



# **Invasive Species Management Plan & Implementation Strategy**

**Appendices 1-9**

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# Appendix 1: Mississauga Invasive Species Management Plan Background Analysis Report<sup>1</sup>

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## 1.0 Introduction

The City of Mississauga's Natural Heritage System and Urban Forest provide a critical role in sustaining the City's green infrastructure by providing numerous ecosystem services and serving as a natural space for the City's residents to enjoy. The ecosystem services and health benefits provided by the urban green spaces (e.g. woodlands, wetlands, meadows and trees located throughout the City) directly benefit human health and well-being. Ecosystem services include environmental services such as climate change mitigation, community benefits and services such as supporting active living, economic benefits and services such as decreased heating and cooling costs, and physical and mental health services such as stress reduction. These green spaces are the natural and cultural heritage features that bring together the residents of the City by providing a shared resource that connects Mississauga's past, present and future.

Invasive species have become a major threat to the ecological integrity of the City's Natural Heritage System and the Urban Forest canopy. Invasive species are usually non-native species that displace some or most of the native components of a community (White et al. 1993) and negatively impact the function of the ecosystem. For the purposes of this study, invasive species include terrestrial plants and insects as these are considered the greatest

threat to the ecological integrity of our natural spaces and the urban forest canopy of the City. The ecological effects of invasive species can be irreversible and extremely difficult to control or eradicate once established. Invasive flora including Garlic Mustard (*Alliaria petiolata*), European Buckthorn (*Rhamnus cathartica*), and Dog-strangling Vine (*Vincetoxicum rossicum*, *V. nigrum*) are prevalent in portions of certain Natural Areas within the City, and pose a threat to native biodiversity. Invasive fauna including Emerald Ash Borer (EAB), Gypsy Moth, and Asian Long-horned Beetle (ALHB) are impacting the tree canopy of Natural Areas, thereby altering the vegetation structure and ecosystem dynamics in a way that benefits the establishment and spread of non-native invasive species.

The City is currently involved in the management of several plant and insect invasive species (e.g. Gypsy Moth, EAB and Giant Hogweed (*Heracleum mantegazzianum*)); however, the City does not currently have an integrated and comprehensive City-wide management approach for dealing with terrestrial invasive plant and insect species. The City has management plans for specific targeted species; however, the approach used to address other invasive species (e.g., Garlic Mustard and European Buckthorn) has often been site specific, or in response to requests or initiatives from stewardship groups. Therefore, the Urban Forest Management Plan (UFMP) recognized the need to develop a

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<sup>1</sup> Prepared by North-South Environmental Inc., April 2016.

proactive and comprehensive invasive species management plan for the City that provides an overarching City-wide approach to management of invasive flora and fauna.

Developing a comprehensive Invasive Species Management Plan and Implementation Strategy (ISMP&IS) that balances the ecological, economic and social vision for the City can allow the City to work towards better protecting and enhancing the City's natural resources. This Background Analysis Report constitutes the basis for discussion with City staff and key stakeholders. This report provides a comprehensive background review to enable the development of the ISMP&IS. The main purpose of this background analysis is to review current practices for managing invasive species and to identify priority species and Natural Areas on which the City can focus limited resources in order to maximize results.

## 1.1 Objectives

The objective of this Background Analysis report is to:

1. Review invasive species management efforts of neighbouring municipalities and conservation authorities.
2. Outline a vision for managing invasive species to 2033 (the 20-year timeline identified in the NHUFS and the UFMP; a timeline which ends in 2033).
3. Identify priority terrestrial and wetland species to target for management.
4. Identify priority Natural Areas to target for management.

## 2.0 Methods

### 2.1 Review of Mississauga's Initiatives

The City of Mississauga's current invasive species management initiatives were reviewed at the project start-up meeting to provide a common base of knowledge, and for the consulting team to learn from the City's experiences.

### 2.2 Document Review

Public documents relating to invasive species priorities, management, and public outreach published by the City as well as by neighbouring municipalities, conservation authorities, and other agencies were reviewed. These documents were reviewed to identify information and methods which may be applicable to invasive species management in Mississauga. This process provided insight into the successes and failures of similar jurisdictions which can be applied to the development of the ISMP&IS. Documents included in this review:

- Natural Heritage and Urban Forest Strategy (NSE et al. 2014)
- Urban Forest Management Plan (UFI et al. 2014)
- City of Mississauga Emerald Ash Borer Management Plan (Marchant 2012)
- Invasive Species Strategy (CVC 2009)
- Peel Region Urban Forest Strategy (TRCA 2011)
- Creating an Invasive Plant Management Strategy: A Framework for Ontario Municipalities (Sherman 2015)
- Exotic Plant Species Management Plan, Point Pelee National Park (Dunster & Associates 1990)

### 2.3 Agency Consultation

The efforts of neighbouring municipalities and conservation authorities in controlling invasive species were researched. The intent of this analysis was to identify opportunities or constraints and to better inform the ISMP&IS for Mississauga. Municipalities and conservation authorities identified as having similar programs and challenges were contacted by telephone. These include:

- Municipalities
  - Town of Oakville

- City of Burlington
- Town of Brampton
- City of Toronto
- City of Hamilton
- Conservation Authorities
  - Credit Valley Conservation
  - Conservation Halton
  - Hamilton Conservation Authority
  - Toronto and Region Conservation Authority

The agencies listed above were chosen based on their location relative to Mississauga and the probability that they may have experience with invasive species management relevant to Mississauga. The following questions were posed to these agencies:

- Do you have invasive species management initiatives (e.g. plan, strategy, active removals/treatments)?
  - If so:
    1. How do you prioritize invasive species management? Are there criteria or is it in response to demand?
    2. What are the priority invasive species? Why?
    3. How do you prioritize sites for management?
    4. Is there a preference between managing flora and fauna invasive species? If so, why?
    5. How much budget is allotted annually for these initiatives? Do you rely on other funding or volunteer sources? If so, who?

6. Do you engage other agencies or volunteers in invasive species removal (e.g. Garlic Mustard pulls, etc.)? If so, how do you decide this?
7. How do you dispose of invasive plant materials removed from a site?

- If not:
  1. What is the perspective on invasive species in your jurisdiction?
  2. Do you rely on other documents/agencies to provide guidance and/or management?

## 2.4 Identification of Priority Species and Natural Areas

The City's Natural Heritage System has been studied in great detail. Therefore an essential task in the background review was to gather and review the most current information available. In addition to information obtained from other organizations and agencies, existing consultant reports and databases were also used to obtain relevant information. For example:

- Mississauga's Natural Areas Survey Update 2015 (report, Natural Area factsheets, and database)
- Life Science Area of Natural and Scientific Interest (ANSI) reports
- Early Detection and Distribution Mapping System (EDD MapS) for Ontario

Based on the information obtained for the City's Natural Areas and acquired from the information sources identified above, a summary of existing conditions and issues was prepared and included in this report.

As publicly-held lands, Natural Areas are subject to current management/planning direction in the form of park or open space plans, or management practices. Existing management plans

(e.g. Cawthra Woods, NSE 2015) were investigated as a source of valuable site-specific information and to gain an understanding of the intended outcomes of current plans and/or practices. This task consisted of consultation with City staff to assemble existing information on current management direction, followed by review, summary and general evaluation of current management effectiveness.

