



100 John West Way
Aurora, Ontario
L4G 6J1
(905) 727-3123
aurora.ca

Town of Aurora

Memorandum

Operational Services Department

Re: Lymantria Dispar Dispar (LDD) Control Options

To: Environmental Advisory Committee

From: Sara Tienkamp, Manager, Parks & Fleet

Date: November 24, 2021

Recommendation

1. That the memorandum regarding Lymantria Dispar Dispar (LDD) control options be received; and
2. That the Environmental Advisory Committee comments regarding LDD control options be received and referred to staff for consideration and further action as appropriate.

Background

LDD is a non-native insect from Europe introduced to North America in the 1860's.

Since its introduction, this leaf defoliating insect has spread across the Great Lakes Basin and evolved to a state of naturalization that Canadian Food Inspection Agency (CFIA) does not attempt to control or eradicate the species. They were first detected in Ontario in 1969 and can now be found as far north as Sudbury/Algoma Districts and east to the Quebec border. The insect prefers Oaks as their primary host and can be found both in rural and urban forests; however, LDD, also feeds on Aspen, Birch, Maple Poplar, Willow and even conifers, like Spruce and Pine.

LDD population can be best described as boom or bust, often occurring every 8-12 years. During these cycles, certain areas can reach epidemic proportions for a few years only to collapse and remain at endemic levels for another eight (8) years or more. Healthy trees can typically withstand repeated years of defoliation (generally up to four (4) years). Each LDD caterpillar can eat up to one (1) square metre of leaf area resulting in mass defoliation during outbreaks. Severe infestations have occurred in Ontario in 1991, 2002 and 2008, Aurora first saw epidemic populations in the early 1990's.

When an outbreak occurs, extremely large numbers of caterpillars can be found feeding on tree leaves and hanging from silk threads. The population is influenced by several factors, e.g., precipitation, temperature, parasites, and pathogens, making it difficult to predict future populations. One significant impact to LDD population is the naturally occurring nuclear polyhedrosis virus (NPV), which is found in populations of LDD moths, spreads extremely quickly and causes mass mortality with population collapse.

Lifecycle of LDD Moth.

The LDD moth has four (4) distinct developmental stages in its lifecycle like other butterflies and moth species. Several management options for LDD described in this report are only effective and timed during specific life cycle stages.

Egg (Late August to early May):

- Dormant stage (easiest to manage).
- Egg masses range in size from 2-8 cm long and can contain between 100-1,000 eggs.
- Egg masses are usually oval shaped and beige/light brown in colour.
- Often found on tree trunks and the underside of larger branches.

Caterpillar (Early May to mid-July):

- Tree damaging stage.
- Newly hatched caterpillars are about half a centimetre long and dark in colour. As they grow, they change colour becoming dark coloured and hairy with a double row of five (5) pairs of blue spots followed by a double row of six (6) pairs of red spots, down the back.
- Caterpillars can be found feeding on the leaves of trees since this is their main food source.

Cocoon (Mid July to early August):

- Stage lasts for ten (10) to fourteen (14) days.
- Once the adult moth emerges, it leaves the empty cocoon behind which can be seen on infested trees.

Moth (Late July to late August):

- Stage lasts ten (10) days.
- An adult LDD moth's only function is to reproduce and not eat anything, unlike other moth and butterfly species.

- Female is larger, white and cannot fly.
- Male is smaller, brown and is attracted to pheromones produced by female moths.

Council approves motion to explore control options including a targeted spray program.

Aurora experienced a high incidence of LDD in 2020 in a few areas in Town and in 2021 the population exploded causing extensive defoliation of trees on residential and public lands.

