*Getting to know the *&?$! (LDD / Gypsy) moth ….. and what to expect in 2022*

Friends of the Tay Watershed

February 24, 2022

Eric Boysen, New Leaf Forest Services

Webinar overview

- Quick review of moth history, life cycle, etc
- 2021: defoliation season recap
- 2022: what to expect depends on where you are
  - Monitoring and risk assessment
  - Defoliation prediction
  - Homeowner and woodlot owner options
  - Impacts on trees / forests – short term, and long term

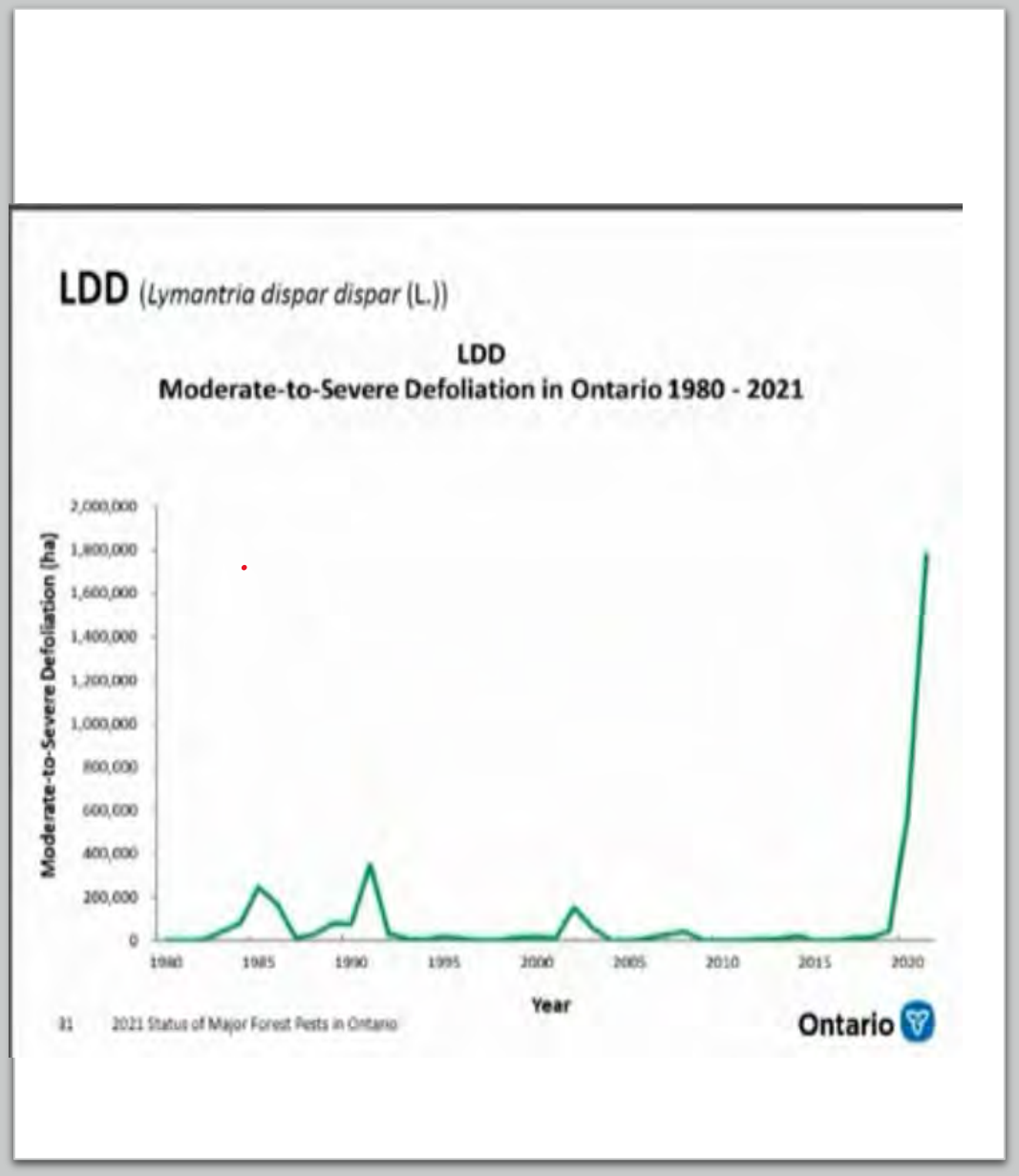
- Discussion / questions

First, what do we call it now?

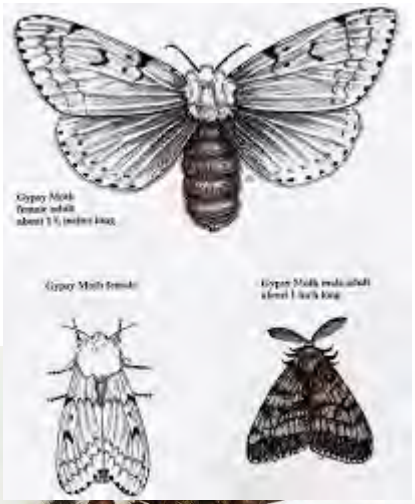
- Until recently, *Lymantria dispar dispar* was known as the Gypsy moth
- The American Entomological Society establishes common names for insects
- “Gypsy” was a culturally inappropriate term and needed to change
- LDD was used in the interim while a new common name was selected
- Meet the “Spongy Moth”

