U.S. Fish & Wildlife Service

Wild Things

Investigating Invasive Species

Educator's Guide
Grades 6-8

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Cover photo by Jerry Asher, BLM, Bugwood.org

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Invasive Species Introduction

So, you want to be a detective! Well, guess what! By learning to recognize the clues presented during this program, you will be able to track down invasive species in your area.

Here's an overview of what you'll learn in this program:

- What is an invasive species?
- Why are invasive species harmful?
- What is the Fish and Wildlife Service doing to control invasive species?
- What can YOU do to help control invasive species?

Starting with this program packet, you will get information and links to online resources to allow you to identify National Wildlife Refuges in your area where invasive species are a problem.

What's a National Wildlife Refuge?
A refuge is a special area of land or water set aside to protect wildlife and habitat - the places where plants and animals live. These national wildlife refuges, found all across the United States, are part of the U.S. Fish and Wildlife Service. In fact, there are over 555 National Wildlife Refuges, with at least one in every state and U.S. Territory.

What are Invasive Species?
Who would have thought that plants and animals could be considered a menace or threat to our waters and lands? It's true! They're called invasive species, and they're everywhere! In some instances, in your own backyard. There have been sightings of invasive species at many wildlife refuges. We'll find out what makes them an invasive species, what harm they are causing, what the U.S. Fish and Wildlife Service is doing to stop this invasion, and what you can do to help.

Students removing invasive plants at Occoquan NWR/USFWS

Learning Objectives

Part 1: What is an invasive species?
Students will be able to:

- define an invasive species
- know the difference between native and non-native
- identify several characteristics of two or more invasive species
- name two or more types of invasive species
- identify a local invasive species

Part 2: Why are invasive species harmful?
Students will be able to:

- know the difference between helpful and harmful non-native species
- list two or more reasons why they are harmful

Part 3: What is the U.S. Fish and Wildlife Service doing to control invasive Species?
Students will be able to:

- explain two or more things that the Service is doing to control invasive species

Part 4: What can YOU do to help control invasive species?
Students will be able to:

- identify a threat to their local community
- list two or more activities that they can do to control invasive species

Purple Loosestrife/USFWS

Part 1

What is an Invasive Species?

What comes to mind when you hear the words "**alien**," "**intruder**," "**exotic**," "**non-native**" or "**invasive**?" An invasive species is either an animal (including insects), plant, or other life form (e.g., microbes) that has been introduced into an environment in which it did not originate. Human actions are the primary means of invasive species introductions. Usually, invasive species lack natural enemies or other restraints to limit reproduction, growth, and spread. Their introduction causes or is likely to cause economic or environmental harm or harm to human health.

Not all non-native species are invasives. Many non-native species found in our gardens, homes, and cities provide us with food, enjoyment, and beauty. These species are never labeled as invasive species. In fact, the majority of species introduced to a region or country never become a problem. The few that do, however, because they are able to take advantage of their new environment, rapidly colonize new habitats. These species often out compete and displace native plant and animal species.

One of the characteristics of an invasive species is that they are non-native to an area. So, how did they get from there to here? They travel the globe. Sometimes they catch a ride naturally on the wind or in the sea, but they also hitch a ride whenever they can. For example, animals, plants, and other life forms are transported on clothing, in cars, boats, and planes as humans move around the globe from place to place.

To help you understand about one such hitchhiker and its implications for economic, environmental, and human health, let's look at an invasive that has invaded waters across the United States. Imagine an animal, the size of a thumbnail, with the power to shut down electrical utilities by clogging water intake pipes. The electrical utility company has to spend dollars to clear their intake pipes. The companies then pass on this cost to the consumer – that's you and your parents – thus increasing the cost of electricity. The invader is the zebra mussel.

The zebra mussel has assumed an important niche in their new ecosystems. They are "**filter feeders**." In other words, they filter **plankton** from the water, and by doing so remove it from the food chain. This decreases the supply for other filter feeders. The zebra mussel filters out and uses beneficial plankton and expels potentially toxic substances. Higher order organisms such as small mouth bass consume the toxic substances and become carriers of these harmful substances. In turn, humans catch the small mouth bass and eat them, thereby exposing themselves to the toxic substances.

Zebra mussel on native mussel/USFWS

To find these invaders you have to look underwater. Native to the Caspian and Black Seas, the tiny striped-shelled (looks like zebra stripes) mussel was discovered in North America in 1988. Marine biologists believe it arrived by ship as an undetected stowaway in the **ballast water** that was discharged from ships into Lake St. Claire (a lake between Lake Erie and Lake Huron in the upper eastern part of the United States.) The zebra mussel has spread rapidly since then throughout lakes and waterways in the eastern United States and Canada, from the Great Lakes through the Mississippi River **watersheds**. In addition to spreading through our waterways, these invaders can also travel overland by hitching rides on waterfowl, turtles, or other wildlife or, most likely, on the hulls and motors of boats, as well as on anchors, ropes, and trailers.

Native or Non-Native

Activity

In this activity, students explore local plant communities and research the history of plants they find. Students living in urban areas without access to parkland might focus their collection on tree leaves or vegetation growing in undeveloped lots.

Begin by checking the rules for collecting plant specimens from public lands or parks and ask for permission from owners of any private lands you'd like to explore. (As an alternative to collecting plants, you might bring along plant identification guides and photograph or sketch and measure specimens.) Next contact a local agricultural or land managing agency, a university natural resources or botany department, or a museum to learn if there are any rare or endangered plants that students should not collect. Explain the proper procedures for collecting plant specimens. Take care not to trample vegetation and take only the minimum necessary to make an identification (one sprig with leaves and flower for woody plants; for others, you might need the whole plant, but uproot a plant only if there are at least 20 others nearby). Be careful to avoid spreading the seeds of uprooted plants.

Have each student collect up to six different plant specimens during their walk. Back in the classroom, students should press the plants between layers of newspaper in a press or under a heavy book. When the plants are dry, they can be mounted on cardstock with diluted white glue. Students should then refer to plant guides to label each plant with its common and scientific name, and divide the plants into native and non-native categories. Have students research their plants in both local historical accounts and in plant guides.

