



# Severn Sound Invasive Species Strategy

Severn Sound Environmental Association  
Invasive Species Program  
2021

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## Executive Summary

The introduction and spread of invasive species threatens ecosystems, the economy, and communities. The Severn Sound Environmental Association (SSEA) developed the Invasive Species Program (ISP) in 2017 to work with Severn Sound municipalities on collaborating with regional, provincial, and federal government as well as local organizations to prevent, monitor, manage and communicate invasive species. The overall purpose of the ISP is to provide a centralized approach in which members/partners and their ratepayers can access information, updates and resources on invasive species. More than 70 different invasive organisms have been detected within the Severn Sound watershed area to date, including a wide range of terrestrial and aquatic plants, invertebrates, fish, mammals, algae, and micro-organisms.

With the support of SSEA's eight partner municipalities, SSEA has developed the Severn Sound Invasive Species Strategy (SSISS) to further coordinate a collaborative approach with local municipalities on invasive species. The purpose of the SSISS is to address the ecological, economic and social impacts of invasive species. A coordinated approach will minimize the potential for duplication while increasing the opportunity for synergies and success across jurisdictions. Community engagement, partnership creation and collaboration between groups is imperative to increasing the scope and success of the SSISS.

The SSISS will be implemented through four strategic actions, and further outlines goals and recommendations for each strategic action that will be primarily led by SSEA with support from Severn Sound municipalities:

### 1) Prevent

**Goal:** Increase emphasis on invasive species prevention and take measures to stop the introduction of new invaders and reestablishment of previously controlled species within the Severn Sound watershed area

#### **Recommendations:**

- Identify specific invasive species introduction sources
- Characterize the risk of introduction pathways based upon potential invader types and intensity of human use
- Educate the public regarding the role of humans in the spread and dispersal of invasive species
- Install targeted and standardized signage throughout the watershed area
- Implement best practices related to invasive species containment
- Explore incentive programs to encourage best practices

### 2) Monitor

**Goal:** Continue and intensify invasive species detection and monitoring to map invasive species distributions, identify susceptible ecosystems and guide management decisions

**Recommendations:**

- Designate priority sites for invasive species monitoring and management
- Provide invasive species monitoring and identification training to municipal staff and the community
- Provide training and resources to participants in SSEA citizen science invasive species detection and monitoring programs (*Invasive Species Spotters*)
- Support volunteer and community based invasive species mapping
- Provide intuitive platforms to electronically submit invasive species reports
- Summarize and share invasive species data through annual reports

3) Act

**Goal:** Respond to invasive species threats by actively leading control efforts, supporting community initiatives and utilizing policy to enhance overall invasive species management

**Recommendations:**

- Support municipally-led invasive species management actions
- Train and support volunteers, community groups and municipal staff on invasive species best management practices
- Create site-specific invasive species management plans for priority areas
- Explore invasive species related funding opportunities to supplement the cost of management projects
- Empower and encourage residents to organize local removal projects
- Designate priority invasive species as local noxious weeds to improve enforcement of their management on private property

4) Adapt

**Goal:** Promote an adaptive approach to invasive species management through the integration of sound scientific procedures, local knowledge and stakeholder feedback

**Recommendations:**

- Continue sharing information and experiences through the SSEA invasive species working group
- Update and implement monitoring and best management practices to match local conditions and priorities
- Research and experiment with new advancements in treatment techniques
- Strive to further promote knowledge sharing between partners, including Indigenous communities

## 1.0 SSEA Invasive Species Program Background

In 2017, the Severn Sound Environmental Association (SSEA) began the Invasive Species Program (ISP), a pilot project which aimed to coordinate the efforts of local municipalities to reduce the impacts of invasive species. The Town of Midland, and the Townships of Severn, Tay and Tiny participated in 2017, and the Township of Georgian Bay and Town of Penetanguishene joined in 2018. In 2020, the ISP became one of SSEA's core projects and as such the Program has been expanded to all SSEA municipalities; new to the program in 2020 were the Townships of Oro-Medonte and Springwater.

The SSEA ISP works to detect and control priority invasive species populations, while educating the broader community. With a focus on prevention, monitoring and management, the goal of the ISP is to reduce the ecological, economic and social impacts of invasive species. The SSEA ISP includes developing and periodically updating a cross-municipal strategy to assist promoting partnerships and collaboration between municipalities, residents, and community groups. Collaboration includes linking with provincial and federal invasive species initiatives and coordination of a multi-partner working group to share information and lessons learned at a local level.



*Multi-partner Invasive Species Working Group meeting*

The ISP aligns with the overall mission of the SSEA by protecting the environmental quality of the Severn Sound watershed area through sound science, collaboration and partnerships. New and established invaders threaten the environment and communities within Severn Sound therefore priority actions pertaining to invasive species have been integrated into the SSEA 2018-2023 Strategic Plan that guides the overall work of the organization and supports the goals of: building scientific knowledge and resilience,

empowering community members to take action and increasing overall watershed area awareness.

## 2.0 Introduction to Invasive Species

With over 30,000 species of plants, animals and microorganisms spread across wetlands, forests, prairies, lakes and rivers, Ontario is one of the most ecologically diverse provinces in Canada (Ministry of Northern Development, Mines, Natural Resources and Forestry [MNDMNR], 2012). Numerous government agencies and non-governmental organizations contribute to preserving and protecting the integrity of Ontario's natural resources. The introduction and spread of invasive species threatens the health of this province's native ecosystems. A condensed introduction to invasive species is provided in the Invasive Species Quick-Start Guide (**Appendix A**).

### 2.1 Terminology

The following definitions will be used for the purposes of the SSEA Municipal Invasive Species Strategy:

Native species refers to organisms that were historically established in Ontario prior to European contact. Examples of species native to Ontario include the eastern white pine (*Pinus strobus*), brook trout (*Salvelinus fontinalis*) and forest tent caterpillar (*Malacosoma disstria*).

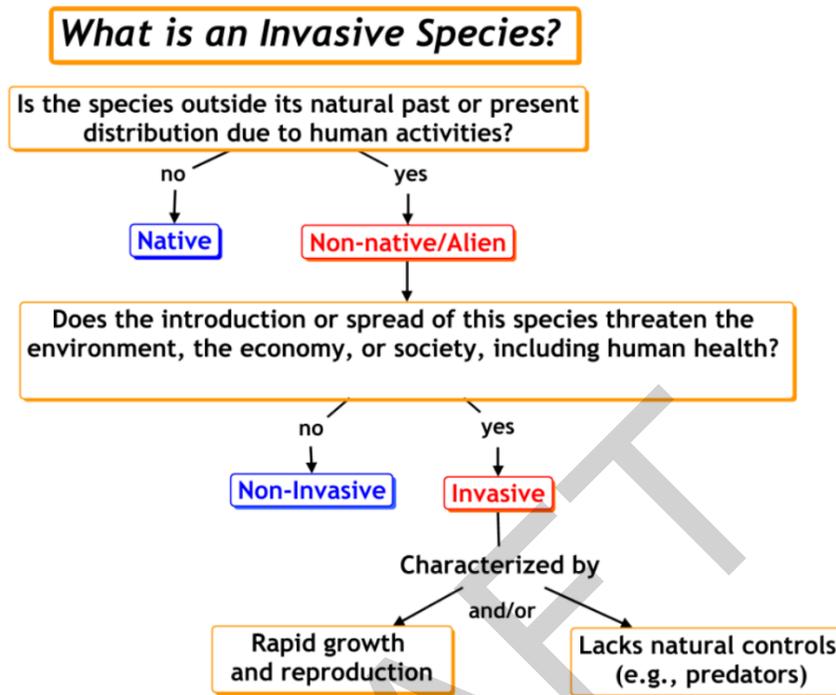
Non-native or alien species are those that were not historically present within Ontario, but have been introduced. This can include non-invasive, non-native species that have successfully established in the province without any perceivable detrimental impacts to the environment, the economy or society. Examples of non-invasive, non-native species in Ontario are red fife wheat (*Triticum aestivum* var red fife) and domestic livestock such as: sheep (*Ovis aries*) and cattle (*Bos taurus*).

Invasive species are non-native organisms that have spread outside of their historical distribution with negative impacts to ecological systems, society (e.g., human health) and/or the economy. Examples of two invasive species in Ontario are the round goby (*Neogobius melanostomus*) and European common reed/Phragmites (*Phragmites australis* ssp. *australis*).