At the September 28, 2021, Council meeting the following motion was passed, directing staff to report back on control options for the insect:

Whereas areas of the Town of Aurora are experiencing an infestation of the caterpillar stage of the of Lymantria dispar dispar, commonly known as LDD moths; and

Whereas, according to the LSRCA, the LDD moth is “an invasive insect (that) goes through cycles in which the population increases for several years and then declines”. This year is predicted to be an outbreak year, based on observations, and monitoring in 2020 and through the winter of 2021; and

Whereas the LDD moth population tends to peak every ten (10) years, and each outbreak can last a few years; and

Whereas we are currently in year two of a boom; and Whereas the LDD moth can have serious, negative impacts on the forest canopy, defoliating a significant volume of trees during an infestation; and

Whereas healthy trees can generally survive, back-to-back years of LDD moth feeding can weaken a tree, making it susceptible to disease and damage from other insects and even death for some trees; and

Whereas the Town has provided information for residents on how to protect the trees on their property and was the first municipality in York Region to provide burlap wraps to homeowners;

1. Now Therefore Be It Hereby Resolved That staff review and report back on all options to control the LDD moth infestation and manage future years of this cycle, including burlap banding, removal of eggs, pheromone traps in

areas with moderate to severe infestation, and consider targeted spraying of BTK (Bacterium Spray Treatment) within the appropriate timeframe in all severely infested areas of public lands and Town trees within the Town's right of way on severely infested streets; and

2. Be It Further Resolved That the Town of Aurora adopt the same practice as neighbouring municipalities, taking a "good neighbour" approach and spraying buffer strips on the borders of publicly owned Town of Aurora lands and private lands where there is known to be a severe infestation of LDD moths.

Analysis

Aurora's LDD strategy for 2021 included providing burlap banding kits to residents.

In 2020, staff and residents observed heavy infestations in localized areas of Town, primarily west of Yonge. Other municipalities were witnessing activity as well and as a result York Region undertook egg mass counts in late fall of 2020 in all nine (9) municipalities. Data provided by York Region's consultant indicated the potential for larger widespread outbreaks of LDD throughout Region, including Aurora.

As a result, the York Region Forestry Working Group met to discuss an action plan for 2021 which included a unified communication plan to ensure consistent information was being provided throughout the Region to the public. For the most part all municipal strategies focused on strong communication plans with a few select groups choosing to treat prominent specimen Oaks within their landscapes and others with larger staff resources planned for egg mass removal on Oak prominent streets.

In May, caterpillars began to emerge and grow, tree defoliation became overwhelmingly evident and public concerns mounted. Municipalities then started to pivot and adapt to the situation with their strategies by including additional resources and controls. The measures undertaken by staff for LDD included:

- Participation on Regional Urban Forestry Group – inter-municipal working group that includes all nine (9) regional municipalities, representatives from Toronto and Lake Simcoe Regional Conservation Authorities and City of Toronto. Group shares Information, previous experiences, best practices, and measures.

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- Communications Strategy – aiming to educate the public and provide ongoing updates, utilizing various media means including social media, mobile signage, website.
 - TreeAzin® injections – Treatment of large mature specimen Oaks e.g., Cultural Centre, Arboretum.
 - Burlap Giveaway – staff provided residents with approximately 2,500+ burlap bands and utilized the opportunity to answer questions and provide tree advice in person (first municipality to do so in the Region). This initiative was extremely well received, and staff received excellent feedback.
 - Sweeping of sidewalks/roads – during height of caterpillar stage staff completed sweeping of streets and sidewalks where there was a high incidence of caterpillar frass (Attachment #1).
 - Watering program – staff watered the most vulnerable trees to ensure they remained healthy and recovered quickly, especially during hot dry weather. Residents encouraged to do same on their properties through our communication efforts.
 - Monitoring of population and locations.
 - Monitoring for NPV and manual spread of NPV infected caterpillars collected from Newmarket into Case/Sheppard's Bush Woodlots.

Impact of LDD on urban forest and parkland compounded by additional stressors but can be mitigated as seen in 2021.

Trees in urban settings are exposed to many environmental stressors that trees growing in rural settings/woodlots are not subject to. These impacts include drought, compacted soils, limited soil volume, fewer natural predators, and air pollutants. All these factors can compound the affects how trees recover from an LDD infestation as they may have limited resources to recover following defoliation.