For native plants, students should try to discover the following:

- What is the plant's place in the food web?
- What animals use the plant for food and shelter?
- What do humans do with the plant?
- What might they do with it in the future?
- Is the plant species increasing or decreasing in number in your area, and why?
- Are there threats to the plant's existence?
- What can people do to ensure the plant's survival?

For non-native plants, students should investigate the following:

- When, why, and how was the species introduced locally?
- What are the drawbacks and benefits of its presence?
- Is it an invasive weed?
- What animals use the plant for food and shelter? Are these animals native or introduced species?
- What natural balancing mechanism kept the plant in check in its place of origin?
- Does this plant threaten native plant communities? If so, how?
- What can people do to ensure that this plant does not damage native plant communities?

Your county extension agent, a local botanist, land management agency, or local nature center may be able to assist with the project.

This activity was written and produced by the Office of Environmental Education and Volunteers, Bureau of Land Management, Department of the Interior, and reprinted with their permission.

World Travelers

Activity

Objectives
The students will:

1. identify native and exotic plant and animal species through local investigation;

2. interpret graphs and maps of the concentrations of native and non-native species; and

3. identify the effects of introduced species on ecosystems.

Grade Level 5-8

Subject Areas
Science, Math, Environmental Education

Duration
two to three 45-minute sessions

Group Size
any size class divided into groups of three or four students

Setting
outdoors and indoors

Project Wild Conceptual Framework Topic Reference
ITIIA2, ITIIA2a, ITIIA2b

Key Terms
exotic, introduced, native, dominant species, invasive species

Method
Writing materials to create a report and a graph or pie chart; field guides; tape measures; string to mark plots; reference materials (Internet, natural resource agency publications, newspaper articles, etc.); copies of the Dominant Species Chart for each group.

Background
Definitions:

- Non-native - in conservation biology, a plant or animal that has been brought into a new area, synonymous with "exotic." (Examples from the United States include the house mouse, common carp, Eurasian watermilfoil, Australian pine, feral horse, alewife and ring-necked pheasant.)

- Introduced - an organism that is brought into a community.

- Native - a species that naturally occurs in an ecosystem; not introduced by humans.

- Dominant Species - plant or animal species that exert major controlling influences on a community. (Dominants generally make up the greatest total biomass (living material) in a community in terms of numbers and/or total weight.)

- Invader - in conservation biology, a species that spreads into a community where it did not previously exist.

A non-native species does not occur naturally in a specific location. While species always have migrated from one place to another, natural land barriers have prevented indiscriminate movement. Over time, human modification has changed these barriers. For example, organisms and seeds can be transported in a ship's ballast water, on clothing, and in cars or on boats as humans move from one place to another.

Zebra mussels were introduced into the Great Lakes in the ballast water from ships. Female zebra mussels are capable of laying over one million eggs each year. Unlike native freshwater mussels, they attach to solid surfaces using tiny thread-like fibers and as a result, clog the water systems of power plants and water-treatment facilities and cover the shells of native mussels. They also compete with other mussels and larval fish for food.

Sea Lamprey/USFWS

Zebra mussel/USFWS

Purple loosestrife/USFWS

Sea lampreys, common to the Atlantic Ocean from Florida to Labrador, swim inland into fresh water to spawn. They reached the Great Lakes through human-made canals. Lampreys are parasites of many native fish species, including paddlefish, lake trout, and whitefish. They attach to fish and feed upon them. Although this action usually doesn't kill the fish, it makes them susceptible to disease and illness.

Some plants and animals that were introduced intentionally also have caused problems for native ecosystems. Purple loosestrife was brought to the United States from Europe in the 1800s for use as a landscape plant and to provide nectar for honeybees. It has no natural predators here, reproduces rapidly, and grows quickly on disturbed soil. Purple loosestrife has taken over wetlands, marshes, pastures, and riparian meadows. The result is the degradation of habitats where native plants grow, fish spawn, and wildlife live and breed.

Another example of an introduced, non-native species is the gypsy moth. This moth was brought to Massachusetts from France to crossbreed with silkworms. These voracious eaters can be responsible for the defoliation of millions of acres of forests, slowing the growth of trees, making songbirds vulnerable to predators, and increasing the water temperature of local streams.

Why do these invaders have such success? While not all non-native species succeed, those that do are aided by their ability to out-compete native species for resources and the lack of natural predators and parasites to control them.

The main objectives of this activity are for students to identify native and non-native plant and animal species through field surveys and to examine the positive and negative effects of their presence.

Kudzu/USFWS

Examples of Six Non-Native Plant Species

- Purple loosestrife *(Lythrumrum salicaria)*
- Russian olive *(Elaeagnus angustifolia)*
- Kudzu *(Pueraria lobata)*
- Tree-of-heaven *(Ailanthus altissima)*
- Multiflora rose *(Rosa multiflora)*
- Japanese Stiltgrass *(Microstegiumvimineum)*

The above species are described at: **http://www.invasiveplantatlas.org/index.html**
A picture of each plant is included.

Examples of Six Non-Native Animal Species

- House sparrow *(Passer domesticus)*
- Brown tree snake *(Boiga irregularis)*
- Mediterranean fruit fly *(Ceratitis capitata)*
- Burmese python *(Python molurus bivittatus)*
- Nutria *(Myocastor coypus)*
- Emerald ash borer *(Agrilus planipennis)*

The above species are described at the following website: **www.issg.org/database/welcome/**

A picture of each species is included.

Procedure

Before the activity:

1. Identify six non-native species found in your community. Students will target, or focus on these species for this activity. Information on local species may be obtained from natural resource agencies, field guides, Internet sites or library references. Collect information and pictures of these species for the class.