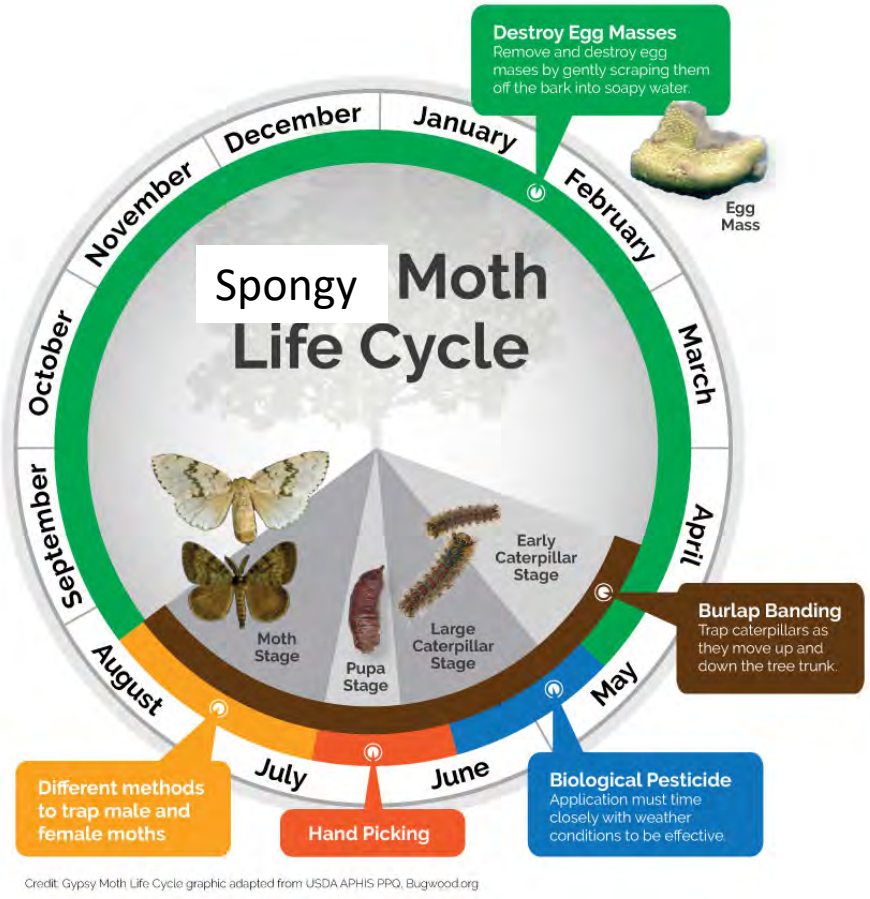
The moth in Ontario

- First detected in Ontario on Wolfe Island in 1969
- First outbreak commenced in 1981 near Kaladar. By 1985 had spread throughout south-eastern Ontario. MNR implements an aerial spray control program
- By 1996 moth larvae noted south of a line from North Bay to Sault Ste. Marie
- Outbreak peaks in 1985, 1991, 2002 with moderate to severe defoliation in Mississauga and Etobicoke in 2005, 2018
- Moderate to severe defoliation across 570,000 ha of southern and central Ontario in 2020
- **Expanded in 2021 to almost 1.8 million hectares**

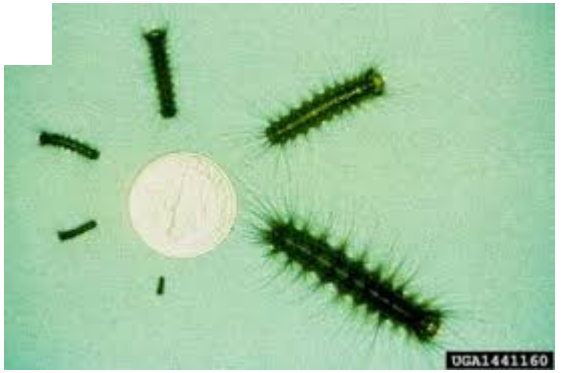


Annual Life Cycle





Credit: Gypsy Moth Life Cycle graphic adapted from USDA APHIS PPQ, Bugwood.org



Larval stages:

Males – 5

Females – 6

When did this new cycle start?

- Defoliation expanded into eastern Ontario in 2020 – took many by surprise
- But the population had been building before then, and southwestern and central Ontario had suffered beginning in 2018
- This overlapped with severe defoliation caused by Forest Tent caterpillar defoliation (2016 to 2019)