Data collected during this review was used in identifying the top terrestrial flora and fauna species to target for management. This data was also used to prioritize sites for targeted management efforts. The Natural Areas Survey (NAS) database contains records of invasive species from each Natural Area in the City, when those species were documented, and in some cases, specific locations for species of concern. The Natural Area Factsheets associated with the Natural Areas Survey identify the most prevalent invasive species at each Natural Area as well as noting management concerns, or opportunities for specific management approaches. The data collected for the Natural Areas Survey, in addition to the consulting team's personal familiarity and knowledge of the sites, both contributed to the identification of target sites and species.

## 3.0 Background and Guiding Principles

### 3.1 Summary of Existing Conditions and Issues

Through an analysis of the City's NAS database, it was determined that each of the 141 Natural Areas surveyed have one or more invasive plant species present. In addition to floral invasive species documented in the NAS database, terrestrial fauna invasive species have also been recorded within many of these Natural Areas (e.g. Emerald Ash Borer (EAB), Asian Long-horned Beetle (ALHB), and Gypsy Moth). EDDMapS Ontario identified ten invasive flora within the City, all of which had also been documented through the NAS. However, the EDDMapS Ontario program did not document any invasive fauna. EAB has been documented throughout the City through a study of the City's woodlands in 2013 and 2014. EAB is present in most of the City-owned woodlands, in varying stages of

infestation and with varying degrees of impact. The impact of EAB often results in the loss of the forest canopy providing conditions favourable for invasion and spread of non-native invasive plants.

ALHB is quarantined within the northeast corner of the City, according to the Canadian Food Inspection Agency (CFIA). This agency has issued an Infested Place Order (CFIA 2013) to help stop of the spread of the species outside of this area. According to City staff currently overseeing management practices for Gypsy Moth, this species is primarily present in the Sawmill Valley, Windy Hollow Park, and Lorne park areas where oak trees are prevalent.

The presence of invasive species in the City's Natural Areas can have a number of negative impacts including:

- out-competing native species
- creating a human health risk
- decreasing biodiversity
- altering ecosystem function
- decreasing ecosystem services

The way in which non-native invasive species out-compete native species for resources and space is achieved by specific mechanisms including, but not limited to:

- ability to rapidly colonize after disturbance
- absence of natural predators
- absence of limiting factors (e.g., climate, species competition)
- tolerance to changing environmental conditions (e.g. drought)
- high reproductive rates
- wide dispersal by wind, water, wildlife, and humans

- ability to inhibit growth or establishment of other species by predation or the release of toxins (allelopathy)
- ability to kill native species (e.g. as in several forest pathogens)
- hybridization (i.e. genetic contamination)

### 3.2 Mississauga's Current and Past Initiatives

Current invasive species management in the City has been limited to a few species-specific programs and occasional work completed by City staff and stewardship groups. Species-specific programs include the control of the noxious Giant Hogweed, at a minimum in areas where it may come into contact with people. The management methodology for Giant Hogweed currently relies on City staff, consultants, and residents to report locations of the plant due to limited staff resources for surveying sites to identify individuals or populations.

The second species-specific program relates to the management of EAB infestation. EAB is the subject of the City's recently-implemented, multi-year control program, as outlined in the Emerald Ash Borer Management Plan (Marchant 2012). The management approach for EAB is somewhat different from other invasive species in that there is no completely effective control method for eradication. The goal for EAB management is to preserve viable ash in the canopy in order to maintain some proportion of ash within the City. A small number of significant ash trees may be preserved indefinitely through repeated injections; these are typically located in parks and as street trees.

A third program is completed by City staff to control Gypsy Moth populations located throughout the City in natural areas with high oak (*Quercus* spp.) populations. Gypsy Moth populations are monitored in 20 woodlots and on street trees throughout the City annually and management options identified for that year based on population projections. The 20 woodlots monitored had been sprayed with Btk pesticide in 2006/2007.

There have been other initiatives, primarily with volunteers, to control Garlic Mustard, but these projects have not been a result of a strategic program. Key challenges include the lack of resources to implement actual on-the-ground control, long term management efforts and the lack of effective control strategies for some species (e.g. Dog-strangling Vine).

Historically, the City has also managed for Cankerworm, Fall Webworm, and Bronze Birch Borer. These species are not currently considered a management issue. However, they all have the potential to become an issue again in the future if an outbreak occurs.

### 3.3 Guiding Principles

The NHUFS identifies targets for 2033 and includes a goal of substantially improving overall terrestrial and aquatic quality across the City using 2013 as a baseline. To achieve these targets, the NHUFS provides guiding principles for the management of the natural heritage system within the City that encourage maximizing native biodiversity and accounting for adaptive management.

Principle #3 in the NHUFS identifies the need to maximize native biodiversity to build resilience to future climate shifts and other changes in the environment. As invasive species have the ability to outcompete native species for resources and space, there is the potential for decreased biodiversity with the spread of invasive species. Therefore, the management of invasive species within the City would aid in the preservation of biodiversity and resilience within the natural heritage system.

The NHUFS also recognizes the need to practice adaptive management through the 2033 timeline (Principle #11). Natural systems are complex, particularly when they are embedded in urban areas, and their responses to changes in the environment are hard to predict. Adaptive management recognizes this reality and the need to refine techniques to respond to environmental changes or unexpected events (NHUFS 2013). For example, there are non-native invasive species that currently have not been

identified within the City's boundaries, but have potential to immigrate into the City within the 2033 timeframe (e.g. Kudzu vine (*Pueraria montana*) that is migrating northwards from the United States). Consideration of adaptive management within the plan will be essential for early detection and rapid response techniques for identifying and managing newly-invading species.

Additionally, the UFMP (2014) supports the development and implementation of an Invasive Species Management Plan for the City. The UFMP identifies invasive pests and pathogens as among the most significant stressors to urban trees, and considers invasive species management as a key opportunity to improve the condition of the urban forest. It includes a strategic Action Item (#10) to "undertake targeted invasive plan management in the Natural Heritage System" and highlights best practices such as area-based prioritization and leveraging partnerships to increase management efficacy. The Invasive Species Management Plan will fulfill this Action Item through the implementation of these and other best practices. The UFMP also includes, as an Appendix, an invasive species management plan which is being updated and expanded through this project.

### **3.4 Knowledge Gained from Neighbouring Agencies**

Five Municipalities and four Conservation Authorities in close proximity to the City of Mississauga were contacted to discuss their invasive species management initiatives. Although only one of the agencies that were contacted have an invasive species management plan or strategy, many municipalities are in the process of developing policies regarding invasive species management. The following provides a synopsis of the information gathered through interviewing the Municipalities and Conservation Authorities.

All of the agencies that were contacted are currently undertaking invasive species initiatives. The highest priority invasive for all agencies is the Emerald Ash Borer (EAB). This invasive species is typically managed by the forestry department as a separate

entity and typically management efforts also receive direct funding. Municipalities typically manage invasive species through parks and maintenance departments and tend to have a limited budget. Conservation authorities tend to have more resources (e.g. financial and staff) allocated to invasive species management.