2. Divide the class in groups of three or four students. Explain to the students that they will be identifying plants on the school grounds or at a local city park. Make sure they understand the meaning of the words native, non-native, and introduced. Demonstrate the different terms used to identify trees and plants, such as leaf shapes, leaf arrangements, flowers, buds and bark. Describe the six local target non-native species (step 1). Show additional examples of different non-native and native plant species in your area.

3. Explain that each group will be working in a designated plot so that each group is not identifying the same organisms. A 10-foot by 10-foot plot is recommended; however, the size of the plot can vary depending on the space available. Each group's plot will border another group's plot so the end result is one large inventoried plot.

4. Make copies of the Dominant Species Chart. Review the categories with the students prior to the field trip: Species (common and scientific name), Number Found (the number of individuals found), Characteristics (students should name at least three characteristics they used to identify the plant), Remarks (where the plants were found, do they seem healthy, apparent age or anything unusual about the population) and Native/Non-Native.

In the field:

Take the students to a school ground or a local city park. Have each group measure its plot and mark the boundaries with string.

5. With the aid of field guides, all groups then identify the four dominant species in the plot. In this situation, dominance is based upon which species is the most numerous. Make sure the students also record any of the target non-native species found.

It also will be helpful to include any large tree (a diameter of three inches or more at breast height) within the section even if it is not one of the four dominant species. In addition, make sure students do not assume that just because a plant is not one of the target non-native species that it is native. Many landscape plants, including turf grasses, are not native. If the students encounter other dominant non-natives in their plot, they should refer to their field guides. Do not remove any leaves or twigs from the specimen.

6. If there are too many individuals of one species to count, show the students how to estimate the number by counting the individuals in a one square foot sub-plot and then extrapolating for the total area. A section at the bottom of the Dominant Species Chart is provided to compute the percentage of the identified individuals that were native and non-native.

7. While students are identifying the specimens in their plots, have them diagram the major features of their sites and include the locations and names of plants they found. Also, have them include any features that could affect the health or make-up of the site.

Analyzing the Data in the Classroom:
Students may analyze the data from each group or from the class as a whole by developing pie charts and vegetative maps:

- Pie charts - Each group calculates the percentage of the non-native species and the percentage that were native. Combine the data from all of the groups to develop a classroom pie chart.
- Vegetative maps - Groups combine their plot diagrams showing the locations and identities of plants. Group members will need to agree on what symbol represents each species.

8. Have students conduct research on the non-natives found. Ask them to write short reports explaining how the non-natives arrived here, what positive and negative impacts they have had on the environment and wildlife, and what management techniques are or have been used to control their populations.

9. Ask the students to share the findings from their research with the class. Compare the role of wildlife managers and citizens. How do citizens contribute to the dispersal of non-native species? What can citizens do to retard dispersal? Ask the students to reflect on the importance of habitat evaluation in the management of exotic species.

Extensions

1. Follow the same procedure but observe and identify insects instead.

2. Establish some long-term control plots for the activity. Establish two plots, each 10 feet by 10 feet. Leave one plot as the control and let it develop without disturbances. For the second plot, try a management technique such as hand removal of a non-native species. This long-term project demonstrates how ecosystems change over years. Have classes observe the plots over several years and record, draw, or photograph the changes.

3. Take a field trip to a wetland or marsh to do the observations and identifications. Repeat the trip annually. Keep a record of the charts and maps done each year so that students can see how the presence of non-natives alter the ecosystem and so that students can become a valuable part of recording natural history.

4. Make this activity aquatic by researching some of the local non-native species affecting waterways and by having the students keep an inventory of what they find. Use the same methods of recording and evaluating the data. In order to identify some species, students may need to collect samples. It may be helpful to ask a local naturalist or biologist to speak to your class concerning safety issues and different ways of collecting the data.

5. Increase public awareness by creating a brochure, web site, or newspaper article documenting the class findings.

6. Have students research and develop a native species garden for an outdoor classroom. The students also could focus on native plant species that attract native animal species that may be declining in population.

Evaluation

1. What impact do non-native species have on their native counterparts?

2. What methods are there for controlling populations of non-native plant and animal species?

3. What are the pros and cons of having non-native plants and animals?

4. How can you help prevent the spread of non-native species?

5. Do non-native species affect humans? How?

6. Describe methods used to identify plants.

Additional Resources

Naturalist Journal Sample page can be found on inside back cover

http://plants.usda.gov
http://www.seagrant.umn.edu

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www.projectwild.org

Dominant Species Chart

Team _____

Plot _____

Species	Number Found	Characteristics	Remarks	Native/ Non-Native

(Total Number of Non-Natives/Total Number of Species Found) x 100 = % Non-Natives

(Total Number of Natives/Total Number of Species Found) x 100 = % Natives

Part 2

Why Are Invasive Species Harmful?

Invasive species have no natural enemies, competitors, or other restraints. They have high reproductive rates, often grow fast, and colonize quickly. Invasive species crowd out native plants and animals and wreak havoc on native habitats. Did you know that some invasives cause direct threats to agricultural crops that result in lower crop yields? Others poison wildlife, reduce water quality, and cause soil erosion.

Plants and animals evolved over millions of years to fill unique ecological niches. These plants and animals developed in and are native to their ecosystem. They are kept in check in their environment by insects or diseases and by competition with other species. In order to survive in their native ecosystems, many species developed characteristics that make them hardy.

Early European settlers in North America accidentally brought many invasive species with them. They were transported in clothing or bedding, in the feed for animals, or in ships' ballast water. Some settlers purposely brought plants from their home country to reseed areas, make dye for clothing, and for ornamental use. Without their natural enemies, some non-native species became invasive, reducing the biological diversity of native plants and animals while negatively affecting the quality of their habitats.

Sadly, certain invasive species are transforming entire ecosystems. These alien species are changing the rules of the game under which other species must live. For example, they change an ecosystem's natural water flow, and/or soil composition.

Melaleuca, an evergreen tree imported from Australia, is transforming the landscape of the Florida Everglades' fragile ecosystem. Melaleuca was introduced in 1906 for ornamental purposes and used in the 1930s to dry up wetlands and provide a new source of lumber. Its wood, however, turned out to be too hard for lumber use.