MNRF Defoliation Survey results 2019

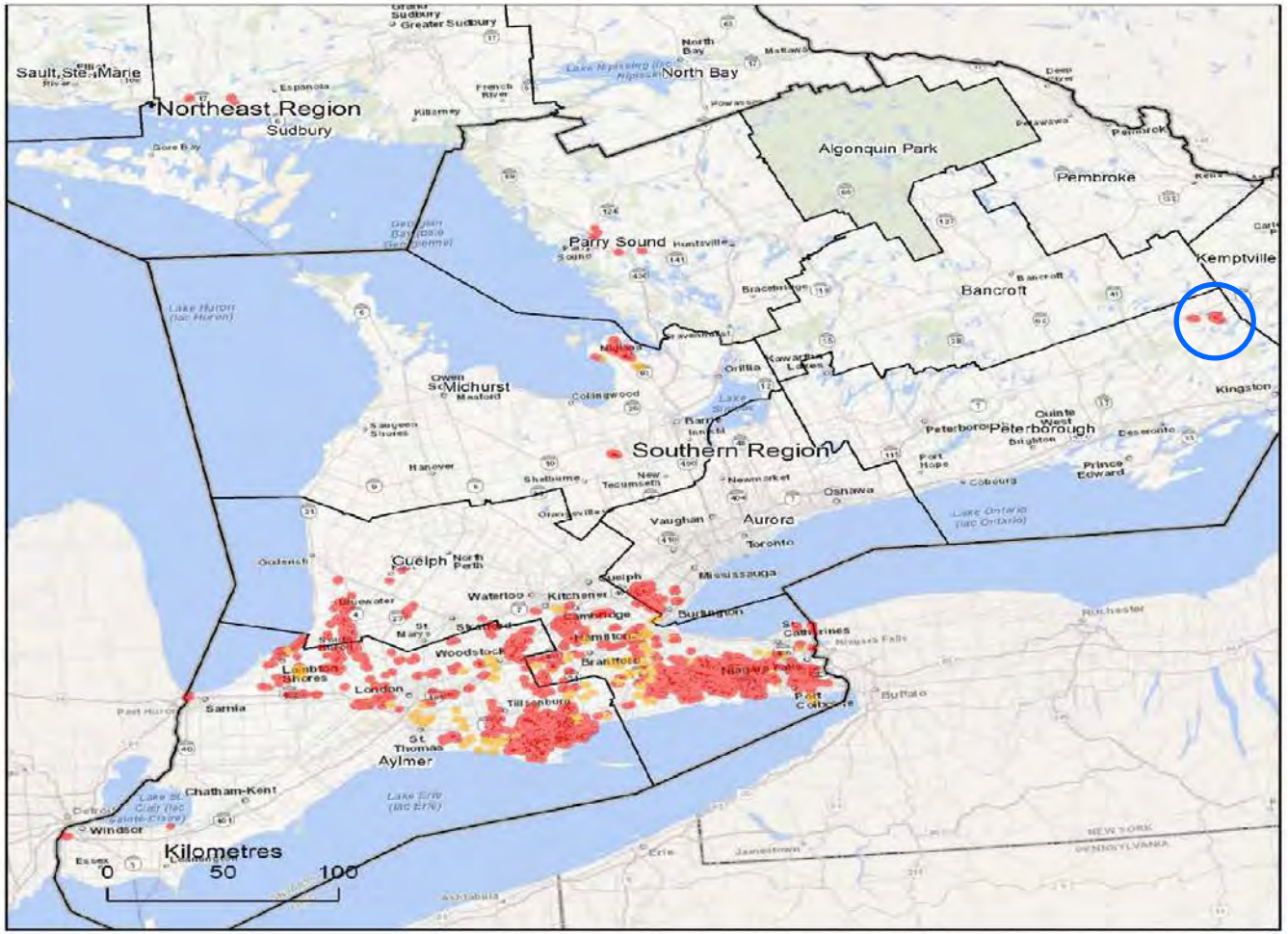
Gypsy moth 2019

Areas in the Ontario where gypsy moth caused defoliation

Light = 4,007 ha
Moderate to severe = 41,617 ha

Area of light defoliation

Area of moderate to severe defoliation



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MNRF Defoliation Survey results 2020

Gypsy moth 2020

Areas in Ontario where gypsy moth caused defoliation

Light = 17,002 ha
Moderate to severe = 569,465 ha

Area of light defoliation

Area of moderate to severe defoliation

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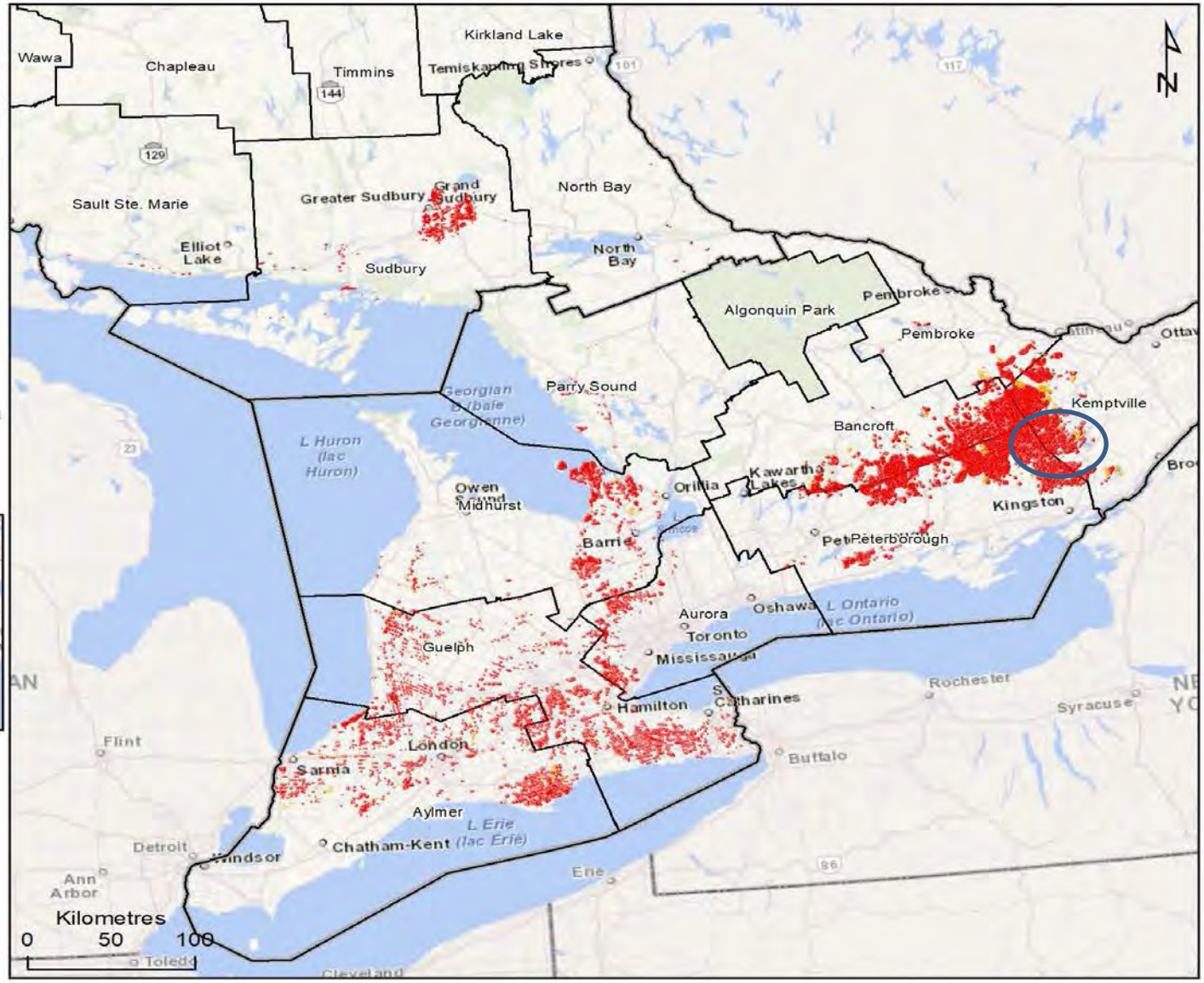
MNRF Science



