DAVEY RESOURCE GROUP

A Division of The Davey Tree Expert Company

LDD Moth Monitoring Report

Town of Pelham, Ontario, Canada

February 3, 2024

Prepared for

The Town of Pelham

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Table of Contents

Executive Summary

This report provides a summary of data collected in the 2024 survey of the forest damaging insect population: LDD Moth (*Lymnatria dispar dispar*). The Town of Pelham commissioned Davey Resource Group (DRG) to survey trees along Town-owned streets and within Town-owned properties within its municipal limits for signs of LDD Moth. The objective of this report is to identify if action thresholds for treatment established by the Town of Pelham have been reached and provide options on the most effective treatment types and locations to reduce tree mortality.

LDD Moth was sampled by assessing the quantity of egg masses laid onto trees on 102 plots using the "5 Tree Plot" sampling methods. A total of 446 new LDD Moth egg masses were found across 26 of the 102 plots, only 7 of which had over 20 new egg masses observed.

The numbers collected are below the threshold for utilizing aerial spray insecticides such as *Bacillus thuringiensis "kurstaki"* (BTk). However, localized ground spraying treatments are advised in the areas where new egg masses were observed to prevent an increase of new LDD Moth egg masses next year.

Introduction to LDD Moth

The LDD Moth (*Lymnatria dispar dispar*) is an invasive species, first arriving in North America from Europe in the 1860's. The insect can reproduce extremely quickly, causing sudden spikes in the population (Nealis, 1993). It was first discovered in Ontario in the late 1960's, and has been known to cause widespread defoliation in sub-urban as well as forest ecosystems (MNRF, 2018).

LDD Moth eggs will over winter after being laid in late summer as masses containing up to 1000 individuals. Larvae hatch in spring, and develop throughout the summer, moving through several instars. The insect moves up and down the tree to feed on the live foliage, and is both nocturnal and diurnal depending on the stage. The sounds of the insects feeding, and their droppings, are often the first shocking signs to residents that there is an extensive outbreak.

Figure 1. LDD Moth Egg masses (DRG, 2024)

The moth generally selects the hardwoods also chosen by homeowners for their shade and aesthetic value. Trees such as Oak (*Quercus*), Maple (*Acer*), Apple (*Malus*), and Mountain Ash (*Sorbus*), among many others, are known hosts of the insect.

It is important to consider that method of forecasting is adapted for application in the urban environment, which has not been expressly tested. Furthermore, there is significant variability in the characteristics of the LDD Moth, where it is expensive and difficult to survey enough sites, eliminate the variability noted, and thereby establish an accurate survey (Leibhold, 1994. Herms, 1991). This study strives however to be precise and aims to establish whether or not there is a LDD Moth outbreak across the city, and utilize the plot information to guide actions.

LDD Moth in Pelham

In 2009, Pelham successfully reduced LDD Moth populations within its municipal boundaries to within acceptable levels. However, in 2017, the Town of Pelham received report from residents stating an increase in the number of LDD Moths observed. Pelham responded to this by performing aerial sprays in the summer of 2018. In 2019 two egg mass surveys were conducted, one early in the year by Trees Unlimited and one later in the year by BioForest (BioForest, 2020) with an aerial spray conducted that summer. The aerial sprays in 2020 were based on the latter egg mass survey conducted by BioForest. BioForest performed egg mass surveys in 2021 and 2022 which were followed by aerial sprays in their respective summers.

With the Gypsy Moth Management Policy S802-03 in place (Town of Pelham, 2020), the Town of Pelham was able to perform aerial spray applications of the bacteria *Bacillus thuringiensis "kurstaki"* (BTk) to work towards reducing the insect population to below established thresholds and prevent widespread tree mortality. The policy establishes the aerial spray threshold at 2500 egg masses/hectare, a precedent for annual egg mass surveys, funding, a Community Volunteer Program, and Gypsy Moth Control Program. The Gypsy Moth Control Program is an Integrated Pest Management (IPM) strategy at managing LDD Moth which emphasizes using control methods appropriate for the situation.

Figure 1. LDD Moth Egg masses (DRG, 2024)

Egg mass surveys performed in previous years show a decrease in severe and moderate defoliation risk from 2021. In 2019, egg mass surveys found 61% of plots having severe or moderate defoliation forecast for 2020 (BioForest, 2019); in 2020, egg mass surveys found 75% of plots having severe or moderate defoliation forecast for 2021 (BioForest, 2020); in 2021, egg mass surveys found 53% of plots having severe or moderate defoliation forecast for 2022 (BioForest, 2021). The downward trend in severe and moderate defoliation forecasts shows the effects of the efforts of the Town of Pelham in controlling the LDD Moth.

Methods

LDD Moth Egg Mass Count

Egg masses will typically be laid on the trunk and branches of their host trees, though they will also be found on the ground, on man-made structures, and on non-preferred hosts depending on the extent of an outbreak. New and old egg masses were counted then the ratio of new-to-old eggs was applied to the whole plot, and scaled (multiplied by 100, as the plot represents about 0.01 ha) to reflect an egg mass per hectare population estimate. A healthy population of LDD Moth typically have a greater number of new egg masses compared to previous years (less than 25% old egg masses) while a greater number of old egg masses indicated a declining population (Liebhold et al., 1994).

Establishing an egg mass/hectare (em/ha) number can predict the defoliation forecast for the next year. Based on industry standards, and to remain consistent with previous reports, this report uses the USDA defoliation prediction model developed by Gansner et al. 1985 (Table 1). In 2020, under Policy S802-03, the Town of Pelham established a threshold of 2,500 egg masses per hectare as their action limit for aerial spraying (Town of Pelham, 2020). However, the Town may take action on a tree-by-tree basis. Breaching the 2500 em/ha limit triggers the cities response to reduce the impacts of the insect throughout the affected area.

Egg Masses/Hectare	Defoliation Forecast
0	Nil
1-1250	Light
1251-3750	Moderate
3751-5000	Heavy
>5001	Severe

Table 1: Egg Mass count and corresponding forecast.

LDD Moth Egg Mass Size

New egg mass size was measured for all egg masses within reach. Egg mass size can be used to estimate whether the population of LDD Moth are increasing or decreasing based on the size of the egg mass. Healthy, increasing populations have large egg masses (over 30mm), while those with decreasing populations generally have small egg masses (<20mm) (Nealis and Erb, 1993). For the purposes of this assessment, egg mass sizes over 20mm will be used as the threshold for large egg masses indicating a potential increase in LDD Moth population.