**Figure 1** can be used to distinguish between native, non-native and invasive species.

Noxious and nuisance species can be either native or non-native, and specifically pose negative impacts to the health and well-being of the public and/or agricultural and horticultural industries. Under the right habitat conditions, these species can become locally dominant within an area. Examples of noxious species include: native poison ivy (*Toxicodendron radicans*) and invasive giant hogweed (*Heracleum mantegazzianum*). A

list of noxious weeds is maintained by the Ontario Ministry of Agriculture, Food and Rural Affairs (**Appendix B**).



**Figure 1. SSEA Species Flowchart to categorize native, non-native, and invasive species**

## 2.2 Invasive Species in Ontario

Ontario has been identified as the province with the highest concentration of invasive species within Canada, followed by Quebec and British Columbia (Canadian Food Inspection Agency [CFIA], 2008). Invasive species in Ontario are comprised of a wide range of terrestrial and aquatic organisms including: plants, invertebrates, fish, mammals, reptiles, algae, and micro-organisms. The most common types of invasive species in Ontario are plants and fish, with 441 species of invasive plants (CFIA, 2008) and 28 species of invasive fish (Sturtevant et al, 2019) being monitored within the province. Some of the most widespread and significant invaders in Ontario include: the emerald ash borer (*Agilus planipennis*), zebra mussels (*Dreissena polymorpha*), Phragmites, and wild parsnip (*Pastinaca sativa*).



Due to its geographic location, human population density, proximity to international shipping channels and degraded habitat conditions, Ontario is also at an increased risk for new invasive species introductions (MNDMNRF, 2012). This includes some of the most significant invaders already found in other parts of the Great Lakes such as hydrilla (*Hydrilla verticillata*) and the four species of Asian carps (*Hypophthalmichthys molitrix*, *Hypophthalmichthys nobilis*, *Ctenopharyngodon idella* and *Mylopharyngodon piceus*), which have caused widespread devastation to native ecosystems throughout the USA.

### 2.3 Spread of Invasive Species

The movements of invasive species have changed drastically with increases in global population, trade and transport (Johnson et al, 2001; Mooney and Cleland, 2001; MNDMNRF, 2012). Historically, invasive species were mostly reliant on natural dispersal such as wind, water and animal-based vectors to spread to new areas as seeds, plant fragments, and larvae. These dispersal mechanisms, however, tend to contribute primarily to localized spread and can restrict broader range expansion based upon landscape limitations. For example, although female round gobies may be able to lay over 5,000 eggs at a time (Kovtun, 1978), the dispersal of this invasive species can be limited if no connecting channels exist between waterways. Similarly, while a mature purple loosestrife (*Lythrum salicaria*) plant can release upwards of 2 million seeds per

growing season (Warne, 2016), its dispersal is not as widespread without high winds or water to spread the seed.

Human travel, recreation, development and commerce have contributed to unprecedented increases in the rate of new invasive species introductions since the 1800s (Hulme, 2009). Species that were once confined to specific areas by natural dispersal are now able to undergo rapid range expansion and colonization over long distances through anthropogenic activities. In Ontario, invasive species are moved both unintentionally as “hitchhikers”, for example, through the transportation of goods and materials and contaminated construction equipment, or intentionally, for example, through the ornamental plant trade. Once an invasive species becomes well-established within a new ecosystem, it can be extremely difficult and costly to eradicate therefore prevention is critical.

Climate change can facilitate invasive species introduction and spread into new areas that were historically unfavourable. The combined effects of both climate change and invasive species stressors can further reduce ecosystem resilience and biodiversity (International Union for Conservation of Nature, 2021). Examples of how climate change can favour invasive species spread, establishment and management resistance in the Severn Sound area are outlined in **Table 1**. Projected climate conditions must be considered for preventing the spread of invasive species. Climate and weather conditions, such as fluctuating water levels, also have to be taken into consideration for managing invasive species.

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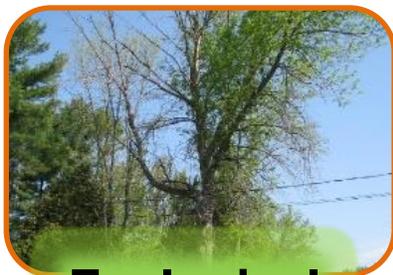
**Table 1. Examples of how climate change favours invasive species spread, establishment and management resistance.**

<b>Climate Change Outcome</b>	<b>Invasive Species Advantage</b>	<b>Hypothetical Example</b>
Frequent extreme weather (e.g., high winds, flooding, wild fires)	Facilitate invasive insect and seed movement	Wind transports Purple Loosestrife seeds to new area
Temperature change	Affects species life cycle and habitat range	Mountain Pine Beetle ( <i>Dendroctonus ponderosae</i> ), an invasive species not detected in Ontario, expands its range to Ontario due to warmer temperatures
Humidity and rainfall change	Favours conditions for invasive species spread	Asian carp spawning is initiated by rising water levels and heavy rainfall
Increased atmospheric carbon dioxide	Increases growth of invasive plants and management resistance	Giant Hogweed plants adapt to be more resistant to herbicide

*Adapted from the Invasive Species Centre (2020) Climate Change Factsheet.*

## 2.4 Impacts of Invasive Species

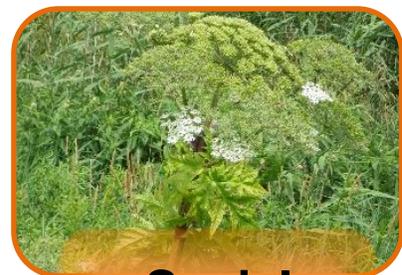
The introduction and establishment of invasive species typically involves complex and extensive impacts to native ecosystems. The severity of an invasive species introduction can be estimated by the type of invasive species introduced, present habitat conditions and the state of an ecosystem (e.g., pristine versus impaired) prior to the arrival of the new species. Risk assessments, first-hand observations, eyewitness accounts, literature reviews and monitoring of ecosystem indicator species are all valid methods for measuring the impacts of invasive species. Impacts associated with invasive species are often divided into three categories: ecological, economic and social.



**Ecological**



**Economic**



**Social**

**Ecological** impacts from invasive species include those that modify the structure, function and composition of local ecosystems. By displacing native species, altering hydrological processes and interrupting or changing nutrient cycling, invasive species are a threat to the health of native systems. The Ontario Biodiversity Council (2015) has listed invasive species amongst the six main threats to Ontario's biodiversity and approximately 25% of Species at Risk listed by the Committee on the Status of Endangered Wildlife in Canada are threatened with extinction due to impacts associated with invasive species (Stronen, 2002). For example, the invasive sea lamprey (*Petromyzon marinus*) has been directly linked to the extinction of the deep water cisco (*Coregonus johanna*). The emerald ash borer has killed millions of native ash trees (*Fraxinus* spp.) throughout the province. Both cases have resulted in major shifts to ecosystem composition and dynamics as the previously dominant species were rapidly displaced from their environments. In each case, the ecological repercussions of invasive species introduction are directly linked to the declining health of industries such as forestry and commercial fisheries. As these populations of native species decline, invasive species are able to capitalize on increased resource availability to form the basis for new "local" ecosystems and prevent native species regeneration reducing biodiversity. Changes to the ecosystem can have local economic impacts as well.

**Economic** impacts from invasive species are defined as the costs to humans as a result of the establishment of invasive species populations. These include both quantifiable economic impacts such as crop yields, real estate values, herbicide costs and research expenses, as well as indirect costs from the loss of naturally occurring ecosystem services like water purification and flood attenuation. For example, the economic impact of zebra mussels to Ontario municipalities is an estimated average of \$4.5 million per year (Vyn, 2019) and Eurasian water-milfoil (*Myriophyllum spicatum*) colonization has been shown to reduce shoreline property values by 16% (Zhang and Boyle, 2010). On a national scale, the accumulative effects of invasive species are staggering. The economic impacts of these species on Canada's agricultural and forestry industries alone has been previously estimated at \$7.3 billion per year (Dawson, 2002), with total costs to Canada predicted to be between \$13.3 and \$34.5 billion annually (Colautti et al, 2006). A more recent study estimates the potential economic impacts of invasive species on forestry, agriculture, fisheries, healthcare, tourism and recreation to be approximately \$3.6 billion per year in Ontario (Vyn, 2019).

**Social** impacts from invasive species can be difficult to measure and value accordingly. These types of impacts are extremely diverse and can vary based upon the perceptions of each stakeholder and individual. Social impacts from invasive species include dangers to public health and safety, cultural, aesthetic and psychological considerations. Examples of these types of impacts include: conflict with adjacent property owners over control methods, exposure to pathogens such as West Nile Virus, contact with toxic and poisonous plants like giant hogweed and wild parsnip, declines in

traditional edible and medicinal species, navigation hazards and the loss of recreational opportunities such as fishing and swimming. Despite being difficult to quantify accurately, social impacts from invasive species are also the most likely to inspire community action at a local level.

