

## The Introduction of Non-Native Species

Can you name a species that lives in Ontario but is not native to Ontario? If so, do you think the species has an impact on the natural environment? How and why did the species get here? The introduction of non-native, or exotic, species to an ecosystem by humans is a major cause of species loss.

Introductions of non-native species usually fail because few species can tolerate an entirely new environment. Remember, for a species to survive it must be within its tolerance limits for all abiotic factors (Section 2.7). Even if a species is adapted to the abiotic environment, it may have difficulty finding food or may be unable to compete with native species.

Occasionally, an introduced species is successful in its new environment. The new ecosystem may lack population controls for the new species, such as predators and diseases. Native species might not be able to compete with the introduced species. When a population is unchecked, it gains an advantage over native species. It can increase rapidly and become invasive.

**Invasive species** are introduced species with growing populations that spread and have a negative effect on their environment.

There are well over 3000 invasive species in Canada. In the Great Lakes there are over 185 invasive species. Ontario is home to six introduced species of carp (Figure 1(a)). You may also be quite familiar with the European earwig (Figure 1(b)). First documented in Canada about 1830, it is now a widespread pest across southern Canada.



**Figure 1** (a) Six species of carp and (b) the European earwig are invasive species in Ontario.

A few individuals of an invasive species can have far-reaching impacts. In 1890 and 1891, Eugene Schieffelin released 100 starlings brought from England into Central Park, New York City. He hoped the starlings would control insect pests. He may have chosen starlings because they were mentioned in the works of Shakespeare. Starlings are now one of the most numerous birds in North America. From the original 100 birds, their population has grown to 200 million. Starlings compete with native birds for nesting sites. They have caused a decline in the populations of songbirds, including bluebirds and tree swallows (Figure 2).



**Figure 2** The intentionally introduced European starling competes with native songbirds.

### DID YOU KNOW?

#### Killing Oak Trees with Your Feet

Sudden oak death is a serious fungal disease of oaks and other tree species. The disease is most common in parks and forests with large numbers of visitors. It is most notable along hiking and biking trails. Humans carry the fungus spores in soil attached to their shoes or vehicles.

**invasive species** a non-native species whose intentional or accidental introduction negatively impacts the natural environment





Invasive species have significant environmental and economic impacts (Table 1). These species change natural ecosystems and cost Canadians billions of dollars annually just to control their population size. Researchers at the Global Invasive Species Programme estimate the global damage caused by invasive species to be \$1.4 trillion annually.

**Table 1** Impacts of Invasive Species

Type of impact	Consequences
ecological	<ul style="list-style-type: none"> <li>Invasive species compete with or feed on native species, leading to population decline or extinction.</li> <li>Invasive species change ecosystem dynamics by altering nutrient cycles or energy flow.</li> </ul>
economic	<ul style="list-style-type: none"> <li>Damage to forests and agricultural crops causes financial losses.</li> <li>Competition with invasive plants lowers crop yields.</li> <li>Diseases and pests may destroy livestock and crops, kill trees, and harm important species such as honeybees.</li> </ul>
tourism	<ul style="list-style-type: none"> <li>Species loss and reduced water quality have negative impacts on wildlife viewing, fishing, and water-based recreation.</li> <li>Waterways can become choked with invasive aquatic plants, rendering them impassable to boats.</li> </ul>
health	<ul style="list-style-type: none"> <li>Disease-causing organisms, such as the West Nile virus, are introduced.</li> <li>Pesticides used to control invasive species cause pollution and are health risks.</li> </ul>

Table 2 gives four examples of invasive species from around the world and the impacts they have had on their new environment.

**Table 2** Examples of Invasive Species

Invasive species	Location and impact
brown tree snake 	<ul style="list-style-type: none"> <li>Pacific island of Guam</li> <li>accidental introduction around 1950</li> <li>caused the extinction of 9 of Guam's 12 forest birds and half of the lizard species</li> </ul>
kudzu 	<ul style="list-style-type: none"> <li>eastern United States</li> <li>intentionally introduced as a forage crop and for erosion control</li> <li>rapidly spreading vine that kills native trees by shading them</li> </ul>
Nile perch 	<ul style="list-style-type: none"> <li>Lake Victoria, Africa</li> <li>intentionally introduced to establish a commercial fishery</li> <li>a large predatory fish that has caused the extinction of more than 200 species of native fishes and decimated the populations of many others</li> </ul>
feral goats 	<ul style="list-style-type: none"> <li>escaped into the wild in many parts of the world</li> <li>voracious herbivores that threaten many species of native plants with overgrazing</li> <li>particularly damaging on remote islands where there are no natural predators</li> </ul>

**DID YOU KNOW?**

**The Blight of Destruction**

The chestnut blight was accidentally introduced when Asian chestnut trees were imported into North America in the early 1900s. The disease, caused by an airborne fungus, spread quickly. In several decades, it had killed billions of American chestnut trees. About 100 American chestnut trees remain.