Melaleuca forms dense monospecific stands, reducing species diversity in marshlands by 60 to 80 percent. Despite efforts to control it, the tree has infested more than 500,000 acres in south Florida, and it spreads at an estimated rate of 50 acres per day! Melaleuca is difficult to destroy because each tree produces millions of seeds that are released when it is stressed, following fire or damage by herbicides.

Burmese Python/Roy Wood, NPS Bugwood.org

Food Web Invasion Game

Activity

Objectives
Students will be able to describe the changes in a river ecosystem caused by the introduction of non-native zebra mussels.

Age
Grades 5-7

Subjects
Science

Skills
Inferring
Predicting
Drawing conclusions

Materials

- Character name tags (double-sided) with zebra mussel written on the back of all 30 tags.
- Divide tags into thirds and label 10 as larva fish, 10 as native mussel, and 10 as larger fish.
- 30 game piece holders
- 3 diving duck name tags without zebra mussels on the back
- 150 red game pieces - indicates zooplankton (microscopic animals)
- 150 blue game pieces – indicates dissolved oxygen
- Chalkboard, pad of paper, and pencil to record students' observations when game is over
- Background on native mussels at http://pubs.ext.vt.edu/420/420-014/420-014.html
- Threat to Pearly Mussels at http://www.fws.gov/midwest/endangered/clams/higginseye/higgins_fs.html
- General aquatic exotic information at http://www.epa.gov/bioiweb1/aquatic/exotic.html

Method
Students play a game to understand the impact that zebra mussels have on native aquatic ecosystems.

Background
Non-native or "exotic" species can potentially alter the balance of native ecosystems. They are species that were not originally found in a particular area but have been introduced by humans. Kudzu, for example, easily out-competes native plants for space and sunlight, killing the native plants. Kudzu was purposely introduced to help control erosion but went way beyond our control. Many non-native species can spread rapidly because they do not have the normal checks that keep them in balance with the ecosystems here, as they do in their homelands. For example, kudzu, in its native area of China, is kept under control by many insects that have adapted to eat various parts of the plant. The zebra mussel, like kudzu, is a non-native species. Zebra mussels are native to Eastern Europe and were first discovered in the mid-1980s near Lake Erie in Michigan. They were accidentally introduced into the United States. It is thought that they arrived here in ballast water released from trans-Atlantic ships that traveled up the St. Lawrence Seaway. By the mid-1990s, zebra mussels had spread throughout many of our Eastern rivers and lakes, causing a lot of ecological and economic damage.

Zebra mussels out compete our native aquatic species for food, oxygen, and space. How do they do it? Although adult zebra mussels aren't much larger than a fingernail, they can reproduce and spread at an alarming rate. Female zebra mussels can produce 30,000 to 1,000,000 eggs per year. While some zebra mussels invade new areas through the transport of currents (this is particularly true in their larval stage), humans are often responsible for zebra mussel invasions of uninfested waters. Not only do they negatively impact aquatic ecosystems, but they also clog pipes and engines, causing millions of dollars in damage to municipal water systems, barges, and boats.

One way that zebra mussels can interfere with native river ecosystems is through their use of dissolved oxygen. Dissolved oxygen is a by-product of photosynthesis, the process used by underwater plants to make food out of carbon dioxide and water. In a river ecosystem, underwater species, including zebra mussels, rely on dissolved oxygen to sustain life. When zebra mussel numbers increase rapidly, they use tremendous amounts of dissolved oxygen, leaving little available for native species, thus killing them. Large numbers of zebra mussels can also attach themselves to aquatic species, like mussels and crayfish, eventually suffocating them.

Zebra mussels illustrate the impacts that non-native organisms can have on our environment. By playing the "Web of Life Invasion Game," students will begin to understand the impact zebra mussels can have on our native river ecosystems.

Object of the Game
To survive as long as possible

Procedures
The following game instructions are based on using 30 students; the game may need to be adjusted for a different number of students. If possible, the game should be played in the gym or cafeteria, on the playground, or any other area with enough room to allow the students plenty of room to move about. Begin the game with 10 larval fish, 10 native mussels, and 10 larger fish.

Round One

1. The teacher scatters the game pieces in a large playing area so all students have easy access to the game pieces. Give each student one of the larval fish, native mussel, or larger fish name tags and a game piece holder.

2. At a signal from the teacher, all students will scramble to collect as many game pieces as possible and put them in the game piece holders. Give the students plenty of time to gather many pieces.

3. After students have gathered the game pieces, have them count the number of dissolved oxygen and zooplankton pieces in their cup. Each larval fish, larger fish, or native mussel needs a certain amount of dissolved oxygen and zooplankton to survive. Have the students use the chart to determine if they have enough pieces to survive.

4. Survivors remain as the same species for the next round. Student who do not have the required number of game species die and become zebra mussels in the next round (turn the tag over.)

Round Two

1. Collect and scatter the game pieces again. Have the students again collect as many game pieces as possible.

2. Repeat step 3 of Round One to determine who survived. If many animals other than zebra mussels survive, repeat round two.

3. At the end of Round Two, each animal keeps the game pieces he or she collected in preparation for Round Three.

Round Three

1. Select three students at random to become diving ducks. The diving ducks may eat any surviving animals by tagging them.

2. The diving ducks take all the game pieces for each animal as he or she is tagged. The tagged animal now has been eaten and is out of the game. The round concludes when all game pieces have been collected.

3. After the game the teacher should discuss with students:

   - Who survived and why (see chart in step 3).

   - The impact zebra mussels have on native species.

   - The impact diving ducks may have on zebra mussel populations.

   - How zebra mussels can destroy an ecosystem and its biodiversity.

4. The results may be different each time the game is played. If you choose, play the game again

	Dissolved Oxygen (blue pieces)	Zooplankton (red pieces)
Larval fish	6	6
Native mussel	6	6
Larger fish	10	10
Zebra mussel	2	2
Diving duck	14	14

(Zebra mussel enter the game in Round Two; diving ducks enter the game in Round Three)

Evaluation

Students should be able to describe one way that zebra mussels impact the native food web. Students should be able to list two ways that zebra mussels are spread in the river system.