MNRF Survey 2021 Prediction

Gypsy moth egg mass survey results

Defoliation forecast 2021

- Severe
- Moderate

Gypsy moth damage 2020

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

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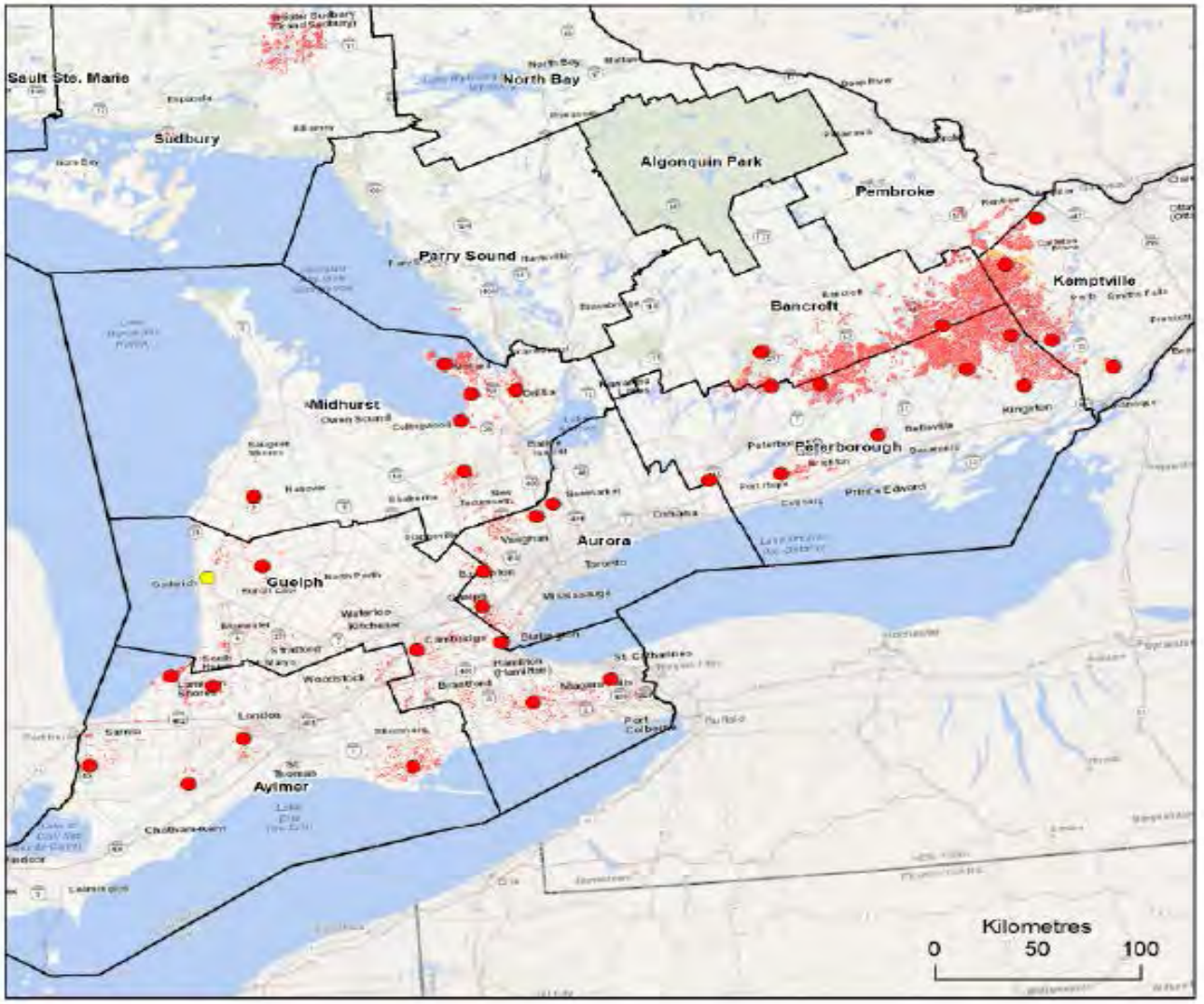

MNDMNRF Defoliation survey results 2021

Lymantria dispar dispar 2021

Areas in Ontario where Lymantria dispar dispar moth caused defoliation

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

Area of light defoliation

Area of moderate to severe defoliation

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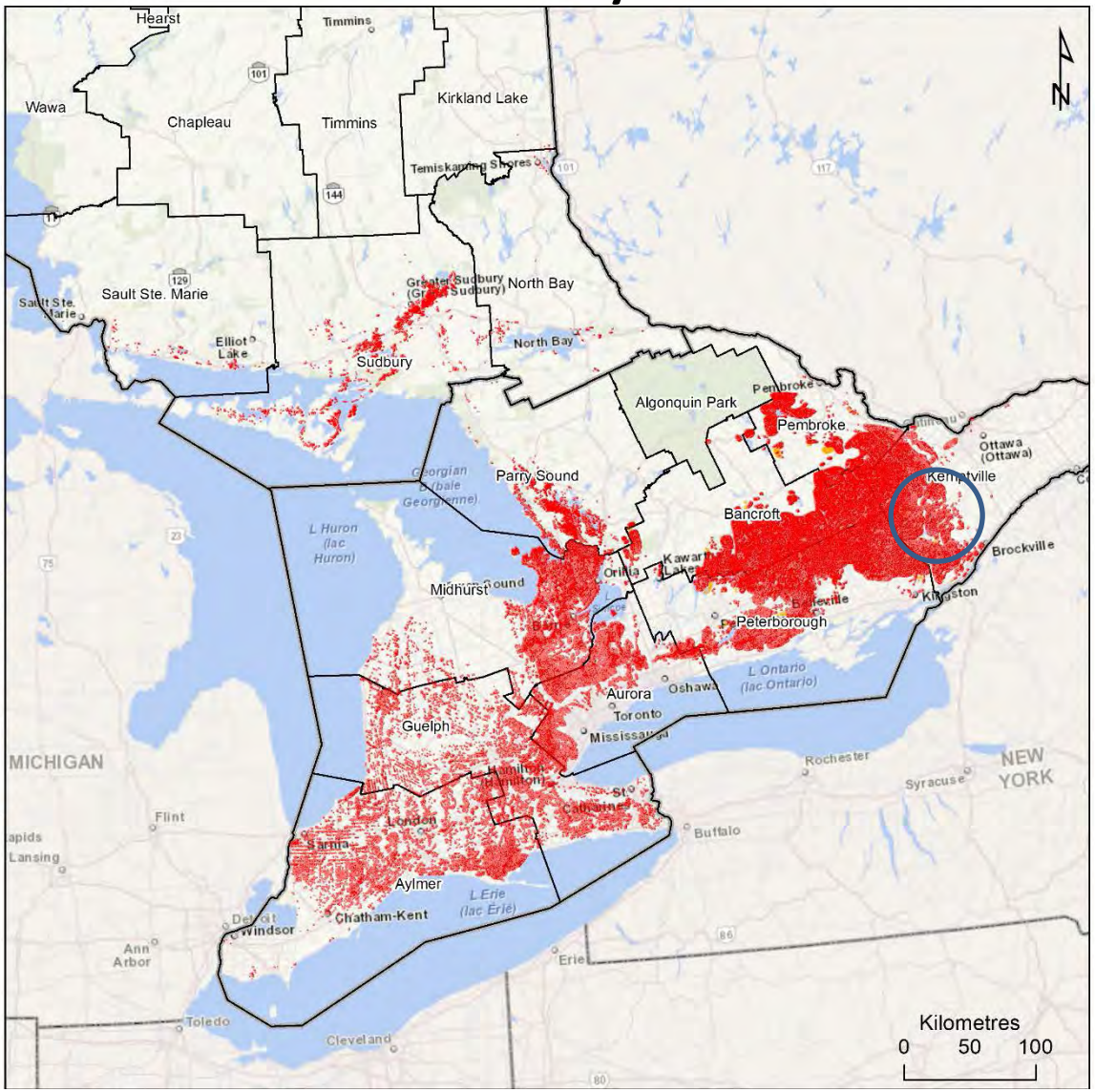


What makes Spongy Moth defoliation so bad?

