branch dieback, reduces growth, and, if infection reaches the stem, eventually kills the tree.
- In 2018, white pine blister rust was found in Northeast Region.

Regional summary

Northeast:

- In Kirkland Lake District, white pine blister rust was found at all three white pine tree improvement sites in Eby, Evanturel, and Ingram townships. Evanturel had the highest occurrence of the disease with 34% of the trees infected, 40% of which were lethal infections (on main stem). In addition, porcupine feeding damage was evident on 20% of the trees in this plantation, as porcupines love to eat the fruiting bodies of the rust. The Eby and Ingram plantations had much lower occurrences of blister rust with 0.7% and 4% of the trees infected, respectively. Winter drying was an issue at the Eby location with 38.7% of trees displaying symptoms.
- In North Bay District, the white pine tree improvement site in Gurd Twp had minmal white pine blister rust with 5.3% of the trees infected, of which only two trees had lethal infections (on main stem).

Southern:

- In 2018, a new white pine tree improvement location was added to Pembroke District, a plantation in the Petawawa Research Forest. White pine blister rust was not observed at this site.

White pine weevil

Pest information

Common name:	White pine weevil
Scientific name:	*Pissodes strobi* (Peck)
Pest origin:	Native to North America
Pest type:	Shoot borer
Host species:	Jack pine, white pine, white spruce
Infestation area:	Localized

Provincial key facts

- White pine weevil is most prevalent on white pine, but other species of pine and spruce can be affected.
- Young trees less than 2 metres tall are most heavily infested.
- This pest targets the terminal leader of affected trees.
- Repeated attacks can result in deformed and multi-topped trees, reducing wood quality.
- In 2018, low levels of weevil damage were reported in Thunder Bay District in Northwest Region.

Regional summary

Northwest:

- In Thunder Bay District at a conifer plantation in Rosslyn, white pine weevil was feeding in leaders of 15 young white spruce and several young white pine trees. Damage from previous years' infestations has caused poor form resulting from dead terminal leaders. The insect was also present in several young jack pine at the Resolute seed orchard in Kakabeka Falls.

Whitespotted sawyer beetle

Pest information

Common name:	Whitespotted sawyer beetle
Scientific name:	*Monochamus s. scutellatus* (Say)
Pest origin:	Native to North America
Pest type:	Wood borer
Host species:	Jack pine, balsam fir, spruce spp.
Infestation area:	Sporadic

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.
- Larval tunnelling damage severely downgrades lumber value.
- Larger populations often occur near other forest disturbances, such as blowdown, drought, multiple years of defoliation, fire, and cutovers.
- This beetle is often mistaken for the invasive Asian long-horned beetle.
- In 2018, whitespotted sawyer beetle was not aerially mapped, but larval and maturation feeding was still observed during ground surveys in the Northeast and Northwest regions.

Regional summary

Northwest:

- In Kenora District, whitespotted sawyer beetle was observed causing damage in many areas. Whitespotted sawyer beetle larvae were observed in several stands with snow damage from last winter. North of Sioux Narrows, along Hwy 71 to the junction of Hwy 17, where snow damage was heavy, extensive whitespotted sawyer beetle activity was present. On fringe balsam fir branches, north of Nestor Falls, maturation feeding of the adult whitespotted sawyer beetle was noted.
- In Red Lake District, west of Balmertown along Hwy 125, extensive whitespotted sawyer beetle activity was observed. Larval feeding, egg laying sites, and maturation feeding damage was noted on jack pine, spruce, and

balsam fir trees. Site stress from repeated flooding and advanced age of the trees also made them more susceptible to beetle damage.

