

Invasive Species



Activity 12

Throughout history, people have intentionally and unintentionally moved plant and animal species to new environments. Some of these species have proved beneficial, but others invade natural habitats causing environmental, and sometimes economic harm. Students will research invasive species to determine how these species got to their new locations and what characteristics make them so challenging.

Levels

Grades 5-8

Subjects

Science, Math, Social Studies

Concepts

- Biological diversity results from the interaction of living and nonliving environmental components such as air, water, climate, and geologic features. (1.1)
- Successful technologies are those that are appropriate to the efficient and sustainable use of resources, and to the preservation and enhancement of environmental quality. (1.6)
- International cooperation directed toward conserving resources and protecting environmental quality is beneficial to human health and the well-being of other life forms. (2.6)

Skills

Analyzing, Researching, Synthesizing and Creating



Differentiated Instruction

Key Vocabulary, Prior Knowledge, Paired/Cooperative Learning



Technology Connections

Internet Resources, Word Processing Software, Presentation Software

Materials

Copies of “Alien Invaders” student pages; map of the world, access to the Internet

Time Considerations

Preparation: 20 minutes
Activity: One 50-minute period, and time for research and making student presentations

Related Activities

Every Tree for Itself, Are Vacant Lots Vacant?, Field, Forest, and Stream, Tropical Treehouse

OBJECTIVE

- Students will learn what invasive species are, why they are problematic, and how to prevent their spread.

ASSESSMENT OPPORTUNITY

- Use students’ presentations to assess: How well do students understand the concept of invasive species? How well did they communicate why invasive species are a problem? Did they offer solutions for preventing further spread of invasive species? How creative were they in getting across their message?

BACKGROUND

A **native species** is a plant or animal that occurs naturally in a certain area. Because it evolved in that area over time, it typically co-evolved with other species that served to keep its population in check through predation, competition, or disease.

Non-native species (also known as exotic species or alien species) are ones that have been introduced or moved by human activities to an area where they do not naturally occur. A non-native species is not necessarily harmful, and in fact, some non-native species are beneficial (e.g., apple trees). However, when a non-native species overruns or **outcompetes** native species in natural communities or ecosystems and causes ecological or economic problems, it is called an **invasive species**.

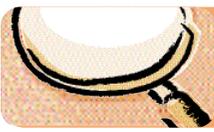
In their new locations, invasive species do not have the natural controls that serve to limit their population in their native range. This, coupled with the fact that they typically have a high rate of reproduction and are tolerant of a large array of conditions, enables them to take over in non-native areas. (See the box on the next page.)

Invasive species are a problem worldwide as they degrade and alter habitats, crowd out native species, choke waterways, ruin native fisheries, keep forests from regenerating, and compete with agricultural crops. Once established, invasive species

are nearly impossible to remove. Controlling invasives is very time consuming and expensive.

Invasive species are not a new phenomenon, but globalization has brought increased world-wide travel and shipment of goods, resulting in an ever-increasing number of new invasions. In the United States alone, scientists estimate about 7,000 invasive species have established themselves. These species include plants, mammals, birds, amphibians, reptiles, fish, arthropods, and mollusks. Some have caused major environmental damages and economic losses—totaling about \$138 billion per year—in agriculture, forestry, and other segments of the United States economy.

There are many pathways by which invasive species end up in a new location, far away from their native range. In some cases, people intentionally introduce them to the new area, not realizing the untold damage they could cause. For example, the nutria is a large rodent nearly the size of beavers. Nutrias were imported to the United States from Argentina in the 1930’s. The purpose was to raise them and produce furs. However, individuals quickly escaped, and by 1955 their population was already in the millions. This rodent can cause millions of dollars worth of damage to agriculture crops and weaken levees. Another species, purple loosestrife, was intentionally introduced in the northeastern part of the United States in 1800’s as an ornamental