After EAB some of the more common species targeted for management are Giant Hogweed, Wild Parsnip (*Pastinaca sativa*), and in some cases Common Reed (*Phragmites australis*) and Buckthorn. In addition, Conservation Authorities also manage Dog Strangling Vine and Japanese Knotweed (*Reynoutria japonica*). Municipalities generally determined site prioritization based on public requests, while Conservation Authorities utilize criteria such as areas of high biodiversity, environmental sensitivity, patch size, and popularity of public use to prioritize their management activities. Some agencies target their community engagement efforts through local schools and local organizations (e.g., non-government organizations, corporate groups, community volunteers). All agencies conduct chemical treatments for the removal of certain invasive species. Some agencies have licenced staff that can apply herbicides/pesticides while others use contractors for these services. Giant Hogweed is typically treated where locations are known while Wild Parsnip is only treated when located in close proximity to the edge of trails. Invasive plant material is usually bagged and taken to the landfill.

## **4.0 Vision for Invasive Species Management to 2033**

The guiding vision for invasive species management was created with a solid base of background information and lessons learned from previous efforts, within and outside of the City. The vision projects management goals for a period of 18 years, coinciding with the timeline for the UFMP, 2014 to 2033. The significance of the timeline reaching until 2033 is that it is expected that the plan will be re-evaluated at the end of this period.



The vision for invasive species in the City of Mississauga until 2033 takes into account a sustainable future for the City that includes:

- healthy ecosystems;
- safe natural spaces for the enjoyment by the community; and
- a healthy environment protected from new invasive species, where established invasive species populations are managed through a proactive, comprehensive community approach to stewardship, led and supported by the City and its partners.

Proactive and integrated management of invasive species within the City will aid in the attainment of the above listed qualities of a sustainable future.

## 5.0 Setting Priorities

### 5.1 Framework for Determining Priorities

All of the City's Natural Areas have non-native invasive species present. The diversity and abundance of invasive species present varies between sites. In some Natural Areas, the extent of invasive species is minimal, and if the site is relatively large and in good condition, invasive species may not currently be a major threat to the ecological integrity of the site. However, ecological degradation of Natural Areas due to the presence of invasive species is a substantial concern in many of the City's Natural Areas. Due to the prevalence of invasive species and the financial costs of their management, invasive species and Natural Areas must be prioritized for management such that the species with the most invasive qualities are managed in the areas where there is the potential for the greatest success (UFMP 2014).

To develop a framework for determining priority invasive species and sites within the City, a key consideration is acknowledgment that resources are limited relative to the magnitude of the issue.

Therefore, the UFMP (2014) identifies the following principles for establishing priority management:

1. Focus management on the species with the greatest potential to impact Natural Areas,
2. Target flagship Significant Natural Areas for thorough management, and
3. Focus on species that pose a potential threat to human health.

The rationale behind these principles is to place a higher management priority on Natural Areas that have the greatest ecological significance and provide the best opportunity for preserving high quality ecological structure and function in the long term. Smaller Natural Areas are generally more difficult to manage due to the high edge-to-interior ratio, and the potential for the introduction of non-native invasive species through adjacent land uses (e.g. invasion from adjacent residential gardens) and recreational use (e.g. humans as vectors for the introduction and spread of invasive species). Therefore, to achieve the greatest ecological benefit while using the City's limited resources effectively, the larger, higher quality sites are given a greater priority. Although smaller Natural Areas may be more difficult to manage, it is also important to note the presence of significant features within those areas that may be threatened by the presence of invasive species (i.e. an invasive species may alter the composition of a significant vegetation community to the point where the features which define the significance of the area are no longer present) and/or the presence of strong community connection and involvement.

### 5.2 Priority Invasive Species

To assist in setting priorities for species management in the City's natural areas, a list of high priority invasive species and the degree of their invasiveness are provided in Table 1. The following considerations were used to identify those species which are

**Table 1.** Priority invasive species for management within the City’s natural areas.

Scientific Name	Common Name
<b>Flora</b>	
<i>Acer negundo</i> L.	Manitoba Maple
<i>Acer platanoides</i> L.	Norway Maple
<i>Aegopodium podagraria</i> L.	Goutweed
<i>Alliaria petiolata</i> (M. Bieb.) Cavara & Grande	Garlic Mustard
<i>Alnus glutinosa</i> (L.) Gaertn.	European Alder
<i>Celastrus orbiculatus</i> Thunberg	Oriental Bittersweet
<i>Cynanchum rossicum</i> (Kleopov) Borhidi	Dog-strangling Vine
<i>Elaeagnus umbellata</i> Thunb.	Autumn Olive
<i>Euonymus alatus</i> (Thunb.) Siebold	Winged Burning Bush
<i>Ficaria verna</i> Hudson	Fig buttercup
<i>Heraclium mantegazzianum</i> Sommier & Levier	Giant Hogweed
<i>Impatiens glandulifera</i> Royle	Himalayan Balsam
<i>Lonicera</i> spp.	Non-native Honeysuckles*
<i>Morus alba</i> L.	White Mulberry
<i>Pastinaca sativa</i> L.	Wild Parsnip
<i>Reynoutria japonica</i> Houttuyn var. <i>japonica</i>	Japanese Knotweed
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Common Reed
<i>Rhamnus</i> / <i>Frangula</i> sp.	Buckthorn**
<i>Viburnum opulus</i> L.	Guelder Rose
<b>Fauna</b>	
<i>Agrilus planipennis</i>	Emerald Ash Borer
<i>Anoplophora glabripennis</i>	Asian Long-horned Beetle
<i>Lymantria dispar</i>	Gypsy Moth

\*Non-native Honeysuckle includes *Lonicera japonica*, *L. maackii*, *L. morrowii*, *L. tatarica*, *L. x belli*, and *L. xylosteum*.

\*\*Buckthorn includes *Rhamnus cathartica* L. and *Frangula alnus* Miller.

perceived to be the greatest threats to the City’s Natural Areas:

1. Category 1 and 2 floral species from UFORA’s “Invasive Exotic Plant Species Ranking for Southern Ontario” (2002)
2. Human health risks (e.g. phototoxic plants, hazardous trees created through EAB infestation).
3. Credit Valley Conservation’s (CVC) invasive priority list (Table 3 in their Invasive Species Strategy) for both flora and fauna.
4. Existing invasive species management programs within the City for particular species.
5. Observed abundance, distribution, and negative impact on native flora and fauna within the City’s Natural Areas.

Professional judgement and experience with invasive species was applied to refine the species list based on knowledge of invasive species (e.g., proven invasiveness, feasibility of control) within the City’s Natural Areas. From that evaluation, a total of 20 flora species/groups and three fauna species have been identified as priority invasive species for management within Natural Areas (Table 1). The species identified in Table 1 have either already impacted Natural Areas within the City or have a strong potential to do so. These species exhibit the qualities identified in Section 3.1.