## 2.5 Invasive Species Policy and Regulation in Canada

There are multiple regulatory controls under federal, provincial and municipal jurisdiction that address invasive species across the country (**Table 2**). Canada's first line of defense against the introduction of unwanted invaders falls to agencies such as the Canadian Food Inspection Agency and Transport Canada, whose border and customs officials regulate the import, sale and movement of known invasive pests under applicable legislation such as the: Canada Shipping Act (2001), Plant Protection Act (1990) and Seeds Act (1985). Invasive species can impact Commercial and recreational fisheries and fish habitat, and consequently federal legislation including the Fisheries Act (1985), Aquatic Invasive Species Regulations (2015) and Pest Control Products Act (2006) include regulations pertaining to invasive species. Certain ecological features within Ontario are also managed under federal jurisdiction such as the Trent-Severn Waterway, controlled by Parks Canada.

Provincially, the transport, use and control of invasive species is regulated under Ontario legislation such as the: *Public Lands Act* (1990), *Pesticides Act* (1990) and *Ontario Fishery Regulations* (2007). Ontario's *Invasive Species Act* (2015) classifies priority invaders as prohibited or restricted and sets specific penalties for the movement, possession and propagation of those species within Ontario (**Appendix C**). In general, navigable waters not under federal jurisdiction fall within the Crown jurisdiction of the Public Lands Act.

Another piece of important legislation pertaining to invasive species management is the provincial Weed Control Act (1990). Under this act, every landowner must take measures to destroy designated noxious weeds on their property. Noxious weeds are native and non-native plants that pose significant impacts to agricultural/horticultural industries or the public and are designated by the Lieutenant Governor of Canada under the Weed Control Act. At the level of an upper or single tier municipality, or council of a lower tier municipality, the Weed Control Act allows for the appointment of county and municipal weed inspectors who can also designate local weeds as noxious and order the destruction of said plants on any lands within the area.

**Table 2** provides an overview of current legislation that pertains specifically to invasive species. Depending upon the type of species or the location of a proposed work, compliance with additional regulations such as the Ontario Endangered Species Act (2007), may be required.

**Table 2: Regulatory framework pertaining to invasive species in the SSEA area**

<b>Jurisdiction</b>	<b>Agencies</b>	<b>Responsibilities Include (but not limited to)</b>	<b>Regulation/By-Law</b>
Federal	Fisheries and Ocean Canada; Parks Canada; Environment Canada; Pest Management Regulatory Agency; Canadian Food Inspection Agency etc.	<ul style="list-style-type: none"> <li>• Create policy related to the prevention, introduction and management of invasive species etc.</li> <li>• Develop national strategies and support documents</li> <li>• Provide strategic planning and delivery of research, monitoring and management projects</li> <li>• Implement restrictions on international transport and sale of invasive species</li> </ul>	Plant Protection Act, S.C. 1990, c.22
			Seeds Act, R. S.C. 1985, c.S-8
			Fisheries Act, R.S.C. 1985 c.F-14
			Pest Control Products Act, S.C. 2002, c.28
Provincial	Ministry of Northern Development, Mines, Natural Resources and Forestry; Ministry of Agriculture, Food and Rural Affairs; Ministry of Transportation; Ministry of the Environment, Conservation and Parks etc.	<ul style="list-style-type: none"> <li>• Create policy related to the prevention, introduction and management of invasive species etc.</li> <li>• Develop best management practices and related support documents</li> <li>• Provide strategic planning and delivery of research, monitoring and management projects</li> </ul>	Invasive Species Act, S.O. 2015, c. 22
			Weed Control Act, R.S.O. 1990 c. W.5
			Pesticides Act, Ontario Regulation 63/09
			Public Lands Act, Ontario Regulation 239/13 section 9

Jurisdiction	Agencies	Responsibilities Include (but not limited to)	Regulation/By-Law
Municipal	<p><b>Upper Tier:</b> County of Simcoe; District of Muskoka</p> <p><b>Lower Tier:</b> Town of Midland; Town of Penetanguishene; Township of Georgian Bay; Township of Oro-Medonte; Township of Severn; Township of Springwater; Township of Tay; Township of Tiny</p>	<ul style="list-style-type: none"> <li>• Management of designated municipal and county properties</li> <li>• Develop and implement local by-laws</li> <li>• Appointment of County/Municipal Weed Inspector</li> <li>• Funding and equipment support</li> <li>• Disposal of invasive plant material at waste management facilities</li> </ul>	<p>Weed Control Act, R.S.O. 1990 c. W.5</p> <p>Area/municipal weed inspectors</p>

*Adapted from the Nottawasaga Valley Conservation Authority Phragmites and Invasive Species Action Plan (2016) with information from the provincial and federal government*

### 3.0 Invasive Species in the Severn Sound Watershed Area

The Severn Sound watershed is approximately 1,000 km<sup>2</sup> and supports a diverse range of ecosystems and areas including: Great Lakes coastal dunes and shorelines, provincially significant wetlands, inland lakes, forests, agricultural, rural and urban or semi-urban landscapes. The SSEA area is in close proximity to major urban centres like Toronto and Barrie, and is a significant seasonal tourism, boating and cottage destination, which can facilitate or contribute to invasive species introductions. Unfortunately, most habitat types within the watershed area are at risk from colonization by invasive species. Preliminary monitoring has shown that there are a multitude of invasive species already in the region, with a high probability that new introductions will continue to occur. A list of the invasive species that have been detected by the SSEA to date can be found in **Table 3** and their confirmed locations can be seen in **Figure 2**. The Early Detection and Distribution Mapping System (EDDMapS), a global invasive species monitoring network, and iNaturalist, a social network for identifying native and non-native organisms, contain records of invasive species sightings, including records submitted by the public that have been verified. In total, **75** different invasive organisms have been observed in the SSEA area including invasive plants, fish, invertebrates and microorganisms, based upon the combined records of the SSEA, EDDMapS and iNaturalist.



### Microorganisms

e.g., Butternut Canker  
(*Ophiognomonia  
clavigignenti-  
juglandacearum*)



### Invertebrates

e.g., Banded Mystery  
Snail (*Viviparus  
georgianus*)



### Fish

e.g., Round Goby



### Plants

e.g., Japanese  
Knotweed (*Fallopia  
japonica*)

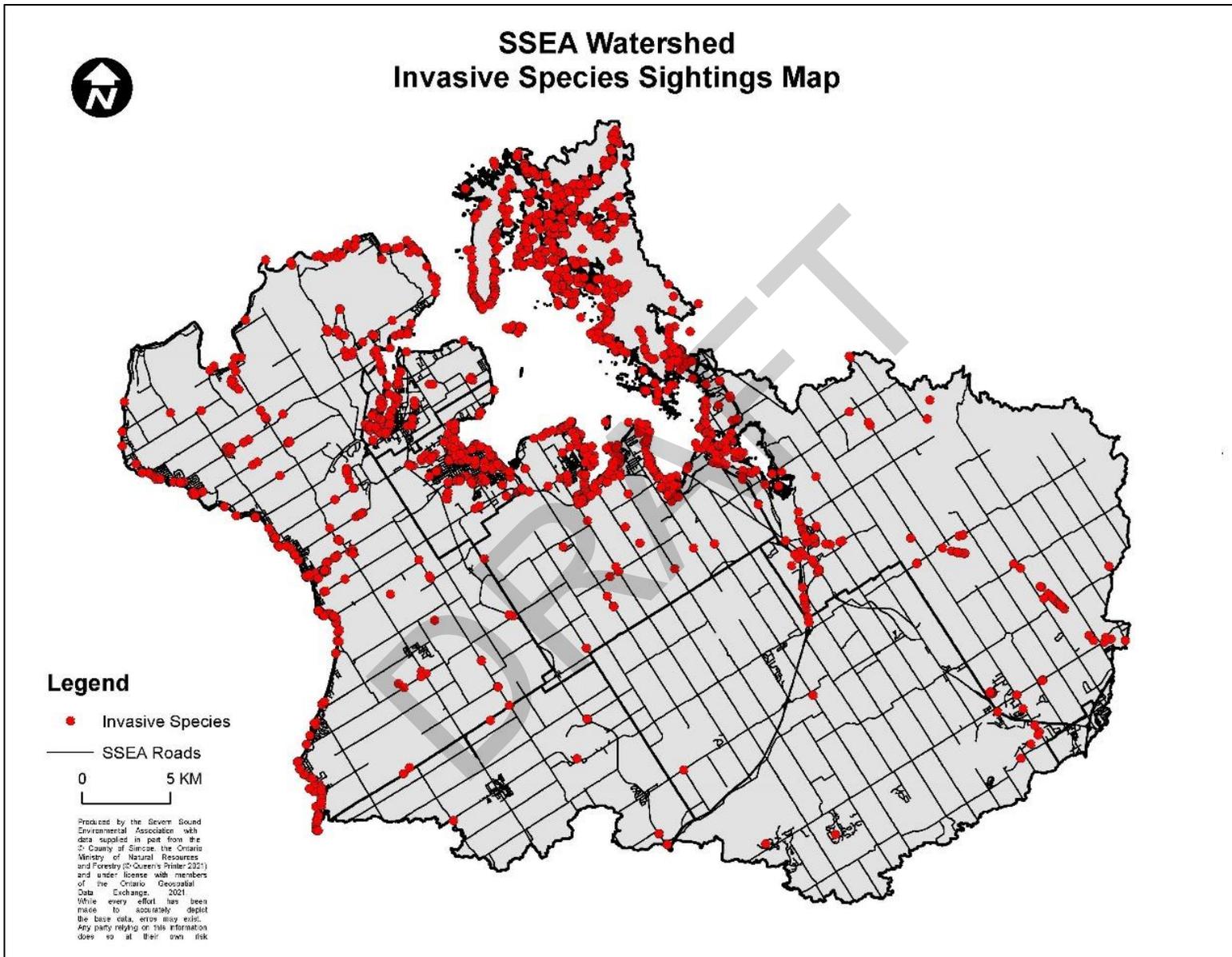
Despite the abundance of invasive species within the Severn Sound watershed area, not all of the species listed in **Table 3** are likely to cause significant detriment to ecosystems and communities within the area. Some of the invasive species were prioritized for prevention, monitoring and management projects based upon a review of current species distributions, literature and relevant case studies. Approximately **23% (15-17)** of the species present in Severn Sound should be considered high risk, top priority invaders, listed in **Appendix D**. Priority rankings can change as a result of new species introductions, public interest and yearly invasive species monitoring results. Since the Severn Sound area is part of the Great Lakes watershed with water management and significant tourism, boating, cruise ship and commercial shipping activities, there is an increased risk for the introduction of new and potentially catastrophic invaders, such as those listed in **Appendix E**.

