Committee of Whole

Meeting Date: **August 10, 2021**

Submitted by: **Mark Brown, Woodlands Conservation Officer/Weed Inspector**

SUBJECT: **LDD MOTH (EUROPEAN GYPSY MOTH)**

BACKGROUND:

At the July 13th 2021 meeting of County Council a presentation was made concerning LDD Moths within the County Forest. A motion passed by Southwest Middlesex Council concerning the infestation of gypsy moths in County owned woodlots was also on the agenda. The motion stated:

> "*THAT neighbouring counties, cities and municipalities, as a result of infestation of the gypsy moth, have taken action against the spread by doing spray programs; and*
>
> *THAT Southwest Middlesex has 2100 acres of County owned woodlots within the municipality and as such are recommending that Middlesex County initiate a County wide spray program to control the gypsy moth infestations*."

The County owns and manages the County Forest which consists of 2500 acres (1040 hectares) within 27 tracts. The County Forest is located within three geographic areas: the Dorchester Swamp, the Big Swamp, and the Skunk's Misery / Bothwell Forest Complex. The largest component of the County Forest is the Skunk's Misery / Bothwell Forest Complex which is located within Southwest Middlesex. The County Forest represents 2.7% of the woodlands within the County and 12.3% of the woodlands within Southwest Middlesex. It is the understanding of staff that the Southwest Middlesex Council motion is intended to refer to all County-owned woodlands and not privately owned woodlands.

County Council has adopted a 'Protection and Enhancement of Tree Canopy and Natural Vegetation Policy' (Legislative Policy 4.01) that includes a number of initiatives that, cumulatively, protect and enhance the tree canopy and natural vegetation within the County including the sustainable management of the County-owned Forest.

Council has established the following Vision for the County Forest:

> "*The Middlesex County Forest will be managed to ensure the ecological sustainability of the Middlesex County Forest and their associated natural heritage features and social and economic values through the utilization of an integrated ecosystem-based approach to management*."

This report provides background concerning the LDD Moth and its life cycle, outbreaks within Ontario, potential impacts within rural and urban settings, natural controls, management options, a select jurisdiction review, observations from the County Forest, and recommends that the County utilize a passive management approach.

ANALYSIS:

Introduction

The LDD Moth (*Lymantria dispar dispar*) (also known as the European Gypsy Moth) is a non-native insect from Europe that was introduced to North America in the 1860s. The insect has spread widely in areas across the Great Lakes Basin where Oak is found, its preferred host tree species, in both rural and urban ecosystems. The LDD moth prefers approximately 150 primary hosts but feeds on more than 300 species of trees and shrubs including: Aspen, Birch, Cedar, Cottonwood, Fruit trees, Larch, Oak, Poplar, and Willow.

The insects' population dynamics can best be described as boom and bust, where often every 8-12 years, the population within certain areas will reach epidemic proportions only to collapse again and remain at endemic levels for another eight years or so. LDD moth outbreaks may appear suddenly and may continue for two to five years in a location. The boom cycle makes LDD moth outbreaks more noticeable than other insect infestations.

During a population outbreak, the caterpillars in very large numbers can be observed feeding within trees, defecating, and dangling from silk threads. The LDD population is influenced by a complex combination of factors such as precipitation levels, temperatures, predation, parasites, and pathogens; making it difficult to predict future populations.

While LDD moths are considered an invasive species, the species has evolved to a state of naturalization and as such the Canadian Food Inspection Agency (CFIA) does not otherwise attempt to treat, control, or eradicate the LDD moth. As this insect is well established and widely spread within Eastern Canada, the CFIA only utilizes phytosanitary regulations for import and export of materials that could inadvertently export the pest to other locations where it is not yet established.