- Size and impact of the population (each egg mass may contain 100 to 300 eggs)
  - Each larva can consume 1m² of foliage (do the math!)
- Defoliates many different species (in order of preference)
  - Hardwoods include oaks, basswood, cherry, fruit trees, poplars, white birch, elms, willow, sugar maple, beech, and even ironwood
  - Conifers include white pine, white and blue spruce, balsam fir, hemlock, larch
  - Also likes shrubs and garden plants

Trees that the Spongy Moth will defoliate

Most Preferred	Preferred	Seldom Attacked
Aspen (*populus*)	Alder (*Alnus*)	Arborvitae (*Thuja*)
Apples and crabapples (*Malus*)	Balsam fir (*Abies*)	Ash (*Fraxinus*)
Birches (*Betula*)	Black walnut (*Juglans*)	Azalea (*Azalea*)
Blue spruce (*Picea*)	Butternut (*Juglans*)	Black locust (*Robinia*)
American beech (*Fagus*)	Cherry (*Prunus*)	Catalpa (*Catalpa*)
Basswood (*Tilia*)	Eastern hemlock (*Tsuga*)	Dogwood (*Cornus*)
Hawthorn (*Crataegus*)	Easter redbud (*Cercis*)	Eastern redcedar (*Juniperus*)
Hazelnut (*Corylus*)	Elm (*Ulmus*)	Honey locust (*Gleditzia*)
Oaks (*Quercus*)	Hickory (*Carya*)	Horsechestnut (*Aesculus*)
Poplar (*Populus*)	Hophornbeam (*Ostrya*)	Lilac (*Syringa*)
Sweetgum (*Liquidambar*)	Maples (*Acer*)	Rhododenron (*Rhododendron*)
Serviceberry (*Amelanchier*)	Paw Paw (*Asimina*)	Tuliptree poplar (*Liriodendron*)
Mountain ash (*Sorbus*)	Plum (*Prunus*)	Viburnum (*Viburnum*)
Witch hazel (*Hamamelis*)	Sassafrass (*Sassafrass*)	
White pine (*Pinus*)	White and Norway Spruce (*Picea*)	

What makes Spongy Moth defoliation so bad?

- Is a “late season” defoliator, meaning it does not finish feeding until early to mid-July
  - Hardwoods may re-foliate if environmental conditions are favourable, but this coincides with the summer heat and drought, and uses valuable starch reserves = stressed trees
  - Conifers can not re-foliate, and may die
- Few natural predators
- Nuisance and human health issues

Human Health Impacts - Rash:

- Each caterpillar sheds its bristly skin four or five times as it grows, and the skins pile up.
- The bristles may become airborne and irritate human eyes, skin and respiratory systems, or you can come into direct contact.
- Many people develop a rash similar to poison ivy
- https://www.poison.org/articles/caterpillar-stings

Photo Credit: Andrew Combes, https://www.orilliamatters.com/local-news/gypsy-moth-invasion-leaves-locals-scratching-their-heads-3821676

Nuisance

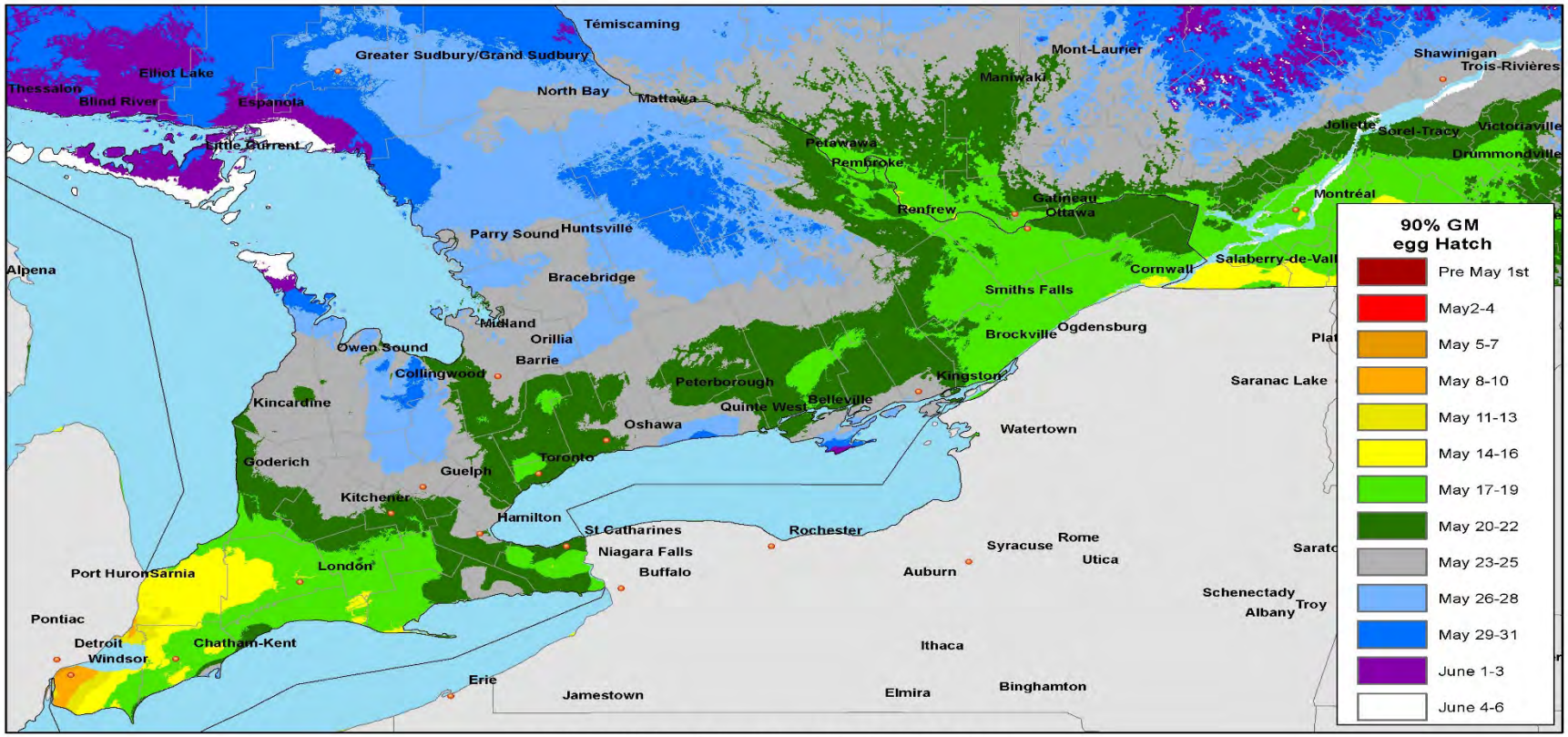
- Frass (caterpillar droppings) can accumulate on decks and patio furniture
- Like any other excess nutrient, droppings get into runoff water and into the local watershed.