**Table 3: List of invasive species detected by the SSEA ISP organized by group.**

Common Name	Scientific Name
<b>Terrestrial/Land Plants</b>	
Amur Maple	<i>Acer ginnala</i>
Autumn Olive	<i>Elaeagnus umbellata</i>
Bittersweet Nightshade	<i>Solanum dulcamara</i>
Black Locust	<i>Robinia pseudoacacia</i>
Bladder Campion	<i>Silene vulgaris</i>
Canada Thistle	<i>Cirsium aevense</i>
Coltsfoot	<i>Tussilago farfara</i>
Common Buckthorn	<i>Rhamnus cathartica</i>
Common Lilac	<i>Syringa vulgaris</i>
Creeping Bellflower	<i>Campanula rapunculoides</i>
Dame's Rocket	<i>Hesperis matronalis</i>
Dog-Strangling Vine	<i>Vincetoxicum rossicum</i>
Everlasting Pea	<i>Lathyrus latifolius</i>
Feather Reed Grass	<i>Calamagrostis acutiflora</i>

Common Name	Scientific Name
Forget-Me-Not	<i>Myosotis scorpioides</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Giant Hogweed	<i>Heracleum mantegazzianum</i>
Glossy Buckthorn	<i>Rhamnus frangula</i>
Goutweed	<i>Aegopodium podagraria</i>
Hairy Willowherb	<i>Epilobium hirsutum</i>
Himalayan Balsam	<i>Impatiens glandulifera</i>
Honeysuckle	<i>Lonicera sp.</i>
Japanese Knotweed	<i>Fallopia japonica</i>
Leafy Spurge	<i>Euphorbia esula</i>
Lily of the Valley	<i>Convallaria majalis</i>
Manitoba Maple	<i>Acer negundo</i>
Miscanthus	<i>Miscanthus sp.</i>
Mossy Stonecrop	<i>Sedum acre</i>
Norway Maple	<i>Acer platanoides</i>
Oriental Bittersweet	<i>Celastrus orbiculatus</i>
Periwinkle	<i>Vinca minor</i>
Reed Canary Grass	<i>Phalaris arundinacea</i>
Ribbon Grass	<i>Phalaris arundinacea 'Ribbon'</i>
Rough Cocklebur	<i>Xanthium strumarium</i>
Scots Pine	<i>Pinus sylvestris</i>
Silver Poplar	<i>Populus alba</i>
Soapwort	<i>Saponaria officinalis</i>
Spotted Knapweed	<i>Centaurea maculosa</i>
Tansy	<i>Tanacetum vulgare</i>
Toadflax	<i>Linaria vulgaris</i>
White Mulberry	<i>Morus alba</i>
White Sweetclover	<i>Melilotus alba</i>
Wild Parsnip	<i>Pastinaca sativa</i>
Winged Euonymus	<i>Euonymus alatus</i>
Yellow Archangel	<i>Lamium galeobdolon</i>
<b>Aquatic Plants</b>	
Curly-leaved Pondweed	<i>Potamogeton crispus</i>
Eurasian Water-milfoil	<i>Myriophyllum spicatum</i>
European Frog-bit	<i>Hydrocharis morsus-ranae</i>
Watercress	<i>Nasturtium officinale</i>
<b>Wetland Plants</b>	
Hybrid Cattail	<i>Typha x glauca</i>
Narrow-leaved Cattail	<i>Typha angustifolia</i>
Phragmites	<i>Phragmites australis ssp. australis</i>

Common Name	Scientific Name
Purple Loosestrife	<i>Lythrum salicaria</i>
Yellow Iris	<i>Iris pseudacorus</i>
<b>Invertebrates</b>	
Banded Mystery Snail	<i>Viviparus georgianus</i>
Chinese Mystery Snail	<i>Cipangopaludina chinensis</i>
Common Swift Moth	<i>Korscheltellus lupulina</i>
Emerald Ash Borer	<i>Agrilus planipennis</i>
Freshwater Jellyfish	<i>Craspedacusta sowerbii</i>
Ldd Moth	<i>Lymantria dispar</i>
Japanese Beetle	<i>Popillia japonica</i>
Quagga Mussel	<i>Dreissena bugensis</i>
Rusty Crayfish	<i>Orconectes rusticus</i>
Spiny Waterflea	<i>Bythotrephes longimanus</i>
Zebra Mussel	<i>Dreissena polymorpha</i>
<b>Fish</b>	
Goldfish	<i>Carassius auratus</i>
Rainbow Smelt	<i>Osmerus mordax</i>
Round Goby	<i>Neogobius melanostomus</i>
Threespine Stickleback	<i>Gasterosteus aculeatus</i>
Tubenose Goby	<i>Proterorhinus semilunaris</i>
White Perch	<i>Morone americana</i>
<b>Microorganisms/Pathogens</b>	
Beech Bark Disease	<i>Neonectria</i> spp.
Butternut Canker	<i>Ophiognomonia clavignenti-juglandacearum</i>
White Nose Syndrome	<i>Pseudogymnoascus destructans</i>
<b>Alga</b>	
Starry Stonewort	<i>Nitellopsis obtusa</i>
<b>Mammals</b>	
Wild Pig	<i>Sus scrofa</i>



**Figure 2. A map of invasive species locations in the Severn Sound watershed, February 2021**

## 4.0 Invasive Species Strategy

### 4.1 The Importance of an Invasive Species Strategy

A review of activities carried out within the Severn Sound watershed area revealed that municipalities and landowners were already dealing with the repercussions of invasive species establishment, ranging from property impacts to human health risks. Prior to the initiation of the SSEA ISP, local response to these issues varied considerably in scope and approach, with some municipalities and groups more actively mobilizing to lead invasive species management efforts than others. By the time an invasive organism becomes well-established within a local ecosystem, it typically becomes increasingly difficult and costly to effectively manage and control its spread.

Generally, the issue of invasive species is not well understood by the public within the Severn Sound watershed area. While some species are broadly known, there is a general lack of understanding regarding the extent of invasive species in the area, the variety of negative impacts they can have, the primary vectors of introduction, and how to control or manage them. These knowledge gaps can directly translate into increased long-term resource requirements and eradication/management costs, while contributing to a legacy of invasive species establishment to be dealt with by local municipalities and taxpayers for generations to come.