Table 1 identifies a list of current priority species which are expected to remain as management priorities until 2033. However, it should also be recognized that this list needs to be reviewed and revised as information on newly discovered invasive species and best management practices becomes available. To keep this list current, the City should seek guidance on newly established invasive species and effective management approaches and then adapt management activities accordingly (NHUFS 2014). In order to accomplish this, the City should regularly confer with agencies such as the Ontario Invading Species Awareness Program and their partners (e.g., CVC, Conservation Halton and Toronto and

Region Conservation Authority) to remain aware of new species which may become established within the City’s boundaries. An additional resource is the Early Detection and Rapid Response Network (EDRR) Ontario project aims to build a network to detect, track, respond to, and control invasive plants and insects in areas including the CVC and Conservation Halton watersheds. This will help to identify species that the City should monitor for within Natural Areas and to adopt an early detection rapid response approach to new arrivals of invasive species within the City.

### 5.3 Priority Sites

Initiatives for managing invasive species should focus on the Natural Areas that have the highest overall value within the Natural Heritage System, referred to here as “flagship” Natural Areas. The overall goal of this type of prioritization is to preserve and enhance the current quality and function of Natural Areas. Criteria applied to select flagship Natural Areas include:

- Excellent or good condition as provided in evaluations from annual NAS updates,
- Designated as Significant Natural Area,
- Presence of provincial Species at Risk,
- Environmental Significant Area (ESA), Area of Natural or Scientific Interest (ANSI), or Provincially Significant Wetland (PSW) designations,
- High Floristic Quality Index (FQI),
- Large size (greater than the 50<sup>th</sup> percentile (7 ha)), and
- City ownership of the majority of the natural area.

Applying all criteria resulted in the selection of 10 “flagship” sites (Table 2). In order to provide a ranking of the importance of sites that met ‘flagship’ criteria, FQI was chosen as a metric to determine the vegetation quality ranking of an area because it integrates many of the characteristics of the criteria listed above.

**Table 2.** High priority Natural Areas for invasive species management, ranked in preferential order.

Rank	Natural Area Name	Natural Area Code
1	Riverwood	CRR10
2	Erindale	CRR6
3	Cawthra Woods	LV7
4	Sawmill Valley Trail	EM4
5	Tecumseh	CL24
6	Meadowvale Station Woods	MV2
7	Credit Meadows	CRR2
8	Britannia Woods	HO9
9	Hewick Meadow	CRR11
10	Lisgar Meadow Brook	LS1

FQI is used to measure the quality of all the floral species found within a Natural Area. The FQI for an area is based on numbers between 1 and 10 assigned by the Province to each native plant according to its habitat requirements: this number is called the Coefficient of Conservatism (Oldham et al. 1995). Very adaptable species that can live in a wide range of conditions have been assigned low scores (e.g., 0-4), while plant species that only inhabit highly specific habitats have been assigned higher scores (e.g., 6-10). The scores for all plants found at a particular site are averaged and summed and subsequently multiplied by the square root of the number of species to obtain the FQI (Oldham et al. 1995). Very high quality habitats with a high diversity of species requiring a narrow range of habitats have higher FQIs than habitats with fewer species of broad habitat requirements. In Mississauga, Natural Areas with a high FQI tend to be large in size, relatively undisturbed, have Species At Risk (SAR) present and are subsequently often designated as Significant Natural Areas and/or ESAs, ANSIs or PSWs.

All of these Natural Areas have portions of publicly owned lands where the City can implement invasive species management.

**Table 3.** High priority Natural Areas for invasive species management with priority invasive species present. Natural Areas are listed in order of priority.

Scientific Name	Common Name	1 Riverwood (CRR10)	2 Erindale (CRR6)	3 Cawthra Woods (LV7)	4 Sawmill Valley Trail (EM4)	5 Tecumseh (CL24)	6 Fletcher's Flats (MV2)	7 Credit Meadows (CRR2)	8 Britannia Woods (HO9)	9 Hewick Meadows (CRR11)	10 Lisgar Meadow Brook (LS1)
<b>Flora</b>											
<i>Acer negundo</i> L.	Manitoba Maple	X	X	X	X	X	X	X	X	X	X
<i>Acer platanoides</i> L.	Norway Maple	X	X	X	X	X	X	X		X	X
<i>Aegopodium podagraria</i> L.	Goutweed	X	X		X		X	X		X	X
<i>Alliaria petiolata</i> (M. Bieb.) Cavara & Grande	Garlic Mustard	X	X	X	X	X	X	X	X	X	X
<i>Alnus glutinosa</i> (L.) Gaertn.	European Alder										
<i>Celastrus orbiculatus</i> Thunberg	Oriental Bittersweet										
<i>Cynanchum rossicum</i> (Kleopov) Borhidi	Dog-strangling Vine	X	X	X	X	X	X				
<i>Elaeagnus umbellata</i> Thunb.	Autumn Olive	X	X		X		X			X	
<i>Euonymus alatus</i> (Thunb.) Siebold	Winged Burning Bush	X	X	X	X	X		X		X	
<i>Ficaria verna</i> Hudson	Fig buttercup	X									
<i>Heracleum mantegazzianum</i> Sommier & Levier	Giant Hogweed	X	X		X	X				X	
<i>Impatiens glandulifera</i> Royle	Policemans Helmet	X	X					X		X	
<i>Lonicera</i> spp.	Non-native Honeysuckles*	X	X	X	X	X	X	X	X	X	X
<i>Morus alba</i> L.	White Mulberry		X	X	X		X			X	
<i>Pastinaca sativa</i> L.	Wild Parsnip	X	X			X	X	X		X	
<i>Phragmites australis</i>	Common Reed	X	X	X			X	X			X
<i>Polygonum cuspidatum</i> Siebold & Zucc.	Japanese Knotweed	X		X	X		X				
<i>Rhamnus</i> / <i>Frangula</i> sp.	Buckthorn**	X	X	X	X	X	X	X	X	X	X
<i>Viburnum opulus</i> L.	Guelder Rose			X	X	X		X			X
<b>Fauna</b>											
<i>Agrilus planipennis</i>	Emerald Ash Borer	X	X	X						X	X
<i>Anoplophora glabripennis</i>	Asian Long-horned Beetle										
<i>Lymantria dispar</i>	Gypsy Moth										

\*Non-native Honeysuckle includes *Lonicera japonica*, *L. maakii*, *L. tatarica*, *L. x bellii*, and *L. xylosteum*.

\*\*Buckthorn includes *Rhamnus cathartica* L. and *Frangula alnus*.

The City should proceed with management on publically-owned lands, and initiate landowner contact to explore opportunities for management on privately-owned lands.

Table 2 identifies the highest priority Natural Areas for invasive species management based on their high floristic quality and existing recognition as designated Significant Natural Areas. A secondary priority list has also been identified by removing the criteria for ESA, ANSI, or PSW designations. Although these Natural Areas are not considered as top priorities within the City, they are candidates for invasive species management based on their residual high ecological value. The following Natural Areas are identified as secondary priorities for management (ordered alphabetically by Natural Area code):

- Bishopstoke Walk (CC1)
- Sugar Maple Woods (CE7)
- Erin Wood (CE10)
- Jack Darling Park (CL16)
- Birch Glen (CL21)
- Whiteoaks (CL39)
- Meadowvale Conservation Area (CRR1)
- Riverview and Timothy Street (CRR3)
- Richard Jones (CV12)
- Willowvale Fields and Creditview Wetlands (EC13)
- Edward L. Scarlett and Red Oak Plain (ETO3)
- Garnetwood (ETO4)
- Orchard Heights (ETO8)
- Not Yet Named (LV1)
- Totoredaca (MB6)

- Credit River Flats (MI7)
- Mary Fix (MI17)
- Not Yet Named (MV12)
- Mississauga Valley (MY1)
- Not Yet Named (NE4)
- Wildwood (NE9)
- Not Yet Named (SD1)
- Not Yet Named (SP3)
- Turney Woods (SV1)

There may be Natural Areas that possess values of community or cultural interest, and may be considered for invasive species management based on social and cultural values, and complimentary management opportunities (e.g. pairing other management efforts, such as tree planting, with invasive species management). Where there is interest from community groups to management invasive species, the City can encourage management efforts by providing encouragement and assistance to community groups who wish to undertake management in particular areas, including areas outside of the above lists.