Getting ready for 2021 (and 2022)

- Egg mass scraping / removal
  - Lots of people spent considerable time scraping egg masses from October to April
  - Some tried Dormant Oil spray, torching, vacuuming
  - Remove and destroy the eggs, don't just scrape them onto the ground
- Over-winter egg mass mortality?
  - No evidence that the brief period of -20°C temps had any impact
  - Some egg predation by small birds,
  - A species of wasp (*Ooencyrtus kuvanae*) also parasitizes egg masses
- Preparing to Spray
  - Small scale – sourcing BTK or other pesticides
  - Large scale – working with licenced applicators

The hatch begins

- The hatch of egg masses is dependent upon accumulated heat – eggs hatch when there are leaves to feed upon



2021 90% Gypsy Moth Egg Hatch

BioSIM map based on 90% GM egg hatch
Source: Environment Canada daily weather data as of
Monday, April 19, 2021 and 30-year climate normals (1981-2010).

0 180 360
Kilometers

BioForest

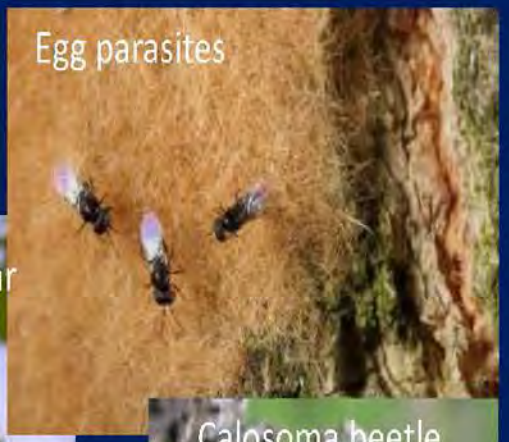
N W E S

The 2021 defoliation timeline in Maberly, Ontario

- Earliest hatching noted in mid-April – likely egg masses on the sides of buildings heating up prematurely …. Then it snowed!
- May 4 - Most egg masses in the forest began to hatch by (10%)
- **May 14 - 90 % hatch. Oak 50% elongated leaves**
- May 16 – first instar crawling everywhere
- **May 17 – full dispersal – hot & dry, SW winds to 30 kph**
- May 21 – first moulting – reports of GM rash
- May 22 – basswood full leaf extension – GM feeding immediately in crowns
- **May 25 – cool morning, winds 13 kph, RH 74% - heard spray helicopters**
- May 29 – frost in A.M. – LT aspen still emerging, but being defoliated before leaves expands. First signs of NPV!!
- **June 1 – third instar for most, but seeing 1st, 2nd, 3rd and 4th instars**
- June 3/ 4 – RAIN!! Larvae descending from crown and crawling over everything again
- June 10 – peak 4th instar
- **June 18 to 25 – rains coincide with mass die-off of maturing caterpillars by both fungus and virus**

Outbreaks collapse from:

- Cold temps < -20C
- Starvation, competition
- Host tree induced defenses
  - Tougher, less nutritious leaves
- Predation, parasitism
- NPV (nucleopolyhedrosis virus)
  - Density dependent mortality
  - Greater effect at higher populations
- Fungus *Entomophaga maimaiga*
  - Density independent mortality
  - Greater effect in wet cool spring weather



Entomophaga maimaiga

Gypsy moth virus NPV

Upside down V

Planning for 2022

Step 1: Do your own risk assessment

- Egg mass counts
- Consider Forest / individual tree health impacts
- Value / costs
- Impacts on your management objectives
- Scale (tree level vs forest level protection)

Step 2: Consider management options and tactics

Step 3: Plan and implement

- Can you do it alone, or do you need help?

Forecasting defoliation Egg Mass Sampling

- To predict LDD moth defoliation, use a Modified Kaladar Plot (MKP) protocol at select locations across the defoliated area.
- The total number of egg masses per hectare is used to forecast LDD moth defoliation for the following year:
  - severe defoliation (more than 75% of forest stand) is projected in areas with more than 6,175 egg masses per hectare
  - moderate defoliation (40% to 75% of forest stand) is projected in areas with 1,236 to 6,175 egg masses per hectare
  - light defoliation (1% to 40% of forest stand) is projected in areas with 1 to 1,235 egg masses per hectare
- **In terms of individual susceptible trees, 5 to 8 egg masses per tree could result in 40% + defoliation**

Lymantria dispar dispar egg mass survey results

Defoliation Forecast 2022

- Severe
- Moderate
- Light

Lymantria dispar dispar defoliation 2021

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

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Kilometres
0 50 100

2022 LDD forecast

Defoliation in 2022 is forecast to be:

- **Severe** in parts of Aylmer, Guelph, Parry Sound, Bancroft, and Pembroke districts
- **Moderate** in parts of Aylmer, Parry Sound, Bancroft, and Pembroke districts
- **Light** in parts of Midhurst District

Lymantria dispar dispar egg mass survey results

Defoliation Forecast 2022

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Lymantria dispar dispar defoliation 2021