"5 Tree Plot"

The "5 Tree Plot" was used in this study, as the majority of plots were located on street rights-of-way where the MKP method was impractical due to tree density. The "5 Tree Plot" is a version of the MKP plot that counts 5 trees in an identified plot-reflecting the number of trees normally found in in the MKP method (Bioforest, 2008).

Surveyors accessed the random plots chosen as outlined below and found the closest available mature host tree on town property. The remainder of the trees were selected for their suitability as hosts and proximity to the previously assessed tree. Using binoculars, trees were examined from all sides, with all new egg masses counted.

Site Stratification

For this project, a shapefile of roads and Town-owned property locations for sampling was provided by the Town of Pelham. A random sample of 120 plots within locations were created to assess trees for the presence of LDD Moth. For the purposes of this study, only 100 plots were required; over-producing random plot locations allowed for some spots to be abandoned should no suitable host trees be observed within the park/cemetery polygon.

Summary of Findings

LDD Moth Survey Results

There were 102 plots spread randomly within the rights-of-way of town-maintained roads and town-owned properties. Of those, 4 plots (4%) were found likely to have moderate defoliation in 2024, 20 plots (20%) were found likely to have light defoliation in 2024, 78 plots (78%) may see "Nil" or no detectable defoliation, no plots are likely to have heavy or severe defoliation.

27% of egg masses tallied are new and no plots had more new egg masses than old egg masses indicating a declining population.

Egg masses over 20mm were only found at plots with 1251-3750 em/ha (moderate defoliation forecast).

Plot details can be found in Appendix 2.

Discussion

LDD Moth Forecast

With the data compiled, it is apparent that there will be a light infestation across the Town of Pelham with pockets of more moderate infestation. These defoliations will be aesthetically displeasing and a nuisance to residents but are unlikely to cause tree mortality in a single occurrence.

LDD Moth Mitigation Factors

There is the potential that natural factors that may decrease the population of the LDD Moth. Fungal and bacterial pathogens, predators, and weather are known to cause significant declines in the population. For LDD Moth, the most significant of these is the nucleopolyhydrosis virus (NPV). This virus, transmitted within a LDD Moth population and always present even in small outbreaks, typically causes large scale population declines 1-2 years into an outbreak (McCullough, 2001).

Weather, specifically deep cold, may also reduce the populations of insects. It would be necessary for the temperature to reach below -28ºC for an extended period of multiple days (Madrid, 1981. Grupp, 2018) to achieve a significant population decline.

Recommendations

Ground Spraying

Locations with a moderate defoliation forecast or light defoliation forecast near woodlots and/or within urban boundaries should be considered for street level spraying programs using BTk or other pesticide products such as Mimic © already in use for the control of LDD Moth, that may control or eradicate the pockets. Pesticides should be selected based on minimal non-target impact and proven effectiveness. Equipment should be selected that has the capability of reducing overspray by getting as close to the targets as possible, through the use of ladders of aerial lifts.

Monitoring and other Control

The remainder of the plots that are not expecting defoliation or with a light defoliation forecast should continue to be monitored in the summer and winter of 2024. While tactics such as banding and egg mass scraping have been recommended in the past, these methods have not been found to be an effective method of control (Herms, 1991). It is therefore not recommended here for those grids that are not to be treated otherwise.

Residents should continue to be informed on the identification and life cycle of the insect, to aid in monitoring the spread of the insect outside of the heavily infested areas already surveyed. It is highly possible other pockets of defoliation have not been collected in these studies. Pelham should continue to utilize community outreach programs such as Pelham's Forest Health Volunteers to assist in monitoring efforts throughout the municipality.

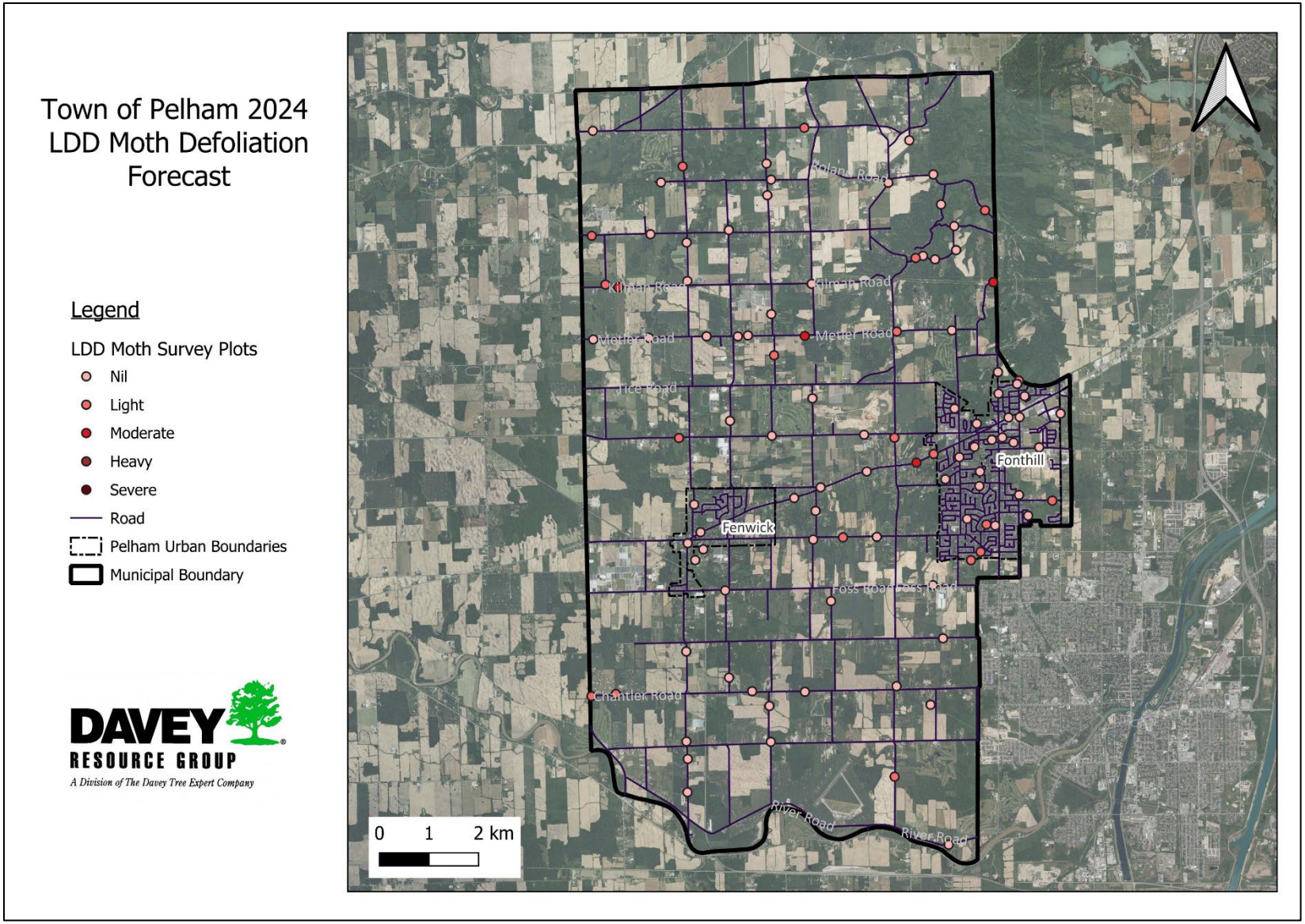
Follow-up studies are required to determine if treatments are effective, if the insect spreads, or if the proves to be a greater threat than anticipated, and does not reduce its' population naturally in areas outside treatment zones targeting LDD Moth.