### 4.2 Value of a Cooperative Invasive Species Approach

Creating strong relationships and collaborative partnerships between stakeholders is one of the most important aspects of successful invasive species management, especially considering that these organisms do not respect private, municipal, or regulatory boundaries. Removing one population of an invasive species and leaving a second untouched on adjacent land that lies on private property or across a jurisdictional line wastes precious resources, can create negative public perceptions, and is likely to result in the regeneration of that species in both locations.

The scope and nature of the invasive species problem necessitates a collaborative approach. The SSEA is well positioned to support SSEA municipalities and maximize opportunities for success in preventing, detecting, managing, monitoring, and communicating about invasive species. The SSEA's invasive species pilot project laid the groundwork for a longer-term program to coordinate municipal and public efforts to reduce the impacts of invasive species within the Severn Sound watershed area. In addition, the SSEA developed a network of invasive species resources and connections with local governments, community associations and residents, as well as a municipal Invasive Species Working Group to share experiences and resources. Working to address invasive species issues on private land and cooperation between municipalities is critical to efficient and effective program delivery, minimizing the potential for duplication while increasing the opportunity for synergies and success. **Table 3** provides an example of role sharing between partner organizations to improve invasive species management.

**Table 3: Example of role sharing between partner organizations to facilitate efficient cooperative invasive species management**

Task	SSEA	Lower Tier Municipalities	County of Simcoe/ District of Muskoka
Liaise between partner organizations	X		
Public education	X		
Technical training	X		
County forest management			X
Sightings database	X		
Support local removal projects	X	X	
Roadside management		X	X
Volunteer organization	X	X	
County/Municipal Weed Inspector		X	X
Management guidance, technical expertise	X		X
Plant material disposal	X	X	X

Individual approaches to invasive species management can be sufficient for temporary control of small-scale and localized infestations, but as part of a broader ecosystem and regional approach, this tactic is not sustainable over the multiple years that are typically required to effectively control or eradicate an invader and restore environmental integrity. A coordinated approach to communication, monitoring, mapping and management will maximize success in reducing the impacts of invasive species across jurisdictions.

#### 4.3 Severn Sound Area Invasive Species Strategy

Severn Sound municipalities are leading the way on cross-municipal invasive species management. The municipalities of Georgian Bay, Midland, Oro-Medonte, Penetanguishene, Severn, Springwater, Tay and Tiny support SSEA to coordinate the monitoring and management of invasive species on a watershed scale. Severn Sound municipalities have worked with SSEA, community associations and other partner

organizations to establish monitoring and management programs for invaders such as Japanese knotweed, Phragmites, and spotted knapweed. Given that current and new invading species are persistent and continue to threaten Severn Sound ecosystems and communities, the SSEA has developed a strategy for addressing the growing threat of invasive species across the municipalities of the Severn Sound watershed area.



Drawing upon federal, provincial and non-governmental organization plans for implementing landscape level invasive species management programs (MNDMNR, 2012; CFIA, 2008; McEwan et al, 2000; City of London, 2017; Credit Valley Conservation, 2009), the Severn Sound Invasive Species Strategy (SSISS) provides a framework of specific actions that can be applied on a watershed area scale to fill key knowledge gaps, mitigate current vulnerabilities and develop prevention, monitoring, education and management programs for invasive species. The overall purpose of the SSISS is to facilitate preservation and restoration of biodiversity and natural heritage of local ecosystems within the Severn Sound watershed area by reducing the ecological, economic and social impacts of invasive species. To support the fulfillment of this objective, the SSISS will be implemented through four strategic actions: 1) **Prevent**, 2) **Monitor**, 3) **Act** and 4) **Adapt**. Through implementation of the SSISS and its four strategic actions, the SSEA can provide the tools and training to help reduce impacts of invasive species in each municipality within the Severn Sound watershed area. The

recommendations for each strategic action are intended to be SSEA-lead. The SSISS includes the following objectives:

- 1) Prevent new invasive species introductions
- 2) Conduct comprehensive invasive species monitoring
- 3) Facilitate management of priority invasive species populations
- 4) Promote communication and public involvement
- 5) Develop partnerships with local organizations and government agencies
- 6) Contribute to the advancement of invasive species policy

#### 4.3.1 Prevent

**Goal:** Increase emphasis on invasive species prevention and take measures to stop the introduction of new invaders and reestablishment of previously controlled species within the Severn Sound watershed area

**Recommendations:**

- Identify specific invasive species introduction sources
- Characterize the risk of introduction pathways based upon potential invader types and intensity of human use
- Educate the public regarding the role of humans in the spread and dispersal of invasive species
- Install targeted and standardized signage throughout the watershed area
- Implement best practices related to invasive species containment
- Explore incentive programs to encourage best practices

Prevention is a critical component of the SSISS. Prevention is typically more effective than management of invasive species; management is often needed on an ongoing basis and can be costly and time consuming. Connected and resilient ecosystems are less susceptible to domination by a non-native and invasive species. There are a number of tools and resources that promote the integrity and natural heritage of ecosystems and can help to prevent potential damage from invasive species introduction and spread; for example, municipalities can promote prevention campaigns including signage at high use boat launching facilities, require that contractors/operators adhere to Ontario's Clean Equipment Protocol. Other actions can also be taken such as identifying potential sources of invasive species introduction and working with industries, such as tourism and shipping, to support implementation of best management practices and prevention methods.

The prevention of invasive species will include the identification of sources that contribute to the introduction and spread of invaders within the Severn Sound watershed area, such as:

- nurseries selling non-native species,
- major boating areas like the Trent-Severn Waterway,
- recreational destinations such as popular trails,
- construction and road equipment that is used in multiple locations throughout the municipality,
- Great Lakes shipping industry,
- Great Lakes cruise ship industry

Following initial identification, each introduction source should be characterized based upon the number and type of invasive species being spread and the intensity of human use. The most active or likely sources of invasive species dispersal should be determined to concentrate prevention resources on priority vectors. Given that the spread of invasive species is primarily human-related, it then becomes crucial to engage the broader Severn Sound community on implementing invasive species prevention measures. Targeted messaging relating to specific priority species or transmission activities can be disseminated throughout the entire watershed area using signage at strategic locations, social media, training workshops, videos and public service announcements. Equally important is ensuring that residents are aware of how to report a suspected invader, if encountered.

#### 4.3.2 Monitor

**Goal:** Continue and intensify invasive species detection and monitoring to map invasive species distributions, identify susceptible ecosystems and guide management decisions

**Recommendations:**

- Designate priority sites for invasive species monitoring and management
- Provide invasive species monitoring and identification training to municipal staff and the community
- Provide training and resources to participants in SSEA citizen science invasive species detection and monitoring programs (*Invasive Species Spotters*)
- Support volunteer and community based invasive species mapping
- Provide intuitive platforms to electronically submit invasive species reports
- Summarize and share invasive species data through annual reports

Collecting accurate information related to the location and size of invasive species populations is important to creating an effective invasive species management strategy. Active surveillance programs for invasive species allow for the detection of invasive populations within the early stages of their establishment, greatly increasing the ability of ecosystem managers to effectively treat and control those species. Detection and monitoring activities should be repeated regularly, to capture changes in the distribution of invasive species over time, due either to new introductions/range expansions or decreases due to successful management.

Gathering invasive species distribution information helps to inform critical management decisions by identifying which invasive species are the most abundant, what types of site locations promote the establishment of invasive species and which habitat types require special protection from invasive species colonization. Site specific observations related to habitat conditions are also key considerations for selecting the appropriate type and timing of treatment activities. Invasive species monitoring information collected by the SSEA is compiled into an independent sightings database and uploaded to the EDDMapS program.

The vast size of the Severn Sound watershed area, means that no single entity is currently capable of, or should be expected to, monitor the full expanse of this area. To collect the information required to guide management decisions, municipalities within the watershed area need to work collaboratively to establish a network of staff, organizations, community groups and volunteers to assist with the collection and reporting of invasive species data from strategic sampling locations. For example, cottage and property associations are generally interested in preserving environmental integrity within their surrounding community. Community members currently report select invasive species sightings to SSEA informally. SSEA has established an invasive species citizen science program (Invasive Species Spotters) to detect and monitor invasive species on private and public property and engage volunteers in stewardship initiatives. Volunteer citizen scientists are trained and report invasive species information in a standardized manner through the Invasive Species Spotters program. Given training in invasive species identification and support from governments and agencies, property associations and volunteers are well suited to contribute to invasive species monitoring within their local areas.