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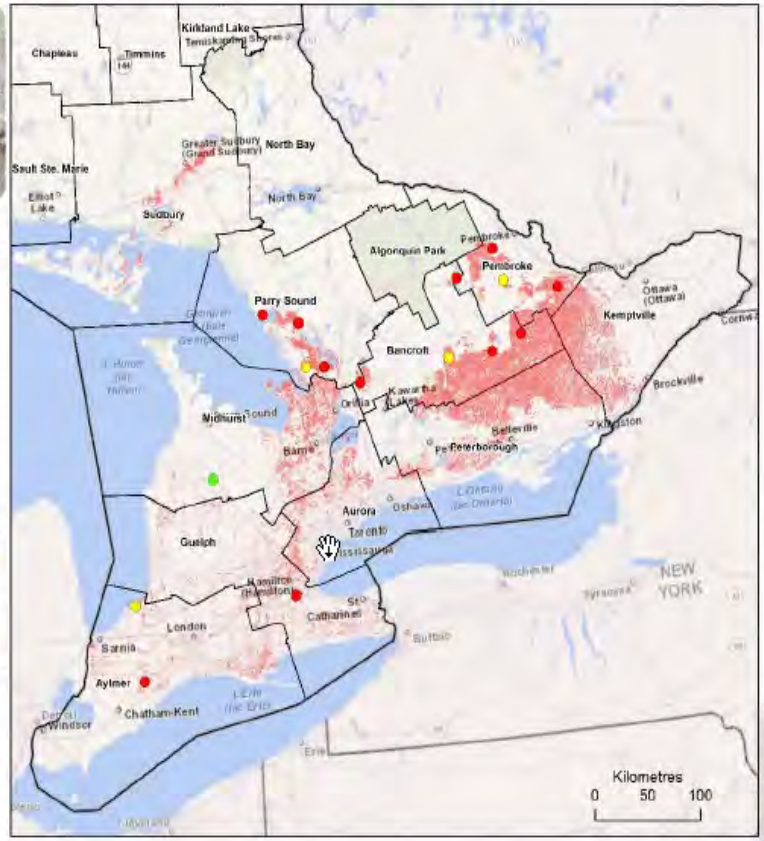

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Management and Control Options

1. Do nothing
   - Wait for the population to collapse from natural factors
2. Take local, small scale actions
   - Intervene at all life stages
   - Trap, remove, destroy accessible larvae and pupae as they develop
   - Protect special trees (ie close to the house, unique species, other tree health issues, etc)
   - Water your trees well during and following defoliation to reduce overall stress
   - Collect and destroy eggs

Lymantria dispar dispar (LDD) moth life stage and control options

timing	life stage	control options
1 — August to mid April	 **egg masses**	Remove egg masses and discard
2 — Mid-April to mid-May	 **early stage caterpillar**	Apply biological pesticides
3 — Mid-May to June	 **late stage caterpillar**	Attach burlap bands and discard larvae
4 — June to mid-July	 **pupae**	Remove by hand and discard
5 — July to August	 **adult moth**	Short lived; focus on other stages

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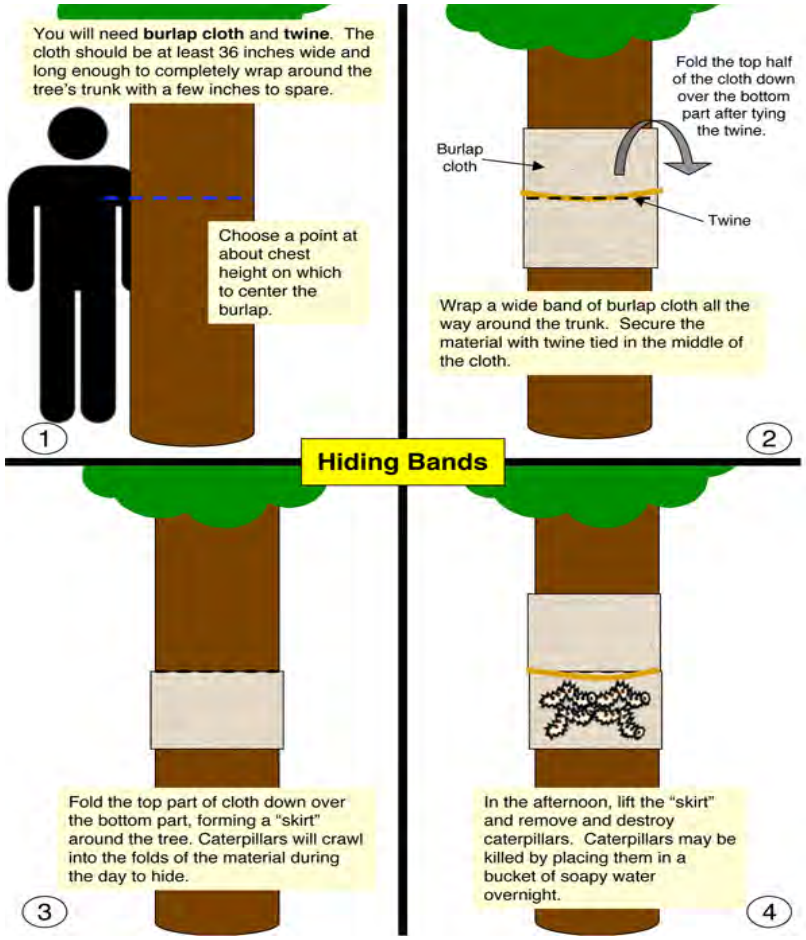



BTK
Safer's
BIOLOGICAL INSECTICIDE
INSECTICIDE BIOLOGIQUE
CONCENTRATE/CONCENTRÉ
CONTROLS CATERPILLARS
COMBAT LES CHENILLES
GUARANTEE: Bacillus thuringiensis subsp. kurstaki, strain ABTS-51. Potency: 10,600 Cabbage Looper Units (CLU)/mg of product (equivalent to 10 billion CLU/kg) The potency measurements are not internationally standardized • Warning: contains the allergen sulfites • REG.NO. 24536 P.C.P. ACT • READ THE LABEL BEFORE USING • KEEP OUT OF REACH OF CHILDREN • DOMESTIC
NET CONTENTS
CONTENU NET
100mL
LBL172110F-5 0215
GARANTIE : Bacillus thuringiensis, sous-espèce kurstaki souche ABTS-51. Puissance: 10 600 Chou unités Looper (CLU) / mg de produit (ce qui équivaut à 10 milliards de CLU / kg) Les mesures ne sont pas la puissance normalisé au niveau international • Avertissement: contient l'allergène, sulfites • N° D'ENR. 24536 LOI P.A.
LIRE L'ÉTIQUETTE AVANT L'EMPLOI
GARDER HORS DE LA PORTÉE DES ENFANTS
DOMESTIQUE
Woodstream Canada Corporation, 25 Bramtree Court, Unit 1, Brampton, ON L6S 6G2 • 1-800-800-1819

Pesticide options

BTK - *Bacillus thuringiensis kurstaki*

- Biological, certified organic
- Specific to larvae of moths and butterflies
- Best applied to early stages of larvae development
- The choice of most homeowners and applicators
- Formulations include Foray 48B, Dipel

Mimic® 240LV is an insect growth regulator (IGR) that was developed to control specific caterpillar pests that defoliate trees and forests. The active ingredient of **Mimic 2LV/ Mimic 240 LV** is tebufenozide (not available to the homeowner).