Extensions

Play the game again adding crayfish, insects, and snails. Play the game at least 10 times. For each game, chart the results of survivors and deaths among each species. Compare and discuss the results.

Chart the results from the first and second games. Compare the results to see how, in nature, the food web interactions are constantly changing. More zebra mussels will reduce the number of larger fish because zebra mussels are depleting necessary nutrients and life support.

Play the game using different numbers of animals per species for different results.

This activity was adapted from "The Web of Life Game" in the Zebra Mussel Mania Curriculum Guide, with permission from Robin Goettel at the University of Illinois.
Developed by Illinois-Indiana Sea Grant College Program, University of Illinois at Urbana-Champaign and Purdue University. **www.iisgcp.org**

Part 3

What is the U.S. Fish and Wildlife Service Doing to Control Invasive Species?

Invasive non-native species in the United States number approximately 50,000, with new invasions occurring weekly! An interconnected global economy, new transportation routes, and quicker transit times have all led to this explosion of invasive species. Invasive species cost us hundreds of billions of dollars each year. As invasive species spread, little question remains that they represent a challenging problem for government agencies and private organizations around the country. Thousands of invasive species are affecting our ecosystems, including those that make up the National Wildlife Refuge System and other areas managed by the U.S. Fish and Wildlife Service. For example, some 2.5 million acres of Service-managed lands are infested with invasive plants!

What is the Service doing to control these invasives on public lands? Plenty.... With responsibility for managing fish and wildlife on a national level, the Service is a leader in addressing invasive species problems affecting land, water, and wildlife resources.

Ever hear of integrated pest management? Simply put, it is the management of pests, or in this case, invasive species, by using biological, cultural, physical, and chemical tools in a way that minimizes or lowers the economic, health, and environmental risks. For example, the Service serves as a catalyst for bringing partners together to implement on-the-ground projects that prevent and control the spread of nuisance or invasive species. We help to raise the public's awareness through educational programs while developing and implementing the policy necessary to support our efforts. On the ground and in the water, Service wildlife refuge managers and biologists are pulling, trapping, and spraying to eradicate these troublesome species.

Another effective tool is biological control. An example of this is occurring on two Oregon national wildlife refuges — Umatilla and Basket Slough National Wildlife Refuges, where two leaf-eating beetles were released to control purple loosestrife. As their name implies, the beetles eat the leaves of the plant, effectively stopping seed production which may result in the killing of mature plants.

On the opposite coast, in Maryland, nutria are playing havoc in our marshes due to their feeding and digging behaviors. Nutria, a small, fur-bearing, semi-aquatic rodent-type mammal, was introduced into the Chesapeake Bay area as early as 1943 in an effort to help the local fur trade. Nutria feed on the roots and stems of marsh vegetation, digging underneath and overturning the plants to feed. The loss of marsh vegetation is staggering, totaling thousands of acres lost each year. At Blackwater National Wildlife Refuge, located on the Chesapeake Bay on the Eastern shore of Maryland, over 7,000 acres have been lost from nutria damage. However, in recent years the refuge has been very successful controlling the nutria population. In places like Maryland and Louisiana, the nutria population has grown since 1958 from less than 50 animals to millions of nutria!

Something has to be done! In cooperation with federal, state, and private partners, the Service has tested a 3-year pilot project to develop an effective way to get rid of nutria from the Chesapeake Bay. This pilot program involved approximately 63,000 acres along the Eastern shore of Maryland and includes Blackwater National Wildlife Refuge. Since the techniques have proven effective in getting rid of nutria in Maryland, they are now being applied in other states infested with nutria.

Physical control of melaleuca/USFWS

Chemical control of melaleuca/USFWS

Nutria/USFWS

Part 4

What can YOU do to Help Control Invasive Species?

The U.S. Fish and Wildlife Service and other agencies and organizations responsible for wildlife conservation are dedicated to doing everything possible to protect, enhance, and restore lands and waterways. We can't do it alone. Everyone can help.

There are many ways students and teachers can help to control invasive species. The list is endless. To get you started, here are a few:

- Know your own backyard.
- Identify your area's native and non-native species.
- Find out whom to contact to report new invasions, or to receive guidance on controlling invasives on your property.
- Spread the word – educate yourself and others about the problem of invasive species.
- Landscape with native species or non-invasive ornamental plants appropriate to your area.
- Don't pick wildflowers or plants. Many wildflowers are actually invasive weeds.
- Don't bring plants, fruits, soil, or animals into the country from overseas – or to Hawaii – without first having them inspected by the proper officials.
- Adopt a local natural area and work with the appropriate officials on a weed removal plan.
- Clean boats and boating equipment before transporting them from one body of water to another to avoid spreading aquatic pests. Remember the zebra mussel?
- Stop aquatic hitchikers. Learn to prevent the spread of aquatic invasive species. Information can be found at www.protectyourwaters.net
- Join volunteer efforts to remove invasive species in or around natural areas on public or private lands. Volunteer at a National Wildlife Refuge; take the online volunteer training course (see the volunteer information on page 41) With over 555 national wildlife refuges in the United States, it's likely that there is one close to where you live. To locate a national wildlife refuge near you, call 1-800-344-WILD. By volunteering, you can help Fish and Wildlife Service staff maintain healthy habitats.

Here's an example of a successful volunteer effort:

Four high school students from Columbus, Montana, along with their vocational-agriculture teacher, successfully introduced the horned beetle to reduce the spread of leafy spurge, a rapidly spreading weed with a 20-foot taproot that does not respond to most traditional control methods. These beetles are natural biological control agents whose larva attack the root system of the spurge, weakening and eventually killing the plant. The environmentally safe beetles are often more effective than herbicides. Starting with a modest 200 beetles, the students successfully reproduced millions of the insects. The beetle project is part of the Stillwater Project, a cooperative venture between Columbus High School, the Bureau of Land Management, and other partners that links automated weather monitoring with the introduction of insects for invasive weed control.