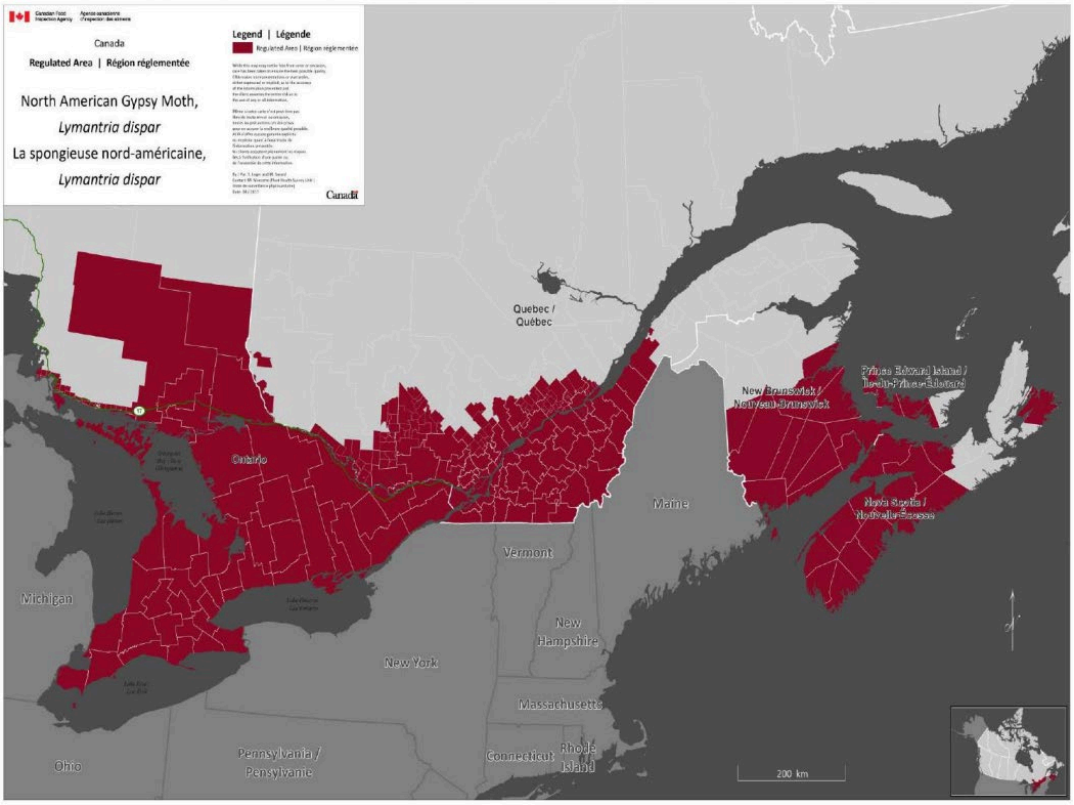


Figure One - CFIA Regulated Area and LDD Moth Habitat within Canada

LDD Moth Life Cycle

The LDD moth has four distinct life cycle stages:

- egg – usually laid on or near the host tree
- caterpillars – emerge in late spring (early May) and climb the tree to feed
- cocoon – mid July to early August caterpillars cocoon
- moth – mid to late August, adult moths emerge from cocoons and reproduce

The LDD moth has many preferred egg-laying sites:

- In bark cavities, under loose bark, and in bark crevices
- On branches, on the ground or on the underside of any type of ground litter
- On logs, including firewood
- On outdoor household articles such as birdhouses and picnic tables
- On stone walls and in the crevices of stone walls
- On the underside of rocks not tight to the ground
- On tree trunks in sheltered spots, such as under limbs
- Under the siding and eaves of buildings
- Egg masses may be found anywhere near trees in areas with preferred hosts.

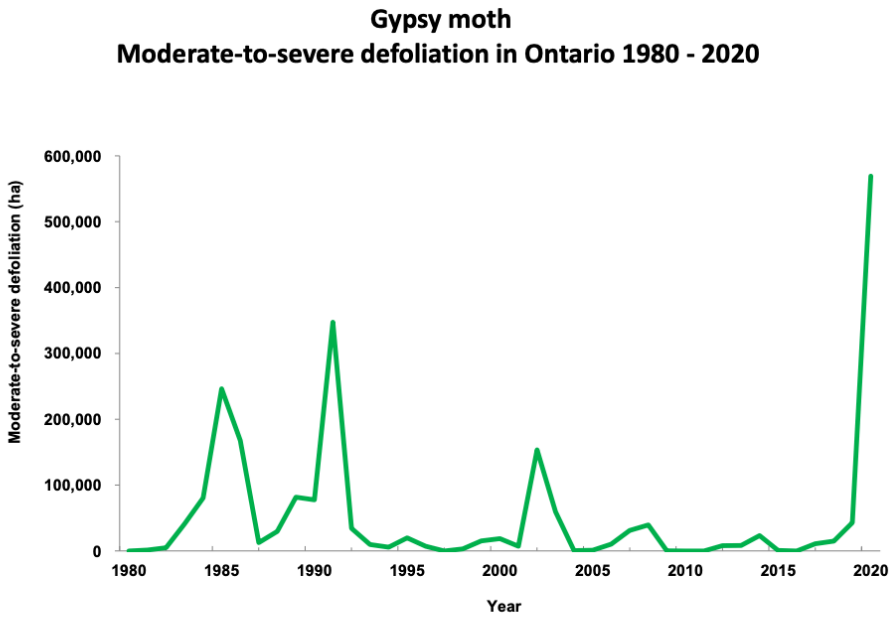
Outbreaks in Ontario

The Ministry of Natural Resources and Forestry (MNRF) monitors forest health through annual ground and aerial surveys that map major forest health disturbances. When pest populations reach outbreak level, MNRF also completes specific forecast surveys to help predict defoliation in future years. Ministry surveys show last year's LDD moth defoliation more than doubled from previous levels.