## 6.0 Summary

Based on an extensive background review, a total of 20 floral species/groups and three faunal species have been identified as top priorities for management and 10 Natural Areas have been identified and ranked as “flagship” Natural Areas worthy of specific invasive species management efforts. To aid in the implementation of this strategy, the priority species have been cross referenced with the priority Natural Areas (Table 3). The floral information is based on the NAS database and should be updated annually as inventory information is refined for each Natural Area. The faunal observations are based on site-specific studies and general

information. The information in Table 3 identifies the presence of invasive species within these Natural Areas; however, in order to prioritize management, it is recommended that abundance of invasive species populations is also taken into consideration. Abundance information should be obtained in the field through the implementation of the ISMP&IS.

## 7.0 References

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# Appendix 2: Template for Tracking Resource Allocation and Management Activities

Natural Area	Baseline Inventory Date Completed	Priority Invasive Species Identified	Approximate Cost for Management	Funding/ Grants Applied for	Partners Identified and Contacted	Community Outreach Initiatives and Date	Public Educational Opportunities (list)	Volunteer Engagement	Actual Cost of Management	Follow-up Retreatment	Monitoring
e.g. Area 1	June 28, 2017	European Buckthorn, Garlic Mustard, Japanese Knotweed, Norway Maple, Manitoba Maple, Tatarian Honeysuckle	\$160,000	TD Friends of the Environment, Ontario Trillium Foundation	CVC, Region of Peel	Pamphlets handed out door to door (June 9, 2017)  Signs erected at entrance to Natural Area (June 9, 2017)	Community workshop (June 9, 2017)	Garlic Mustard and buckthorn pull (June 28, 2017)	\$136,000 (lower than estimated due to volunteer engagement)	Garlic mustard and buckthorn pull on (June 28, 2018)	June 9, 2018  Planned for June 2020

# Appendix 3: High Quality Vegetation Communities in Mississauga

ELC Code	ELC Name
<b>FOC3-1</b>	fresh-moist hemlock coniferous forest type
<b>FOD2-1</b>	dry-fresh oak - red maple deciduous forest type
<b>FOD2-2</b>	dry-fresh oak - hickory deciduous forest type
<b>FOD5</b>	dry-fresh sugar maple deciduous forest ecosite
<b>FOD5-1</b>	dry-fresh sugar maple deciduous forest type
<b>FOD5-2</b>	dry-fresh sugar maple - beech deciduous forest type
<b>FOD5-3</b>	dry-fresh sugar maple - oak deciduous forest type
<b>FOD6-5</b>	fresh-moist sugar maple - hardwood deciduous forest type
<b>FOD7-4</b>	fresh-moist black walnut lowland deciduous forest type
<b>FOD7-5</b>	fresh-moist black maple lowland deciduous forest type
<b>FOD9-3</b>	fresh-moist bur oak deciduous forest type
<b>FOD9-4</b>	fresh-moist shagbark hickory deciduous forest type
<b>FOM3-1</b>	dry-fresh hardwood - hemlock mixed forest type
<b>FOM3-2</b>	dry-fresh sugar maple - hemlock mixed forest type

ELC Code	ELC Name
<b>FOM4</b>	dry-fresh white cedar mixed forest ecosite
<b>FOM6-1</b>	fresh-moist sugar maple - hemlock mixed forest type
<b>MAM2</b>	mineral meadow marsh ecosite
<b>MAM2/MAS2-1</b>	mineral meadow marsh ecosite/cattail mineral shallow marsh type
<b>MAM2-2</b>	reed-canary grass mineral meadow marsh type
<b>MAM2-2/MAS2-1</b>	reed-canary grass mineral meadow marsh type/cattail mineral shallow marsh type
<b>MAS2-1</b>	cattail mineral shallow marsh type
<b>MAS3-1</b>	cattail organic shallow marsh type
<b>SAF1-3</b>	duckweed floating-leaved shallow aquatic type
<b>SWD3-1</b>	red maple mineral deciduous swamp type
<b>SWT3-2</b>	willow organic thicket swamp type
<b>TPO1</b>	dry tallgrass prairie



# Appendix 4. Field Data Sheets

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**Form Definitions and Instructions:**

**Baseline Monitoring or New Pop. (BM or N):** Indicate if the population is newly discovered (N) or part of the baseline monitoring data (BM).

**Baseline Monitoring OR New Pop. Poly/WP:** List the baseline monitoring polygon (Poly) or waypoint (WP) name or, if a new population, create a new name as follows.

- New Waypoint: SITE CODE-YEAR-WP-#. For example, ME8-2020-WP-1.
- New Polygon: SITE CODE-YEAR-P-#. For example, LV7-2020-P-3.

\*New polygons (Poly) can be marked on a hard-copy air photo with associated notes and waypoints (WP) documented on a datasheet, or information can be recorded with GPS.

**Controlled (Y/N):** Indicate if control occurred for the Poly of WP. In some cases, a new population may be discovered and control may not occur.

**Control Poly/WP name:** Assign a control name to all areas that are controlled.

- Control WP: SITE CODE-YEAR-C-#. For example, ME8-2020-C-1
- Control Poly: SITE CODE-YEAR-C-#. For example, LV7-2020-C-3.

\*Note that multiple existing polygons and waypoints can be included in the same control polygon.

\*Note that baseline monitoring/ new population Poly and WP names do not need to match control names.

**Species code:** Use ELC species codes based on scientific nomenclature (e.g., RHA CATH = Rhamnus cathartica).

**Pop. size:** Population before control begins, use codes to approximate number of individual plants.

- Population Codes: 1 = 1-2, 2= 3-5, 3= 6-20, 4= 21-50, 5= 50-100, 6= 100+

**Distrib. (I, S, P, D):** Distribution of plants:

- individuals (I) - few individuals in close proximity
- scattered (S) - plants scattered evenly throughout area
- patchy (P) - plants in distinct patches
- dense (D) - a large dense patch

