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Town of Pelham
2022 Spongy Moth Aerial Spray Program
Summary Report

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Introduction

In May 2022, the Town of Pelham implemented an aerial spray program to treat various parts of the Town for spangy moth. Lallemand Inc./BioForest (“BioForest”) was contracted to provide spray timing and assessment services. This report presents an overview of the spray program and the methods for and the results of the timing and assessment of the program.

Program Overview

In the Town of Pelham, a total of 109 hectares were treated with two applications of Foray 48B (*Bacillus thuringiensis* var. *kurstaki* [Btk]), supplied by Valent BioSciences Corporation and applied at a rate of 50 BIU/4.0L/ha. The first application of Btk took place on May 24, and the second application took place on June 2, 2022. Applications were made south of Fenwick, east of Fonthill, and in the northern part of town. Maps illustrating all spray blocks are provided in Appendix A.

Methods

Spray Timing

The benefits of using Btk to control spangy moth are maximized when first applications target host leaves that are providing an optimum deposit surface. For white oak and red oak, the target level of leaf development is 30-40% and 50-60%, respectively. These stages of leaf development typically coincide with first and second instar spangy moth larvae.

BioForest monitored spangy moth development using BioSIM, a software tool for predicting larval development. Host leaf development and egg mass hatch was monitored from field measurements.

BioSIM Forecasts

BioForest used the latest version of the BioSIM phenology model developed by the Canadian Forest Service to provide advance indication of probable program start dates based on 90% spangy moth egg hatch. BioSIM was also used to assist with the timing of field activities.

Host Development

To monitor host development, plots were established in three spray blocks – Fonthill (Canboro Road), North (Tice Road), and Fenwick (Sumbler Road). Development plot locations are provided in Appendix A.

Sampling in development plots took place at regular intervals between May 3 and May 20. On each sample date, visual ground surveys were conducted at each plot using binoculars to determine percent leaf expansion.

Egg hatch observations were made by marking egg masses at each development plot and monitoring those same egg masses for the duration of the assessment period. Field crews included egg masses at various heights and at different exposures, to account for these factors that influence egg hatch timing.

Weather

On spray days, for both applications, BioForest field crews monitored weather conditions in or near the spray blocks being sprayed. Temperature, relative humidity, wind speed and direction were recorded every five minutes. Any significant deviations from specified weather parameters were reported to the Town’s project manager.

Spray Assessment

Spray Deposit

For both applications, spray deposit was assessed using the ADAM (Accurate Deposit Assessment Method) Field Kit supplied by Valent BioSciences Corporation. Following each application, foliage samples were collected from five spray blocks (Cream Street, Foss Road, Pancake Lane, Sumbler Road, Welland Road) within 8 hours. Foliage samples were stored at 4°C until they could be processed in the lab. All samples were processed within 12-24 hours of collection. The amount of deposit was determined for each sample, and a deposit index was calculated for each spray block sampled. The deposit index calculations were based on the following ADAM Kit deposit categories:

- 1 = nil (0 ng Btk proteins/ml)
- 2 = low (< 20 ng Btk proteins/ml)
- 3 = moderate (20 – 100 ng Btk proteins/ml)
- 4 = high (> 100 ng Btk proteins/ml)

Defoliation Surveys

Host defoliation rates were assessed upon completion of spongy moth larval feeding. BioForest staff evaluated 10 trees for defoliation in all spray blocks. Surveys took place on July 8. Evaluated trees were a combination of red, white, and bur oaks, with some alternate host such as basswood, poplar, and maple when oak was not available. Numerous branches from each tree were assessed and assigned one of the following six defoliation classes: <5%, 6-25%, 26-50%, 51-75%, 76-95%, or >95%.

Results

Spray Timing

BioSIM Forecasts

The first BioSIM run on April 8, 2022, predicted that 90% egg hatch would occur in Pelham between May 20 and May 22 (Figure 1).

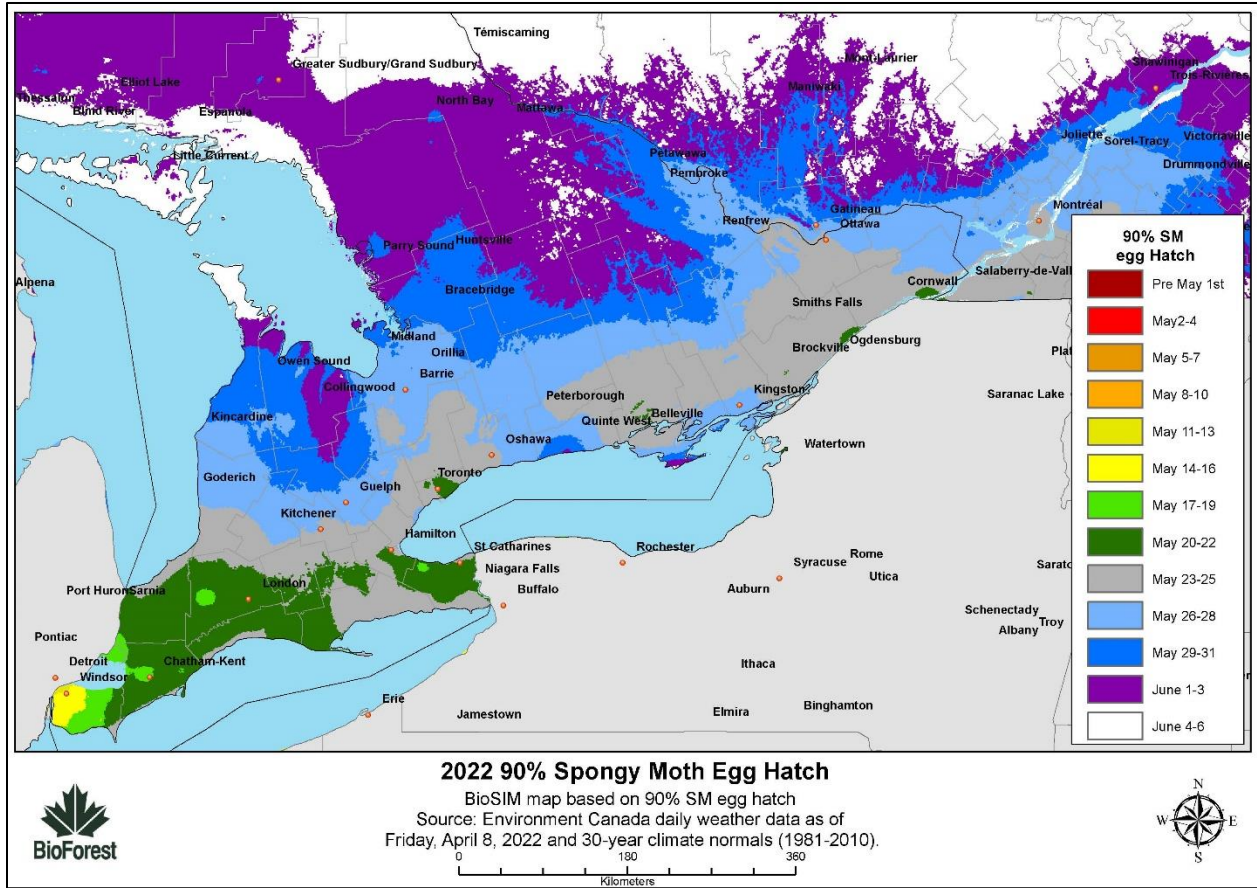


Figure 1. BioSIM 90% spongy moth egg hatch forecast map for southern Ontario, April 8, 2022.

To fine tune that prediction, field sampling to monitor host development and egg hatch began on May 3, 2022.

Host Development and Egg Hatch

Figure 2 presents red and white oak development from each of the development plots that were monitored. Figure 3 presents spongy moth egg hatch from each of the development plots where egg masses were monitored.