The Ministry of Natural Resources and Forestry has noted that several caterpillar species often feed alongside of each other and that they cumulatively have an impact on woodlands. For example, the Forest Tent Caterpillar causes significant defoliation within Ontario and is often mistaken for the LDD Moth. Figures Two, Three, Four and Five provide some background from the Ontario Ministry of Natural Resources and Forestry related to LDD outbreaks within the Province.

Over the past two years, forestry staff has been made aware of several localized population outbreaks within Middlesex County, primarily in the Campbellville, Kilworth and Dorchester areas, where residents have voiced concerns relating to the impact on their properties, tree health, nuisance, etc. During the 2021 season, overall the County is receiving fewer complaints than in previous years but an increase in complaints across Southwest Middlesex including in relation to the County Forest.

Gypsy Moth (*Lymatria dispar* (L.))



Ontario

Figure Two – LDD Moth Defoliation in Ontario 1980 – 2020

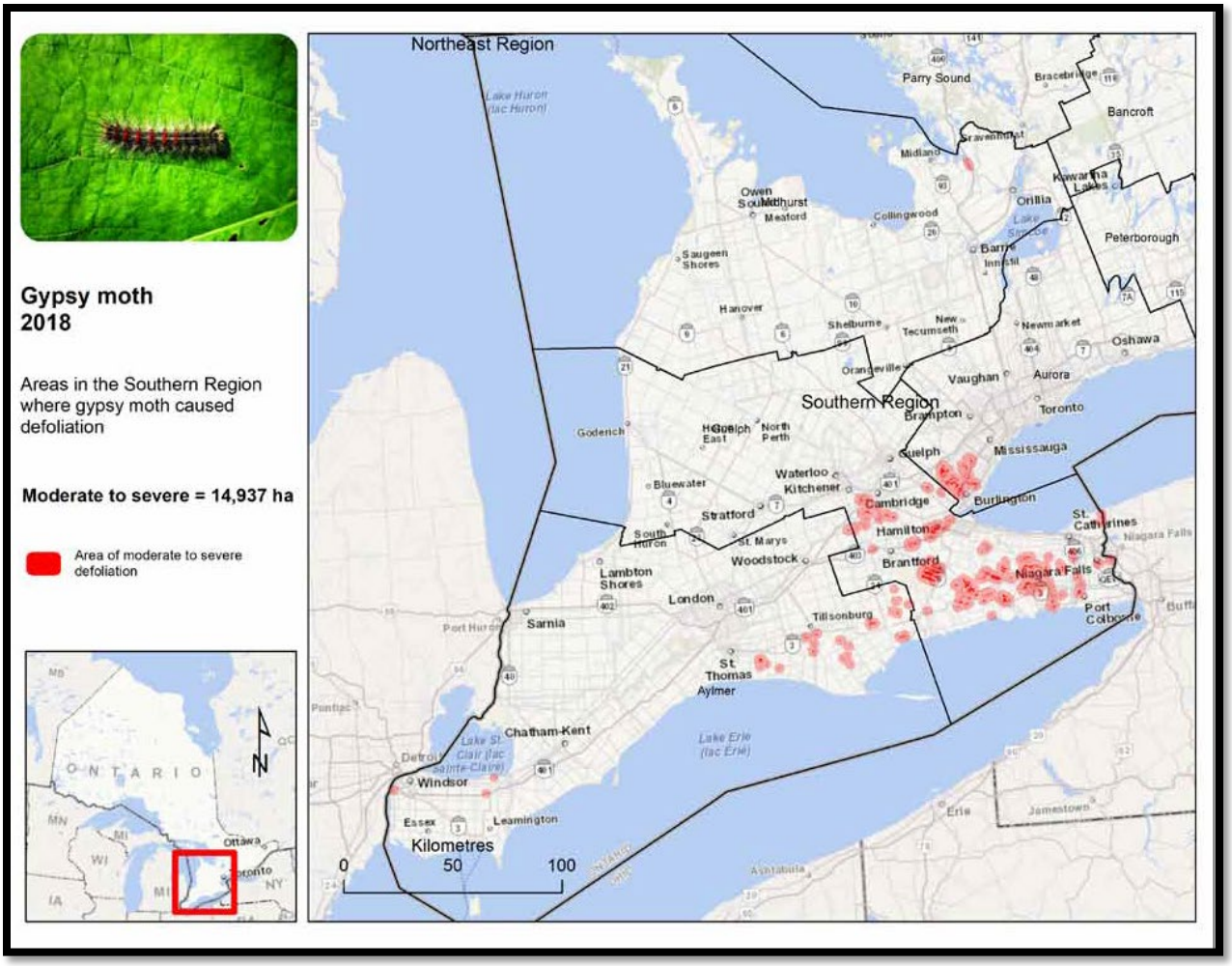


Figure Three – LDD Moth 2018 Defoliation

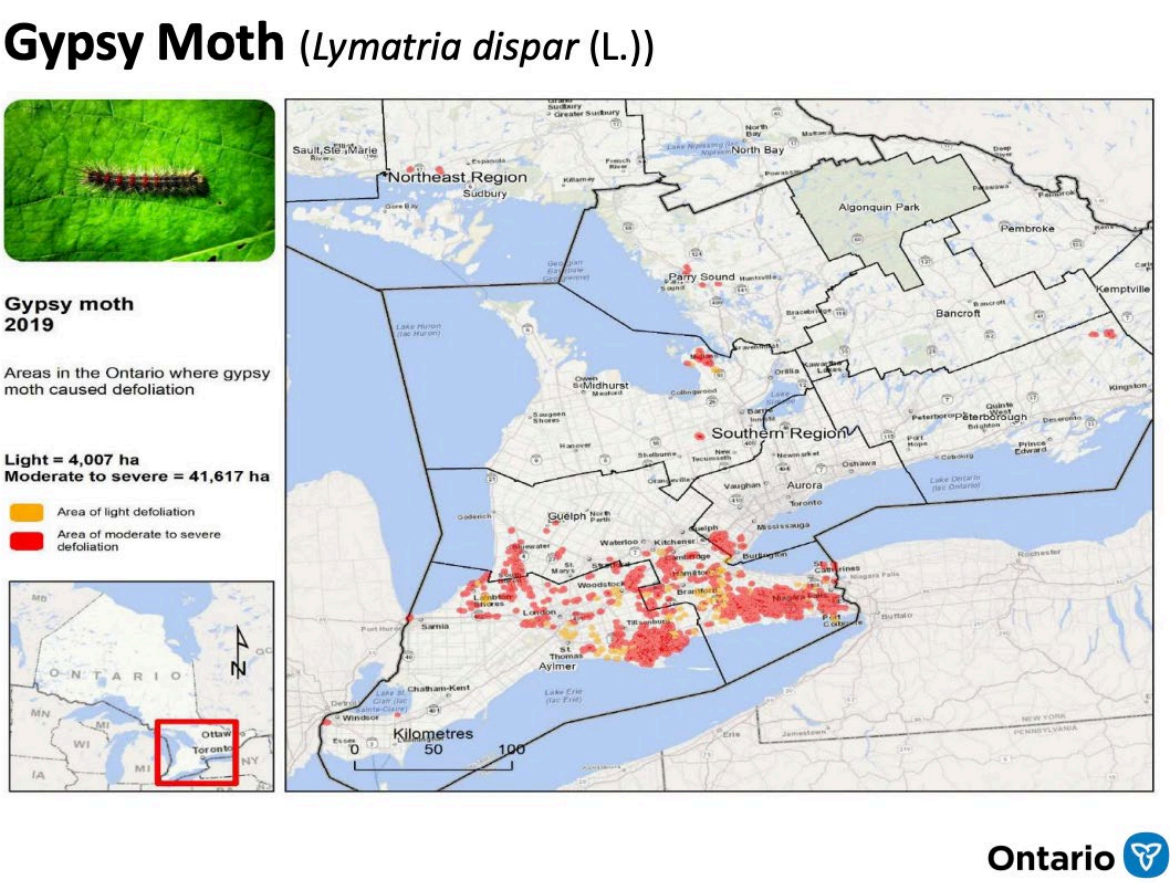


Figure Four – LDD Moth 2019 Defoliation

