



Integrated Pest Management Guidelines

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HALIFAX

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Integrated Pest Management Strategy

Introduction to Integrated Pest Management

A pest is a plant or animal that has a destructive impact on one or all the following: built infrastructure, natural assets or human health and safety. Many pests are also considered invasive species, which are defined as harmful, non-native species whose introduction or spread threatens the environment, the economy or society, including human health. An invasive species often lacks natural enemies or other forms of competition to keep it in check; therefore, it can quickly increase its range and population to take over an area in a short amount of time¹.

Integrated Pest Management (IPM) is a holistic, ecological decision-making model to prevent and manage pest damage below specific thresholds (unacceptable levels), using a combination of preventative practices and carefully selected control strategies and treatments with an emphasis on reducing pesticide use.

An IPM strategy has many benefits, including:

- Promotion of healthy plant and wildlife communities
- Promotion of alternative pest management strategies that are sustainable
- Protection of native species
- Reduction of pesticide use and associated risks such as contaminated air and water, and exposure to pesticides
- Increase the cost-effectiveness of pest management programs



Figure 1: "giant hogweed" by antefixus21 is licensed under CC BY-NC-ND 2.0

Principles

Integrated Pest Management is based on the following principles:

- Minimizing human health and environmental risks.
- Following an ecological approach to pest management by integrating preventative measures and applying alternative control technology before considering pesticides - pesticides are considered a last resort.

¹ Ontario Invasive Plant Council (March 2015). "Creating an Invasive Plant Management Strategy: A Framework for Ontario Municipalities": https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/PlantManagementStrategy_2015_March172015_D3_PRINTFINAL.pdf

- Considering operational feasibility and cost-effectiveness in decision-making.
- Demonstrating a leadership role by promoting a pest management approach that is integrated and environmentally-sound.
- Following a flexible approach that allows changes to best practices as conditions change or new strategies evolve.
- Ensuring that any HRM Contractors for pest management follow an IPM philosophy and best practices.

Rationale

The risk of invasive species in HRM is increasing with climate change. A changing climate affects species' life cycles, creates favourable conditions for spread from warmer regions, and adds pressure to native species that are adapted to Nova Scotia's climate². This applies to some problematic native species that are harmful to human health, such as blacklegged ticks. Blacklegged ticks, which is the only tick species in Nova Scotia that can be a carrier for Lyme disease, require a minimum number of days with above-freezing temperatures to increase their life cycle. Warming temperatures have allowed tick populations to increase and move northwards³.

Invasive species and problematic pest populations in HRM will likely become more of a problem over time. Implementing an IPM strategy now allows the municipality time to create species-specific guidelines and manage populations in an ecologically responsible manner.



Figure 2: "Emerald Ash Borer" by USDAgov is licensed under CC BY-NC-ND 2.0

Purpose

In lieu of a formal IPM strategy, business units have taken a piecemeal approach to pest management through operations and maintenance.

Key business units include:

- Parks and Recreation
- Transportation and Public Works
- Solid Waste
- Planning and Development
- Property, Fleet and Environment

² Issues Brief (February, 2021). Invasive Alien Species and Climate Change. International Union for Conservation of Nature: <https://www.iucn.org/resources/issues-briefs/invasive-alien-species-and-climate-change>.

³ Constible, Juanita (April 26, 2018). "A New Reality: Climate Change and Lyme Disease in Canada", NRDC: <https://www.nrdc.org/experts/juanita-constible/new-reality-climate-change-and-lyme-disease-canada>.

The IPM guideline communicates municipal roles, responsibilities, and initiatives for pest management to the public and is a tool for public education. It informs residents about current and alternative pest management practices. The education campaign will focus on publishing the IPM guidelines on the website and through social media. Other education measures may be delivered to targeted audiences on individual species as outlined in species-specific management plans. The IPM guidelines will be updated as needed and management plans for more species will be added as needed.

Prioritizing Pests and Invasive Species

The following table (Table 1) has been adapted from the Ontario Invasive Plant Council⁴. The risk rating will help HRM staff in prioritizing species for management action. Each category is described below and either a 0, 1 or 2 can be assigned to the species. The total score will determine the risk rating of each species as very high (4-8), high (3), moderate (2) or low (1). Species that rank High or Very High should be further investigated and a pest management plan developed and implemented. HRM recognizes that pests and invasive species will continue to enter the municipality. The purpose of this table is to prioritize our response to those threats.

While this table is a great resource to help staff with on-the-ground decision-making, it is important to understand that this is to be used on a case-by-case basis. Additionally, new invasions and introductions are not captured by this tool. All new introductions to HRM should be prioritized as management is the most feasible shortly after an introduction.

⁴ Ontario Invasive Plant Council (2015). Creating an Invasive Plant Management Strategy: A Framework for Ontario Municipalities: https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/PlantManagementStrategy_2015_March172015_D3_PRINTFINAL.pdf

Table 1: Invasive species prioritization matrix, adapted from the Ontario Invasive Plant Council.