Common Characteristics of Invasive Species

- **The more of these characteristics a species possesses, the more likely it is to be invasive:**
- **Tolerates a wide range of conditions**
Example: The European starling can live in a variety of habitats from woodlands to open fields to cities.
- **Produces lots of seeds or eggs**
Example: One zebra mussel can release up to one million eggs per year.
- **Has few natural controls such as predators, disease, or insects**
Example: Leafy spurge is inedible to the native insects and animals of the American West, and has greatly reduced the plants that these native species can eat.
- **Disperses itself with ease**
Example: Cogongrass was introduced from Southeast Asia into the southeast United States in the early 1900's to help control soil erosion. Each plant produces several thousand seeds that can be dispersed up to 15 miles by wind.
- **Has a long growing season or short generation time**
Example: Buckthorn has a much longer growing season than native plants, which means they can mature faster than the native plants.
- **New location has climate and environmental conditions similar to native habitat.**
Climate change has created environmental conditions similar to native habitat.

How to Prevent Invasive Species

You can help stop the introduction and spread of harmful invaders in your community.

Gardening

- Avoid growing plants known to be invasive. If you don't know it, don't grow it!
- Be cautious when buying plants from nurseries or seeds from other regions of the country.
- Avoid using seed mixtures, especially ones labeled "wildflowers."
- Landscape with plants native to your area.
- Never dispose of unwanted plants or garden clippings in a nearby park, local body of water, or natural area.

Boating and Fishing

- Never transport water, animals, or plants from one body of water to another.
- Do not release live fish, including bait, into a new body of water.
- Remove all aquatic plants and animals from hulls, propellers, intakes, trailers, and gear before leaving a launch area.
- Wash all fishing tackle, downriggers, and lines to prevent spreading small, larval forms of aquatic invaders.

Pets

- Buy any non-native pets only from reputable dealers.
- Don't release any pets or aquarium fish into a native habitat or natural body of water.
- Purchase certified weed free hay for horses

Traveling

- Never carry fruit, seeds, live plants, soil, or animals into or out of the country.
- Within the country, don't transport items such as hay, wood, soil, sod or gravel from one part to another.
- Wash your boots and tires to remove soil and weed seeds before you hike in a new area.
- Abide by local and international quarantines to prevent the spread of serious pests, weeds, and diseases.

Take Action!

- Tell others about the harm that invasives cause.
- If local nurseries sell invasive plants or seeds, let them know your concerns.
- Volunteer to help remove invasive plants from your local park or nature reserve.
- Learn to recognize common invaders and keep an eye out for signs of new ones. Check trees, gardens, vacant lots, roadsides, yards, agricultural areas, wetlands, ponds, and lakes.
- If you think you've found a new infestation, contact your county agricultural agent or state Department of Natural Resources. Early detection is crucial to stopping an invasive from becoming permanently established!

Source: Adapted from "What You Can Do to Prevent Species Invasion." Union of Concerned Scientists.

Accessed 3/29/04 at

http://www.ucsusa.org/global_environment/invasive_species/page.cfm?pageID=390

plant and for its medicinal properties. Because purple loosestrife adapts readily to natural and disturbed wetlands, it out-competes many native grasses and flowering plants, thereby negatively impacting waterfowl habitat. In other cases, the introduction of invasive species is unintentional. People unknowingly transport species lodged in or on barges, boats and trailers, animals, vehicles, commercial goods, packing materials, produce, footwear, or clothing.

Many aquatic invasive species are transported to new regions by way of the ballast water of ships. Ballast water is taken into partially empty cargo ships to provide stability during ocean crossings, and then is pumped out when the ships pick up their loads somewhere else. Some ships transport millions of gallons of water, laden with organisms, to other locales. Species such as zebra mussels and spiny water fleas, which were unintentionally introduced this way, then spread throughout the United State’s interior waterways via recreational boats and other human activities.

The best way to manage invasive species is to prevent their spread. See the box for suggested actions individuals can take to prevent invasive species.

GETTING READY

Make copies of the student pages and cut out each species.

DOING THE ACTIVITY

 **1.** Begin the activity by asking students what the word “invasion” means. Ask them whether they have heard the term “invasive species” and what they think this term might mean. “Why might invasive species be a problem?”