While tree canopies can be severely or completely defoliated, trees are relatively resilient and adapted to defoliating insects and diseases. Trees in good health will replace leaves later in season to perpetuate annual growth and development with little adverse impact, however, trees can see branch or crown dieback if energy stores are depleted for successive years and in some cases, mortality can occur, usually when other stressors are present such as drought.

Spring of 2021 was extremely dry in York Region, with late May and June experiencing drought conditions. This was during the peak of the LDD outbreak and there was concern about how the trees may recover if conditions perpetuated into July and

August. As a result, staff educated the public about the importance of providing adequate hydration to their trees to assist in the recovery and regrowth of leaves. A watering campaign was also undertaken by Operations staff to water vulnerable street trees that had been impacted. Deep watering (Attachment #2) four to five (4-5) times per week over two (2) weeks by a resident illustrates how effective water can be on leaf regeneration.

July brought the typical rains we see in June and helped regenerate leaf canopy cover on parkland and within Woodlots across the Region. (Attachment#3).

Outbreaks in Ontario hit historical record high in 2020.

Over the last two (2) years, LDD populations have spiked in Ontario and outbreaks have been found across the province in many cities and communities within the insect's range.

The Ministry of Natural Resources and Forestry (MNRF) observed 586,385 ha of defoliation by LDD across Ontario in 2020, approximately twelve (12) times the area defoliated the previous year. The LDD population in 2020 produced the largest modest-severe defoliation recorded (Attachment # 4).

In 2020, York Region undertook an LDD egg mass survey to assess and forecast populations of LDD caterpillars in 2021. Hot spots were primarily west of Yonge Street, with severe pockets just north of Wellington Street and around Henderson Drive and south.

The egg mass survey by York Region for 2021 was not completed at the time of this report; however, information shared between the municipalities suggests staff are seeing a general decline in egg masses through their monitoring, though hot spots remain present.

Naturally occurring killing NPV virus detected in York Region.

NPV is a virus that is one of the most important factors in population collapse of LDD and occurs when caterpillars are in abundance regardless of climatic conditions.

In 2021, NPV was detected in many York Region municipalities, though staff did not observe it in Aurora; however, it was more than likely present based on neighbouring municipalities detection and influx.

Newmarket did have widespread NPV occurring in a few woodlots and collected caterpillars for distribution to neighbouring municipalities for dispersal in hot spot locations. Town staff introduced NPV infected caterpillars to Case Woodlot and Sheppard's Bush in late June.

Control methods part of Integrated Pest Management (IPM) strategy.

Aurora manages its urban forest utilizing IMP methodology to care for its trees, shrubs, and herbaceous plants. The focus is improving and maintaining overall health by monitoring insect and disease levels applying strategies for control when tolerance/threshold levels directly impact vegetation health. These methods include cultural, biological and pest/disease treatments.

In addition to the methods deployed as part of the 2022, LDD Management Plan by staff additional control options are available and can be adopted into the strategy for treatment.

Option 1 – Spraying.

Bacillus thuringiensis (Btk) bacterium is a spray treatment registered in Canada for the control LDD on trees after egg hatch, as it is only poisonous to the larvae (caterpillars). Health Canada identifies Btk as a natural biological-based insecticide derived from bacteria naturally found in soil.

Btk crystals and water are combined to create a solution that can be sprayed on infected trees. These crystals accumulate on leaves which are then consumed by the caterpillar. Btk affects the organism's stomach by activating with the alkaline conditions and breaks down the walls of the insect's stomach causing sepsis and death. Humans and mammals are unaffected by the Btk due to the acidic conditions within their stomachs which prevents the activation of toxins, but it is very important to note that Btk, will kill other insect species that have a similar cyclical life cycle such as other moth and butterfly species.

For Btk to be most effective, it is usually applied to infested areas more than once. It breaks down in the environment very quickly, in three (3) to seven (7) days and faster with sunlight. The caterpillars must be in an early larval stage for the Btk to work, and not all caterpillars hatch at the same time. For maximum efficacy, two (2) rounds of spraying are recommended, approximately ten (10) days apart. It is estimated to kill 60-80% of the treated population, which means 20-40% of caterpillars are not affected by

the treatment. Also, re-population of treated areas is possible as caterpillars from untreated areas can travel up to 200m especially when food sources are depleted.