Score	Human Health & Safety	Ecosystem	Infrastructure	Recreation & Aesthetics	Persistence
2	Immediate and detrimental effect on human health	Within the scope, the threat is likely to seriously degrade, destroy, or eliminate native habitat by 31-100% within ten years or three generations	Direct impact on infrastructure (e.g., roads, buildings, underground utilities, etc.)	Direct impact on recreation and aesthetics	Removal requires a trained professional
1	Potential impact on human health	Within the scope, the threat is likely to moderately degrade/reduce native habitat by 11-30% within ten years or three generations	Indirect impact on infrastructure (e.g., creates hazard trees)	Impedes recreation access and/or affects viewscales	Requires 3 or more repeat manual treatments
0	No direct impact	Within the scope, the threat is likely to only slightly degrade/reduce native habitat by 1-10% within ten years or three generations.	No significant impacts	No significant impacts	Removal typically requires only 1 to 2 repeat manual treatments

Federal and Provincial Roles and Responsibilities

Managing invasive species is a shared responsibility between all levels of government. Table 2 outlines federal and provincial legislation and departments relevant to invasive species management.

Table 2: Federal and provincial responsibilities relating to invasive species management in Nova Scotia.

Level of Government	Legislation	Description
Federal	Pest Control Products Act	Aims to protect human health and safety and the environment by regulating pest control products
	Canadian Food Inspection Agency	Coordinates programs to prevent the introduction and movement of invasive species between borders, and aids with education and monitoring within Canada
	Fisheries Act	Supplies a full suite of regulatory tools to prevent the introduction of aquatic invasive species into Canadian waters and to control and manage their establishment and spread, once introduced.
	Migratory Birds Convention Act	Aims to protect migratory birds, their eggs, and their nests.
	Species at Risk Act	Aims to protect species of conservation concern in Canada. The federal government must be consulted before any pest control actions affect federally protected species.
Provincial	NS Endangered Species Act	Aims to protect species in NS that have been assessed and determined to be at risk of extinction.
	Non-essential Pesticides Control Act	Prevents the sale of 2,4-D products, with the exception for the management of invasive species including Giant hogweed and Japanese knotweed.

Identification / Inventory

The first step in managing pests is to identify their location and population size and create a record of the sighting. An up-to-date inventory is essential to understand the severity and scope of the problem and the resources required for management. Field and operations staff are encouraged to use the web-based iNaturalist app to identify and track invasive species. Using iNaturalist will provide data on location and automatically adds the sighting to an inventory of citizen science observations. The [Nova Scotia Invasive Species Council \(NSISC\)](#) already maintains an iNaturalist group for sightings of invasive species in Nova Scotia. Another benefit of iNaturalist is that it helps the user identify the species based on the submitted photo. For additional identification resources, please refer to [Invasive Species in Nova Scotia: Identification and Information Guide](#) or some [species fact sheets](#) from the NSISC or the Ontario Invasive Plant Council.

Eventually, other means of tracking invasive species may be implemented in the province, such as EDDMapS – Early Detection and Distribution Mapping System – a program designed to capture spatial invasive species data. Another software that is in the process of being implemented in the province is iMapInvasives. Both mapping software packages allow users to track additional information, such as effort spent surveying, treatment, and removal of invasive species. Until then, it is recommended that HRM staff use iNaturalist to identify the location of pests in the municipality.

Early Detection and Rapid Response

Research indicates that early and organized response to new incursions can dramatically increase the odds of success in managing invasive species.

The best management tool for invasive species is preventing introductions and reducing the spread of invasive species. The first step to prevention is identifying pathways of spread and understanding how invasive species move. Some of these pathways include (but are not limited to):

- Planting invasive species in gardens (e.g., Giant Hogweed)
- Releasing unwanted pets that become invasive (e.g., Goldfish)
- Dumping aquarium plants (e.g., Fanwort)
- Introducing new game species (e.g., Wild Pigs)
- Commercial wood imports (e.g., Emerald Ash Borer)
- Shipping (e.g., Hemlock Woolly Adelgid)

Once established, invasive species can spread naturally by floating downstream, through animal dispersal (i.e., bird poop), and by natural movement. However, they can travel much longer distances much quicker with the help of humans.

Some of the more common ways by which invasive species spread include:

- Hitching rides on boat trailers (e.g., Eurasian Water Milfoil)
- Ballast water tanks (e.g., Zebra Mussels)
- Seeds stuck in hiking boot treads (e.g., Wild Parsnip)
- Seeds stuck in tire treads (e.g., Glossy Buckthorn)
- Seeds stuck to your dog (e.g., Multiflora Rosa)
- Moving firewood (e.g., forest pests)
- Not cleaning off recreational equipment (e.g., Dog-Strangling Vine)

Community outreach is a very important tool to enforce prevention and promote early detection and rapid response.