Conclusion

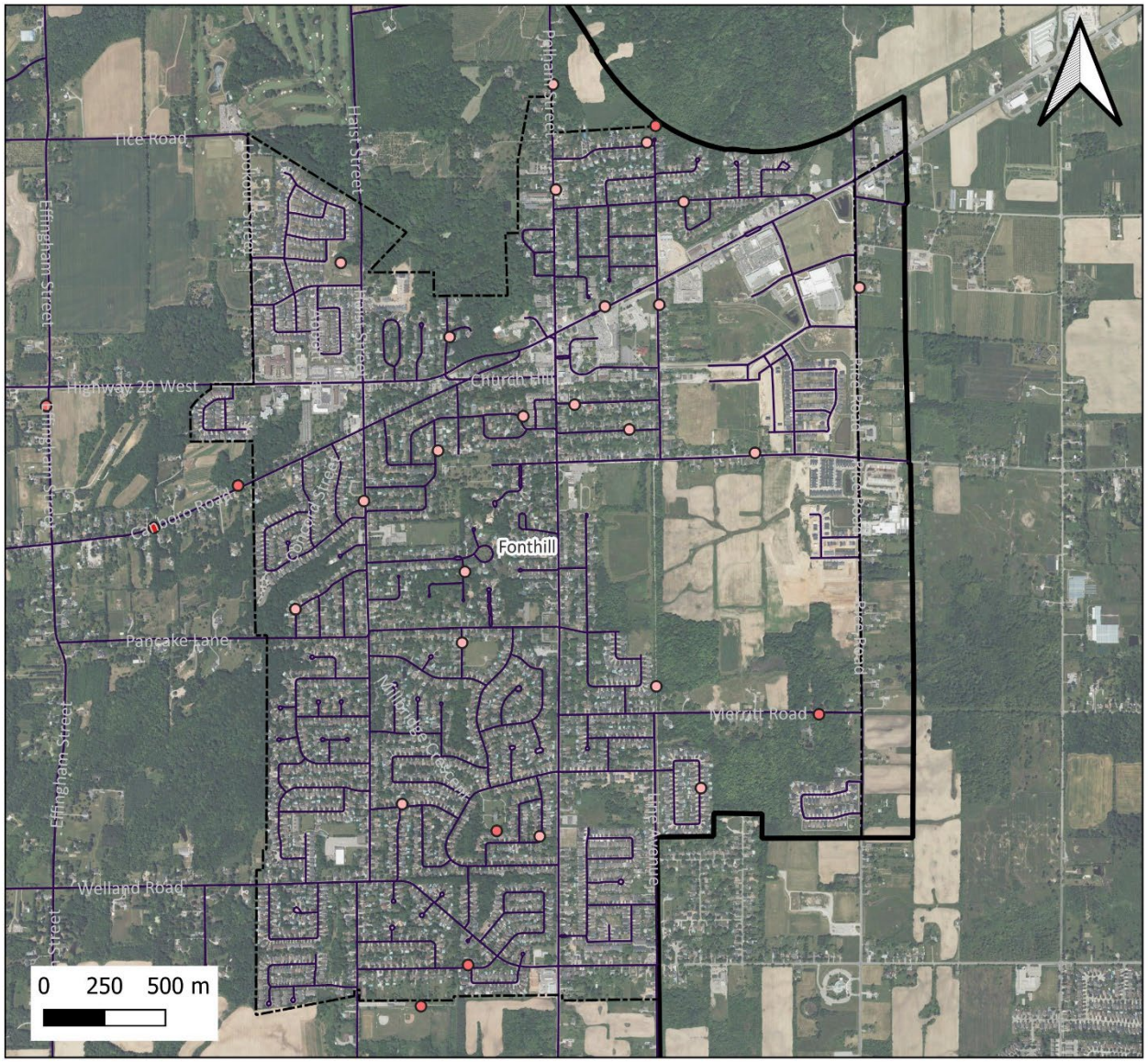
With survey plots located across the target areas of the Town of Pelham, there is significant confidence that the population of LDD Moth is below outbreak levels. However, ground spraying to maintain or reduce current levels of LDD Moth infestation are advised to prevent future outbreaks from occurring.

Managers should wisely choose their treatment options-identifying where more surgical options such as ground level sprays can be utilized over aerial spraying. Follow-up studies can further refine and adapt the survey areas and methods used here to improve accuracy and regain control of the outbreak.

