Invasive Species

Curriculum Guide

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Canada

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Introduction

Invasive species are living organisms that are not native to an ecosystem. For the most part, human activities are responsible for the introduction of non-native species either deliberately — for example, the introduction of ornamental plants — or accidentally through the transportation of goods and through tourism-related activities. The focus of this curriculum guide is on the invasive species that are affecting Ontario's forests and conservation areas. The guide also provides suggested classroom activities, actions that students can take, and additional resources to further promote student engagement.

Photo: Credit Valley Conservation

Invasive plants

Invasive plants can be very harmful to an ecosystem by out-competing native species for resources such as light, moisture and soil nutrients needed by all species to survive and thrive. As a result, species composition can change, affecting wildlife that depend on native plant communities. For example, red-winged blackbirds require cattails for food and nesting. However, cattails are in decline as they are out-competed by phragmites, an invasive species (see page 6). Invasive plants can damage the natural environment by altering the intricate web of biodiversity that allows an ecosystem to flourish.

Invasive plants can also affect food crops. Non-native species play host to diseases and pests that can cause a decline in crop yield. This, in turn, is managed through the use of environmentally harmful pesticides and herbicides.

Some invasive plants can even harm humans. Giant hogweed and wild parsnip produce a sap that is toxic to the skin causing burning and irritation.

Invasive plants share some common characteristics, including:

- The production of a large volume of seeds that are easily dispersed.
- They are often fast-growing.
- Invasives thrive in different habitats.
- Population growth can be explosive due to a lack of natural predators and diseases.

Two of the most common invasive plant species found in the forests, wetlands, and meadows of Ontario are common buckthorn and phragmites. Efforts are ongoing to remove these plants before they can further damage vital ecosystems.

Common buckthorn

Buckthorn is a small shrub native to Eurasia. It was introduced to North America in the 1880s as a decorative shrub for home gardens, although farmers also planted buckthorn for fencerows and windbreaks along their fields. Buckthorn has since spread aggressively throughout Ontario.

This invasive plant can thrive in many different soil and light conditions, allowing it to invade a variety of habitats. It is most often found in woodlands and open fields where it forms dense stands out-competing most other plants. Birds and other animals eat the plant's fruit, and deposit the seeds over long distances through their droppings. Buckthorn raises the nitrogen levels in soil, causing an adverse effect on native species by inhibiting growth. Buckthorn also spreads quickly, thereby pushing native species out of an ecosystem.

Buckthorn is the host to two agricultural pests:

- **Crown rust fungus** produces spores that infect the leaves of the oat plant, interferes with the photosynthesis process, and affects the quality and yield of oats.
- **Soybean aphid** feeds off its host by extracting moisture from the plant, causing a reduction in the growth rate and the yield of soybeans.

Photo: European Buckthorn from the Credit Valley Conservation

Phragmites

Phragmites, or the common reed, is a perennial grass that has been damaging ecosystems in Ontario for decades. It is not known how it was transported to North America from its native home in Eurasia. It releases toxins from its roots into the soil to hinder the growth of native species and eventually kills surrounding plants. While phragmites prefers standing water like wetlands, its roots can grow to extreme lengths, allowing the plant to survive in relatively dry areas.

Phragmites can all but eliminate surrounding native plants and animals by growing quickly and absorbing large amounts of water, drying out wetlands and leaving little water for native plants. Phragmites are particularly harmful to wetland ecosystems by inhibiting the growth of cattails, which are an important species that provides food, shelter and nesting areas for birds, fish, and invertebrates native to marshes and wetlands.

Photo: Phragmites australis by Rasbak from Wikimedia Commons

Photo: Canadian Food Inspection Agency

Invasive insects

Invasive insects can cause severe damage to the ecological integrity of a forest. Absent natural predators to inhibit population growth, non-native insects can spread quickly, feasting on native plants and trees. Deforestation is the result and habitat for native species is then severely diminished. A weakened forest ecosystem is vulnerable to additional invasive species, which further disrupts the delicate balance of biodiversity needed for the overall health of the forest ecosystem.