Figure 3: "Wild Parsnip" by milesizz is licensed under CC BY-ND 2.0

Monitoring

Once the existence and location of a pest or invasive species is found, the population should be monitored, and the following information should be collected:

- Location
- Type of Pest
- Stage of growth or development
- Pest population (number of pests or pest density)
- Reason for treatment
- Outcome (acceptable threshold after treatment for pests)

Currently, the municipality only has capacity to monitor and manage (when appropriate) invasive species on municipal property.

Thresholds

The threshold that triggers pest management varies and is species-specific. Pests and invasive species that have severe human health impacts such as Giant hogweed, may have zero tolerance while other pests that are simply a nuisance may have a higher level of tolerance. It may not be possible to eradicate all pests and invasive species, and there may be levels in which the species can be tolerated. Please refer to specific pest management guidelines (when available) for more information about the management threshold for that species. Please refer to Table 1 for an

outline of how invasive species will be prioritized.

Treatment Practices

Using non-chemical treatments is a primary principal of IPM. A number of treatment types are outlined in Table 3. If pesticides are identified as the best tool for managing the pest, treatment must be an approved chemical and applied with careful timing and precision according to the manufacturing instructions and by qualified professionals. Please refer to individual management plans for each pest for guidance on removal practices. Please note that the Pesticide By-law for HRM was repealed in July 2022. Pesticide use is regulated by the Nova Scotia Department of Environment and Climate Change under the Non-Essential Pesticide Control Act.

Table 3: A description of various treatment practices

Treatment Type	Description
Preventative/Cultural Measures	Pest problems are prevented or minimized through design of the site and could include disease resistant materials, irrigation, fertilizing, top dressing and planting of native species.
Environment Control	Reduce the effects of a pest that will not negatively affect the desired plan through modification of the environment.
Manual Control	Pest is removed by hand. Protocols for PPE should be clearly identified and followed.
Physical and Mechanical Controls	This measure is primarily associated with the use of mechanical equipment to maintain a tolerable threshold. For example, pruning diseased branches from trees.
Biological Control	The use of registered biological agents that are specific to the target species having no negative impact to the environment. This application is administered through the federal government and should not be attempted without guidance.
Chemical Controls	The use of chemicals only when it has been identified as the best strategy for achieving an acceptable threshold. Preference is to be given to control products with low toxicity. Application techniques should be focussed and target specific when available such as back-pack or hand-held sprayers or low volume closed-system applicators (shrouded applicators).



Figure 4: "japanese knotweed" by dankogreen is licensed under CC BY 2.0

Evaluation

After a pest has been treated, follow-up is needed to see if the treatment was effective. Evaluation is dependent on the type of pest and the situation. Evaluation may confirm the effectiveness of the selected treatment or may find that a different treatment option should be selected in the future. Please refer to the specific pest management guidelines for relevant evaluation protocols, when available.

Integrated Pest Management in HRM

The current focus for pest management in HRM is on species that cause issues with health and safety, recreation, property damage, and the health of the urban forest. A management plan for the Emerald Ash Borer is currently available (Appendix D). This document and associated online resources will be updated as new plans are released. Best management practices for several of the below species have been developed by the Ontario Invasive Plant Council and can be used as a reference until HRM-specific plans are published (Table 4).

Management plans for the following species are complete or are currently in development:

Table 4: Status of HRM-specific species management plans

Species	HRM Management Plan Status	Additional Resources
Emerald Ash Borer	Complete	<ul style="list-style-type: none"> Natural Resources Canada: Emerald Ash Borer FAQ
Dog-Strangling Vine: Dartmouth Population	Complete	<ul style="list-style-type: none"> www.etick.ca/
Giant hogweed	In Progress	<ul style="list-style-type: none"> Giant hogweed BMPs (Ontario Invasive Plant Council)
Wild parsnip	In Progress	<ul style="list-style-type: none"> Wild parsnip BMPs (Ontario Invasive Plant Council)
Japanese knotweed	In Progress	<ul style="list-style-type: none"> Japanese knotweed BMPs (Ontario Invasive Plant Council)

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This is a living document; business units may add additional species management plans as required. The management plans are flexible and can be modified as conditions change.

Conclusion

An IPM strategy seeks to reduce the use of pesticides and increase the health of the environment. However, it must be recognized that under certain circumstances and conditions, controlled use of pesticides should be considered and used only when necessary, and in accordance with the regulations set out in the Non-essential Pesticides Control Act. This strategy document provides guidance to develop responsive and adaptive management plans for specific species. Some of these strategies may involve coordination and collaboration with other jurisdictions, including Nova Scotia Environment and Climate Change, Natural Resources Canada, academic researchers, and non-for-profit groups such as the Nova Scotia Invasive Species Council.