**Pop. size controlled:** population of plants controlled. Use population codes identified above.

**Control area:** Identify size of control area (i.e., polygon size) based on GPS track or waypoint.

**Control method(s):** Handpulling (HP), Mowing (MO), Chemical (C), Girdling (G), Mulching (MU), Tarping (T).

**Staff Initials:** Initials of staff involved in control.

**Staff person hours:** Number of staff multiplied by number of hours worked.

**Vol. person hours:** Number of volunteers multiplied by number of hours worked.

**Biomass removed:** Number of bags or truck loads of plant material removed.

**General Equipment Checklist**

<b>Tools</b>	<b>Other Materials</b>
<input type="checkbox"/> Extractagators (1 per staff) <input type="checkbox"/> Shovels (1 per staff) <input type="checkbox"/> Loppers (1 per staff) – make sure they are sharp <input type="checkbox"/> Saw (at least 1)	<input type="checkbox"/> Package of zip-ties <input type="checkbox"/> Small garbage bags (for putting over stumps) <input type="checkbox"/> Large garbage bags <input type="checkbox"/> Spray paint <input type="checkbox"/> Flagging tape <input type="checkbox"/> First Aid Kit <input type="checkbox"/> Additional ID Resources (i.e. field guides, etc.)
<b>Data Collection</b>	
<input type="checkbox"/> Field sheets – daily tracking sheet, photo monitoring sheet <input type="checkbox"/> Writing utensils <input type="checkbox"/> GPS – Garmin <input type="checkbox"/> Spare Garmin batteries <input type="checkbox"/> Camera (or phone to take photos) <input type="checkbox"/> Tablet/iPad	





**Site Information**

NAS Code:		Survey Date (DD/MM/YY):	
Park Name:		Start Time:	
ELC Community:		End Time:	
Park #:	SR#:	Observers:	
Monitoring Year *(circle one):    1    2    3    4    5		GPS Track Recorded:    Y / N	

\*Circling year 1 for Monitoring Year indicates baseline inventory

**Methods/ Equipment Checklist**

Data Sheets	Camera	First Aid Kit
Writing Utensils	Camera Memory Card	Required PPE
GPS	ID Resources (field guides, etc)	
Spare Batteries	ELC Resources	

**Data Summary**

Polygons/Waypoints Marked on Map (attached)	Species at Risk
# Pages (including map)	Toxic Plants
Photos (refer to photo reference table)	
Site Comments:	

**Form Definitions/Instructions**

**Poly/WP #:** Polygons (Poly) can be marked on a hard-copy air photo with associated notes and waypoints (WP) documented on a datasheet, or information can be entered digitally on a tablet with air photo and GPS capabilities.

**Route Description:** Route surveyed when invasive species was encountered: Trail (T), Property Boundary (B), Watercourse/Waterbody (W), Area of Interest (AOI) (e.g., old homestead, old laneway/driveway)

**ELC Code:** Identify Ecological Land Classification unit(s) that polygon overlaps.

**Species Code:** Use ELC species codes based on scientific nomenclature (e.g. RHA CATH).

**Management Triggers** Check column if any are applicable within or adjacent to the polygon.

**Population Characteristics**

**Pop. Size:** Use codes to approximate number of individual plants.

Population Codes: **1** = 1-2    **2** = 3-5    **3** = 6-20    **4** = 21-50    **5** = 51-100    **6** = 100+

**Distribution:**

- individuals (I) - few individuals in close proximity
- scattered (S) - plants scattered evenly throughout area
- patchy (P) - plants in distinct patches
- dense (D) - a large dense patch

**Growth Stage:**

- 1** Immature, could be removed mechanically using a puller or by hand
- 2** Mature, large, requires cutting, girdling, chemical control

**Area Disturbance:** Check disturbance(s) present within (w) or adjacent (a) to the polygon or waypoint. For 'Other' check column and describe in 'comment' column. For large areas of disturbance, mark on map.

**Comments** Provide any additional comments that may help guide management decisions and provide additional context to the site-specific invasive species populations. Phenology, current effects on the surrounding ecosystem, adjacent native plants etc.







# Appendix 5: Restoration Resources

Reference Type	Documents			Information Available
	Author	Year	Title	
<b>Native Plants</b>	Credit Valley Conservation	2018	Plant Selection Guide. Species List for Planting Plans within the Credit River Watershed. Version 2.0	Appropriate ecoregion Coefficient of wetness Species suitable for Storm Water Management ponds
	Conservation Halton	2010	Landscaping and Tree Preservation Guidelines	Herbaceous and woody native species list Suitable nurse crop species Suitable bioengineering species Shoreline species Landscaping plan checklist for consultants
<b>Nurseries</b>	Credit Valley Conservation	2020	Guide to Native Plant Nurseries & Seed Suppliers	Company name, location, and contact Stock type Suitable plant community
<b>Soils</b>	Toronto and Region Conservation Authority	2012	Preserving and Restoring Healthy Soil: Best Practices for Urban Construction. Version 1.0.	Soil quality and depth standards Appropriate soil management best practices Soil management plan Maintenance
<b>Planting Guidelines</b>	Toronto and Region Conservation Authority	2004	Post-construction Restoration Guidelines	Suitable plant types Riparian planting guidelines Planting densities Desired woody coverage for forests
	Conservation Halton	2010	Landscaping and Tree Preservation Guidelines	Species selection Planting density Soils Habitat creation Plant care

Reference Type	Documents			Information Available
	Author	Year	Title	
<b>Restoration Guidelines</b>	Society for Ecological Restoration (SER)	2004	SER International Primer on Ecological Restoration	Attributes of restored ecosystems Reference ecosystems Monitoring and evaluation Planning Integration into other programs
	Society for Ecological Restoration - Ontario Chapter	2011	Native Plant Resource Guide Ontario. 6 <sup>th</sup> Edition. Information and Sources of Planting Materials for Ecological Restoration in Ontario.	Tree seed zones Guideline application Species at Risk Ethics
	IUCN WCPA Ecological Restoration Taskforce	2012	Ecological Restoration for Protected Areas. Principles, Guidelines and Best Practices.	High-level information Why, when, and where to restore Connectivity Principles and guidelines Best practices Processes
	British Columbia Biodiversity Branch, Ministry of Water, Land and Air Protection	Unknown	Ecological Restoration Guidelines for British Columbia	Project planning Project timing Monitoring Maintenance

# Appendix 6: Aggressive Forest Native Species Suitable for Restoration Efforts

Common Name	Scientific Name
<b>Herbs and Graminoids</b>	
Common Milkweed	<i>Asclepias syriaca</i>
Wild Bergamot	<i>Monarda fistulosa</i>
Wild Strawberry	<i>Fragaria virginiana</i>
Large-leaved Aster	<i>Eurybia macrophylla</i>
Virginia Waterleaf	<i>Hydrophyllum virginianum</i>
Starry False Solomon's-seal	<i>Maianthemum stellatum</i>
Ostrich Fern	<i>Matteuccia struthiopteris</i>
Mayapple	<i>Podophyllum peltatum</i>
Bracken Fern	<i>Pteridium aquilinum</i>
Bloodroot	<i>Sanguinaria canadensis</i>
Zigzag Goldenrod, other Goldenrods	<i>Solidago flexicaulis, Solidago spp.</i>
Stellate Sedge	<i>Carex rosea</i>
Woodland Sedge	<i>Carex blanda</i>
Graceful Wood Sedge	<i>Carex gracillima</i>
Plantain-Leaved Sedge	<i>Carex plantaginea</i>
Evening Primrose	<i>Oenothera biennis</i>
New England Aster	<i>Symphyotrichum novae-angliae</i>
Swamp Aster	<i>Symphyotrichum puniceum</i>
Panicled Aster	<i>Symphyotrichum ericoides</i>
Lance-leaved Aster	<i>Symphyotrichum lanceolatum</i>
Blue Vervain	<i>Verbena hastata</i>