Northeast:

- In Kirkland Lake District, whitespotted sawyer beetle was the cause for dying mature jack pine trees along Beauty Lake Road, off Hwy 560, southwest of Elk Lake. Larval feeding was observed sporadically along a 20 km section of Beauty Lake Road, where slash piles had been left along the road. Moderate levels of larvae were observed along the edge of the healthy jack pine stands.
- In North Bay District, whitespotted sawyer beetle damage was observed later in the season due to the extensive number of forest fires that occurred during the summer. Around and in NOR 62, a forest fire which occurred north of River Valley, significant whitespotted sawyer beetle larval feeding was observed. Piles of sawdust at the base of pine trees was observed for approximately 8 km along St. Joseph Road, northeast of River Valley in Crerar and Gibbons Twps.
- In Sault Ste. Marie District, whitespotted sawyer beetle larvae were found in a jack pine stand south of Elliot Lake in the northwest corner of Esten Twp. This area was defoliated by jack pine budworm in 2015 and 2016, is a poor site (shallow soil with bedrock), had drought like conditions in the fall of 2016 and 2017, and drought like conditions in the summer of 2018. Armillaria root rot was also found in the stand contributing to the overall decline. Of the trees surveyed, 38% were dead and an additional 17% had dead tops, with 45% remaining live and healthy.
- In Sudbury district, whitespotted sawyer beetle maturation feeding was observed causing flagging (dead branch tips) on jack pine trees along West Branch Road in Moses Twp. Larvae were also collected from these trees. A patch of blowdown, south along the road, likely contributed to the whitespotted sawyer beetle population in the vicinity. Pine engraver beetle feeding damage in the main stem and branches and tip beetle damage were compounding factors to the trees' decline.

Willow lace bug

Pest information

Common name:	Willow lace bug
Scientific name:	*Corythucha elegans* Drake
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Willow
Infestation area:	Localized

Provincial key facts

- Adults and nymphs damage leaves by piecing lower leaf surfaces with needle-like mouthparts that suck out plant tissue.
- Feeding damage appears as white stippling on the upper surface of leaves.
- Severe infestations can cause leaf discoloration and premature leaf drop.
- In 2018, willow lace bug was only recorded in Northeast Region.

Regional summary

Northeast:

- In Hearst District, scattered areas of light to moderate defoliation were observed north and south of the town of Kapuskasing. Defoliation was noticed later in the season when populations were at their highest. A sample was collected from Bradley Twp.
- Willow lace bug was also observed and collected on willow in Adanac Twp, south of Fraserdale in Cochrane District. Defoliation was moderate.

Winter browning

Pest information

Common name:	Winter browning
Scientific name:	NA
Pest origin:	NA
Pest type:	Abiotic damage — weather
Host species:	Coniferous species
Infestation area:	Localized

Provincial key facts

- Winter browning, also referred to as winter drying, occurs occasionally in Ontario and elsewhere.
- Winter browning is the result of tree needles drying and turning brown. In some species, the needles may appear red, yellow, or grey, or, in the case of blue spruce, purple.
- Winter browning is caused by a combination of factors. During periods of high amounts of sunshine, strong winds, and warm temperatures, conifers lose water from their needles faster than it can be replaced, resulting in the needles drying out.
- When the warm period is followed by freezing temperatures, needles dry even more and eventually die.
- Most affected are trees younger than 25 in plantations and on the edge of forest stands.
- Branches above the snow line are more severely affected while lower branches often remain green and unaffected due to protection from snow.
- The quick transition from cold temperatures to very warm temperatures during the spring of 2018 exacerbated the problem of winter browning in all three regions.

Regional summary

Northwest:

- Along Hwy 17 in Dryden District winter browning occurred on jack , red, and white pine. Sand flats surrounding Ignace and east of Vermillion Bay had the most damage.
- Ornamental blue spruce in communities in Dryden, Sioux Lookout, Kenora, and Red Lake districts showed a

spectrum of light to severe damage. Extension calls revealed this stress made the trees significantly more susceptible to secondary pests and diseases such as bark beetles, cytospora canker, and needle casts.

- Mature blue spruce trees in Norseman Heritage Park, Red Lake District, had moderate to severe damage ranging from 40 to 80%. Later in the season most trees showed signs of recovery with 10% of affected trees dying.
- In Sioux Lookout District, winter drying was observed on mature red, white, and jack pine along Hwy 72 a few kilometres south of the town of Sioux Lookout.
- Open grown white spruce trees in downtown Kenora showed moderate to severe winter drying. Trees had 40 to 80% damage with new shoots showing signs of recovery.

Northeast:

- Winter drying was prevalent in Kirkland Lake District but mostly on ornamental and small cedar shrubs. Older cedar shrubs in New Liskeard showed evidence of severe winter drying.