Appendix 1: 2024 Town of Pelham LDD Moth Defoliation Forecast Maps



Town of Pelham 2024
LDD Moth Defoliation
Forecast
Fonthill



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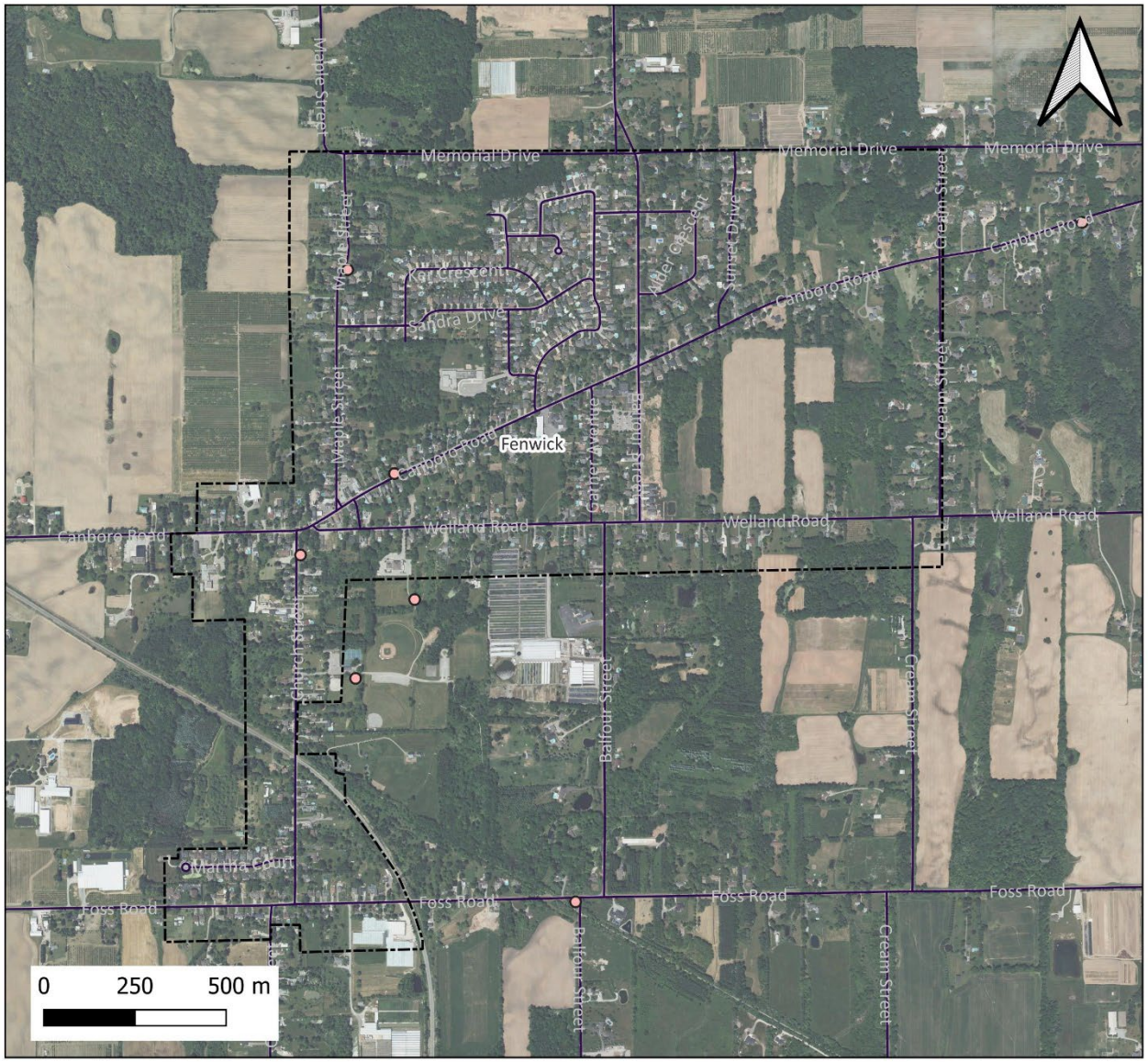
Town of Pelham 2024
LDD Moth Defoliation
Forecast
Fenwick



Appendix 2: LDD Moth Survey Plot Breakdown

Plot ID	Location	New Egg Masses per Site	Old Egg Masses per Site	Egg Mass/Ha	Average New Egg Mass Size (mm)	Defoliation Forecast
1	220 Merritt Rd	29	110	605	18	Light
2	Across from 2145 McGlashan St	10	20	333	3	Light
3	34 Daleview Cres	0	0	0	0	Nil
4	32 Timber Creek Cres	0	0	0	0	Nil
5	2460 Effingham St	0	0	0	0	Nil
6	1960 Cream St	0	0	0	0	Nil
7	Cream St south of Roland Rd	0	0	0	0	Nil
8	749 Metler Rd	0	0	0	0	Nil
9	Maple St north of Roland Rd	9	28	219	5.4	Light
10	130 Port Robinson Rd	0	0	0	0	Nil
11	Balfour St north of Chantler Rd	0	1	0	0	Nil
12	170 Luffmand Dr	0	0	0	0	Nil
13	1051 Quaker Rd	3	10	69	9	Light
14	Chantler Rd and Victoria Ave	10	10	500	6.6	Light
15	Across from 1025 Sixteen Rd	18	60	415	9	Light
16	201 Luffman Dr	0	0	0	0	Nil
18	Centennial Park behind Fire Station 2	0	0	0	0	Nil
19	Hwy 20W near Cream St	0	0	0	0	Nil
20	Shoalts Drive Reservoire	0	0	0	0	Nil
21	200 Roland Rd	0	0	0	0	Nil
22	676 Metler Rd	0	2	0	0	Nil
23	EL Crossley Secondary School	0	0	0	0	Nil
24	257 Caboro Rd	51	116	1557	24	Moderate
25	Woodstream Park	7	32	126	4	Light
26	Maple St north of Kilman Rd	0	0	0	0	Nil
27	Between 380 and 389 Cream St	0	0	0	5	Nil
28	7 Elizabeth Dr	0	0	0	0	Nil
29	1515 Rice Rd	0	0	0	0	Nil
30	390 Welland Rd	0	0	0	0	Nil
31	Between 146 and 164 River Rd	0	0	0	0	Nil
32	1043 Church St	0	0	0	0	Nil
34	North Pelham Park	10	37	213	4	Light
35	205 Luffman Dr	2	6	50	4	Light
36	1180 Centre St	0	0	0	0	Nil
37	31 Emmett St	0	0	0	0	Nil