 **2.** Divide students into teams and give each team two or more different species from the student pages

Species	Native region?	Why/How did it get here?	How far traveled?	Characteristics helping it thrive	Effects

(you may choose to have students work on only one species). Have students read about their species to determine:

- Where is the native region of that species?
- Why or how did the species get to its new location?
- How far did it travel from its native home?
- What characteristics have helped it thrive in its new location?
- What effect does it have on other species or on the environment?

You might have them make and fill in a chart like the one above.

- 3.** Ask teams to discuss:
- What do these species have in common? How do they differ?
 - What are typical characteristics of invasive species?
 - What ways do invasive species spread?
-  Have students draw pictures of invasive species to support the discussion.

4. Explain to students that they will now research an invasive species (different from the ones on the cards) that is a problem in your area. After learning about this species, they will create a poster, video, brochure, door hangers, skit, or other presentation to inform friends, family, neighbors, or city councils about the invasive species, its effects on the environment, and how to prevent its spread. Their presentations should include:

- Where the species originated.
- How and why it got to your area.

- The characteristics that help it thrive.
- Its effects.
- What people can do to get rid of it or prevent it from spreading further.

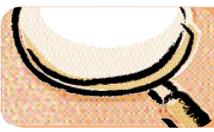
 Students can begin by searching for “invasive species [name of state or city]” on the Internet. They might also check the websites of local or state parks, natural resource agency, or agriculture departments for problem species in your state or region. (See Resources for further suggestions.) Students might use word processing or presentation software to create their presentations.

5. Give students time to research and create their presentations, and then share them with the class and the community.

Enrichment

- Have students participate in an invasive species control project. Contact your local parks or natural resources department to find out about projects in your area. Older students can work together to devise a long-term invasive species control plan for their school or community.

- Invasive species are a problem worldwide—not just in the United States. Have students find out species that originated in the United States, but are considered invasive in other countries. Examples: The American slipper limpet was brought unintentionally to Europe in 1870 with shipments of oysters. It is now found all up and down the Atlantic coast from the Mediterranean to Norway.



You might have them create a class poster based on a world map. Have each team locate on the map where the species originated. Ask them to compare environments between origination and destination points.

- Have students identify and research an area where invasive species have been found. Research the area’s past environmental characteristics before the invasion. Compare with current characteristics. What environmental factors have changed to allow the invasion? (regular fire events, soil compaction from development, increased erosion, people hiking, animal grazing, etc.) What can be done to prevent invasions in the future?
- Once invasive species get a foothold in a new environment, they often reproduce at a geometric rate. Present this math problem using the nutria as an example of how a species population can grow so quickly:

You have a pair of nutrias and they breed twice a year. Each litter has five young, three females and two males. The females can begin to have young after one year. What will the population of nutrias be in five years?

Answer: 28,012



Purple Loosestrife

Answer

	Total Population	Number of Females	Number of Males
After Year 1	12	7	5
After Year 2	82	49	33
After Year 3	572	343	229
After Year 4	4,002	2,401	1,601
After Year 5	28,012	16,807	11,205

READING CONNECTIONS

Batten, Mary. *Aliens from Earth: When Animals and Plants Invade Other Ecosystems*. Peachtree Publishers. 2003. Explores how and why plants and animals enter ecosystems to which they are not native, as well as the consequences of these invasions for other animals, plants, and humans. Grades 3-6. ISBN: 156145236X.

Czarapata, Elizabeth J. *Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control*. University of Wisconsin Press. 2005. Informative, colorful, comprehensive guide to invasive species

that are currently endangering native habitats in the upper Midwest region. Grades 7+. ISBN: 0299210545.

Guiberson, Brenda Z. *Exotic Species: Invaders in Paradise*. Lerner Publishing Group. 1999. What happens when a new and different species of plant or animal is introduced into an ecosystem? This book provides an answer to that question by examining a variety of these “exotic” species and their impacts on their new homes. Grades 4-8. ISBN: 0761313192.