Emerald Ash Borer and Asian Long-horned Beetle are two invasive insects that threaten the health of the forest ecosystems of Ontario. Emerald Ash Borer has been infecting thousands of hectares of ash trees across Ontario since 2002. Conservationists have also been working hard to control the damage to maple trees caused by the Asian Long-horned Beetle. Left unchecked, this invasive insect could pose a significant threat to maple trees and the maple syrup industry.

Photo: Canadian Food Inspection Agency

Emerald Ash Borer Beetle

This beetle is a forest pest native to Asia that has destroyed millions of ash trees in southwestern Ontario. The Emerald Ash Borer arrived here through untreated wooden packaging materials shipped from Asia. The larvae of the Emerald Ash Borer tunnel through a tree's vascular system which has the important function of being the conduit for water, nutrients, and sugars throughout the tree. When the vascular system is unable to deliver essential elements, the tree dies within a few years.

On its own, the Emerald Ash Borer does not travel far — only a few kilometres per year. However, it is easily dispersed long distances by people moving infested materials such as firewood, logs, lumber, and woodchips. Unfortunately, there are no known natural enemies to control the population or spread of the beetle. The reduction of ash trees creates gaps in the tree canopy, increasing the light reaching the forest floor. This can help invasive plant species, like buckthorn, grow and spread.

Photo: Photo credit: Debbie Miller, USDA Forest Service from Bugwood.org.

Asian Long-horned Beetle

The Asian Long-horned Beetle (ALB) is an invasive species native to China and Korea, which has no natural predators in Canada. It attacks hardwood trees such as maple, poplar, birch, and willow. Introduced to North America in the 1990s through untreated wooden shipping pallets, adults lay their eggs in hardwood trees. As with the Emerald Ash Borer, the larvae tunnel through the living tissue, stopping the flow of water and nutrients, eventually killing the tree.

The beetle is most commonly found in maple trees, which make up a significant portion of Ontario's forest composition, and poses a threat to our maple syrup industry. As a mitigation strategy,

the Canadian Food Inspection Agency set up a quarantine area where ALB had been observed in Mississauga and Toronto in 2004. The movement of wood was prevented in and out of the quarantine zone and scientists have been closely monitoring the presence of this invasive insect, which has not spread further than the quarantine zone. This is a good example of how timely and responsive actions can contain and manage invasive species.

Photo: Asian long-horned beetle by Kyle Ramirez, from Wikimedia.

Photo: Jude Infantini from Unsplash

Invasive species management

Conservation authorities have implemented a number of strategies to prevent the spread of invasive species. Ecologists and other experts identify areas where invasives are widespread, determine effective ways to remove them and then restore the area with indigenous species.

Trees infected by non-native insects, as well as surrounding trees, are cut down or quarantined. Insecticides can be effective against certain invasive species, such as the Emerald Ash Borer. Currently, there is no insecticide treatment available for the Asian Long-horned Beetle. The best course of action for Asian Long-horned Beetle is through cutting down infested trees and establishing a quarantine area to prevent the movement of wood, which has been a successful approach implemented in Ontario.

The Government of Canada works with the provinces and territories on strategies to minimize the impact of invasive species. Government border agents inspect shipments of wood products arriving from overseas. Regulations are in place that make it illegal for travelers to bring in certain fruits, vegetables, and meat from other destinations to help prevent transport of invasive species. The Government also supports research into ways of reducing the impact of invasive species on local ecosystems.

Indigenous communities have also been working to prevent the spread of invasive species and their removal. Some communities are using pesticides to treat for Emerald Ash Borer. Other communities are saving ash tree seeds to plant more trees when the insect infestation moves on.

Through awareness raising and education about the threat of invasive plants and insects, there are a number of things we can do to lessen the spread of invasives and help preserve indigenous plants and animals.