Plot ID	Location	New Egg Masses per Site	Old Egg Masses per Site	Egg Mass/Ha	Average New Egg Mass Size (mm)	Defoliation Forecast
38	503 Metler Rd	57	88	2241	20	Moderate
39	665 Chantler Rd	0	0	0	0	Nil
42	796 Poth St	0	6	0	0	Nil
43	Lookout Park	0	0	0	0	Nil
44	1490 Effingham St	5	20	100	5	Light
45	Kilman Rd east of McGlashan St	55	105	1891	20	Moderate
48	Behind 84 Kunda Park Blvd	0	0	0	0	Nil
49	1437 Station St	0	0	0	0	Nil
50	Harold Black Park	1	10	9	3	Light
51	Luffman Dr and Orchard Hill Rd	0	0	0	0	Nil
52	955 Chantler Rd	8	9	376	5.8	Light
53	Metler Rd east of Effingham St	6	30	100	4	Light
54	305 Church St	0	0	0	0	Nil
55	550 Canboro Rd	0	8	0	0	Nil
56	Effingham St and Chantler Rd	0	0	0	0	Nil
58	Maple St south of Sixteen Rd	0	0	0	0	Nil
59	Harold S Bradshaw Memorial Park	0	0	0	0	Nil
60	Hwy 20W near Maple St	25	100	500	18	Light
61	273 Church St	0	0	0	5	Nil
62	2 Brucewood St	0	0	0	0	Nil
63	Across from 1720 Pelham St	0	0	0	0	Nil
64	Roland Rd west of Maple St	0	0	0	0	Nil
66	1215 Maple St	0	0	0	0	Nil
67	420 Welland Rd	32	115	697	14	Light
68	2541 Cream St	0	0	0	0	Nil
69	7 Spencer Ln on Pinecrest Crt	0	0	0	0	Nil
70	Between 885 and 909 Metler Rd	0	0	0	0	Nil
71	653 Metler Rd	0	0	0	0	Nil
75	1354 Haist St	0	0	0	0	Nil
76	695 Sixteen Rd on Balfour St	0	0	0	0	Nil
77	2045 Hansler St	53	91	1951	31.4	Moderate
78	4 College St	0	0	0	0	Nil
79	575 Roland Rd	0	0	0	0	Nil
80	35 Luffman Dr	0	0	0	0	Nil
82	1050 Metler Rd	0	0	0	0	Nil
83	Across from 175 Sumbler Rd	0	0	0	0	Nil
84	770 Canboro Rd	2	0	0	3.2	Nil

Plot ID	Location	New Egg Masses per Site	Old Egg Masses per Site	Egg Mass/Ha	Average New Egg Mass Size (mm)	Defoliation Forecast
85	Sulphur Spring Dr south of Roland Rd	0	0	0	0	Nil
86	Balfour St north of Hwy 20W	0	0	0	0	Nil
87	10 Blackwood Cres	0	0	0	0	Nil
88	511 Sawmill Rd	17	65	352	11	Light
89	Lookout Point Country Club	0	0	0	0	Nil
92	209 Canboro Rd	14	61	261	18	Light
93	44 Huricane Rd	0	0	0	0	Nil
94	Cream St and Webber Rd	0	0	0	0	Nil
95	23 Hwy 20E	0	0	0	0	Nil
96	Balfour St and Foss Rd	0	0	0	0	Nil
97	Shorthill Meadows Ponds	5	10	167	5	Light
98	627 Church St	3	0	0	3	Nil
99	25 Nusery Lane	0	21	0	0	Nil
100	1599 Pelham St	0	0	0	0	Nil
102	30 Roland Rd	7	29	136	9	Light
103	Church St north of River Rd	0	0	0	5	Nil
104	508 Welland Rd on Centre St	0	0	0	0	Nil
105	Across from 1010 Twenty Road	0	1	0	0.2	Nil
106	Behind 416 Pihach St	0	0	0	0	Nil
107	Near 860 Sixteeen Rd	0	0	0	0	Nil
109	Hurleston Community Park	0	0	0	0	Nil
112	Old Pelham Town Hall	0	0	0	0	Nil
113	376 Caboro Rd	0	0	0	0	Nil
114	Centre St south of Tice Rd	0	0	0	0	Nil
115	Across from 212 Foss Rd	0	0	0	0	Nil
116	504 Kilman Rd	0	0	0	0	Nil
117	Across from 195 Effingham St	7	22	169	8	Light
118	34 Fallingbrook Dr	0	13	0	0	Nil
120	Centennial Park near the Lions Club of Fenwick	0	0	0	0	Nil
121	2605 Oille St	0	1	0	0	Nil

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Appendix 4: Team

Alex Weegen, R.P.F. is a Consulting Arborist with Davey Resource Group. They have obtained a Bachelor of Science in Ecology focusing on resource conservation from the University of Guelph, and later completed a Master of Forest Conservation at University of Toronto. They have over 10 years of varied work experience in forestry, arboriculture, tree inventory and tree risk assessment.

Certifications

- International Society of Arboriculture Certified Arborist® (ON-1951A)
- International Society of Arboriculture Tree Risk Assessment Qualification (TRAQ)
- Registered Professional Forester (#2558)
- Certified Ontario Tree Marker

Pawan Paudyal is Consulting Arborist with Davey Resource Group. His formal education includes a Bachelor of Science in forestry from Hemwati Nandan Bahuguna Garhwal University, India and a Master in forest Ecology and Management from Helsinki University. Mr. Paudyal has 10 years of varied work experience in forestry, climate change and environment assessment fields. Mr. Paudyal has worked with DRG as Consulting Arborist.