As with any type of pesticide usage, it can be very controversial, especially when spraying large areas including publicly accessible areas like woodlands with trails and public parks. Homes or private lands adjacent to where spraying is taking place may be exposed to spray drift, which may or may not be acceptable to the public. It should be noted that there has been controversy related to any aerial spraying of insecticides. Although studies have noted that Btk causes few adverse effects, people can be exposed to Btk by breathing in the bacteria while it is being sprayed, and/or by ingesting it after touching sprayed objects that may have been exposed to overspray. The Town will need to be prepared to deal with real and perceived risks associated with spraying and prepared for the rise of resident complaints ranging from allegations of damage to plants and gardens and possible health related issues.

There are two (2) forms of spray treatments which can be utilized in different situations:

1. Aerial Spray:

For larger wooded areas, aerial spray is the most effective way to manage LDD outbreaks due to inhibited access to very tall and concentrated tree stands by ground. In Southern Ontario, there is only one contractor that provides aerial spray services conducted using a helicopter. Securing the services of this contractor must be completed prior to March of the treatment year and pesticide applications are dependent on weather conditions as high wind and rain must be avoided.

When planning aerial spraying in urban areas, an extensive Transport Canada risk assessment and approval process must be prepared and approved. These plans must include application and timing restrictions, aircraft type restrictions, pesticide product restrictions, personnel requirements, public consultation, and notification to residents among other requirements. Municipalities in the GTA who have conducted aerial sprays of public land in 2021 include Burlington, London and Oakville. Toronto and Mississauga did not conduct spraying this year but have in the past. All spraying within the municipalities have taken place on public lands and were confined to a few discrete areas such as woodlands and parks. Toronto and Region Conservation Authority also conducted sprays in conservation Parks in 2021 where camping and recreational activities such as Treetop Trekking take place.

Cost:

An aerial spray program would be considered a new level of service for the Town requiring dedicated funding and staff. Based on 2021 pricing (subject to change and availability) spraying is estimated at \$900/ha and \$4,800 in mobilization/ground support for helicopter. This would include spraying approximately 140 hectares of woodland (two applications as per product recommendations) in multiple locations throughout the Town where outbreaks of LDD have been observed including Case Woodlot, Sheppard's Bush, Willow Farm Lane Woodlot at an estimated cost \$291,600. It is important to note that Sheppard's Bush Woodlot is owned by Ontario Heritage Trust (OHT) and would require their approval to treat. This cost also includes funds for signage and other communication requirements, contracted staff and truck rental to coordinate and oversee the program are estimated at approximately \$30,000.

2. Ground Spray:

Ground spraying would be the appropriate option for Town street and park trees as the trees are spread apart and can be targeted to avoid unintended spray drift onto other properties and surfaces. This type of spraying would be delivered using a contracted service where BTK would be applied using a handheld or boom truck applicator by a licensed exterminator to spray each tree.

Several municipalities have conducted ground spraying of trees in 2021 with most having been on a small scale to target specific trees and areas. These include Mississauga, Brampton, Hamilton, London, Oakville and Toronto.

Costs:

A ground spraying program would be considered a new level of service for the Town which would require dedicated funding and staffing. The estimated cost would be \$1,430,000 and includes treatment of approximately 7,000 trees (\$200/tree) plus \$30,000 for communications materials, a staffing resource and rental truck to coordinate and oversee the program.

Option 2 - Tree injection.

An alternative to ground spraying treatment can be applied through tree injection using TreeAzin®, which is similar to the approach that has been taken to manage Emerald Ash Borer within Aurora (this would not be feasible for forested areas). This method is already accepted by our community for managing invasive pests and the risk of exposure is far less, as the pesticide is injected into the base of the tree by a licensed operator and degrades naturally within tree tissues. Treatment is required once per

growing season and occurs just after tree's leaf out. When caterpillars eat leaves that contain the insecticide, it kills the caterpillars. As such, caterpillars will not grow to their largest and most damaging size.