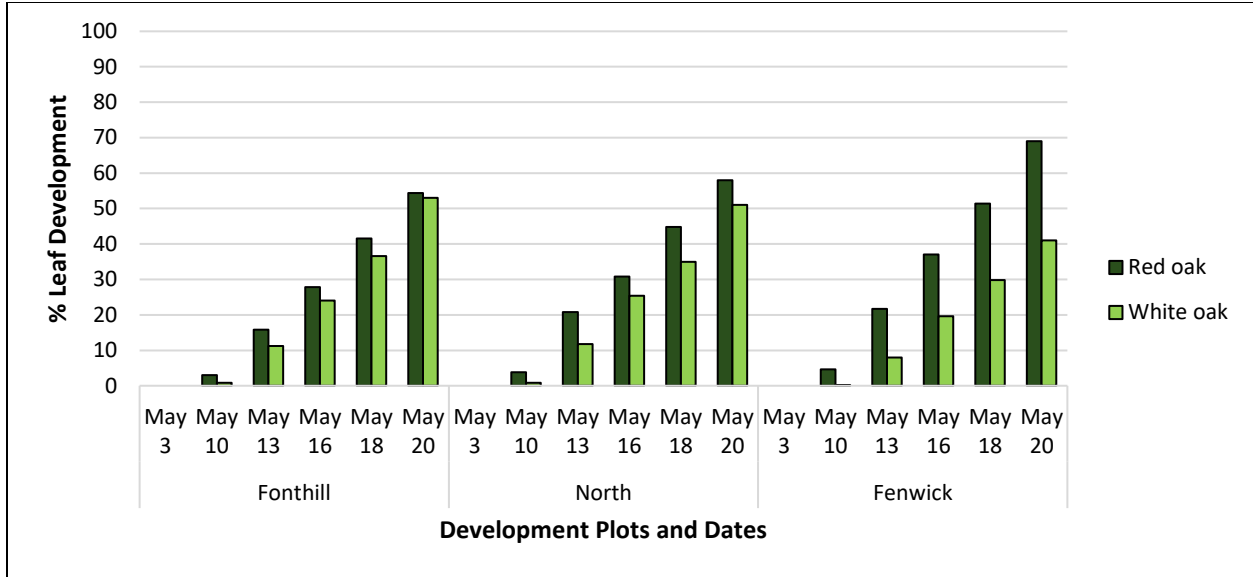


Figure 2. Leaf development of red and white oak in development plots, 2022.

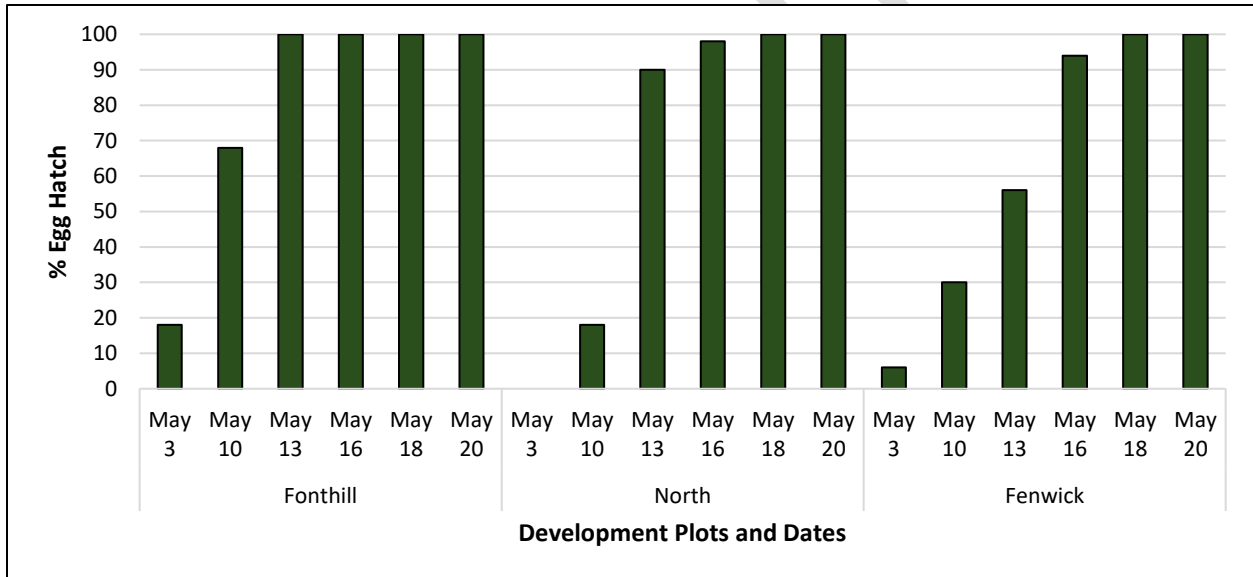


Figure 3. Spongy moth egg hatch in development plots, 2022.

Table 1 presents the application dates for each spray block and identifies which development plot was closest to each spray block. The first application occurred on May 24, when white oak development ranged between 41-53%, red oak development ranged between 54-69%, and egg hatch was observed to be 100% at all plots.

Table 1. First and second application dates for spray blocks.

Spray Block	Date of First Application	Date of Second Application	Closest Development Plot
Canboro Road	May 24	June 2	Canboro Road
Cream Street	May 24	June 2	Tice Road
Effingham Street	May 24	June 2	Tice Road
Foss Road	May 24	June 2	Sumbler Road
Pancake Lane	May 24	June 2	Canboro Road
Sumbler Road	May 24	June 2	Sumbler Road
Tice Road	May 24	June 2	Tice Road
Welland Road	May 24	June 2	Sumbler Road

Weather

Spray weather parameters for the Town of Pelham aerial spray program were:

- Calm winds (less than 16 km/h)
- Temperatures between 2 and 25°C
- High humidity (> 40%)
- No precipitation within 24 to 48 hours following application

Detailed weather data collected on spray days is presented in Appendix B. Table 2 summarizes the weather data collected on each spray day, during the spray event (approximately 6:50am to 9:00am), and Figure 4, Figure 5, and Figure 6 graphically depict the ranges observed on the ground with the optimal spray parameters outlined.

Weather data was also collected for 48 hours prior to and following each spray event. This data is summarized below in Table 3.

Table 2. Weather summaries for the 2022 Town of Pelham aerial spray events.

Spray Date	Application	Blocks Sprayed	Weather Station(s)	Average Wind Range (km/h)	Temperature Range (°C)	RH Range (%)
May 24	1	All	Hillside Cemetery	0.5 – 9.1	10.9 – 13.8	69 – 76
June 2	2	All	Hillside Cemetery	0.0 – 6.1	12.0 – 16.2	61 – 84

Table 3. Weather summaries for 48 hours prior to and following each 2022 Town of Pelham aerial spray date. Sources: Welland-Pelham Station, Environment and Climate Change Canada – Meteorological Services Canada.

Date	Average Wind Range (km/h)	Temperature Range (°C)	RH Range (%)	Total Precipitation (mm)
May 22	3 – 22	9.2 – 17.8	68 – 98	0.6
May 23	2 – 10	8.3 – 15.9	36 – 87	0.0
May 24*	1 – 19	7.0 – 19.0	45 – 88	0.0
May 25	0 – 18	9.5 – 22.5	55 – 89	0.0
May 31	0 – 17	16.9 – 28.7	43 – 87	0.0
June 1	1 – 11	16.7 – 25.9	67 – 96	26.7
June 2*	1 – 17	11.5 – 19.7	43 – 90	0.0
June 3	2 – 15	9.7 – 21.4	44 – 93	0.0