Removal of invasive weeds/USFWS

Can Do!

Activity

Objectives
Students will:

1. identify a problem involving wildlife in their community;

2. suggest and evaluate alternative means by which to either solve the problem or at least improve the situation;

3. successfully undertake the project; and

4. analyze and describe the process by which they successfully solved the problem or improved the situation.

Grade Level
9-12

Subject Areas
Environmental Education, Social Studies

Duration
minimum of three 45-minute sessions

Group Size
any

Setting
outdoors and indoors

Conceptual Framework Topic Reference
WMIC

Key Terms
problem, authority, compromise, constructive, realistic, effective, alternatives

Appendices
Taking Action, Outdoors

Method
Students select an environmental project, conduct research, make plans, and follow procedures to accomplish the project.

Materials
Writing materials

Background
Each of us can make constructive contributions to improving the environment in which we live. Sometimes our actions can improve the environment for people, sometimes for wildlife, and sometimes for both. Sometimes our effectiveness can be improved if we work with other people — sharing ideas, information, and skills.

A working knowledge of the following terms will be useful to students in this activity:

Environmental Problem
A difficult situation involving the interaction between people and the environment.

Environmental Issue
A situation in which there is a disagreement about solutions to an environmental problem, often because of differing values and beliefs.

Authority
An individual or group of people with the power to make changes.

Compromise
A way to settle a problem in which both "sides" usually give a little.

Consensus
When a group of people reach a general agreement on a solution. (It may not be exactly what every member wants, but what they can agree to.)

Given that it is important for young people to learn that they "can do" for people, wildlife, and the environment - use your judgment in the course of this activity to assist students in selecting a project that is realistic, constructive, and possible. If not, the students may experience an activity that contributes to their thinking that they "can't do."

The major purpose of this activity is to provide students an opportunity to experience success in taking constructive actions to improve the environment for people and wildlife.

Procedure

1. Ask the students to think of ways in which they could improve areas of the community as a home for wildlife. They might generate a list of activities that have a negative impact on wildlife. The list might include litter that poses a hazard for some kinds of wildlife; a muddy area that birds use for water but that has been recommended for paving to minimize dust and mud; a proposed pesticide spraying that will kill not only the "pest" but perhaps affect other plants and animals; removal of a tree that presently helps contribute to cleaning the air, produces oxygen, and serves as a food and shelter source for varying kinds of wildlife, etc.

2. Looking at the list of possible issues and suggestions for ways to improve wildlife habitat at school - ask the students to select one they think they realistically could handle and do something constructive about. If there is difficulty in deciding which one, and reasonable support has been offered for each, the students might vote to decide. Students could also make speeches in support of the project they want to tackle in hopes of swaying the class vote.

3. Once the project has been selected, ask the students to work alone or in small groups to begin to generate ideas for possible solutions to the problems or issue and ways to implement the project. Each individual or small group could come up with a plan, including a written description and illustrations or sketches of how it will work and how it can be accomplished.

4. Ask the groups to present their plans to the rest of the students. Students may ask questions for clarification. Once all the plans have been presented, ask the students to select the plan that seems most a) constructive; b) realistic; c) helpful to wildlife; and d) apt to make a lasting

contribution. Students also might develop a new plan based on the ideas presented.

5. Also ask the students to select one or more alternative plans, in case their first choices are not acceptable to authorities.

6. Once a plan and alternatives have been selected, ask the students to select a delegation to present their proposal to the authorities or whomever the appropriate authority is. Remember janitors, grounds keepers, school board, and so on - anyone who would be physically and/or officially involved. A practice session before the students and any interested parents or other students would be helpful. At the practice session the student delegation would make its presentation, responding to any questions from the audience.

7. Have the students make an appointment to present their proposal, make the presentation and report back to the group. If their plan is accepted, they need to make sure they know who to contact next in order to complete their project successfully. Making sure they have all necessary permissions secured, the students should proceed to accomplish its project successfully. If their plan, including alternatives, is not accepted, have the students identify the reasons why. Have them find out exactly what people objected to in their original plan. The students then can respond to those objections with alternative proposals. Creating an alternative plan may require further research, careful interviews and time.

8. Once accomplished, ask the students to analyze their results. Did things work out like they wanted them to? Were there any surprises? Any unforeseen problems? How might they have been any more effective?

Aquatic Extension
Choose an issue to solve that involves water as a component of habitat.

Evaluation
Staff members at a nature center report they have noticed a smaller bluebird population in recent years. People are taking bluebird nest boxes down from trees and breaking them. The nature center director says there is no money to pay for security guards or to make repairs. Make a plan for helping the bluebirds.

Reprinted with permission from the Council for Environmental Education, Project WILD, K-12 Curriculum & Activity Guide. The complete Activity Guide can be obtained by attending a Project WILD workshop. For more information, please contact your State Coordinator by going to the Project WILD website at **www.projectwild.org**

Volunteers learning to map invasive plants at Eastern Neck NWR/USFWS

Program Correlation to the National Science Education Standards

This educator's guide generally correlates to the following National Science Education Content Standards for grades 5 - 8. Educators can correlate this content with their state standards as appropriate.