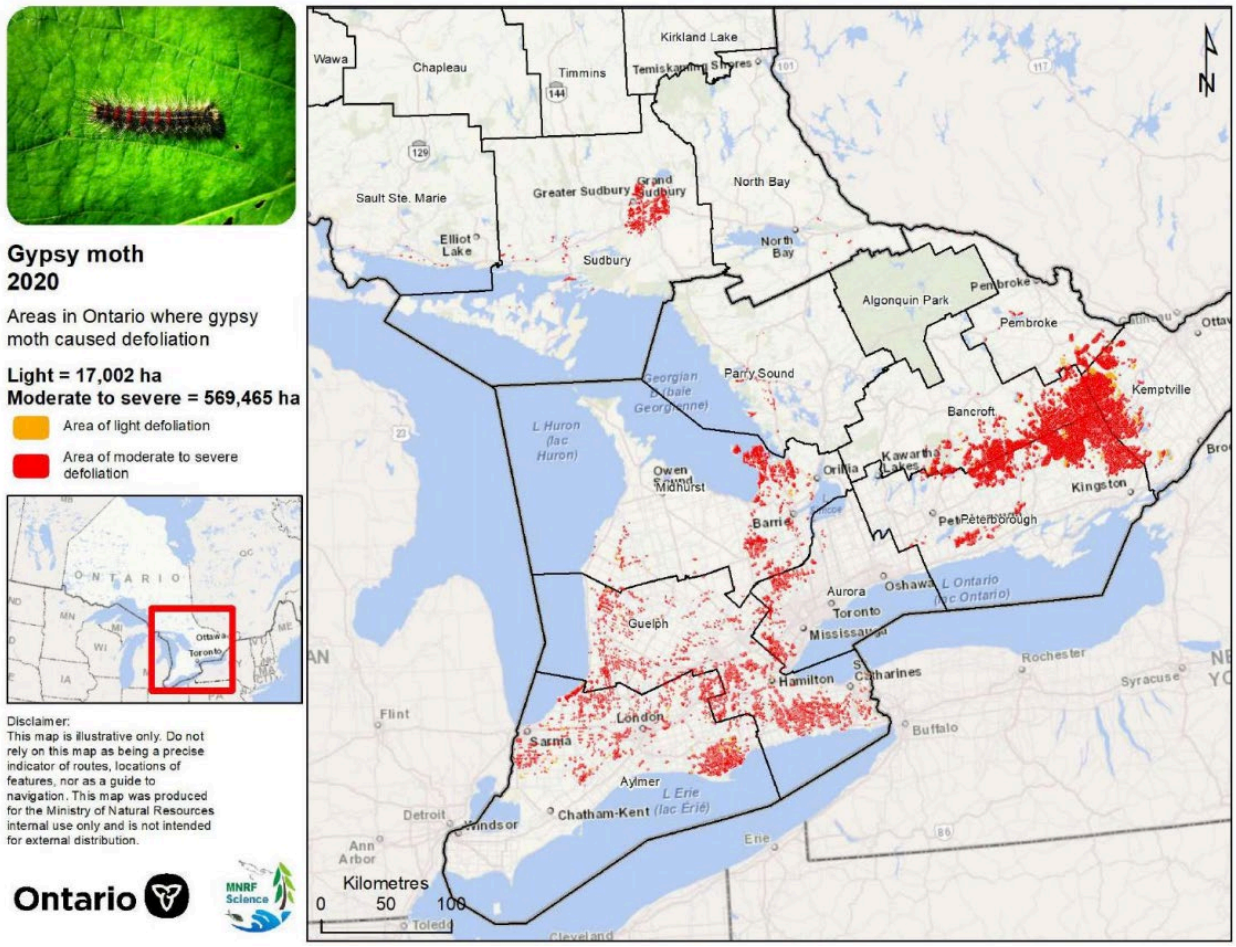


Figure Five – LDD Moth 2020 Defoliation

Tree Damage Rural Woodlands

When the insect population dynamics are at their peak, LDD caterpillars can defoliate its host tree canopy severely and sometimes even completely. However, the oak genus being a very long-lived tree, is relatively resilient and well adapted to threats of defoliating insects and diseases. As a result, most often, healthy trees will replace the leaf loss experienced in spring defoliation events later in the year with new leaf canopy in order to perpetuate annual growth and development with little adverse impact. If significant defoliation occurs in successive years the trees energy stores can be depleted causing branch or crown dieback and even some tree mortality, usually in connection to other stressors such as drought.

Natural rural forests growing in relatively undisturbed woodlands tend to consist of increased species diversity and support greater numbers of insect predators, thereby possessing more resilience to disturbance events. Overall, within Middlesex County LDD defoliation has not been observed as a significant tree mortality issue to date within undisturbed rural forests. It is noted that unlike an invasive species like the emerald ash borer (EAB), LDD moths have not been found to destroy their host trees on the landscape level.

Natural disturbance regimes such as wind, ice storms, and insect outbreaks play a role in forest ecology by changing the structure and diversity within a forest, creating habitat for wildlife that use tree cavities and eat decaying trees, also the creation of small, medium or large gaps in the forest canopy through dieback or tree mortality can make room for new plants and trees to grow. Shade intolerant trees growing in the understorey for many years or even decades are often the benefactors of such changes.

Tree Damage Parkland / Urban Woodlands

In contrast to trees within a rural setting, trees in urban settings are typically exposed to additional environmental stressors such as drought, altered hydrology, compacted soils, fragmentation, pesticides, air pollutants, and fewer natural insect predators. These additional stresses can expose urban forest, parkland trees, boulevard trees, and private yard trees to an increased level of damage as they may have limited resources to draw from during the recovery phase following defoliation.