*spray day

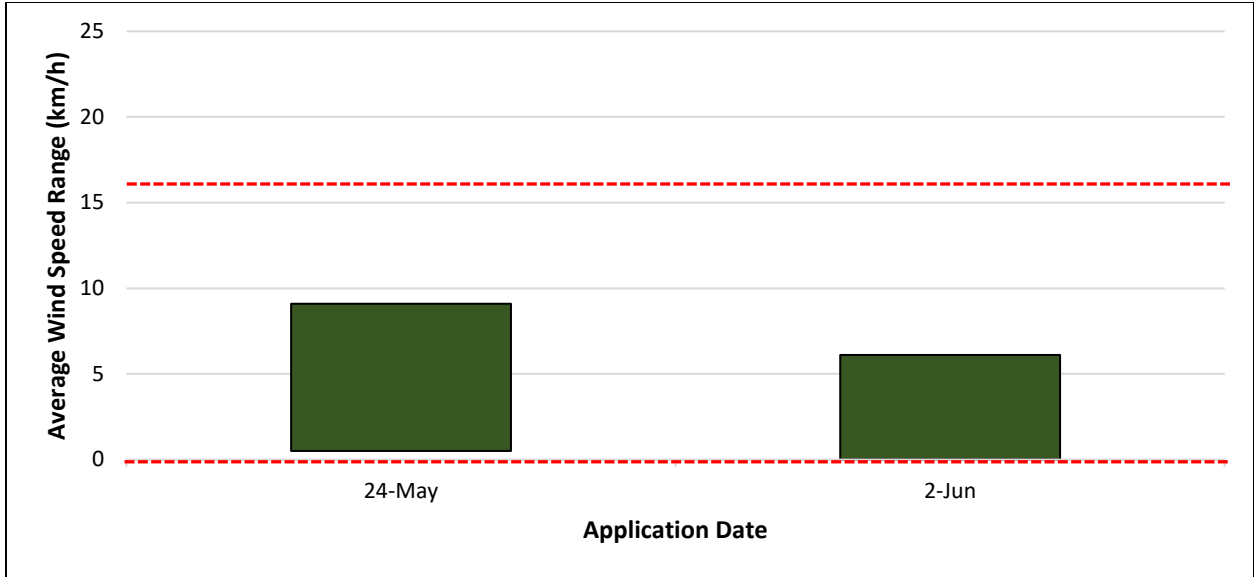


Figure 4. Average wind speed range (km/h) recorded during spray events. Dotted red lines represent parameters for optimal conditions.

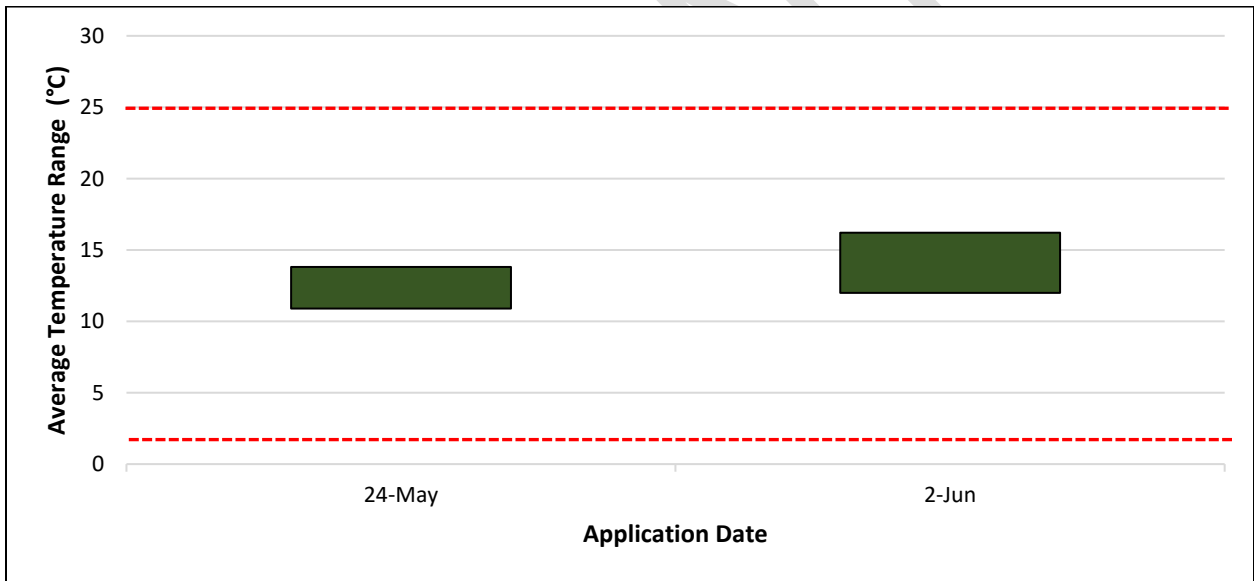


Figure 5. Average temperature ranges (degrees Celcius) recorded during spray events. Dotted red lines represent parameters for optimal conditions.

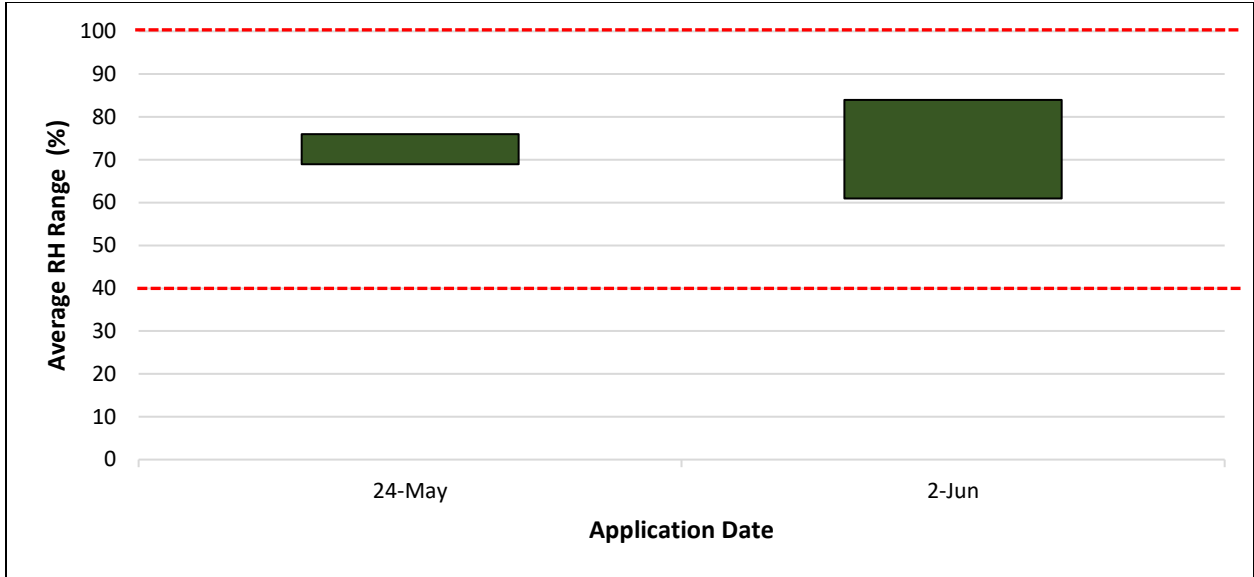


Figure 6. Average relative humidity range (%) recorded during spray events. Dotted red lines represent parameters for optimal conditions.

Spray Assessment

Spray Deposit

After the first application, the majority of branches sampled (91%) had Btk present (Figure 7). 23% of branches sampled had >100 ng Btk/ml (deposit index of 4), and 36% had 20 – 100 ng Btk/ml (deposit index of 3). After the second application, all branches sampled had >20 ng Btk/ml.

Table 4 presents the deposit index after each application for all four spray blocks sampled using the ADAM Kit methodology.