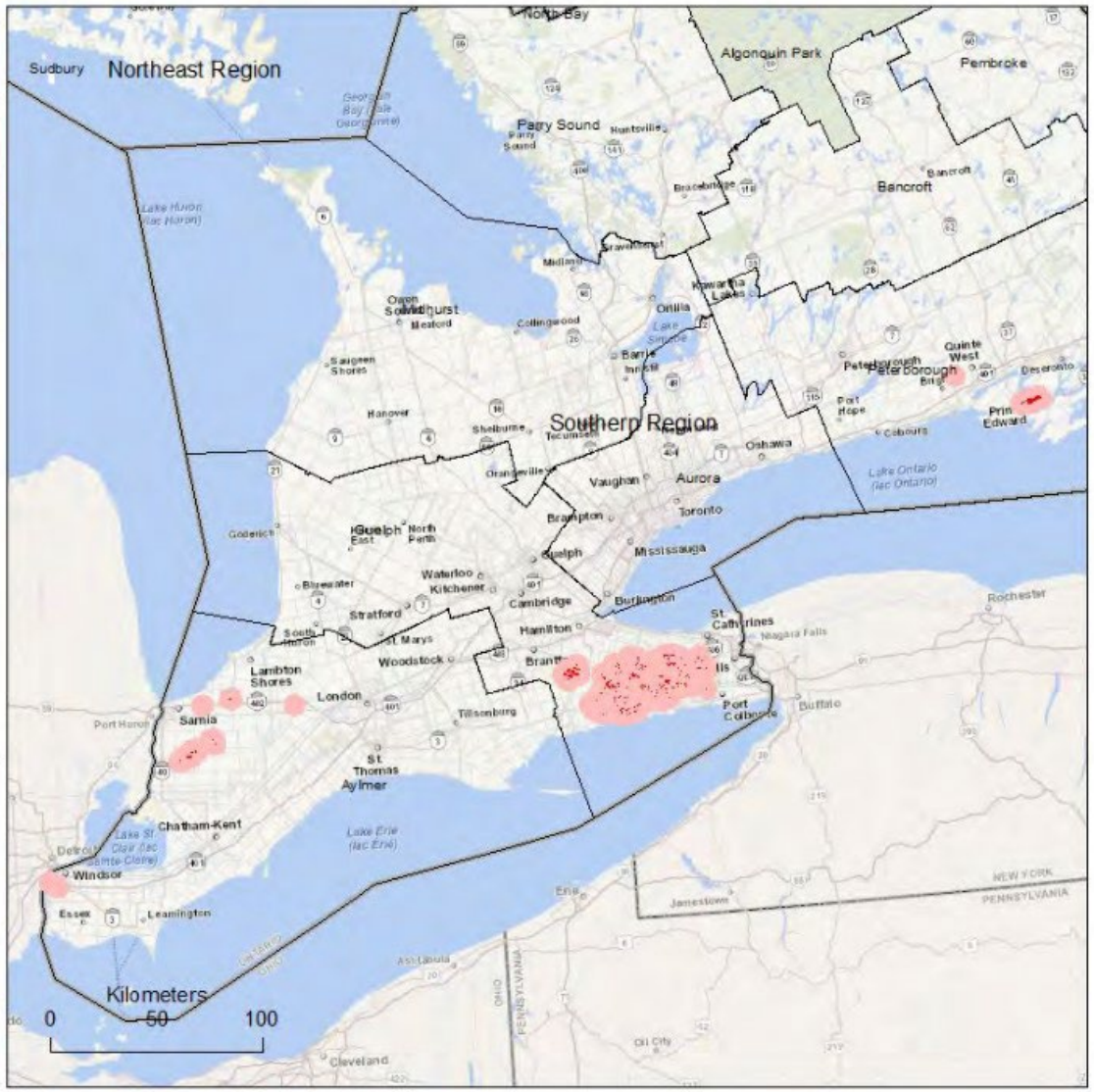
Appendix 5: OMNRF LDD Moth Defoliation Maps 2017-2022