The more severe local occurrences of infestation and defoliation appear to have been associated with small urban or near urban trees and woodlands, particularly if they have become fragmented and disturbed through development or other factors. As a result, isolated groves of host trees either scattered throughout a development or retained in a small urban park setting tend to become the concentrated focus for the resident LDD moth population. As the population increases, they cause an increased level of defoliation in the infested area.

The adult females cannot fly so they are limited to drifting on air currents on silk threads. Therefore, unless they are situated in a large contiguous forest they cannot spread and travel to find new food sources, and as a result, defoliation can become severe in a concentrated area of host vegetation. The impact on nearby residences is more pronounced within an urban context.

Natural Controls

Despite this insect being introduced in North America it has four significant natural enemies:

1. a fungus (Entomophaga maimaiga)
2. a virus (Nucelopolyhedrosis)
3. a small wasp (Encyrtidae family)
4. predation by birds and animals

The fungus and virus can be very effective at naturally controlling populations; however, they generally require a cool wet spring to be effective. The wasp can parasitize up to 30% of the eggs that are near the surface of an egg mass, but cannot reach the eggs in the center of the mass. In addition, birds, bats and several mammals predate the species at various stages of their life cycle.

Intervention Methods

Natural population control factors most often combine to cause a collapse of LDD moth outbreaks. However, consecutive years of the LDD outbreak can cause defoliation which can lead to branch, crown dieback and in extreme situations tree mortality and intervention may be considered. Intervention within urban settings in order to reduce the nuisance for residents is also common. Control of populations should ideally take place as part of an integrated pest management plan.

Any LDD moth program should aim to control outbreak levels of LDD moths in areas where trees are potentially at risk of severe defoliation or mortality if no action is taken. It should be reiterated that the eradication of LDD moths is not a realistic management objective since it is well established in the Great Lakes Basin. The objective of any program would be to reduce the number of caterpillars to a level where they will not defoliate the preferred hardwoods and make them susceptible to other stresses until the LDD population naturally subsides.

The following control measures are commonly utilized:

- Egg mass scraping in the fall and winter can significantly reduce the population in the following years.
- Placing burlap wraps around trees to trap and dispose of the caterpillars climbing up the trees to feed.

- Placing sticky banding around the stems of trees to trap caterpillars climbing up the trees to feed (note that MNRF have cautioned that such measures can impact species at risk such as the Gray Ratsnake).
- Pheromone Traps/Lures - The female adult moth does not fly; therefore, they cannot be trapped, but the male adult moths can be trapped with the use of female sex pheromone traps. Although the traps are commercially advertised as a control method, research (including the City of Toronto) suggests that traps are more relevant to monitoring for the presence of the insect rather than to be considered for use as a control method.
- TreeAzin – high value specimen trees can be injected with this pesticide formula, which, when ingested by the caterpillar, halts its growth and leads to mortality.
- Ground based spraying - high value trees in accessible locations can be sprayed with either Bacillus thuringiensis subspecies kurstaki (Btk) or Nucleopolyhedrovirus for gypsy moth larvae – that is, Lymantria dispar multicapsid nucleopolyhedrovirus (LdMNPV).
- Aerial Spray Program - for high-risk areas, an aerial spray program may be considered when LDD moth outbreaks are severe and widespread across large areas of dense usually oak-dominated forests. BTK is the most common aerial application insecticide although other products such as Nucleopolyhedrovirus for gypsy moth larvae (LdMNPV) may be available.

It is noted that the LDD moth most often travels by hitching a ride on human modes of transport, vehicles, travel trailers, household items, firewood, ATV, etc. It is therefore extremely important that homeowners do not inadvertently vector or relocate this insect when they travel from place to place, move homes, or travel to recreation destinations. Items being transported should be inspected and cleaned prior to transport.

As it relates to private lands, it has been the position of the County that the management of pests (animals, insects, weeds, etc) are the responsibly of the private land-owner. The Woodlands Conservation Officer frequently consults with the public on a variety of pests and offers advice on dealing with such pests. The public are also directed to authoritative information sources (CFIA, etc) and made aware of known private companies that offer pest management services.

Local municipalities may wish at their discretion to undertake control activities for parkland and street trees within areas experiencing an outbreak. This should ideally take place as part of an integrated pest management plan. The Woodlands Conservation Officer is available to assist municipalities with background to such activities.

Select Jurisdiction Review in Ontario

Research has been undertaken to determine activities of other public authorities with a focus on the approach taken to rural woodlands.

The Ministry of Natural Resources and Forestry does not undertake a program to intervene and the Komoka Provincial Park and the Pinery Provincial Park are both experiencing LDD moth outbreaks. In speaking to MNRF it is their position that they continue to be very cautious about any potential BTk spraying because of the effects on non-target Lepidoptera which they are actively re-introducing to the environment. MNRF staff recommend considering the use of other alternate treatments for LDD Moth control in sensitive areas, if forest health monitoring suggests defoliation impacts are reaching significant long-term levels, but do not plan to undertake intervention. In relation to the Pinery Provincial Park, they are observing natural die-back of the LDD moth.