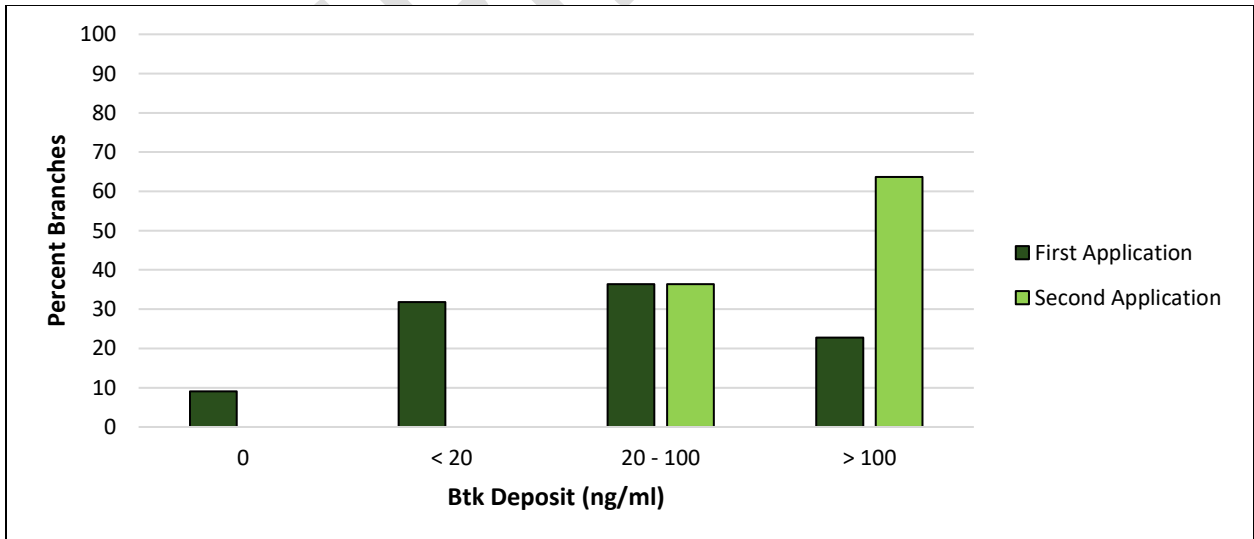


Figure 7. ADAM Kit results showing level of Btk deposit on sampled branches, 2022.

Table 4. Average deposit index (ADAM Kit) after each application in all sampled spray blocks, 2022.

Spray Block	Average Deposit Index – First Application	Average Deposit Index – Second Application
Cream Street	2.6	3.4
Foss Road	2.3	3.3
Pancake Lane	3.2	3.6
Sumbler Road	3.0	4.0
Welland Road	2.3	4.0

Defoliation Surveys

Of the 90 trees that were evaluated for defoliation within the spray blocks, the majority of branches (94.1%) had less than 5% defoliation (Figure 8). None of the branches had more than 25% defoliation.

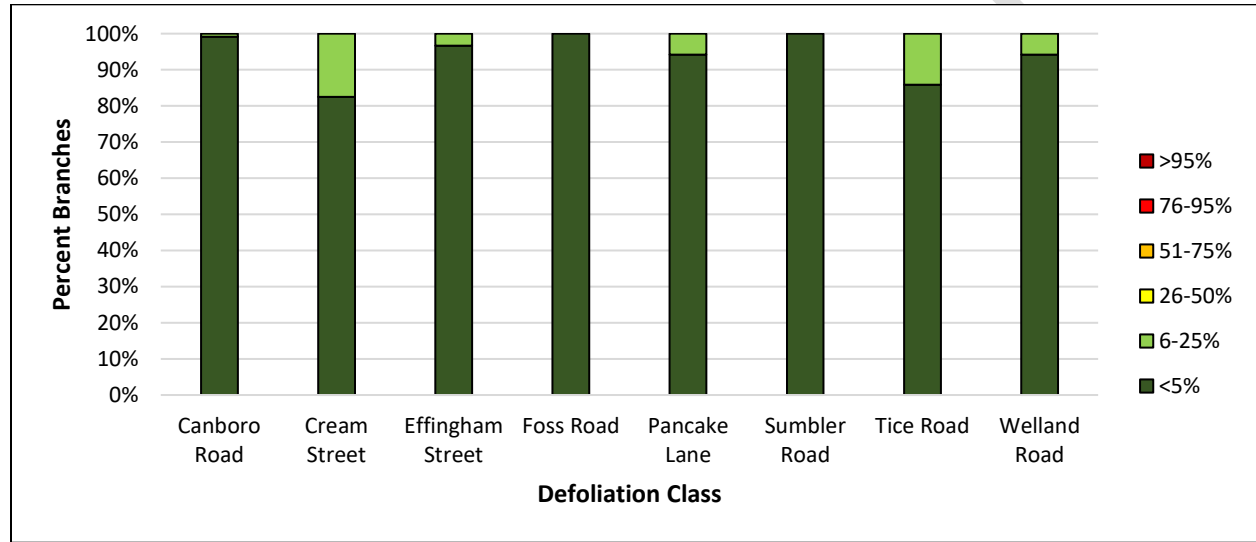


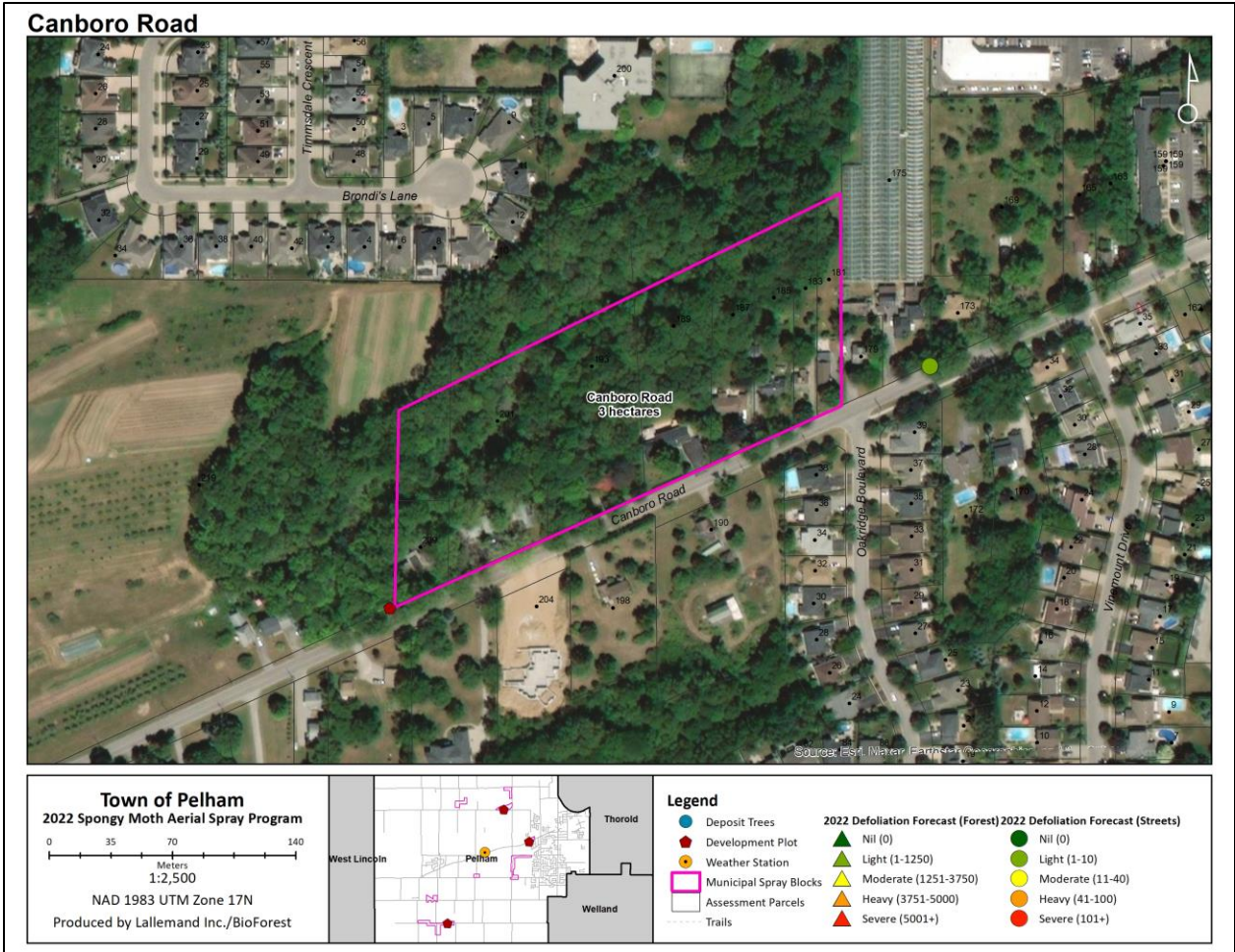
Figure 8. Percent branches in each defoliation class from all spray blocks, 2022.