Life Science: Content Standard C

Populations and Ecosystems

Diversity and Adaptations of Organisms

Science in Personal and Social Perspectives: Content Standard F

Populations, Resources, and Environments

Natural Hazards

History and Nature of Science: Content Standard G

Science as a Human Endeavor

Nature of Science

Adapted from:
National Science Education Standards

National Research Council National Academy Press, Washington, DC 1998

The full text standards are available online at:
http://books.nap.edu/html/nses/html/index.html

Asian carp/USFWS

U.S. Fish & Wildlife Service
National Wildlife Refuge System & Fish Hatcheries
SCALE 1:7,500,000
0 100 200 300 400 MILES
0 100 200 300 400 500 600 KILOMETERS
Region 1
Region 2
Region 6
Region 7
Region 8
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
SOUTH DAKOTA
NEBRASKA
KANSAS
TEXAS
ND
RUSSIA
CANADA
PACIFIC OCEAN
BERING SEA
GULF OF ALASKA

Region 3
Region 5
Region 4
MINNESOTA
WISCONSIN
MICHIGAN
IOWA
ILLINOIS
INDIANA
OHIO
MISSOURI
KENTUCKY
WEST VIRGINIA
VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
VT
NH
CT
NJ
MARYLAND
DELAWARE
NORTH CAROLINA
SOUTH CAROLINA
TENNESSEE
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
LOUISIANA
Color Key
National Wildlife Refuges
Wetlands Management District Office or Waterfowl Production Area Office
Abbreviations
NWR=National Wildlife Refuge
WMD=Wetland Management District
WPA=Waterfowl Production Area
NGP=National Game Preserve
WMA=Wildlife Management Area
NFWR=National Fish & Wildlife Refuge
Principal Islands of HAWAII
SCALE 1:7,500,000
Navassa Island
SCALE 1:7,500,000
Puerto Rico and the Virgin Islands
SCALE 1:7,500,000

Glossary

adapted - To become suitable to a particular environment.

alien - A species that has not historically occurred in a particular area or region.

ballast water - Water carried by ships to provide stability and adjust a vessel's buoyancy for steering and propulsion.

biological control agents or bio-control - The use of live natural enemies of invasive species to reduce their population size and control further spreading.

biological diversity - The variety of species living together at a specific place and time.

colonize - To settle in a new area and make it home.

ecological niches - the specific place or role in which a species lives out its life.

ecology - The study of the relationships of living things to one another and the environment.

ecosystem - An area of any size where all living things interact with their physical environment as a single unit.

endangered - An animal or plant that is threatened with extinction.

exotic - A species that has not historically occurred in a particular area or region.

filter feeders - Any species that feeds by filtering suspended, microscopic plants and animals from the water. As an example, plankton.

habitat - The surroundings or living place of a plant or animal.

invasive species - A species that has been itroduced into an environment in which they did not evolve, and thus usually have no natural enemies to limit their reproduction and spread.

introduced species - A foreign species that has been brought into and established itself in a new region or habitat.

monitor - To keep track of changes over time.

monospecific - A single species type.

native - A species that has not been introduced and that has historically occurred in a particular area or region.

non-native -A species that has not historically occurred in a particular area or region.

ornamental plant species - Species that are brought in an area or region by humans to decorate homes, offices and gardens.

pest - Any unwanted or undesirable animal (including insects) and/or plant species. May or may not be native.

plankton - Free-floating, usually microscopic plant and animal life found in fresh or salt water.

refuge - An area of land or water set aside to protect wildlife, plants, or habitat.

threatened - A species likely to become endangered if protective measures are not taken.

watershed - The area of land that drains into a river, river system, lake or the like.

weed - Any unwanted or undesirable plant species. May or may not be native.

Recommended Online Resources

U.S. Fish and Wildlife Service Invasive Species Program
http://www.fws.gov/invasives/

U.S. Department of Agriculture Invasive Species Program
http://www.invasivespeciesinfo.gov

Biological Control of Non-Indigenous Plant Species
http://www.invasiveplants.net/

Educational Resources for K-12 Students: National Biological Information Infrastructure
http://www.invasivespecies.gov/global/education_public_awareness/public_awareness_index.html

Online invasive species training for volunteers
www.fws.gov/invasives/volunteerstrainingmodule

Information on preventing aquatic invasive species
www.protectyourwaters.net

Invasive Species Educational Resources
http://www.invasivespecies.org/resources/index.html

Invasivespecies.gov: National Biological Information Infrastructure
http://www.invasivespecies.gov/

Wikipedia entry on invasive species
http://en.wikipedia.org/wiki/Invasive_species

Detailed database of invasive species globally
http://www.cabi.org/isc
Invasive species of North America
http://www.invasive.org

Educational materials and resources for invasive plants
http://www.weedcenter.org/education/k-12.html

Invasive species in the Great Lakes
http://www.schoolship.org/schoolship/?id=669

US National Oceanic and Atmospheric Administration lesson plan on aquatic invasive species (grade 9-12)
http://oceanservice.noaa.gov/education/lessons/alien_invasion.html

Florida State University guide to invasive species
http://www.fsu.edu/~imsp/silent_invaders/new_weeds/guide/

Kudzu/Kerry Britton, USFS, Bugwood.org

Appendix

U.S. Fish and Wildlife Service Regional Offices

Region 1
(HI, ID, OR, PI, WA)

911 NE 11th Avenue
Portland, OR 97232-4181
503-231-6118
www.fws.gov/pacific

Region 2
(AZ, NM, OK, TX)

P.O. Box 1306
Albuquerque, NM 87103-1306
505-248-6282
www.fws.gov/southwest

Region 3
(IA, IL, IN, MI, MN, MO, OH, WI)

Federal Building, 1 Federal Drive
Fort Snelling, MN 55111-4056
612-713-5301
http://www.fws.gov/midwest/

RegionalOffice
Region 4
(AL, AR, FL, GA, KY, LA, MS, NC, PR, SC, TN, VI)

1875 Century Blvd.
Atlanta, GA 30345
404-679-4000
http://www.fws.gov/southeast

Region 5
(CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)

300 Westgate Center Drive
Hadley, MA 01035-9589
413-253-8200
http://www.fws.gov/northeast

Region 6
(CO, KS, MT, ND, NE, SD, UT, WY)

P.O. Box 25486
Denver, CO 80225
303-236-7920
http://www.fws.gov/mountain-prairie

Region 7
(AK)

1011 E. Tudor Road
Anchorage, AK 99503
907-786-3542
http://alaska.fws.gov

Region 8
(CA, NV)

2800 Cottage Way, W-2606
Sacramento, CA 95825
916-414-6464
http://www.fws.gov/cno

Region 9
(Washington, D.C.)