SSEA aquatic weed workshop for residents and cottagers on Farlain Lake, Tiny; Source: Farlain Lake Community Association, 2019

Monitoring programs for invasive species provide an excellent opportunity to promote synergy between organizations. Operational staff members already work within the community and can identify and report selected high-impact invaders. Municipal staff can be further trained to recognize and record information related to other significant invasive species. For example, municipal roads staff could be trained in the identification of invasive species that are common to invade and impact road infrastructure and report sightings to SSEA. Municipal and SSEA staff work together to help focus monitoring efforts within a larger area and designate sites as priority invasive species monitoring areas. Monitoring helps to determine the presence of sensitive/significant wildlife habitat or extensive invasive species colonization, which enables municipal and SSEA staff to determine appropriate management options and prioritize susceptible area.

#### 4.3.3 Act

**Goal:** Respond to invasive species threats by actively leading control efforts, supporting community initiatives and utilizing policy to enhance overall invasive species management

**Recommendations:**

- Support municipally-led invasive species management actions
- Train and support volunteers, community groups and municipal staff on invasive species best management practices
- Create site-specific invasive species management plans for priority areas
- Explore invasive species related funding opportunities to supplement the cost of management projects
- Empower and encourage residents to organize local removal projects
- Designate priority invasive species as local noxious weeds to improve enforcement of their management on private property

Following the detection of an invasive species, management action must be implemented before they are able to establish in order to mitigate the negative impacts of these organisms. Without intervention, an invasive species will typically continue to grow and spread within its original introduction zone, increasing the severity of impacts and costs for management. Depending upon the target species, the length of time since introduction, available resources and site conditions, invasive species management outcomes can vary from temporary maintenance control to full eradication.

In a watershed area with over 70 invasive species, local governments will be challenged to decide how to focus limited management resources. Municipalities can help prioritize which invasive species to manage based upon information gathered during the monitoring phase such as: the presence of high-impact invaders (e.g., dog-strangling vine), risks to human health (e.g., giant hogweed) or losses to tourism and recreational opportunities (e.g., Eurasian water-milfoil). A list of the **17** most detrimental invaders to ecosystems within the Severn Sound watershed area has been produced by the SSEA (**Appendix D**) which can be used to help assign management priority and will be updated as new information becomes available. In some cases, municipalities may decide to focus on the eradication or targeted management of a single, high-impact invader and concentrate management efforts accordingly. For example, St. Thomas, ON has created a city-wide initiative to manage *Phragmites* and was declared 90% *Phragmites*-free in 2018.

Successful invasive species management projects require multi-year commitments to sustain site monitoring and continue treatment applications until the desired level of control is reached. Lack of available funding to accomplish such tasks is one of the greatest limitations facing municipalities within the Severn Sound watershed area and could ultimately decide the success of the SSISS. Costs for invasive species management projects include: work permits, specialized equipment purchase or rental/operator expenses, pesticide products and labour associated with field data collection, monitoring teams and management.

A variety of funding sources may be able to help support invasive species projects. Past examples include provincial and non-profit grants, such as Ontario Trillium Foundation, Land Stewardship and Habitat Restoration Program, World Wildlife Fund-Canada Go Wild Community Grant, Sustain Our Great Lakes, Eastern Georgian Bay Initiative, Habitat Stewardship Program, Great Lakes Guardian Fund, TD Friends of the Environment Foundation, and Huronia Community Foundation. Depending upon the funding program and applicant, grants may provide financial assistance for small, community-based or watershed area invasive species projects. The SSEA actively seeks out additional funding opportunities to support these projects that can be applied to directly or municipalities can take advantage of.

As with invasive species prevention and monitoring, community engagement, partnership creation and collaboration between groups is imperative to increasing the scope and success of invasive species management. Collaboration and a coordinated approach is critical to the success of the goals of this strategy. Not only is funding for invasive species management projects highly competitive, but finding capable workers for manual removal projects can be a limiting variable in the amount of invasive biomass that can be harvested from a site. Providing training on removal techniques, loaning basic removal equipment, and broad event promotion can go a long way towards improving the outcomes of volunteer-based projects and also create a sense of ownership and environmental stewardship within participating community groups.

Until this point, the primary focus of invasive species projects facilitated through the SSEA ISP have been on public lands and shared areas within the community such as: parks, beaches and green spaces. To increase the long-term value of the SSISS, an increased emphasis on landowners and private properties (e.g., agricultural community and landowners) must be incorporated into the prevention, monitoring and control planning for invasive species within the Severn Sound watershed area. Invasive species populations left untreated on private property, but adjacent to municipal removal projects, virtually guarantees re-invasion of the managed site and may undermine much of the previous time, labour and resource inputs.

One tool for municipalities to engage landowners on private property is by appointing County/Municipal Weed Inspectors. County/Municipal Weed Inspectors have the authority to order the destruction of noxious weeds on both private and public lands. Furthermore, Weed Inspectors are able to designate significant local weeds within their area as noxious, making their removal mandatory as outlined in the Weed Control Act (1990) subsection 3. For example, the fast growth rates of Phragmites means that populations of this species expand rapidly and the same colony can sometimes be found spanning multiple private and public property boundaries. Although Phragmites is listed as restricted in the provincial Invasive Species Act (**Appendix C**) it is not currently listed as a noxious species under provincial Weed regulations (**Appendix B**). Therefore, landowners are not required to take action to remove this species, which can reduce the overall effectiveness of control programs in the area and damage relations between

landowners and neighbours. Listing Phragmites as a local weed, however, would allow for its temporary classification as a noxious plant and non-conforming landowners could be ordered to take action and contribute to Phragmites eradication on their property.

#### 4.3.4 Adapt

**Goal:** Promote an adaptive approach to invasive species management through the integration of sound scientific procedures, local knowledge and stakeholder feedback

**Recommendations:**

- Continue sharing information and experiences through the SSEA invasive species working group
- Update and implement monitoring and best management practices to match local conditions and priorities
- Research and experiment with new advancements in treatment techniques
- Strive to further promote knowledge sharing between partners, including Indigenous communities

Invasive species represent a legacy issue for municipalities within the Severn Sound watershed area. The geographic location, ecological features and recreational use of this region are all factors that are anticipated to result in continued introduction and spread of invasive species for years to come. Climate change is anticipated to result in the further spread of existing invasive species and establishment of new invasive species. In addition, climate change has already altered the geographical range/suitability of certain tree and plant species. Plants may not be able to migrate or adapt fast enough to these changes, becoming less productive and more vulnerable to pests, diseases and invasive species. As new and current invaders continue to thrive on the landscape, local governments must acknowledge that an effective solution to this issue will require an adaptive approach and a commitment to experimenting with and updating best management practices to fit local site conditions and priorities. This includes providing opportunities for public engagement and initiating knowledge sharing with Indigenous communities in the area. Incorporating lessons learned from past experiences and continually modifying prevention, monitoring and management programs to reflect public values will be critical to ensuring the success of invasive species projects within the Severn Sound watershed area.

## 5.0 Conclusion

The SSEA municipalities have shown leadership by supporting the development of a centralized watershed approach to identifying, preventing, managing and communicating about invasive species. Invasive species pose a significant threat to biodiversity, the economy and enjoyment of SSEA communities and municipalities across Ontario. The SSISS focuses on four strategic actions, Prevent, Monitor, Act and Adapt, and implementing the associated recommendations will help to minimize the negative impact of invasive species on the Severn Sound watershed municipalities. Through the ISP, SSEA will continue to work with experts and incorporate novel invasive species information into updating the SSISS as needed in future.

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## Appendix A: Invasive Species Quick-Start Guide

**What:** Invasive species are non-native organisms that have spread or been introduced into new ecosystems in Ontario and have a negative ecologic, economic or social impact.

**Who:** There are over 70 different types of invasive species already found in the Severn Sound watershed area, with some of the most harmful to the environment, economy and society including:

- **Garlic Mustard**
- **Giant Hogweed**
- **Himalayan Balsam**
- **Japanese Knotweed**
- **Spotted Knapweed**
- **Wild Parsnip**
- **Common Buckthorn**
- **Glossy Buckthorn**
- **Dog-strangling Vine**
- **Phragmites**
- **Purple Loosestrife**
- **Eurasian Water-milfoil**
- **Emerald Ash Borer**
- **Ldd Moth**
- **Round Goby**
- **Starry Stonewort**
- **Zebra and Quagga Mussel**

**When:** Some invasive species have inhabited Ontario for over a hundred years (garlic mustard), while others have only appeared within recent decades (Asian long-horned beetle). Rates of invasive species introductions have risen recently as global transportation, internet-based retail and population increases have promoted the dispersal of these organisms.