## RESEARCH THIS WE DO NOT BELONG!

**SKILLS:** Researching, Communicating

When a non-native species is introduced into an established ecosystem, it may upset food webs or compete with native species for resources. If very successful, these species can become invasive and cause serious damage to an ecosystem. In this activity, you will research an invasive species in Ontario.

1. Use the Internet and other electronic and print resources to compile a list of Ontario's invasive species.



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2. Select two invasive species and record the following information: **T/I**
  - (i) Where did the species originate?
  - (ii) How did the species get to Ontario? Were the introductions intentional or accidental? How are they spreading?

- (iii) What is the distribution of the species in Ontario now?
- (iv) What is the main concern with these species? How are they causing harm?

- A. Classify Ontario's invasive species using a table similar to Table 3 below. For each species, indicate whether it is a terrestrial (T) or aquatic (A) species. **T/I C**

Table 3

Plants	Fish	Molluscs	Crustaceans	Insects	Other

- B. Design an invasive species collector's card. The card should have a picture of the invasive species and an Ontario distribution map on one side and the remaining information on the reverse side. **T/I C**
- C. When everyone is done, use the cards to quiz each other or invent a "We Do Not Belong!" card game. **C**

## Controlling Introduced Species

It is impossible to predict which introduced species will become invasive. Preventing the accidental introduction of a non-native species is ideal but difficult. Insects can arrive as adults, larvae, or eggs in imported foods and containers from around the world. Small seeds are equally difficult to detect. Species that are introduced intentionally should be studied in advance to determine if they pose a risk.

Once an introduced species is established, it may be difficult to control. Elimination is unlikely. There are three types of control measures.

### Chemical Control

Perhaps the most widely used control method is the use of pesticides. Pesticides are used mostly on forest and agricultural pests because trees and crops have significant economic value. Pesticides dramatically reduce crop damage, but there are environmental risks. They may kill non-target native species and pollute the air, water, and soil. You will learn more about pesticides in Chapter 4.

### Mechanical Control

Some invasive species can be controlled with physical barriers or removal. Invasive plants can be cut down, burned, or even removed by hand. Invasive animals can be hunted or trapped.

In Hamilton harbour, barriers were constructed to protect Cootes Paradise, a valuable wetland, from carp, an invasive fish species. Smaller fish can swim in and out of the wetland through the barrier. Larger fish, such as carp, swim into a chamber and are sorted so that only native species can enter. In the fall, the barrier is removed so that remaining carp can leave on their migration. The barrier is replaced before they return. (Figure 3).

### DID YOU KNOW?

#### Underground Invaders

Ontario had no earthworms prior to the arrival of European settlers. Europeans introduced a number of species that have spread throughout Canada. While earthworms can benefit the soil in some ways, they have negative impacts on natural ecosystems. They can cause losses of tree seedlings, wildflowers, and ferns by feeding on young plants.



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**Figure 3** These barriers in Hamilton harbour protect Cootes Paradise from invasive fish species.

## WRITING TIP

### Use Short Sentences

Break a long sentence with more than one idea into shorter sentences. Instead of “For example, three insect species were released in Ontario to control purple loosestrife, an invasive plant that grows in wetlands,” write “Three insect species were released in Ontario to control purple loosestrife. Purple loosestrife is an invasive plant that grows in wetlands.”

## Biological Control

Biological control is a challenging but effective method of controlling invasive species. Biological control uses intentionally introduced organisms to control the invasive species. For example, three insect species were released in Ontario to control purple loosestrife, an invasive plant that grows in wetlands (Figure 4). Tests conducted before their release indicated that the insects are unlikely to feed on native plants. The results are promising. Although biological control rarely eradicates an invasive species, it may reduce population sizes to ecologically tolerable levels.



**Figure 4** Leaf-eating beetles help control purple loosestrife.

## UNIT TASK Bookmark

In this section, you looked at invasive species from around the world. In the Unit Task, described on page 156, your class will examine the impacts of invasive species in Ontario.

## IN SUMMARY

- Invasive species are non-native species whose introduction negatively impacts ecosystems.
- Invasive species have been introduced intentionally and accidentally.
- Invasive species may negatively affect our health and the economy.
- Invasive species can be controlled using mechanical, chemical, or biological methods.

## CHECK YOUR LEARNING

1. Are all introduced species invasive? Explain using examples. **K/U**
2. Explain why most introduced species are not successful in their new environment. **K/U**
3. How does the success of an invasive species depend on its placement in its new food web? Explain. **T/I**
4. List and briefly outline the possible ecological consequences of introducing an invasive species. **K/U**
5. Describe the impacts of invasive species on human society. **A**
6. Give an example of a domesticated animal that has become an invasive species. **K/U**
7. Describe three methods used to help control invasive species. **K/U**
8. How do we sometimes benefit from introduced species that are not invasive? Explain using examples you have witnessed or personally benefited from. **K/U A**
9. The remote Galápagos islands are famous for their unusual wildlife (Figure 5). In 1900, the Galápagos had 112 invasive species. By 2007, that number had risen to 1321. Why do you think island wildlife might be more threatened by invasive species? **T/I**



**Figure 5** Galápagos tortoise