The five conservation authorities that have coverage within Middlesex County have not undertaken intervention programs other than egg mass scraping in priority areas such as campgrounds. In discussion with LTVCA staff (relative to their property adjacent to the County Forest) they indicated that although they have not undertaken a program and do not plan to do so, they are open to discussion with the County for a coordinated approach if the County makes the determination to intervene.

The Thames Talbot Land Trust own woodlands within the County, including in Southwest Middlesex in proximity to the County Forest, and they have not and do not plan to intervene.

Generally, public authorities have not undertaken a program to intervene in rural forested areas. The significant exception to this is the County of Norfolk (treated 230 acres) and the Long Point Region Conservation Authority (treated 1150 acres) that undertook a coordinated program in 2021. They indicated that the program was undertaken in response to successive LDD Moth infestations in order to preserve host species.

Many municipalities have undertaken intervention programs in a more urban / parkland settings including Sarnia, London, Toronto, Hamilton, Mississauga, Oakville, and most notably the Town of Pelham that has undertaken a multi-year public and private intervention program. Within Middlesex, the Municipality of Middlesex Centre has undertaken a program on certain municipal lands in proximity to urban areas.

Some municipalities, most notably Bluewater, have taken a ‘good neighbour’ approach where although they don’t undertake a program of intervention they consent to private land-owners over-spraying public land where it abuts private land that is being subject to spray intervention. They may also treat municipal lands in proximity to areas that are entirely privately sprayed.

The County Forest

The LDD moth population in the County Forest has been at a low and stable level for many years until a rise in population dynamics in 2019, 2020, and 2021. Egg mass surveys indicated that 2021 would likely be a year that saw fairly significant defoliation in areas where the moth has its epicentres. Defoliation by the young caterpillars became evident in late May and progressed with noticeable crown thinning by early to mid June and by June 23rd some trees had lost almost all of their foliage (Figure Six).

During fieldwork staff also observed at this time and into early July that many caterpillars were being killed by the NPV virus and the fungus, indicating that both natural controls were actively spreading throughout the population. Many caterpillars could be observed hanging dead from the bark of trees (Figure Seven).

Despite the number of dead caterpillars being observed many caterpillars are expected to successfully pupate and lay eggs for next year. Egg mass surveys this winter will help predict next years population dynamics and therefore how much defoliation might be expected in 2022.

By mid-July the majority of trees that were earlier defoliated were observed to be producing new foliage and it is likely that the adequate rainfall experienced locally is aiding in their recovery. Some defoliation may still occur later in 2021 as a result of other insects such as fall webworm or Eastern tent caterpillar activity however the trees in the meantime will have an opportunity to photosynthesize and replenish their energy reserves although the growth increment for 2021 is expected to be low. The new leaves tend to be smaller and therefore less efficient however native species of hardwoods are well adapted to replacing leaf canopy.

If successive years of severe defoliation occur and environmental conditions are not as favourable as they have been in 2021, it is expected that crown dieback will be observed. As a survival mechanism trees may isolate select branches or the extremities of the live crown, withdraw the nutrients energy reserves and allow those parts to die in order to secure survival of the rest of the tree. It may become evident therefore that successive severe defoliations result in localized thinning of the tree canopy, some weakened or diseased tree mortality. The County Forest is comprised of diverse species, age and structure and changes to the successional trajectory are to be expected.

In terms of potential impact on lands near the County Forest, within Southwest Middlesex, there are 18 homes within 100 metres and 42 homes within 250 metres of the County Forest. In addition, there are businesses in proximity to the County Forest that may be less tolerant of LDD Moth outbreaks (tree nursery, golf course).

Figure Six – June 23rd 2021 some trees had lost almost all of their foliage

Figure Seven – June 14th 2021 dead caterpillars hanging from mature oak tree

Figure Eight – July 15th 2021 Mature oak refoliating its canopy

County Forest Management Options

There appears to be three management options for the County Forest:

1. Passive Management
2. Aerial Spray Management
3. Good Neighbour Policy

Passive Management

A passive management approach is the most widely used response to the LDD moth within a rural woodland context and involves no controls to modify the infestation. Passive management is generally recommended for public woodlands that are not intensively used for recreation (not campgrounds, urban parks), where woodlands are not within urban settings, and where significant ecological damage to the woodland is not predicted. Passive management (precautionary principal) is the recommended default with a switch to active intervention only where catastrophic risk to overall ecosystem integrity is reliably predicted and the effects on non-target species is proven to be minimal or preventable.