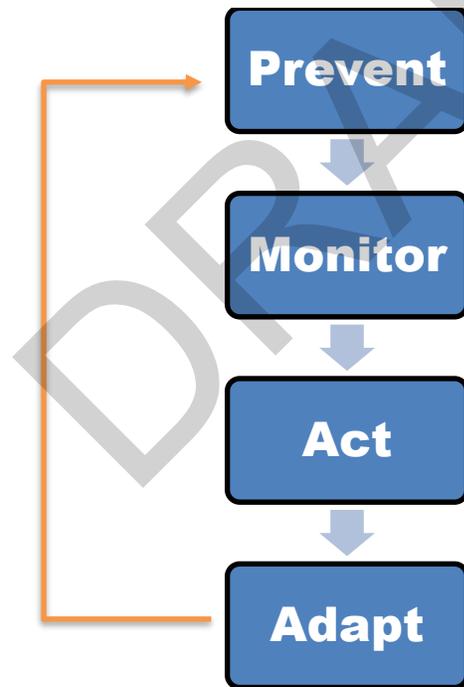
**Where:** Invasive species are located throughout the entire Severn Sound watershed area on private and public property and are concentrated in high-traffic areas such as trails, parks, lakes, community locations, etc. Newer invaders such as dog-strangling vine and emerald ash borer have been moving northward from southern Ontario and elsewhere to establish populations in this region.

**Why:** Invasive species pose significant risks to natural ecosystems, our economy and human health alike. According to the Invasive Species Centre's Economic Impact

Study, the total estimated annual expenditures by Ontario municipalities and conservation authorities is \$50.8 billion (Vyn, 2019).

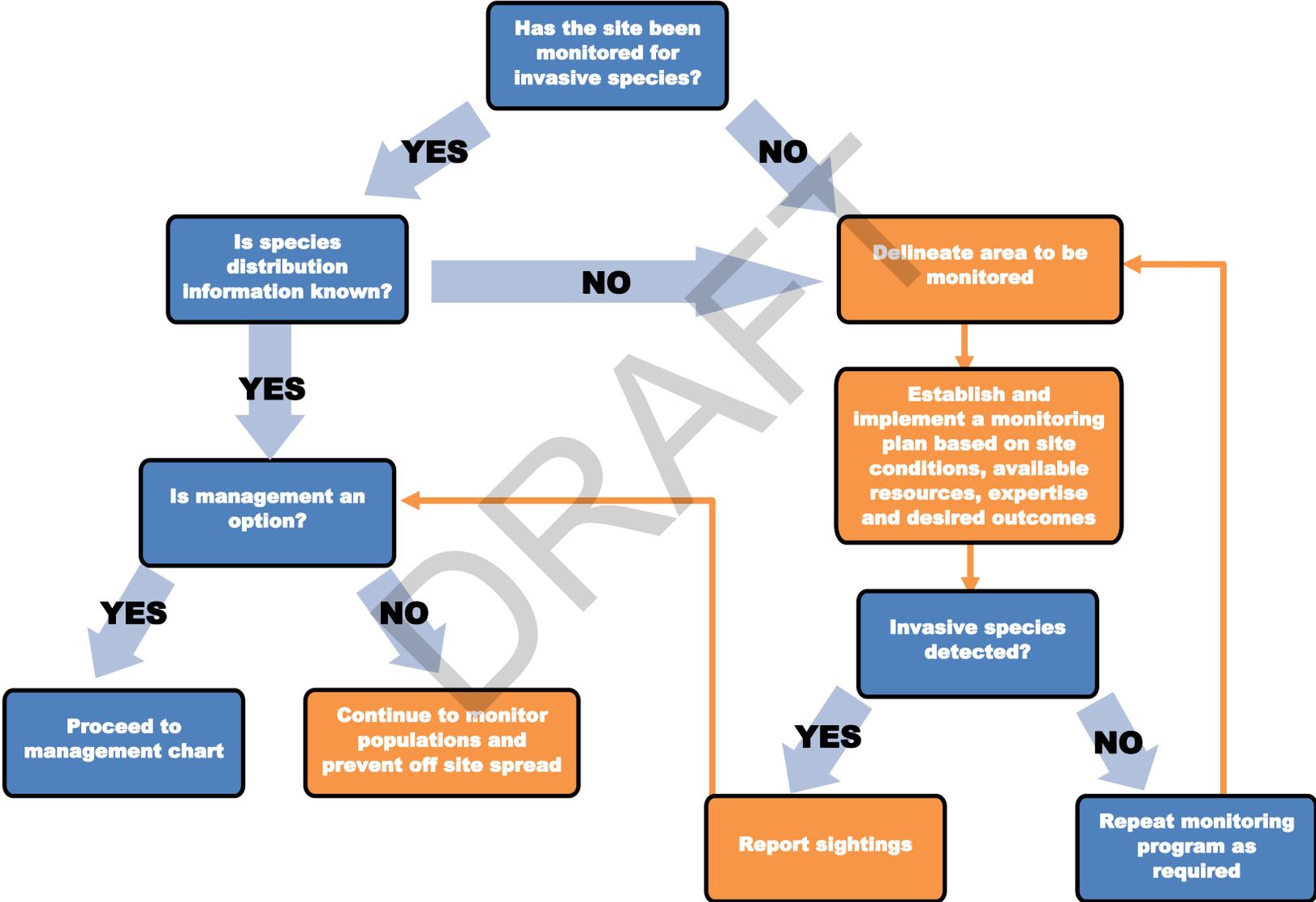
**How:** Contribute to invasive species management by following the four strategic actions outlined in the SSEA Municipal Invasive Species Strategy:

- 1) **Prevent** - Increase emphasis on invasive species prevention and take measures to stop the introduction of new invaders and reestablishment of previously controlled species within the Severn Sound watershed area
- 2) **Monitor** - Continue and intensify invasive species detection and monitoring to map invasive species distributions, identify susceptible ecosystems and guide management decisions
- 3) **Act** - Respond to invasive species threats by actively leading control efforts, supporting community initiatives and utilizing policy to enhance overall invasive species management
- 4) **Adapt** - Promote an adaptive approach to invasive species management through the integration of sound scientific procedures, local knowledge and stakeholder feedback