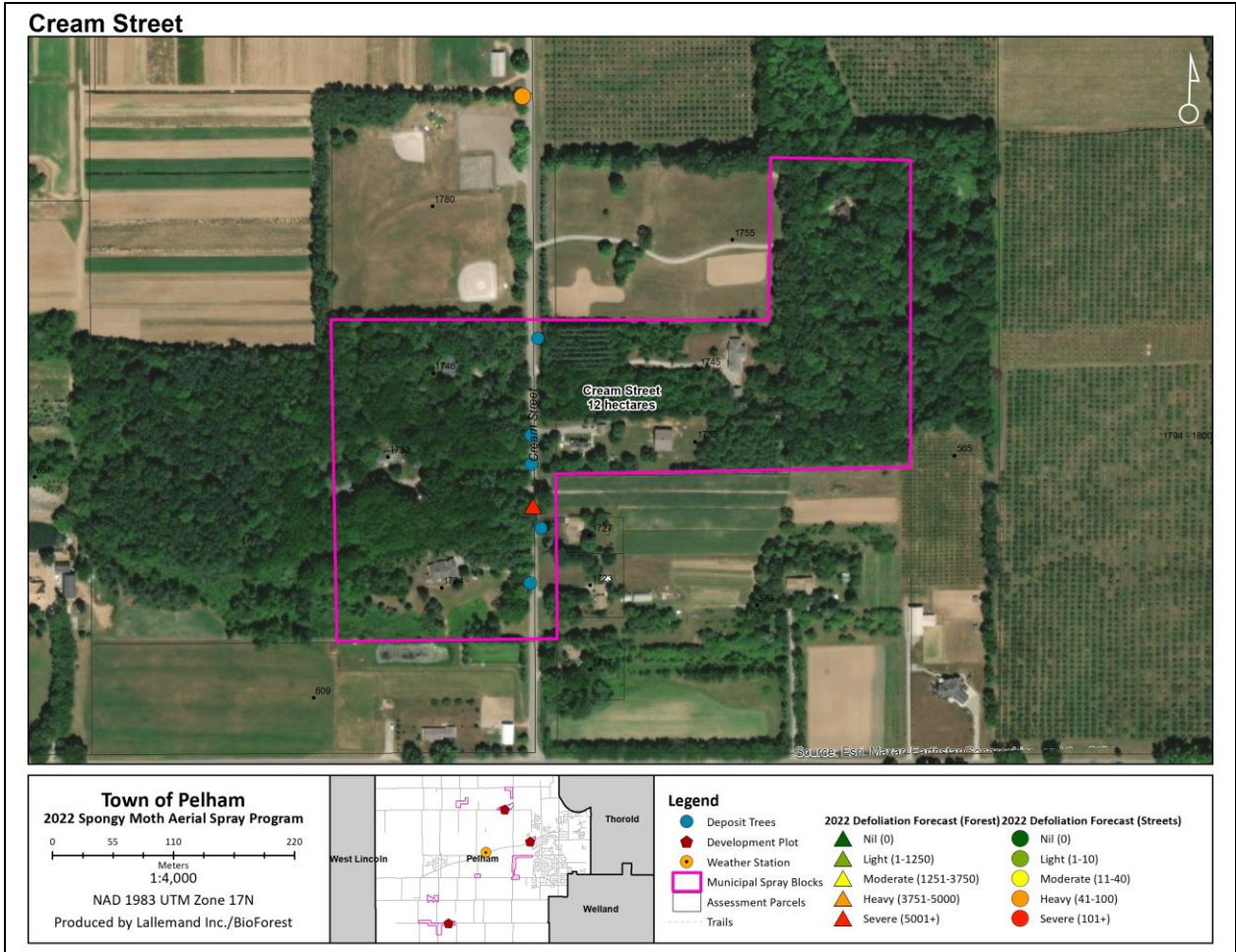
Conclusion

The Town of Pelham’s management objective for the aerial spray program, as per Policy No. S801-14, is to “...protect the tree canopy within its Municipal Boundary against tree mortality caused by defoliation by the LDD moth...”. Assessment of the 2022 Town of Pelham aerial spray program indicates that the program was effective at achieving program goals by significantly reducing forecasted defoliation and maintaining a healthy tree canopy within the Municipal Boundary and beyond. Host development and egg hatch at the time of spraying were within acceptable ranges. For each of the spray dates, the average temperature and relative humidity were within acceptable spray parameters. Following the first application, the majority of branches sampled for deposit (91%) had Btk present and following the second application all branches sampled had Btk present. All blocks sampled had Btk present following both applications. No branches surveyed within the spray area had greater than 25% defoliation and the majority had less than 5% defoliation.