Lesinski, Jeanne M. *Exotic Invaders: Killer Bees, Fire Ants, and Other Alien Species are Infesting America!* Walker & Company. 1996. Describes five species that are not native to

North America—the sea lamprey, fire ants, zebra mussels, European starlings, and African honey bees—and efforts to handle the problems their introduction has caused. Grades 4-7. ISBN: 0802783902.

Souza, Dorothy M. *Plant Invaders*. Watts Franklin. 2004. The book discusses non-native plants, such as the kudzu vine and the tree-of-heaven, which were imported from other countries and now pose a significant threat to the ecosystems of North America. Grades 3-6. ISBN: 0531162478.



Alien Invasion



Zebra Mussels first came to North America in the 1980s as stowaways in cargo ships. Large cargo ships are often top-heavy if they are not fully loaded, so people pump water into their holds to stabilize them for long ocean voyages. This ballast water, which may contain billions of tiny plants and animals, is then pumped out at the destination port. Scientists believe this is how zebra mussels first made their way to North America from their native waters in Western Asia.

Zebra mussels begin their lives as tiny swimming larvae, which are carried by water currents. As they mature, the larvae attach themselves to hard substances like rocks, other mussels, logs, boat hulls, and even the inner walls of pipes. They are a major problem for power plants, public water systems, and other water users because they accumulate very thickly. In Lake

Erie, 700,000 mussels per square yard have been found in some utility water intake pipes.

Mussels feed by filtering water and removing plankton (tiny plants and animals) from it. The water in invaded lakes looks very clean after Zebra mussels take over because they have finer filters than native populations. The problem is that they can filter out all the plankton from a lake or stream, leaving nothing for native animal species to eat.

One adult zebra mussel may release up to a million eggs each year! Adults can also reattach themselves if they break off, and can survive out of water for days by closing their valves and slowing their metabolism. Zebra mussels can move to new locations as larvae, and attach to boat hulls, anchors, or ropes when they are adults.



Purple Loosestrife is a lovely plant—or so it first seems. It has a tall stalk of pinkish, purple flowers that bloom in the late summer. But ever since it was brought to North America in the early 1800s as an ornamental garden plant, this plant has earned its nicknames—beautiful killer, marsh monster, and purple plague.

Soon after coming to the United States, purple loosestrife started spreading into natural areas. By 1830, it could be found all along the New England coast. The construction of the Erie Canal and other canals in the 1880s allowed it to spread further inland. Today it is in wetlands throughout all the lower 48 states except Florida, and in some areas it grows so densely that scientists have counted up to 20,000 seedlings in one square meter.

In Europe, where it is a native plant, purple loosestrife is not invasive because a variety of insects feed on it and keep it in check. None of these insects occur naturally in North America. This, and the fact that a single plant can produce more than 2.5 million seeds annually and grow very quickly, has allowed purple loosestrife to spread uncontrollably.

When purple loosestrife invades a wetland area, it crowds out native plants, reduces the food and cover available to wildlife, and chokes waterways.



Nutrias, at first glance, seem harmless enough. Like their slightly larger cousins, the beavers, nutrias are water-loving mammals with big incisors (front teeth), prominent whiskers, and cloaks of dense, warm fur. But without enough predators to keep them in check, these rodents have destroyed thousands of acres of marsh plants in the United States. This has led to a decline in habitat for nesting waterbirds and songbirds, as well as for fish and crab that depend on the marsh.

Nutrias are originally from South America, where they are called coypu. They were brought to the United States in the 1930s to be raised for their fur. People intentionally released some of them into the wild because they wanted to clear out the plants from a lake or stream. Nutrias soon became established residents in a number of marshes and are now found in 15 states across the United States.

Vegetarians with large appetites, nutrias eat about one-fourth of their body weight every day. They are not picky when it comes to food and will eat almost any land or water plant. Their favorite food is the roots of marsh plants. They dig underneath and overturn the plants to eat just the root mat, a habit which usually kills the plant.

Nutrias breed year-round and, for a mammal, can reproduce very quickly. An adult female can have two or three litters a year, with up to eleven young per litter.