Common Name	Scientific Name
<b>Shrubs</b>	
Smooth Serviceberry	<i>Amelanchier laevis</i>
Alternate Dogwood	<i>Cornus alternifolia</i>
Grey Dogwood	<i>Cornus racemosa</i>
Red-Osier Dogwood	<i>Cornus stolonifera</i>
Bush Honeysuckle	<i>Diervilla lonicera</i>
Chokecherry	<i>Prunus virginiana</i>
Staghorn Sumac	<i>Rhus typhina</i>
Wild Red Raspberry	<i>Rubus idaeus</i>
Black Raspberry	<i>Rubus occidentalis</i>
Purple-Flowering Raspberry	<i>Rubus odoratus</i>
<b>Trees</b>	
Sugar Maple	<i>Acer saccharum</i>
Black Walnut	<i>Juglans nigra</i>
White Spruce	<i>Picea glauca</i>
Trembling Aspen	<i>Populus tremuloides</i>
Bur Oak	<i>Quercus macrocarpa</i>
Red Oak	<i>Quercus rubra</i>
Basswood	<i>Tilia americana</i>
White Cedar	<i>Thuja occidentalis</i>

# Appendix 7: Common Invasive Plant Substitutions in Nurseries in Ontario

Common Name	Scientific Name	Invasive Substitute	Solution
<b>Trees</b>			
Speckled alder	<i>Alnus incana</i> ssp. <i>rugosa</i> (= <i>A. rugosa</i> )	<i>Alnus incana</i> ssp. <i>incana</i> or <i>A. glutinosa</i>	Do not specify <i>Alnus</i> species until properly identified plants are commercially available. Hybridization may also be occurring. Not really appropriate for southern Ontario (improper site conditions).
White (paper) birch	<i>Betula papyrifera</i>	<i>Betula pendula</i> and cultivars	Ensure correct species identification
Eastern cottonwood	<i>Populus deltoides</i>	<i>Populus xcanadensis</i>	Ensure correct species identification
Black willow	<i>Salix nigra</i>	<i>Salix xfragilis</i> ( <i>S. xrubens</i> ), <i>S. alba</i> , or <i>S. xsepulcralis</i> , <i>S. caprea</i>	Ensure correct species identification
American basswood	<i>Tilia americana</i>	<i>Tilia cordata</i> or <i>Tilia hybrids</i> ( <i>Tilia xeuchlora</i> and <i>T. xeuropaea</i> )	Ensure correct species identification. The 'native' cultivar <i>Tilia americana</i> 'Redmond' is a mislabelled <i>Tilia xeuchlora</i> hybrid.
<b>Shrubs</b>			
American bittersweet	<i>Celastrus scandens</i>	<i>Celastrus orbiculatus</i>	Do not specify <i>C. scandens</i> until properly identified plants are commercially available.
Pussy willow	<i>Salix discolor</i>	<i>Salix caprea</i>	Ensure correct species identification.
Highbush cranberry	<i>Viburnum opulus</i> ssp. <i>trilobum</i> ( <i>V. trilobum</i> )	<i>Viburnum opulus</i> ssp. <i>opulus</i>	Do not specify <i>V. trilobum</i> until properly identified species are commercially available. Hybridization may also be occurring.
Note: Return misidentified species to the nursery before planting and inform them that what was received is unacceptable. Insist on correct native species and correct any mistakes made immediately.			

# Appendix 8: Potential Funding Sources for Invasive Species Management Projects

Grant/ Funding Source	Program Name	Partnership with non-profit organization required?	Deadline (approximate)	Types of Projects (relevant to invasive species management)	Funding Limit	Eligible Project Costs	Term
Government of Canada - Environment and Climate Change Canada	EcoAction Community Funding Program	Yes	November	<ul style="list-style-type: none"> <li>• reduce biodiversity loss</li> <li>• protect wildlife and plants</li> <li>• protect and improve habitat.</li> </ul>	For every dollar you receive from the Government of Canada, you must obtain at least the same amount from non-federal government partners (including cash contributions and in-kind support)	<ul style="list-style-type: none"> <li>• human resources</li> <li>• contract and professional service</li> <li>• travel and field</li> <li>• material and supply</li> <li>• printing and production</li> <li>• communication and distribution</li> <li>• equipment purchase or rental</li> <li>• vehicle rental and operation</li> <li>• translation</li> <li>• overhead and/or administration</li> </ul>	3 years
Environment and Climate Change Canada	Habitat Stewardship Program for Species at Risk	No, but recommended	Expressions of Interest and Call for Proposals issued in the Fall	<ul style="list-style-type: none"> <li>• conserve and protect species at risk and their habitats</li> <li>• increase biodiversity</li> <li>• prevent other species from becoming conservation concern</li> </ul>	The program requires a minimum of 1:1 leveraging on funds that it invests. (Financial or in kind resources)	<ul style="list-style-type: none"> <li>• salaries and wages</li> <li>• management and professional service costs</li> <li>• contractors</li> <li>• travel</li> <li>• materials and supplies</li> <li>• communication and printing, production, and distribution costs</li> <li>• equipment rentals</li> <li>• vehicle rental and operation costs</li> <li>• purchase of capital assets</li> <li>• land acquisition, leases, easements, covenants, servitudes</li> <li>• costs of preparing an independent financial accounting</li> <li>• overhead</li> </ul>	1 or more years

Grant/ Funding Source	Program Name	Partnership with non-profit organization required?	Deadline (approximate)	Types of Projects (relevant to invasive species management)	Funding Limit	Eligible Project Costs	Term
TD	TD Friends of the Environment Foundation	No	February and July	<ul style="list-style-type: none"> <li>environmental education</li> <li>outdoor classrooms</li> <li>protection of Endangered Species/Wildlife</li> <li>recycling/ composting</li> <li>tree planting and urban naturalization</li> <li>research</li> <li>habitat restoration</li> </ul>	Needs based; no set minimum or maximum  Average grant size is \$4,000	<ul style="list-style-type: none"> <li>none noted (only list what is not funded, e.g., projects occurring on private land)</li> </ul>	None noted
Ontario Trillium Foundation	Seed Grant	Yes (because population over 20,000)	None noted	<ul style="list-style-type: none"> <li>researching new concept/idea/ approach</li> <li>developing, launching, or testing new idea, approach, or event</li> <li>piloting new program, running a demonstration project</li> <li>conducting feasibility study</li> <li>convening around emerging issue</li> <li>other</li> </ul>	\$5,000 to \$75,000	<ul style="list-style-type: none"> <li>direct personnel</li> <li>direct non-personnel</li> <li>overhead and administration</li> </ul>	1 year
Ontario Trillium Foundation	Grow Grant	Yes (because population over 20,000)	None noted	<ul style="list-style-type: none"> <li>increasing the reach of an existing, proven project</li> <li>replicating, adapting, or scaling a proven model</li> <li>piloting or demonstrating a tested model</li> </ul>	\$50,000 to \$250,000 per year	<ul style="list-style-type: none"> <li>direct personnel</li> <li>direct non-personnel</li> <li>overhead and administration</li> </ul>	2 to 3 years