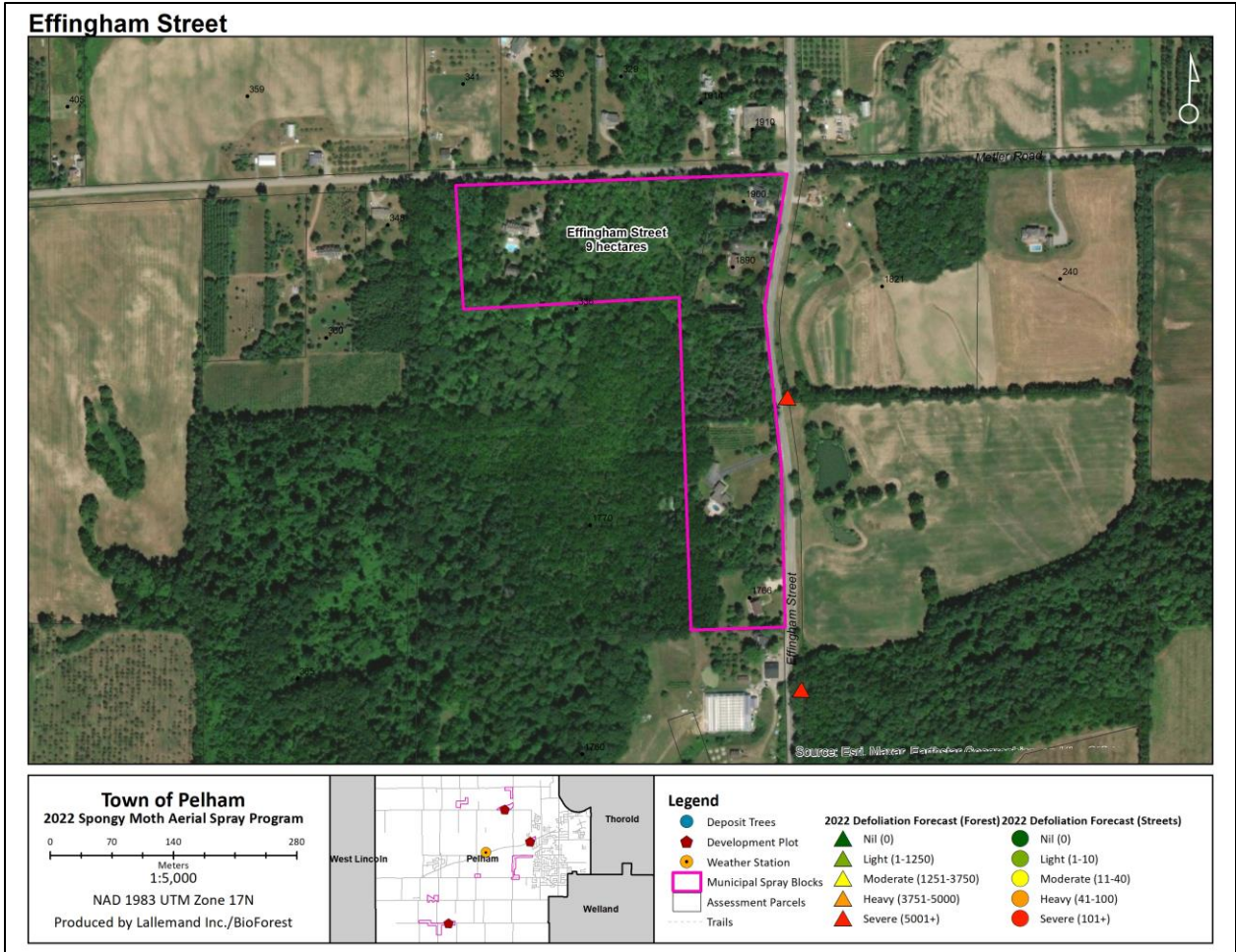
Appendix A: Spray block maps

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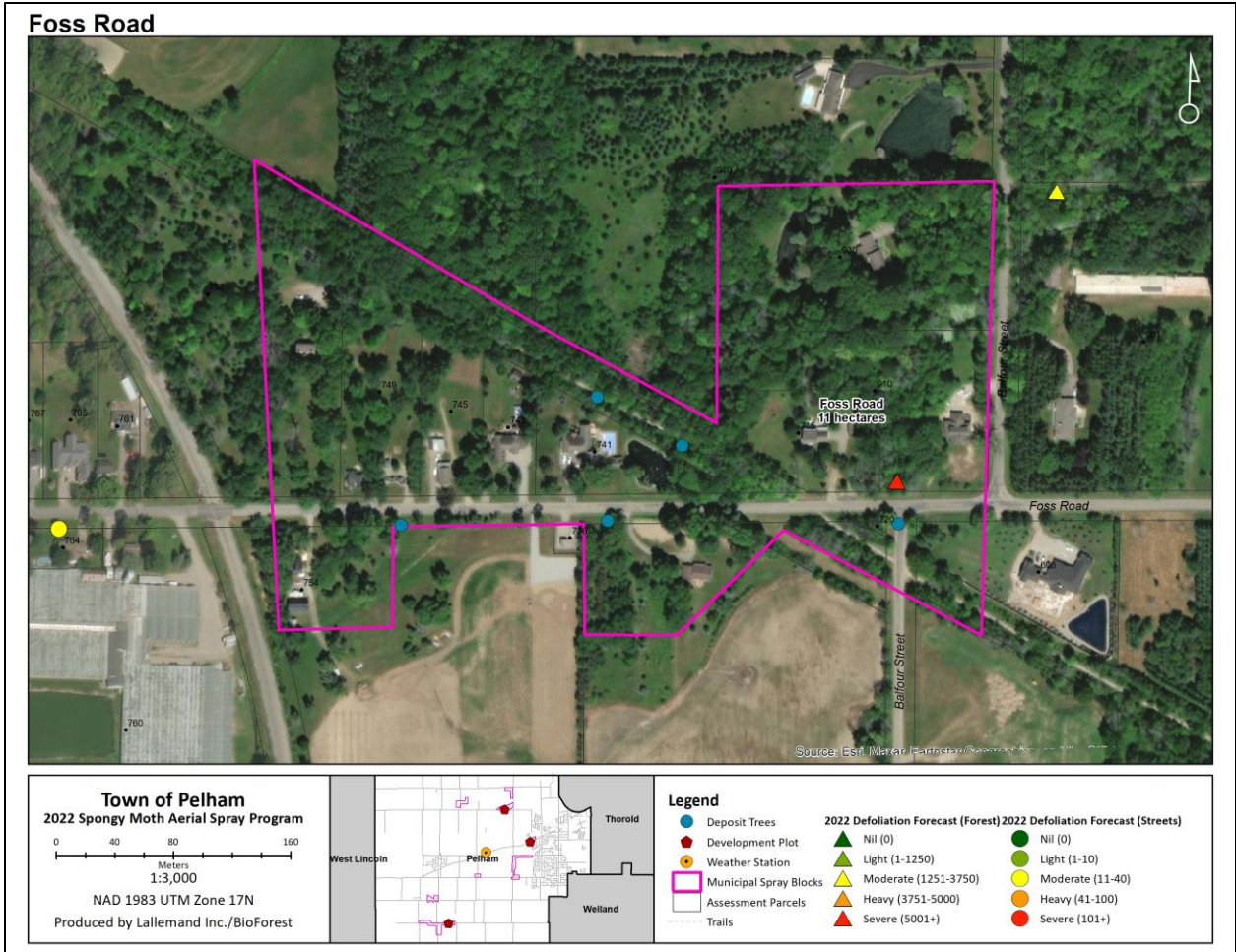