Aerial Spray Management

Given the size of the County Forest, the only practical intervention would be an aerial spray program. Although there may be several companies with the equipment that could undertake aerial spray programs (including at least one based within Middlesex County) it appears that within Ontario almost all programs have been completed by Zimmer Air Services. The company has indicated that for 2020 they have over 6,000 individual contracts to undertake aerial sprays covering approximately 50,000 acres across Ontario.

In terms of costs, there is a wide spectrum of spray program costs. Many more urban spray programs are in the average $300 to $400 per acre. More rural and larger scale programs are less per acre and the least expensive program that staff found information concerning was the Norfolk / Long Point program that was approximately $97 per acre. This would put the cost to spray the entire County Forest in the range of $200,000 to over $800,000 however it is expected that the lower end of the cost range would be more applicable to the County Forest given its relative compact and contiguous form.

Further, if a program was to be undertaken there may be opportunities to consider spraying only portions of the County Forest (areas with target tree species and observed LDD moth outbreaks) however this would need to be considered based upon the use of an entomology consultant to undertake detailed inventory work, estimated to cost $20,000. A very general estimate would be that this entomology work could reduce

the area of the County Forest to be sprayed by as much as 50% resulting in potential program costs of:

- $0 – passive management
- $120,000 – targeted areas within County Forest based on low costs
- $200,000 – total County Forest based on low costs
- $800,000 – total County Forest based on high costs

The above potential program costs are based upon significant variables / assumptions and would only be fully known when an entomology consultant and spray contractor pricing are obtained. Because of the lead-time necessary to secure such services, it would be necessary for Council to make this decision well ahead of the regular budget process so that contractors could be engaged soon for a spring 2022 application.

Good Neighbour Policy

A final policy option would be to adopt a so-called Good Neighbour Policy where the County would consent to a limited overspray of lands by private landowners that are undertaking their own spray management program in proximity to the County Forest.

Conclusion

LDD Moths outbreaks are cyclically being experienced within Ontario, Middlesex County, and the County Forest. It is very difficult to predict LDD population levels from year to year and therefore very difficult to predict the potential impact on woodlands over the long-term. This invasive species has received significant attention due to the associated levels of defoliation and public nuisance they cause. It is clear, that the LDD Moth is a nuisance to many landowners – and causes varying levels of stress to trees.

As it relates to the County Forest, LDD moth defoliation has not been observed as a significant tree mortality issue to date. Although the County Forest is experiencing a LDD moth outbreak, it is expected (and evidence from the field supports) that the County Forest will not be significantly impacted by the LDD moth over the long-term. As a relatively undisturbed woodland with relatively wide species diversity, the County Forest has more resilience to such disturbance events.

A passive management approach is the most widely used response to the LDD moth within a rural woodland context and remains the recommendation of staff. Staff believe that the passive management approach is aligned with Council's 'Protection and Enhancement of Tree Canopy and Natural Vegetation Policy' and the County's Vision for the County Forest.

In addition, the County could develop a ‘Good Neighbour Policy’ to provide opportunity for landowners in proximity to the County Forest to extend their efforts.

FINANCIAL IMPLICATIONS:

As outlined within the Report, there are a number of implementation options and therefore financial implications. At present, funding is not included within the budget for an intervention program and because of the lead-time necessary to put any, if any, program in place it would be necessary for Council to make this decision well ahead of the 2022 budget process.

ALIGNMENT WITH STRATEGIC FOCUS:

This report aligns with the following Strategic Focus, Goals, or Objectives:

Strategic Focus	**Goals**	**Objectives**
Connecting Through Infrastructure	Ensure communities are built on a sustainable foundation that is connected and thriving	• Commit to a sound asset management strategy to maintain and fund critical infrastructure

RECOMMENDATION:

That County Council utilize a passive management response to the LDD Moth and that staff develop a ‘Good Neighbour Policy’.

Attachments

Attachment 1 – County Forest Photo Documentation

Centreville Drive June 23rd 2021 at the height of defoliation

Centreville Drive July 14th 2021 partially re foliated

Centreville Drive July 23rd 2021 almost fully refoliated

Example Trees June 23rd 2021 at height of defoliation

Example Trees July 14th 2021 almost fully refoliated

Attachment 2 – Additional Resources

The CFIA fact sheet: https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/insects/gypsy-moth/fact-sheet/eng/1330355335187/1335975909100

Province of Ontario, Fact Sheet: https://www.ontario.ca/page/gypsy-moth

Province of Ontario, Forest Health Reporting: https://www.ontario.ca/page/forest-health-conditions

Ontario Parks, LDD statement: https://www.ontarioparks.com/parksblog/ldd-moth-caterpillars/

Municipality of Middlesex Centre Program: https://middlesexcentre.on.ca/articles/dealing-gypsy-moths