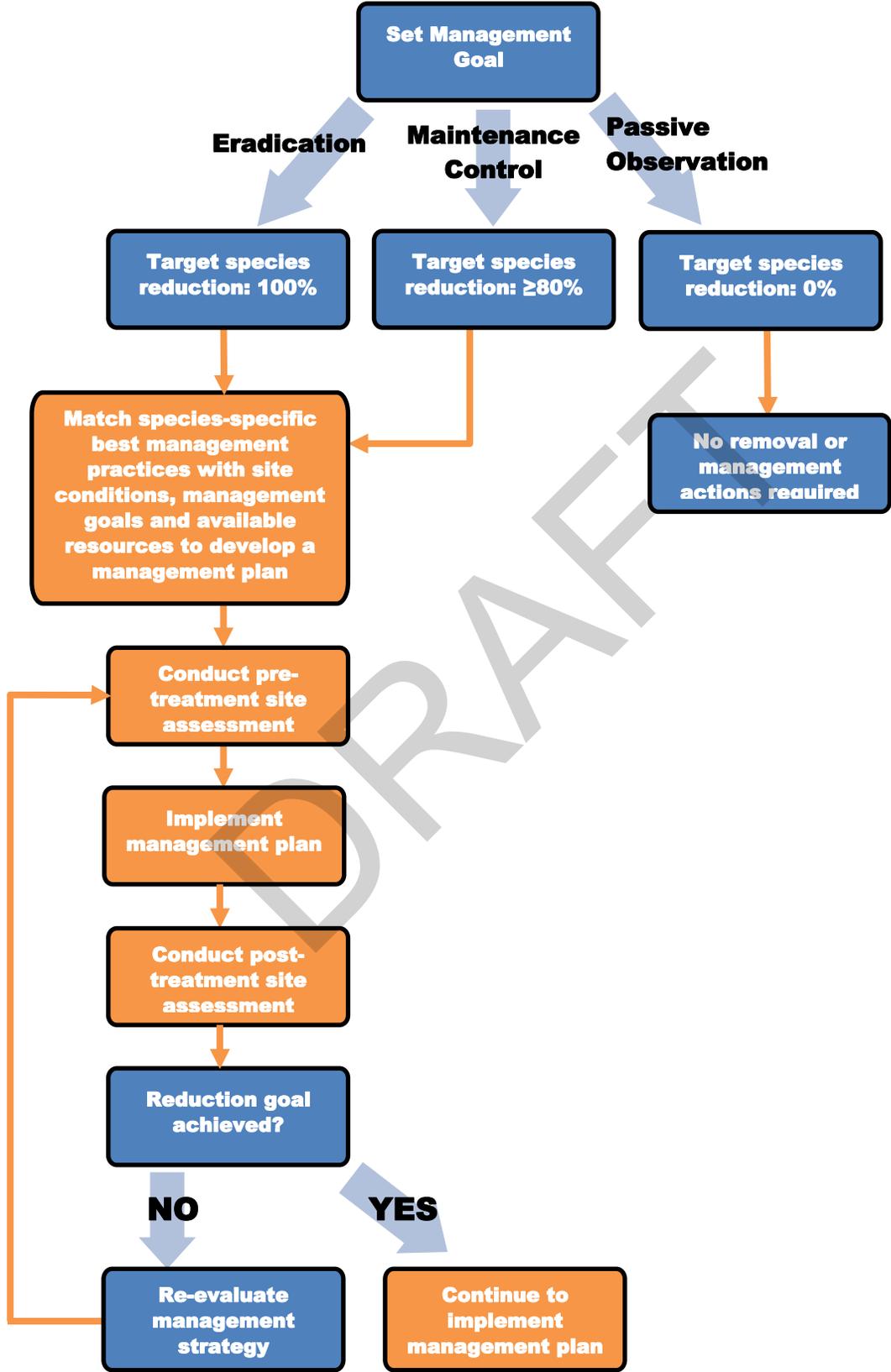
**Action Items**

**STEPS 1 & 2 PREVENT & MONITOR**



**Action Items**

**STEPS 3 & 4 ACT & ADAPT**



## Appendix B: Provincial Noxious Plant List

Common Name	Scientific Name
Black dog-strangling vine	<i>Cynanchum louiseae</i>
Bull thistle	<i>Cirsium vulgare</i>
Canada thistle	<i>Cirsium arvense</i>
Coltsfoot	<i>Tussilago farfara</i>
Common barberry	<i>Berberis vulgaris</i>
Common crupina	<i>Crupina vulgaris</i>
Cypress spurge	<i>Euphorbia cyparissias</i>
Dodder	<i>Cuscuta sp.</i>
Dog-strangling vine	<i>Cynanchum rossicum</i>
European buckthorn	<i>Rhamnus cathartica</i>
Giant hogweed	<i>Heracleum mantegazzianum</i>
Jointed goatgrass	<i>Aegilops cylindrica</i>
Knapweed	<i>Centaurea sp.</i>
Kudzu	<i>Pueraria sp.</i>
Leafy spurge	<i>Euphorbia esula</i>
Poison hemlock	<i>Conium maculatum</i>
Poison ivy	<i>Toxicodendron radicans</i>
Ragweed	<i>Ambrosia sp.</i>
Serrated tussock	<i>Nassella trichotoma</i>
Smooth bedstraw	<i>Galium mollugo</i>
Sow thistle	<i>Sonchus oleraceus</i>

Tansy ragwort	<i>Senecio jacobaea</i>
Wild chervil	<i>Anthriscus sylvestris</i>
Wild parnsip	<i>Pastinaca sativa</i>
Woolly cupgrass	<i>Eriochloa villosa</i>

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## Appendix C: Ontario Regulated Species List (2022)

### Restricted Species

As of January 2022, in Ontario it is illegal to import, deposit, release, breed/grow, buy, sell, lease or trade the restricted invasive species below. Additionally, it is illegal to possess, transport, deposit or release these species in protected areas:

Common Name	Scientific Name	Species Type
Black dog-strangling vine	<i>Cynanchum louiseae</i>	Terrestrial plant
Bohemian knotweed	<i>Reynoutria x bohemica</i>	Terrestrial plant
Dog-strangling vine	<i>Cynanchum rossicum</i>	Terrestrial plant
Giant knotweed	<i>Reynoutria sachalinensis</i>	Terrestrial plant
Himalayan knotweed	<i>Koenigia polystachya</i>	Terrestrial plant
Japanese knotweed	<i>Fallopia japonica</i>	Terrestrial plant
Phragmites	<i>Phragmites australis</i> subsp. <i>australis</i>	Wetland plant
European frog-bit	<i>Hydrocharis morsus-ranae</i>	Aquatic plant
Fanwort	<i>Cabomba caroliniana</i>	Aquatic plant
Yellow floating heart	<i>Nymphiodes peltate</i>	Aquatic plant
Wild pig	<i>Sus scrofa</i>	Mammal

### Prohibited Species

As of January 2022, in Ontario it is illegal to import, possess, deposit, release, transport, breed/grow, buy, sell, lease or trade the following prohibited invasive species:

Common Name	Scientific Name	Species Type
Bighead carp	<i>Hypophthalmichthys nobilis</i>	Fish
Black carp	<i>Mylopharyngodon piceus</i>	Fish
Grass carp	<i>Ctenopharyngodon idella</i>	Fish
Prussian carp	<i>Carassius gibelio</i>	Fish
Silver carp	<i>Hypophthalmichthys molitrix</i>	Fish
Snakehead	<i>Channidae sp.</i>	Fish
Stone moroko	<i>Pseudorasbora parva</i>	Fish
Tench	<i>Tinca tinca</i>	Fish
Wels catfish	<i>Silurus glanis</i>	Fish
Zander	<i>Sander lucioperca</i>	Fish
Common yabby	<i>Cherax destructor</i>	Aquatic invertebrate
Golden mussel	<i>Limnoperna fortunei</i>	Aquatic invertebrate
Killer shrimp	<i>Dikerogammarus villosus</i>	Aquatic invertebrate
Marbled crayfish	<i>Procambarus virginialis</i>	Aquatic invertebrate
New Zealand mud snail	<i>Potamopyrgus antipodarum</i>	Aquatic invertebrate

Red swamp crayfish	<i>Procambarus clarkii</i>	Aquatic invertebrate
Brazilian waterweed	<i>Egeria densa</i>	Aquatic plant
European water chestnut	<i>Trapa natans</i>	Aquatic plant
Hydrilla	<i>Hydrilla verticillata</i>	Aquatic plant
Parrot feather	<i>Myriophyllum aquaticum</i>	Aquatic plant
Water soldier	<i>Stratiotes aloides</i>	Aquatic plant
Mountain Pine Beetle	<i>Dendroctonus ponderosae</i>	Terrestrial insect

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## Appendix D: SSEA Priority Invaders List

Common Name	Scientific Name
<b>Terrestrial Plant</b>	
Garlic mustard	<i>Alliaria petiolata</i>
Giant hogweed	<i>Heracleum mantegazzianum</i>
Himalayan balsam	<i>Impatiens glandulifera</i>
Japanese knotweed	<i>Fallopia japonica</i>
Spotted knapweed	<i>Centaurea maculosa</i>
Wild parsnip	<i>Pastinaca sativa</i>
<b>Terrestrial Shrub</b>	
Common buckthorn	<i>Rhamnus cathartica</i>
Glossy buckthorn	<i>Frangula alnus</i>
<b>Terrestrial Vine</b>	
Dog-strangling Vine	<i>Vincetoxicum rossicum and louiseae</i>
<b>Wetland Plant</b>	
Phragmites	<i>Phragmites australis subsp. australis</i>
Purple loosestrife	<i>Lythrum salicaria</i>
<b>Aquatic Plant</b>	
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>
<b>Terrestrial Insect</b>	
Emerald ash borer	<i>Agrilus planipennis</i>
Ldd moth	<i>Lymantria dispar</i>
<b>Fish</b>	
Round goby	<i>Neogobius melanostomus</i>
<b>Aquatic Macroalgae</b>	
Starry stonewort	<i>Nitellopsis obtusa</i>
<b>Aquatic Invertebrate</b>	
Zebra and quagga mussel	<i>Dreissena polymorpha and bugensis</i>

## Appendix E: SSEA Invasive Species Watch List

Invasive Species that have not been detected in the Severn Sound area but have been detected in the Great Lakes watershed and present an imminent threat.

Common Name	Scientific Name
<b>Fish</b>	
Asian carp (4 species) Bighead carp Black carp Grass carp Silver carp	<i>Hypophthalmichthys nobilis</i> ; <i>Mylopharyngodon piceus</i> ; <i>Ctenopharyngodon idella</i> ; <i>Hypophthalmichthys molitrix</i>
<b>Terrestrial Insect</b>	
Asian long-horned beetle	<i>Anoplophora glabripennis</i>
Hemlock woolly adelgid	<i>Adelges tsugae</i>
Spotted lantern fly	<i>Lycorma delicatula</i>
<b>Aquatic Plant</b>	
European water chestnut	<i>Trapa natans</i>
Hydrilla	<i>Hydrilla verticillata</i>
Water soldier	<i>Stratiotes aloides</i>
<b>Microorganisms/Pathogen</b>	
Oak wilt	<i>Bretziella fagacearum</i>

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