York Region, Mississauga and Toronto treated trees with TreeAzin® in 2021. Treatments were conducted on streets and in parks including more susceptible trees such as conifers which cannot regrow their needles at the same rate as deciduous trees can with their leaves. Typically, a limited number of significant, high value and/or more vulnerable trees are generally selected for this treatment.

Cost:

The Town's contractor treated high value trees as a pilot in 2021, the extent of treating all impacted street and park trees would be considered a new level of service for the Town requiring dedicated funding and staffing. The estimated cost would be \$1,430,000. The cost includes injection of approximately 7,000 trees (\$200/tree based on 2021 contract pricing and subject to change as contract expires end of 2021) plus \$30,000 for communications materials and a staffing resource and rental truck required to coordinate and oversee the program.

As part of the Town's EAB treatment program, the contractor offered treatments of TreeAzin® to private property owners for their trees utilizing the Town's preferred pricing. The uptake was not significant but very positively accepted. Staff can include this option in a new contract for 2022 season.

Option 3 – Egg mass removals.

Manual removal of egg masses from impacted trees is a common method for addressing LDD, particularly because each egg mass can contain anywhere between 100 to 1,000 caterpillar eggs. This activity can begin as early as September once the moths have finished laying eggs. Currently, some of our neighbouring municipalities (Richmond Hill/Vaughan and Markham) with staff resources, have been able to complete some vacuuming and scraping on streets and in parks. This tactic could be employed by a contractor (Town does not have staff available for this level of service) over the winter months until caterpillars emerge in April 2022.

Cost:

The estimated contracted cost for this activity is approximately \$30/tree. It is estimated 7,000 street trees in hot spot areas could be treated for a total cost of \$210,000

Option 4 – Expansion of burlap kit program.

A common method used to minimize the impacts of LDD is the installation of burlap traps around the trunk of the trees at chest height. These traps are secured with a string or rope in the centre with the top half folded over the bottom half which provides a cool place for caterpillars to hide from the midday heat and makes them easier to collect and dispose of. Burlap traps also have been found to promote spread of the NPV virus when the caterpillars accumulate in large numbers within the trap.

In 2021, Aurora and Newmarket distributed burlap banding kits to homeowners to help manage LDD on residential properties and/or on Town street trees.

In Aurora, the burlap kit initiative was a very effective way of engaging and educating residents about LDD and will aid in minimizing damage and controlling spread. Town staff gave away approximately 835 burlap kits (three (3) to a kit). Based on the number of residential properties impacted and number of calls received during April and May when caterpillars were most active, staff are proposing the creation and distribution of an additional 2,200 burlap kits in 2022. Each kit would include three pieces of burlap, twine and a fact sheet. Kits would be distributed at the Joint Operations Centre (JOC) or through an organized distribution event with COVID-19 health and safety measures in place if required.

Cost:

The estimated cost for this activity would be approximately \$22,000, which includes a staffing resource to create the kits and distribution to the public.

Option 5 – Expanded Street and Sidewalk Sweeping.

In the spring of 2021, Town staff conducted limited street sweeping in areas where concerns were received by residents. To help mitigate the impacts of LDD on neighbourhoods, street and sidewalk sweeping on a regular basis would help alleviate the accumulation of caterpillar droppings that create unsightly and potentially hazardous conditions.

Cost:

If the program were expanded, it would require a contractor to supplement the current service level. The estimated cost for this activity would be approximately \$150/hour using external contracted services for six (6) week period 2-3 days a week depending on

severity. Sweeping activities would take place when the caterpillars are most active (Late May to early July).

Attachments

Attachment #1 – Street Sweeping

Attachment #2 – Impact of Water on Street Trees

Attachment #3 – Defoliation York Regional Forest

Attachment #4 – LDD Defoliation in Ontario 1980-2020