Gypsy Moth
2017

Southern Region
Areas-within-which gypsy moth caused defoliation

Moderate-to-severe = 10,856 ha

Area of moderate-to-severe defoliation

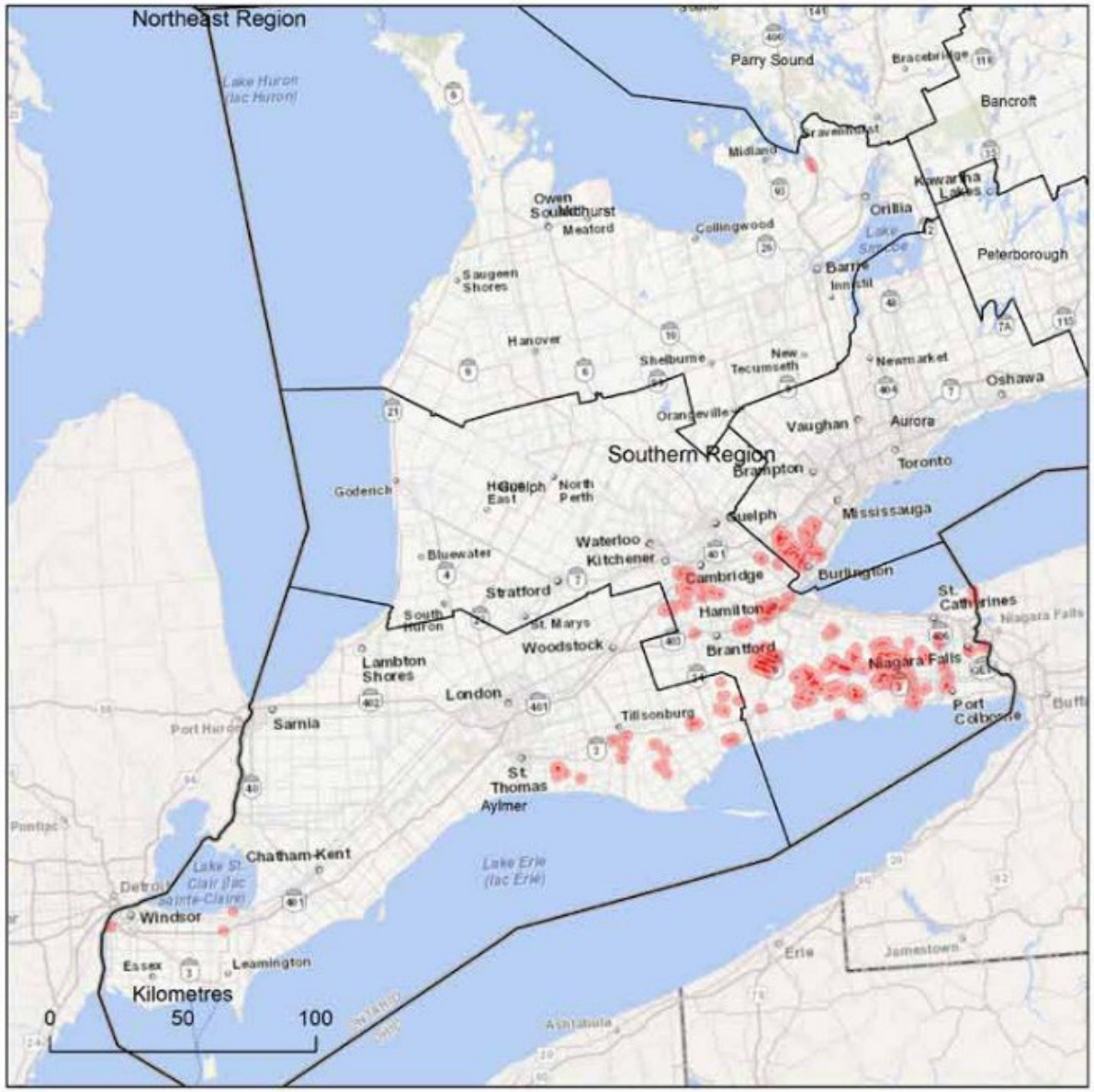


Gypsy moth 2018

Areas in the Southern Region where gypsy moth caused defoliation

Moderate to severe = 14,937 ha

Area of moderate to severe defoliation



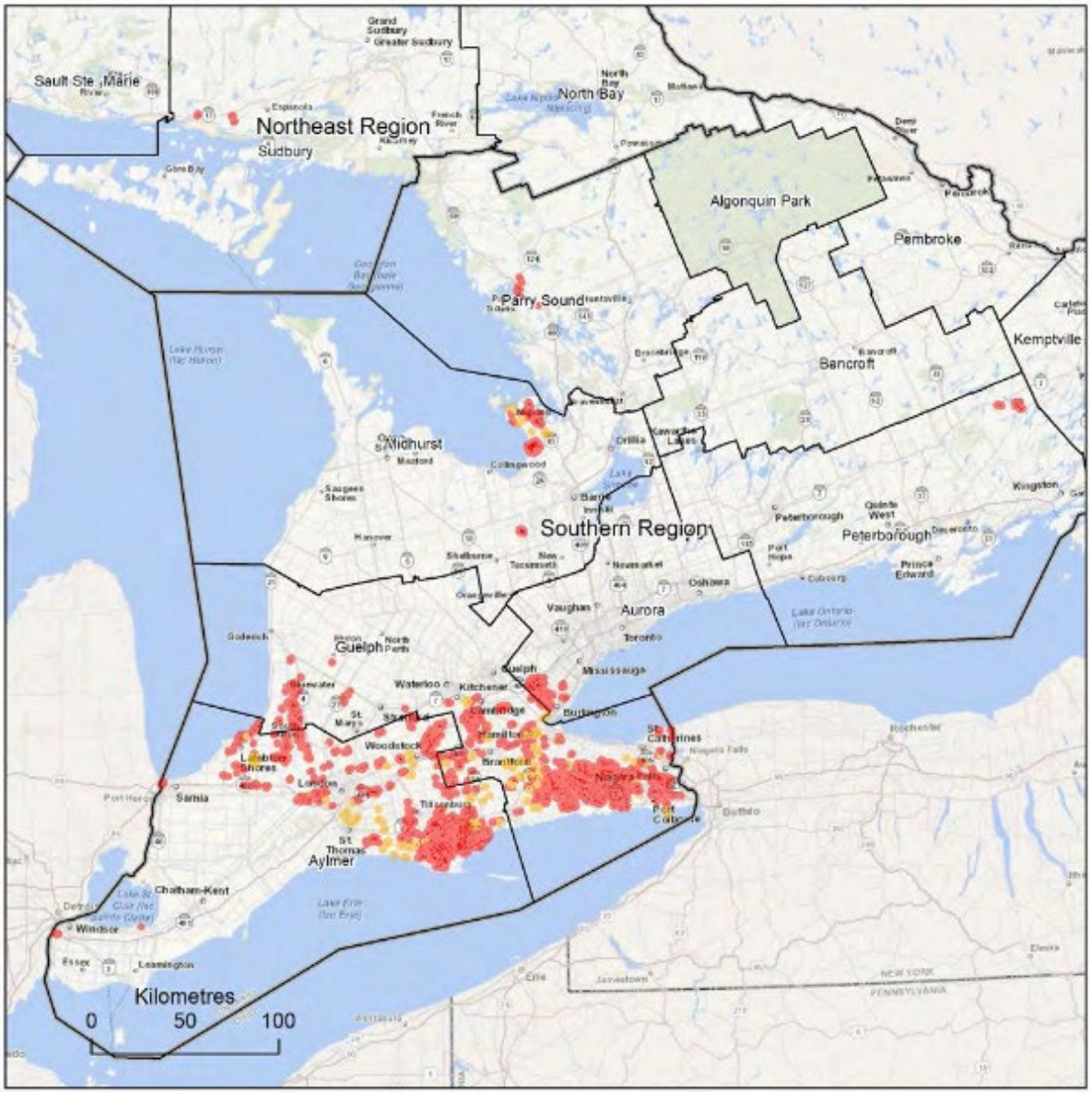
Gypsy moth
2019

Areas in the Ontario where gypsy moth caused defoliation

Light = 4,046 ha
Moderate to severe = 43,157 ha

Area of light defoliation

Area of moderate to severe defoliation



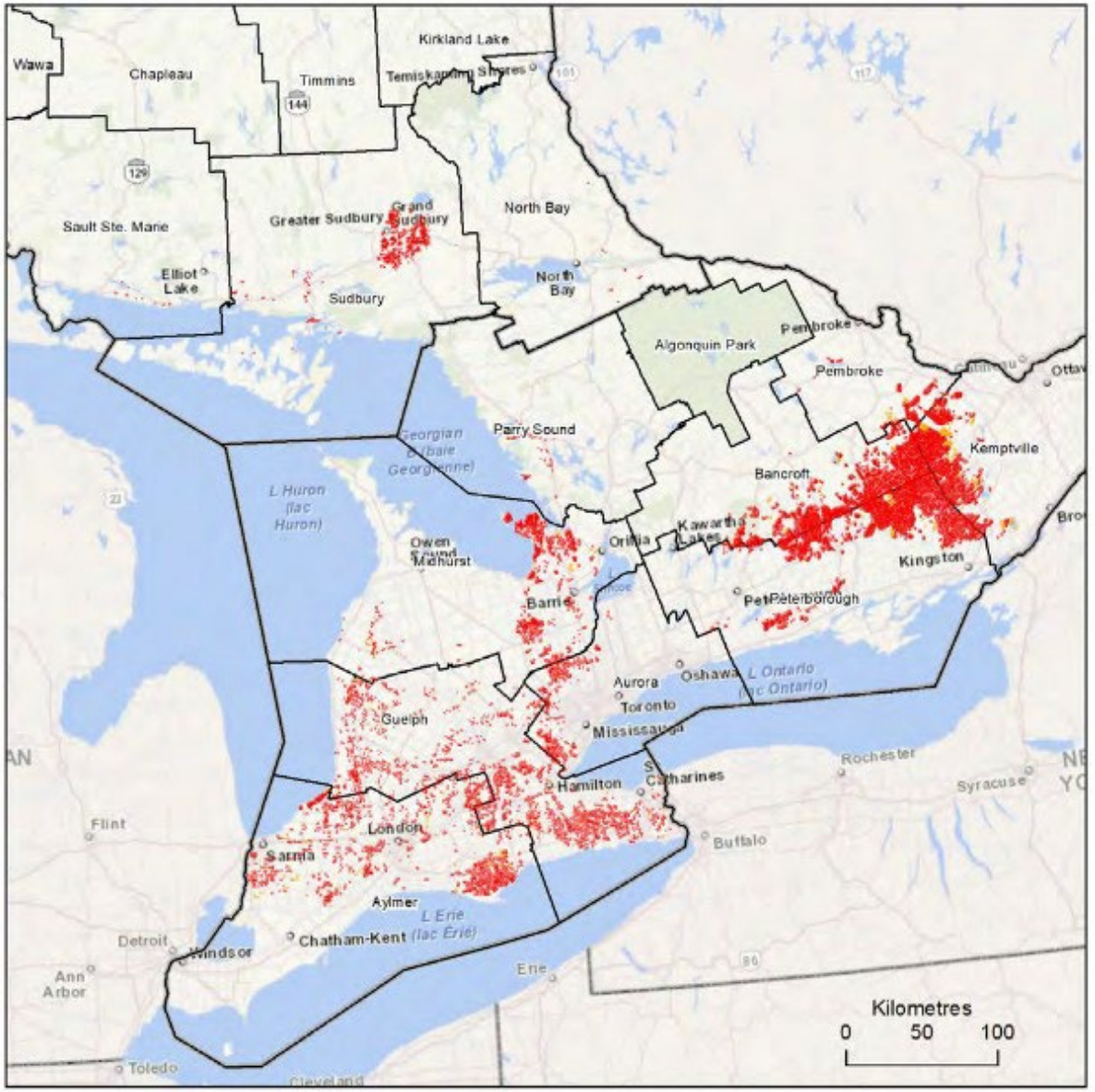
Gypsy moth 2020