Grant/ Funding Source	Program Name	Partnership with non-profit organization required?	Deadline (approximate)	Types of Projects (relevant to invasive species management)	Funding Limit	Eligible Project Costs	Term
Ministry of Natural Resources and Forestry	Land Stewardship and Habitat Restoration Program	No	December	<ul style="list-style-type: none"> <li>upland or terrestrial improvements</li> <li>wetland restoration</li> <li>invasive species control through mechanical or ecological means, or site modifications</li> <li>native species reintroduction</li> </ul>	\$20,000 per project (no more than 50% of total project cost)  (can submit only 1 project for funding each year)	<ul style="list-style-type: none"> <li>human resources</li> <li>administration</li> <li>equipment</li> <li>materials and supplies</li> <li>vehicle and travel</li> </ul>	1 year
Ministry of Natural Resources and Forestry	Species at Risk Stewardship Fund	No	October	<ul style="list-style-type: none"> <li>management and planning</li> <li>surveys, inventories, and monitoring</li> <li>outreach and awareness</li> </ul>	No limit; matching funding preferred	<ul style="list-style-type: none"> <li>human resources</li> <li>administration</li> <li>equipment</li> <li>materials and supplies</li> <li>vehicle and travel</li> <li>publication design, printing, and distribution</li> </ul>	Up to 3 years
Toronto Foundation	Helen McCea Peacock Foundation	Yes	March	<ul style="list-style-type: none"> <li>conservation and protection</li> <li>tree planting and stewardship</li> <li>naturalization and restoration</li> </ul>	\$2,000 and \$8,000	Will NOT support: <ul style="list-style-type: none"> <li>operating deficits</li> <li>capital campaigns</li> <li>100% staff salaries</li> <li>attendance at conferences</li> <li>endowment funds</li> <li>political or religious activities</li> <li>event or fundraising sponsorship</li> <li>marketing materials</li> <li>activities that occur before September 2016</li> </ul>	None noted
Honda	Honda Canada Foundation	Yes	None noted	<ul style="list-style-type: none"> <li>operating expenses</li> <li>project costs</li> <li>program costs</li> <li>matching funds</li> </ul>	N/A	<ul style="list-style-type: none"> <li>operating expenses</li> <li>project costs</li> <li>program costs</li> <li>scholarships/ fellowships</li> <li>research</li> <li>matching funds</li> </ul>	None noted
Ontario Wildlife Foundation	Grant	No	May	<ul style="list-style-type: none"> <li>awareness for the conservation and enhancement of Ontario's natural resources through research and restoration</li> </ul>	Unknown	Will NOT provide funds for travel expense to conferences/ seminars, for legal action or for land acquisitions	None noted

# Appendix 9: Glossary

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**Abundance** is a measurement of a species presence within an ecosystem or area and can be given in coverage area, rankings or number of individuals.

**Alien species** are species introduced into Canada's forests within recent history. They are also referred to as "exotic," "non-native" and "foreign."<sup>2</sup>

**Bole** is the trunk of a tree.

**Containment of** an invasive species entails taking on the ground actions to keep the species in its current geographic locations and prevent its spread to new areas.<sup>3</sup>

**Control of** an invasive species entails keeping the population sizes of the invasive species at an acceptably low level.<sup>2</sup>

**Defoliation** is the process of loss of leaves due to the presence of pests or disease.

**Ecological Integrity** is a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes.<sup>4</sup>

**Ecosystem services** are the benefits humankind experience from natural environments. These include, but are not limited to: pollination, cleaning of drinking water, soil stabilization and climate regulation.

**Epicormic Shoots** are shoots (young branches) on woody vegetation from a previously dormant bud on the trunk or limb.

**Eradicate** refers to actions directed at total elimination of the invader. Efforts can be directed at eradicating a species from the province or eradicating a species from a specific geographic region.<sup>2</sup>

**Established** species are invasive species that are reproducing naturally without being cultivated or otherwise assisted by intentional human action.<sup>2</sup>

**Infestation** is the presence of a species in large enough numbers that it may cause damage to native species or natural environments.

**Introduction** is entry of an organism to a geographic region, brought about by human action, resulting in the establishment of a population.<sup>2</sup>

**Invasibility** of a species is determined by traits that increase its rate of spread, such as rate of reproduction and method of distribution.

**Invasive species** are native or alien species whose introduction or spread threatens the environment, the economy, and/or society including human health.<sup>2</sup>

**Native species** are indigenous species that have existed in Canada for thousands of years.<sup>1</sup>

<sup>2</sup> Natural Resources Canada. (2016, 03 23). Forest Pest Management. Retrieved 21/10/2016, from Natural Resources Canada: <http://www.nrcan.gc.ca/forests/fire-insects-disturbances/pest-management/13361>

<sup>3</sup> Ontario Ministry of Natural Resources. July 2012. Ontario Invasive Species Strategic Plan. Toronto: Queen's Printer for Ontario. 58pp.

<sup>4</sup> Parks Canada. 2013. Ecological Integrity. Retrieved 10/3/17 from Park Canada: <http://www.pc.gc.ca/eng/progs/np-pn/ie-ei.aspx>



**Naturalized species** are alien species which have established stable self-sustaining populations such that control/eradication efforts are not feasible.<sup>2</sup>

**Non-native species** are species that do not naturally occur in a region but have become established after transportation by human actions.<sup>2</sup>

**Noxious plants** are plants with toxic chemicals in their sap that pose a health risk for humans, including rashes.

**Occurrence** is the presence of an organism in a geographical region.<sup>2</sup>

**Pathogens** are biological agents that cause disease or illnesses to their hosts.<sup>2</sup>

**Pathways** are one or more routes by which an invasive species is transferred from one ecosystem to another. It is the physical means by which an invasive species is transported to a new region by humans, either deliberately or accidentally. Within a pathway, one or more vectors or routes of transfer exist by which an invasive species is transferred.<sup>2</sup>

**Phototoxin** is a toxic chemical in plants that causes a burn or rash that is worsened when the toxin is exposed to sunlight on the skin.

**Pilot Sites** are the first locations to experience invasive species control in a region and can help develop methods specific to the region by evaluating feasibility of the project.

**Satellite populations** are small (<10m<sup>2</sup>), isolated populations of a species that occur sparsely over an area.

**Significant vegetation communities** are rare vegetation communities with ranks of G1, G2, G3, S1, S2 or S3.

**Silviculture** is the practice of controlling the establishment, growth, composition, health and quality of natural forests to meet diverse needs and values.<sup>5</sup>

**Species at Risk** refers to any naturally-occurring plant or animal in danger of extinction or of disappearing from the province. Species are classified as “at risk” by the federal and provincial government.<sup>2</sup>

**Spread** is the expansion of the geographical distribution of an organism within a geographical region.<sup>2</sup>

**Vectors** are routes of transfer within a pathway by which an invasive species is transferred.

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<sup>5</sup> Food and Agriculture Organization of the United Nations (FAO). 2017. Silviculture in Natural Forests. <http://www.fao.org/sustainable-forest-management/toolbox/modules/silviculture-in-natural-forests/basic-knowledge/en/>



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