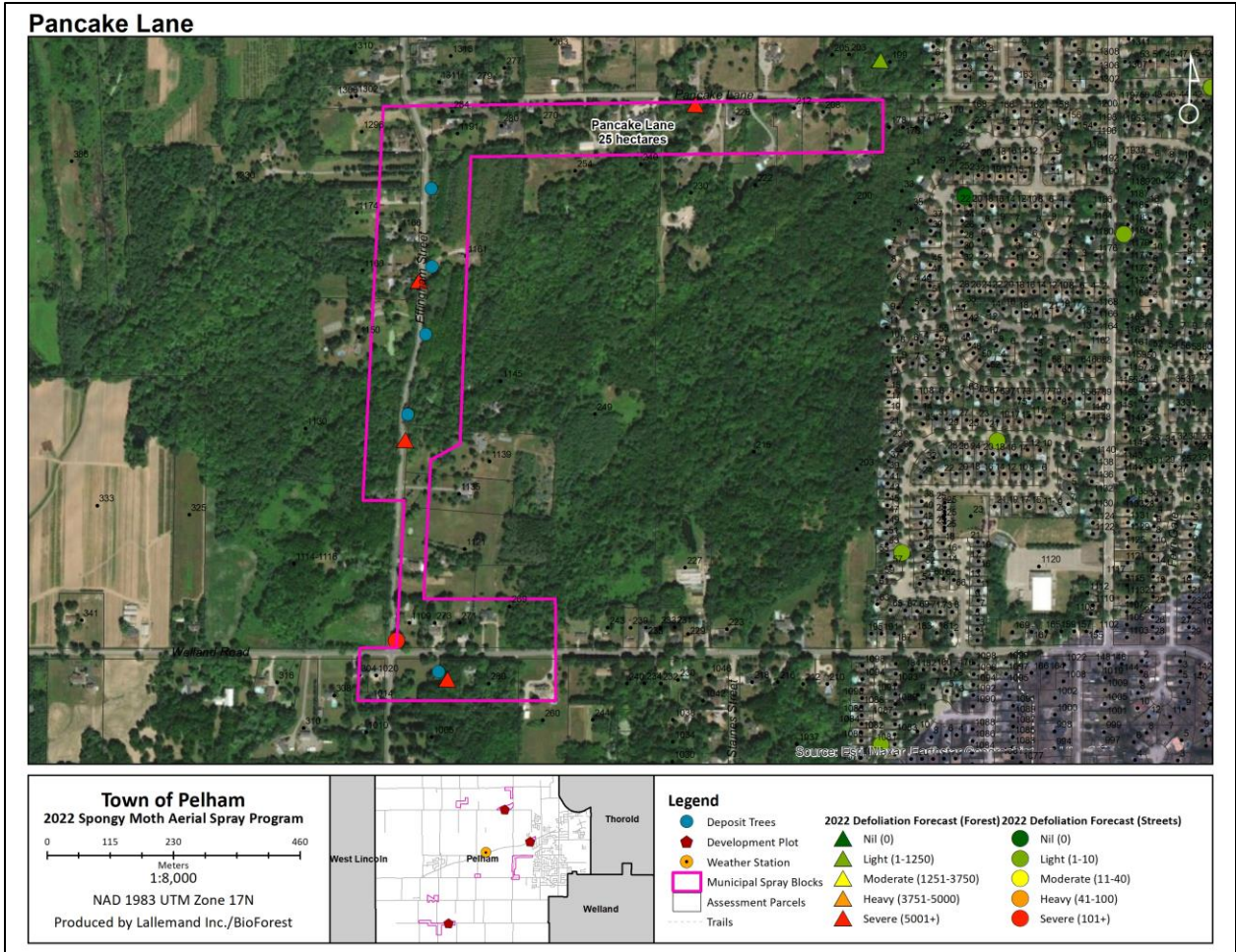


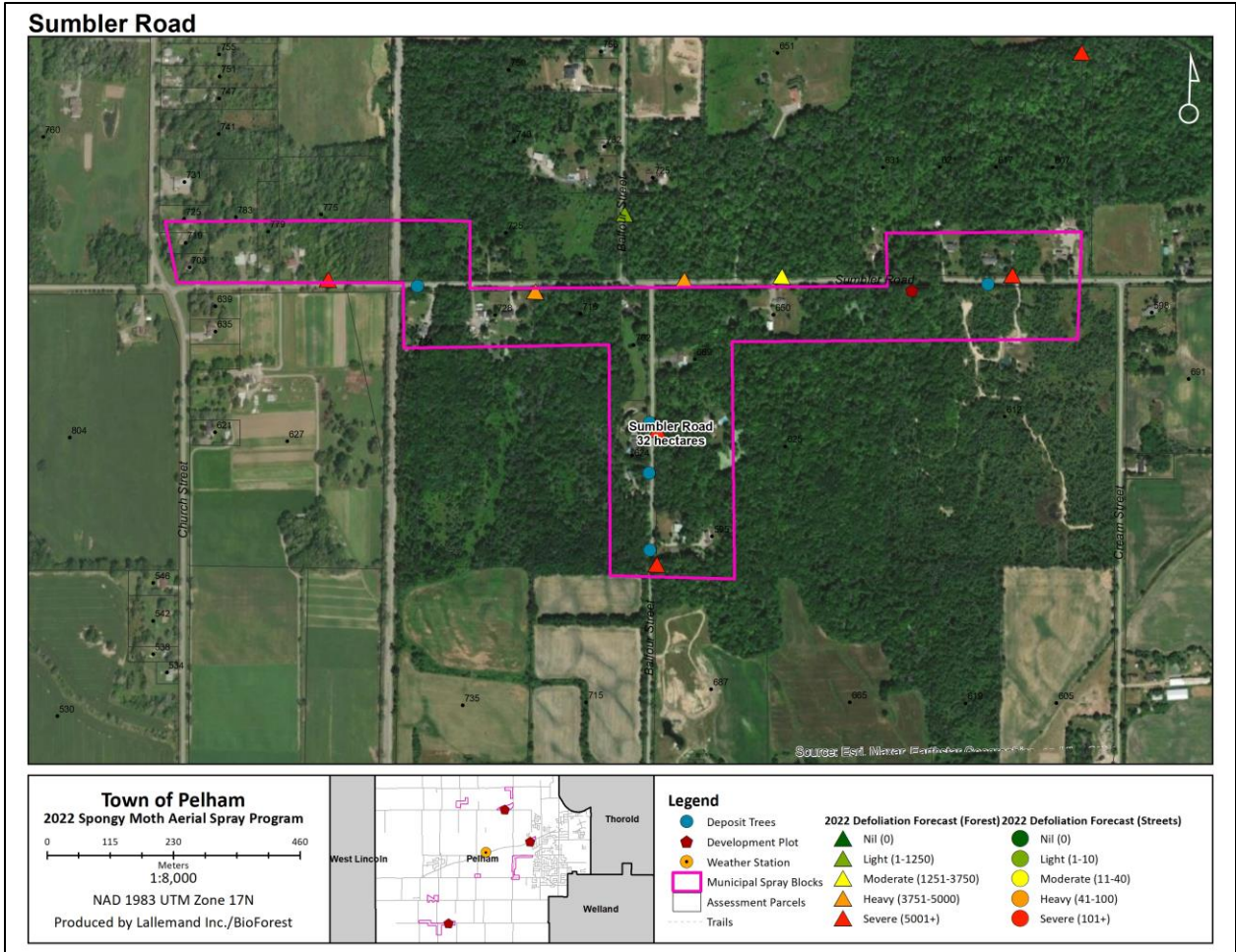
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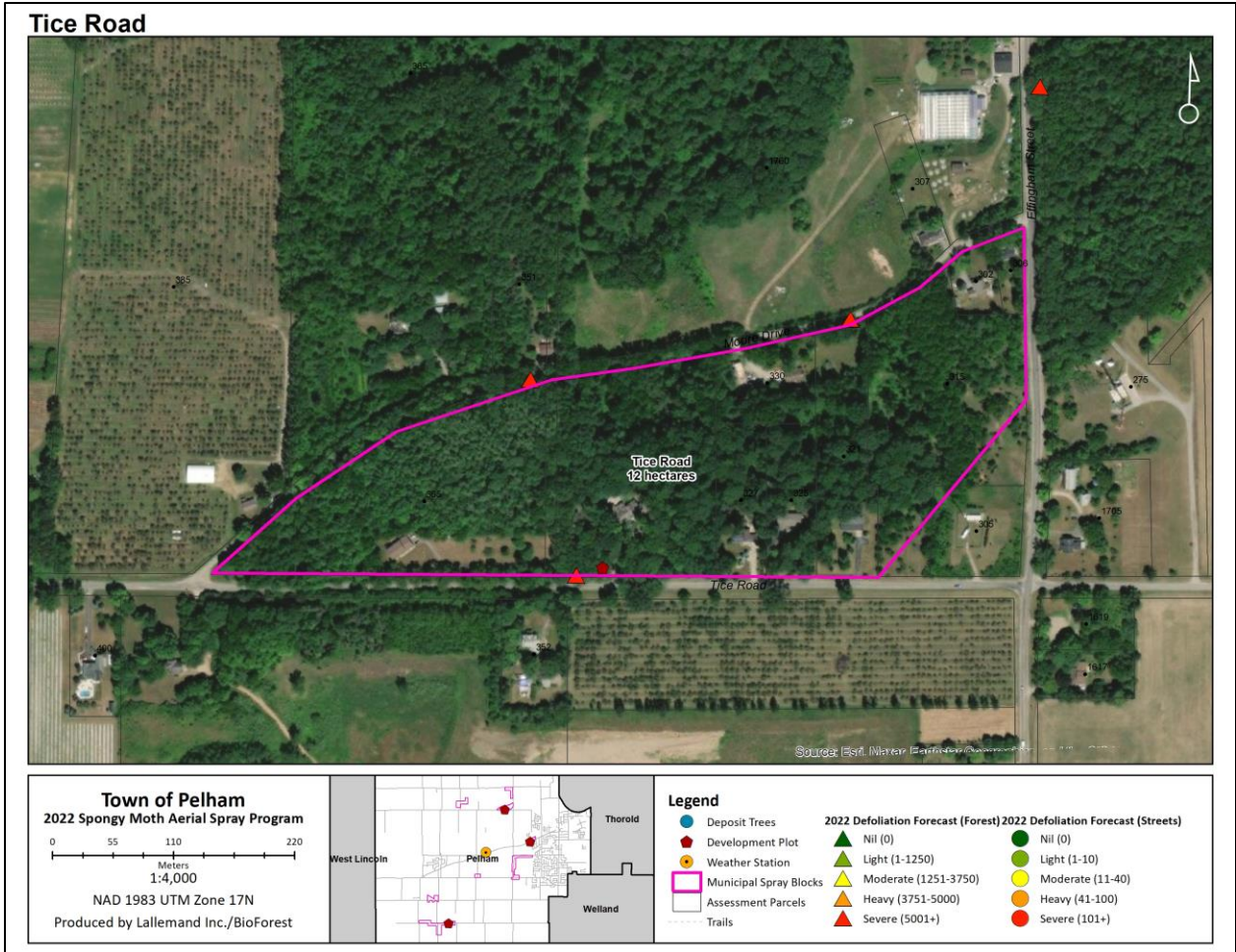
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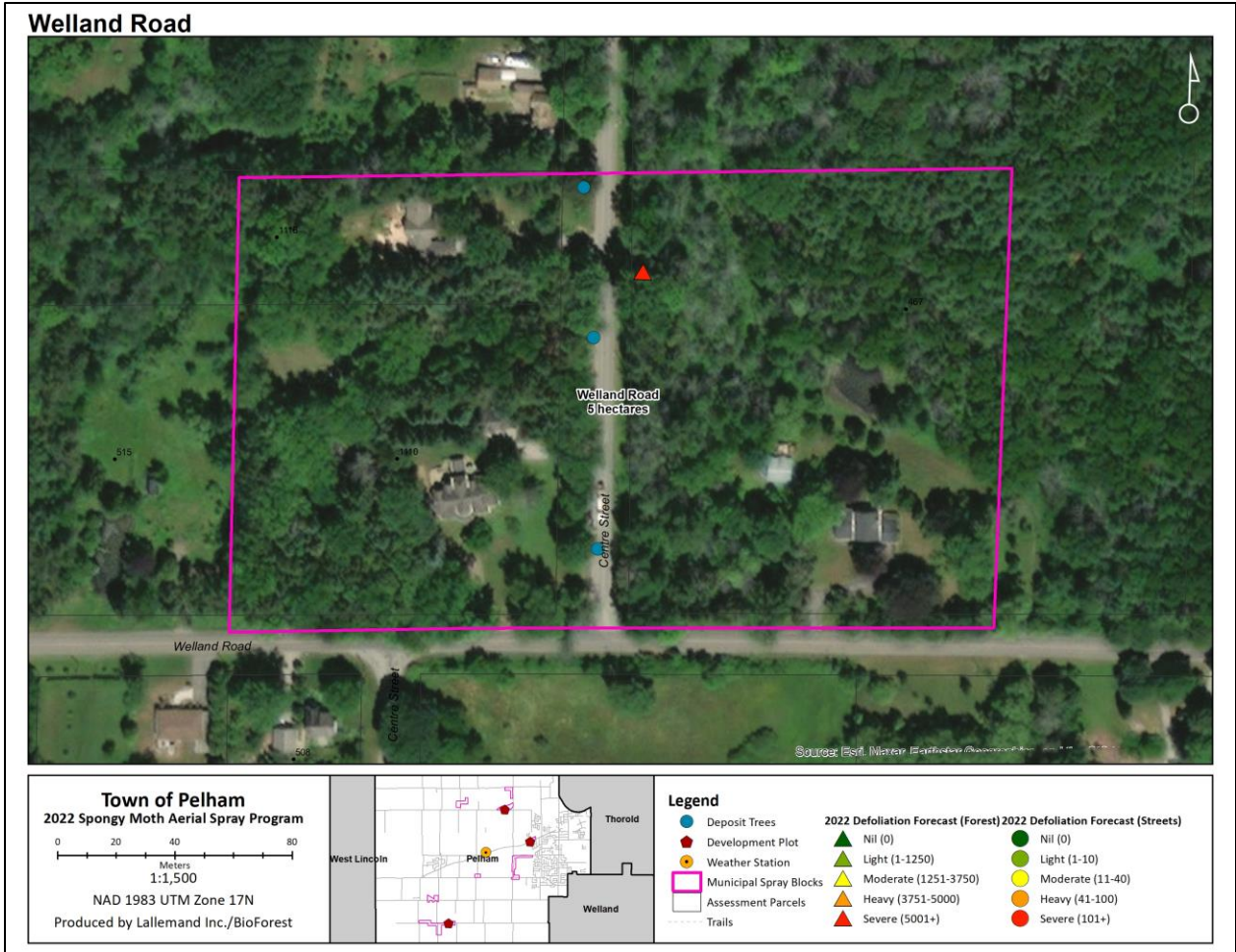