Classroom activities

General Science Activities (applicable to all grades)

1. As part of introducing the lesson, ask students to brainstorm about what they know or have heard about invasive species. Instruct the students to "think-pair-share" their ideas. These can be recorded on a whiteboard or flip chart and shared with the class.
2. Working in small groups, students research a single invasive plant or animal species in Ontario, including where it came from, how it got here, what other species it resembles, and how it affects native plants and the natural environment. Students can draw a creative "Wanted" poster to illustrate the invasive species and share their findings using these three headings: "known as," "last seen," "crimes committed." Posters can be displayed around the school to educate the community about the issue of invasive species.

Grade Specific Activities

Grade 5 (Social science - investigate Canadian environmental issues from various perspectives)

Topic: Indigenous communities' traditional use of plants affected by invasive species.

Activity: Ask students to list all the ways that invasive species could affect Indigenous people's traditions and the importance of this impact. Students then construct a map of the ranges of different Indigenous communities, showing an overlap where various invasive species have spread through Ontario, to see the impact of invasive species on Indigenous peoples. To find the traditional ranges of different Indigenous groups students can use the https://native-land.ca interactive map.

Grade 6 (Science - explain how invasive species reduce biodiversity in local environments)

Topic: Invasive species' effects on the biodiversity of Ontario forests and wetlands.

Activity: Ask students to create food webs or chains that include a native plant species (ash tree, cattails) and then create a second diagram by replacing the native plant species with an invasive one (phragmites). Discuss how the food web or chain changes when invasive species replace native species and how that can reduce biodiversity.

Grade 7 (Science - assess the impact of human activities on the environment)

Topic: The impact of buckthorn introduced by humans in Ontario.

Activity: Students can work in groups. Using a mind map (a brainstorming exercise where a network of words is connected with lines, colour, pictures, and shapes in order to portray a complex issue), write "human introduction of buckthorn" in the middle of a large sheet of paper. Ask students to come up with at least 2 subtopics (eg. loss of biodiversity; increase in agricultural pests). For each subtopic, think of 2 more sub-subtopics (eg. native species have to find new habitats; crop yields are reduced). The final mind map will be a visual representation of the web of issues around invasive buckthorn.

Grade 8 (Science - assess the impact of human activities on the sustainability of water resources)

Topic: The impact of invasive species on wetlands.

Activity: Give each group of students an aluminum baking pan, clay, a sponge, a watering can, and sand, which they use to create a model of a wetland, using the clay to make native plants and animals. The sponge represents the roots of the native plants (cattails) that allow the wetland to absorb and store water. Ask students to pour water in the pan and observe what happens (the sponge should absorb some but not all the water). Next, replace the sponge (roots of cattails) with packed sand. Instruct students to pour the same amount of water on the sand and observe any differences from the first model. The water should mostly get absorbed by the sand, leaving little water for plants and animals. Phragmites thrives in wetlands but can dry them out because of all the water the plant requires. The students can discuss the differences they observed in the two conditions and how the introduction of phragmites could affect the native plants and animals in a wetland.

Actions students can take

- When visiting conservation areas or forests, make sure to stay on the trails and wipe off your shoes when leaving to prevent carrying out seeds and insects. Do the same if you are out with your pet (wipe off their paws) or riding your bike (brush off the tires).

- If you see an invasive species, report it on the Early Detection & Distribution Mapping System website https://www.eddmaps. org/ontario/. Biologists are able to track and monitor where invasive species are occurring in Ontario so they can stop their spread.

- If you go camping, remind your family to only use firewood provided in the area you are camping and to not take it home with you, as you could be transporting the Emerald Ash Borer.

- Share the information you have learned about invasive species and tell your friends and family so they can be part of the solution. We can all work together to help stop the spread of invasives.

Additional Resources:

Ted-Ed Talk on Invasive Species
http://bit.ly/youtubeinvasive

CBC news article on Emerald Ash Borer and Indigenous communities
http://bit.ly/emeraldashfirstnations

CBC news article on the impact of cold snaps in winter on the Emerald Ash Borer
http://bit.ly/emeraldcoldsnap

The Waterloo Record article on issues with phragmites in Waterloo and the Grand River Conservation Authority parks
http://bit.ly/GRCAphragmites

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