Sevin® brand carbaryl insecticide provides broad-spectrum control of dozens of important pests including beetles, weevils and worms in tree fruit, nut, vine, citrus vegetable and other crops (not available to the homeowner).

Disparvirus is a multiple nucleopolyhedrovirus (MNPV) preparation for the biological control larvae of the gypsy moth larvae. It was developed in Canada by the CFS and MNR, but is not available to the homeowner

Others - Pyrethrins , permethrins, Malathion

READ THE LABLE AND USE APPROPRIATELY!!!

Aerial Spraying Option

- CONTACT SPRAY COMPANY EARLY
- COMMIT EARLY

- MARCH 1 DEADLINE
- ALLOWS FOR TIMELY MAPPING &
- PESTICIDE PROCUREMENT
- PROGRAM SETUP/PLANNING

CONTACT INFORMATION
March 1, 2022 Deadline

Ontario Centre for Forest Defoliator Control

- P.O. Box 98
- Chatham, Ontario N7M 5K1
- **https://www.ocfdc.com/**

1-888-276-9372 Toll Free
226-996-9702
Email info@ocfdc.com

Ontario Centre for Forest Defoliator Control
OCFDC

Defoliation / Re-foliation examples

Basswood – end of June

Mid-July

Defoliation / Re-foliation examples

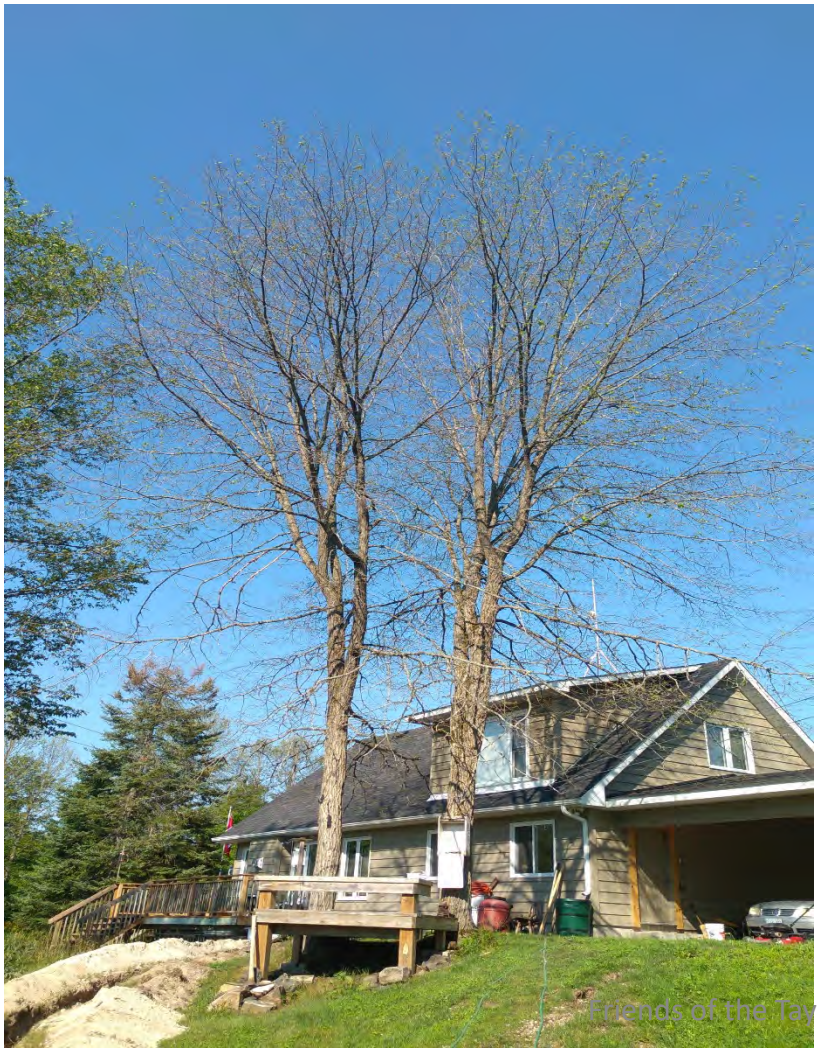
Sugar Maple – end of June

Mid-July

End of August

Defoliation / Re-foliation examples

Rock Elm – early July



End of August

Defoliation / Re-foliation examples

White Pine – two year and older needles consumed – no recovery. Two years of defoliation in a row will cause tree to die

Watch your trees ..

- Monitor the short and long-term impacts on your trees / forests – some trees will die, or suffer crown loss

Red oak – 1.0 m DBH

White spruce – 30 cm DBH

Final thoughts and actions ..

- Think longer term – cumulative impacts of drought, climate change, other insects and diseases
  - Pay attention to other invasive species, and report / control as possible
  - Use EddMaps (https://www.eddmaps.org/ontario/) or Community Science Tree Check Form (https://www.invasivespeciescentre.ca/take-action/community-science/)
- Work together
  - With your neighbours
  - At a municipal level
  - At a woodlot association level
- If you are thinking about aerial spraying, sign up early
  - If you do get sprayed, monitor the results

Acknowledgements and References

Thanks to:

- Invasive Species Centre, SSM
- MNDNRF Forest Health Monitoring Program
- Dr. Taylor Scarr, CFS, SSM
- Zimmer Air Services, Blenheim
- BioForest, SSM
- Google

Useful References:

- https://www.youtube.com/watch?v=iySrjRHyrCw **June 10, 2021 Gypsy Moth Webinar**
- https://www.youtube.com/watch?v=U4BZOM8GtyU **Dec 1, 2021 Gypsy Moth Webinar**
- https://www.invasivespeciescentre.ca/invasive-species/meet-the-species/invasive-insects/gypsy-moth/
- https://www.ontario.ca/page/lymantria-dispar-dispar-ldd-moth
- https://www.ontario.ca/page/forest-health-conditions#section-1