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Appendix B: Spray block wind, temperature and relative humidity records for Town of Pelham spray days

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Spray Day Weather Record											
Location: Hillside Cemetery							Date: 24-May-22				
GPS Coordinates:			Zone	Easting			Northing				
			17T	636360			4766065				
Crew:		AT			Application:		1st	2nd			
Time	Wind					Temperature			RH		Comments
	Avg		Max			°C	↑ ↓ →	%	↑ ↓ →		
	kph	Direction	kph	Direction	Time						
7:15	0.5	NE	1.1	NE	7:18	10.9	→	75	→		
7:20	3.3	NE	4.4	NE	7:20	11	→	74	→		
7:25	2.5	NE	4.9	NE	7:26	11.2	→	74	→		
7:30	4.8	NE	6.4	NE	7:32	11.3	→	74	→		
7:35	3.3	NE	5.1	NE	7:35	11.3	→	75	→		
7:40	2	NE	4.1	NE	7:41	11.4	→	76	→		
7:45	3.9	NE	5.9	NE	7:46	11.2	→	76	→		
7:50	3.8	NE	7.5	NE	7:50	11.4	→	76	→		
7:55	3.6	NE	5.3	NE	7:58	11.4	→	76	→		
8:00	3.2	NE	4.3	NE	8:03	11.7	↑	76	→		
8:05	3.1	NE	5.1	NE	8:05	12.4	↑	74	↓		
8:10	4	NE	9.1	NE	8:11	13	↑	72	↓		
8:15	3.8	NE	6.2	NE	8:18	12.8	↑	73	↓		
8:20	3.3	NE	6.2	NE	8:20	12.9	↑	73	↓		
8:25	3.7	NE	8.7	NE	8:27	12.9	↑	73	↓		
8:30	4.2	NE	7.3	NE	8:32	13	↑	73	→		
8:35	3.1	NE	5.1	NE	8:37	13.1	↑	73	→		
8:40	3.3	NE	7.5	NE	8:41	13.1	↑	72	→		
8:45	4.1	NE	6.7	NE	8:46	13.3	↑	70	↓		
8:50	3	NE	4.1	NE	8:50	13.8	↑	69	↓		

Spray Day Weather Record											
Location:		Hillside Cemetery					Date:		2-Jun-22		
GPS Coordinates:		Zone		Easting			Northing				
		17T		636359			4766061				
Crew:		AT			Application:		1st	2nd			
Time	Wind					Temperature			RH		Comments
	Avg		Max			°C	↑ ↓ →	%	↑ ↓ →		
	kph	Direction	kph	Direction	Time						
6:50	0.3	NW	1.1	NW	6:52	16.2	→	61	→		
6:55	0	-	0	-	6:57	13.6	→	74	→		
7:00	0	-	0	-	7:02	13.2	→	76	→		
7:05	0	-	0	-	7:07	12.8	→	79	→		
7:10	0.67	NW	3.3	NW	7:09	12.1	→	83	→		
7:15	0	-	0	-	7:17	12	→	84	→		
7:20	0	-	0	-	7:22	12.1	→	84	→		
7:25	0.74	NW	4.5	NW	7:26	12.1	→	82	→		
7:30	0.36	NW	0.9	NW	7:28	12.1	→	80	→		
7:35	0.91	NW	4.7	NW	7:34	12	→	77	→		
7:40	0.76	NW	3.1	NW	7:38	12.2	→	77	→		
7:45	1.14	NW	3.3	NW	7:47	12.1	→	76	→		
7:50	1.1	NW	4.7	NW	7:50	12.3	→	77	→		
7:55	2.64	NW	6.1	NW	7:56	12.2	→	76	→		
8:00	1.59	NW	3.7	NW	7:58	12.3	→	75	→		
8:05	2.41	NW	5.3	NW	8:05	12.7	↑	74	→		
8:10	4.03	NW	5.3	NW	8:08	12.8	↑	71	→		
8:15	3.04	NW	5.3	NW	8:13	13.1	→	70	↓		