(continued on next page)

Alien Invasion (continued)



Hemlock Woolly Adelgid (*uh-DEL-jid*) has killed eighty percent of the hemlock trees in Virginia's Shenandoah National Park. These tall trees with thick, evergreen foliage were destroyed by the tiny sucking insect related to aphids. The hemlock woolly adelgid feeds on sap at the base of the hemlock needles, causing them to fall off. Without needles, the tree starves to death, usually within a few years of the initial attack.

Native to Japan and China, the hemlock woolly adelgid was accidentally brought to the western United States in 1924 on imported wood. Western hemlocks have a natural resistance to the insect. But when it traveled to the eastern United States in the 1950s, it became clear that

eastern hemlocks are not resistant to it. The adelgid now threatens entire hemlock forests in the eastern United States. As the trees die, the plants and animals that depend on the hemlock forest are also put at risk.

Hemlock woolly adelgids are spread by wind or are carried by migratory birds, mammals, and humans. Infested nursery plants have carried the insects into some areas. Once infested, adelgid populations can increase dramatically since one individual can yield up to 90,000 new adelgids in one year.

Balsam woolly adelgid, which is related to the hemlock woolly adelgid, has also destroyed three-quarters of spruce and fir trees in the southeastern United States.



Tamarisk trees guzzle so much water each year in the dry southwestern United States, that the total amount of water could cover 5 million acres with a foot of water. Their roots can grow deep into the desert earth, sucking springs dry. When rain does fall, tamarisk causes flooding by blocking natural flows of water with its dense growth. And as its alternate name—saltcedar—suggests, tamarisk secretes salt from its leaves, making the soil around it unsuitable to native plants.

Originally from Eurasia, this tree was first brought to the region by western settlers in the 1800s as a source of wood and shade. It has now spread to over one million acres, primarily in the Southwest. The numbers and variety of birds, small mammals, and other animals greatly decrease when tamarisk replaces native woodland species.

Tamarisk has been successful largely because there are no natural predators or disease to keep it in check. It is also very quick to multiply—each plant produces up to a half million seeds per year and can grow as much as 10 feet a year. Cattle raising also seems to give tamarisk an edge over native plants. Because cattle prefer native cottonwood and willow trees to tamarisk, the uneaten plant is able to outcompete the natives.



European Starlings came to the United States in 1890 when a drug manufacturer, Eugene Scheiflin, released 40 pairs of them in New York's Central Park. He said he wanted to bring to America all the birds mentioned in the writings of William Shakespeare. The birds quickly established themselves in the wild, and by 1930 had spread all the way to the western states. Two hundred million starlings are now found over most of North America, Mexico, and parts of the Caribbean.

The starling is an intelligent and interesting bird, but is bad news for native bird species such as woodpeckers, bluebirds, and swallows. Starlings compete with these birds for nest cavities in trees, often destroying eggs and young birds in the process. Also, because they have a habit of forming large wintering flocks, they are an unwelcome pest to people.



Gypsy Moths were first brought to the United States in 1869 by a scientist who wanted to see if he could use them to produce silk. By accident, several of the caterpillars blew off the window sill of his home in Massachusetts and escaped. Twenty years later, there was a gypsy moth outbreak in the surrounding areas. Today the gypsy moth is one of the most damaging forest pests in Northeastern United States, removing the leaves from millions of acres of trees each year.

Tree damage is caused by the insect larvae, or caterpillars, which emerge from their eggs beginning in early spring. The larvae move to the leaves of trees and begin to eat and eat and eat.

Gypsy moth caterpillars are not fussy eaters. While they prefer oak, maple, and elm tree leaves, they will feed on approximately 500 different plants. When food is scarce, the larvae will eat almost any vegetation.

Gypsy moths are spread in two different ways. Newly hatched caterpillars spin short lengths of silken thread, which allow them to be blown by the wind. But, most new outbreaks occur because people move their outdoor household belongings—cars, RVs, firewood, lawn furniture, and the like—to new places, not knowing that they hold gypsy moth eggs.