Areas in Ontario where gypsy moth caused defoliation

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

Area of light defoliation

Area of moderate to severe defoliation



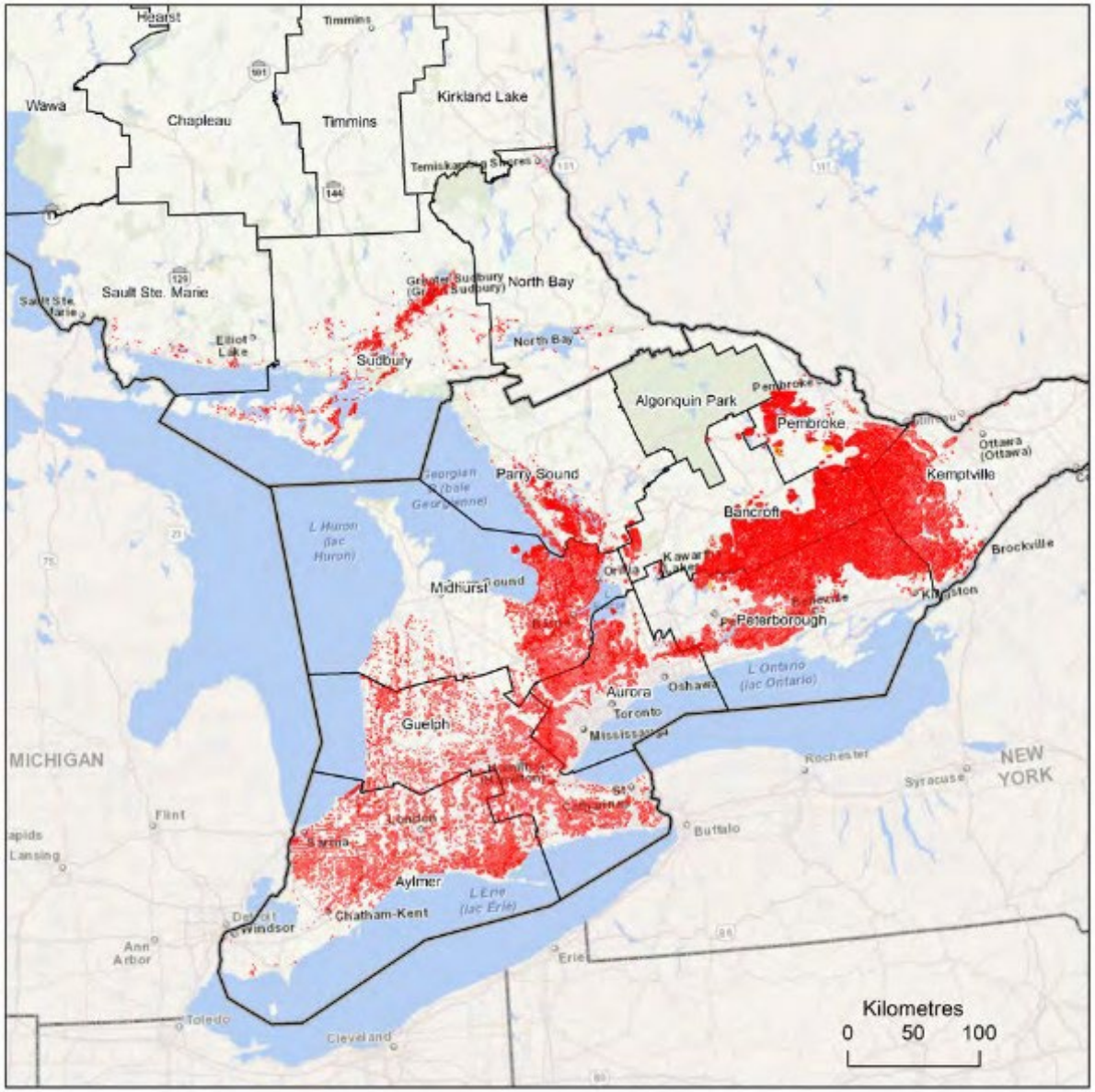
Lymantria dispar dispar 2021

Areas in Ontario where Lymantria dispar dispar caused defoliation

Light = 9,101 ha
Moderate to severe = 1,779,744 ha

Area of light defoliation

Area of moderate to severe defoliation



Spongy moth 2022

Areas in the Southern Region where spongy moth caused defoliation

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

Area of light defoliation

Area of moderate to severe defoliation