Southern:

- Moderate winter browning was seen on ornamental white cedar in the town of Parry Sound.

Yellowheaded spruce sawfly

Pest information

Common name:	Yellowheaded spruce sawfly
Scientific name:	*Pikonema alaskensis* (Roh.)
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Spruce
Infestation area:	Localized

Provincial key facts

- Yellowheaded spruce sawfly is a common pest in Ontario.
- This sawfly is a serious pest of Christmas tree plantations, open-grown trees, and plantations.
- This sawfly generally feeds on open-grown or roadside trees less than 10 years of age.
- Severe infections by this sawfly can kill branches or the entire tree; less severe defoliation can impede growth.
- In 2018, yellowheaded spruce sawfly was reported in Northwest and Southern regions in Ontario.

Regional summary

Northwest:

- In Kenora District, defoliation by yellowheaded spruce sawfly was observed on roadside trees in the northern part of the district along Hwy 105. Moderate to severe defoliation was observed on young white spruce trees north of Kenora on Olson Road. Damage resulted in 100% defoliation on several of the trees while most were 50% defoliated.
- In Red Lake District, light feeding was observed on young open-grown white spruce in Centennial Park in the town of Red Lake for the second consecutive year. Trace to light damage was also observed on roadside spruce along the north part of Hwy 105. In the town of Ear Falls, light defoliation was observed on open grown young white spruce for the second consecutive year.
- In Dryden District, defoliation by yellowheaded spruce sawfly was noted on young hedgerow white spruce 2 km

west of Vermillion Bay. Scattered pockets of light feeding were also observed on spruce regeneration alongside Hwy 17 between Dryden and Ignace. Damage to ornamental white and blue spruce was noted in many areas throughout the City of Dryden.

- Defoliation of young roadside spruce was noted along Hwy 72 in Sioux Lookout District. Damage was light to moderate in affected areas.
- In Thunder Bay District, light to moderate defoliation was observed on roadside spruce along sections of Hwy 61, south of the City of Thunder Bay. On municipal properties in the community of Oliver Paipoonge, scattered ornamental blue and white spruce were up to 90% defoliated.
- In Nipigon District, patches of young roadside spruce along Hwy 11, between Rossport and Marathon, suffered severe defoliation near the Ashburton Bay Area.

Southern:

- In Aurora District, light yellowheaded spruce sawfly defoliation was observed along Hwy 407 on young roadside spruce. Trace defoliation was also seen in Rattlesnake Point Conservation Area.
- In Midhurst District, light defoliation from yellowheaded spruce sawfly was recorded along Hwy 10, north of Shelburne, affecting young roadside spruce trees.

Yellownecked caterpillar

Pest information

Common name:	Yellownecked caterpillar, Drexel's datana
Scientific name:	*Datana ministra* (Drury), *Datana drexelii* Hy. Edw.
Pest origin:	Native to North America
Pest type:	Defoliator
Host species:	Basswood, birch, elm, honey-locust, oak, maple, mountain-ash, walnut, blueberry, apple, and other fruit trees
Infestation area:	Sporadic

Provincial key facts

- This insect is found in southern Canada and the United States.
- Larvae feed gregariously, and mature larvae consume all the tissues of infested leaves, except the larger veins.
- On mature trees, periphery foliage is consumed causing little harm to the tree, but younger stems can be completely stripped of leaves, which if repeated could result in twig dieback, as feeding takes place in mid- to late summer.
- There are two species of this insect; they are very similar in appearance and both were collected in Southern Region in 2018.

Regional summary

Southern:

- In Midhurst District, this colourful insect was present on Floral Road, east of Washago in north Simcoe County with several colonies feeding on mature basswood causing trace defoliation. This insect was confirmed to be *Datana drexelii*. In Grey County, *Datana ministra* larvae were feeding near Skinners Bluff in Georgian Bluffs, northwest of Owen Sound. Larvae were observed on a small tree (4 m tall) where 20% of foliage had been consumed towards the end of feeding in mid-August. In Bruce County, young basswood along Boat Lake Road near Wiarton, were 30% defoliated by *Datana ministra*.