1849 C Street, NW
Washington, DC 20240
800-344-9453
http://www.fws.gov

For information about educational programs offered by the U.S. Fish and Wildlife Service please visit our website:
http://www.fws.gov

Volunteer assisting visitor/USFWS

Brown Tree Snake

What You Should Know
Brown tree snakes, native to the Solomon Islands, Papua New Guinea, and parts of Australia, have become entrenched in Guam. They will eat almost anything, but prefer birds and have eaten several species into extinction on this Pacific island territory. Nocturnal and growing to a length of 10 feet, the snake is an aggressive, damaging, and venomous pest. Given the opportunity, the snake has been known to attack humans with a painful but non-lethal bite.

How To Control This Invasive Pest
Department of Agriculture scientists are finding promise in stuffing dead mice with two 300 milligram capsules of a common, over-the-counter pain reliever containing acetaminophen; when brown tree snakes take the bait, they die within three hours, probably of internal bleeding. But research trials to insure that no other wildlife will be harmed by widespread administration of the drug could take as long as five years.

The Invasion
The brown tree snake most likely found its way to Guam aboard military transports during or after World War II. Since the 1940s, the snake has attained a staggering population, reaching as many as 13,000 per square mile in some areas.

What Can I Do?
Individual citizens can support efforts to research more effective control measures.

Background
Brown tree snakes have eliminated 12 species of birds on Guam, some of which were found nowhere else in the world. Many of the birds were key pollinators and the long-term effects of their extinction is not yet known. While the snakes favor shrubbery, they also crawl along power lines, causing frequent power disruptions. They invade any building, including homes and have been known to attack human infants as well as puppies, kittens and small rodents. The snake is of particular concern in Hawaii, where several stowaways have been found on aircraft. There is more concern about the snake gaining a foothold on the mainland, where they could thrive and do serious damage in most warm-climate states, such as Texas, Louisiana, Florida and elsewhere.

More Information
For further information about the brown tree snake, consult the U.S. Fish and Wildlife Service at:

http://www.fws.gov

The U.S. Department of Agriculture Animal and Plant Health Inspection Service at:

http://www.aphis.usda.gov

U.S. Fish & Wildlife Service
1 800/344 WILD
http://www.fws.gov

Brown Tree Snake/USFWS

Zebra Mussel

What You Should Know
The first descriptions of zebra mussels were recorded in 1769 and were based on observations made along the Caspian Sea and Ural River, although the species is believed to have originated in Poland. The species gains its name from a striped pattern on its shell. Zebra mussels can grow to a length of about 50 mm and have a lifespan of from 4 to 5 years. Females may produce more than 40,000 eggs in one reproductive cycle. The mussels eventually attach themselves to a hard surface, although they have been known to attach to vegetation as well.

How To Control This Invasive Pest
Several approaches are being tried or tested with varying measures of success. Methods range from manual removal to the use of steam, chemicals, vibrations, electrical current, filters, ultraviolet light, flushing and introduction of predators, parasites or disease.

The Invasion
Zebra mussels were first discovered in North America in 1986, on the Canadian side of two of the Great Lakes. By 1990, they were reported in all the Great Lakes. The mussels escaped the Great Lakes shortly thereafter and following introduction into the Illinois River, moved to the Mississippi River. By 1994, zebra mussels had been spotted in at least 20 states extending as far west as Oklahoma. There is wide agreement that the zebra mussel was most likely introduced through the ballast water discharge by international freighters that enter the Great Lakes through the St. Lawrence Seaway.

What Can I Do?
It isn't likely you'll encounter the zebra mussel unless you are on a waterway that is infested. Should you find them attached to your boat, it is important that they be destroyed upon removal. If you are moving your boat from an infested waterway to one that is not, it is particularly important to conduct a thorough inspection.

Background
Zebra mussels are among the invasives causing serious problems. They are capable of corroding wood, steel and concrete, fouling water intake pipes for industry as well as ship engines, and their weight can sink navigational buoys. They are believed to have a minimal impact on Great Lakes fish populations, but some believe it is too early to gauge their effect. The mussels' only known predators, carp, sturgeon and some diving ducks, have not had a significant impact on the zebra mussel population.

More Information
You can find a wealth of information about this destructive pest along with descriptions of efforts to fight the zebra mussel on the internet.

U.S. Fish & Wildlife Service 1 800/344 WILD http://www.fws.gov

Zebra Mussels on a native mussel/USFWS

Leafy Spurge

What You Should Know
Leafy spurge's (*Euphorbia esula*) deep root system and unusual ability to disperse seeds allow it to spread rapidly and makes the plant very difficult to eradicate. Leafy spurge roots can extend as deep as 30 feet. Shoots grow erect, one to three feet high. Small yellow green flowers are enclosed by yellowish heart-shaped bracts, which themselves have the appearance of flowers. The plant, including the root, has a milky discharge that is damaging to eyes and sensitive skin. Leafy spurge is very aggressive in dry areas and can overtake other vegetation on open rangelands. By squeezing out competing plants with shade and taking available moisture, it can cut the productivity on grazing land by 50 to 75 percent. It is unpalatable to cattle, but sheep and goats eat the plant.

How To Control This Invasive Pest
Mowing, burning, plowing and chemicals all have been used with varying success in attempts to control leafy spurge, which has infested all but 15 of the 50 states. In some cases, insect biocontrol agents have had some measure of success, along with goats and sheep, who unlike cattle, will eat significant quantities of leafy spurge.

The Invasion
Leafy spurge is a Eurasian herb, first noticed in the United States in the late 1820s. It is believed to have been introduced either by accident, through agricultural seed supplies, or intentionally for its rather attractive flowers.

What Can I Do?
If you see it, dig it up before the plant has a chance to go to seed. If possible, burn it.

Background
Leafy spurge today covers nearly 3 million acres of rangeland, and Wyoming, the Dakotas, Nebraska and Montana are hard-hit by its presence. Left unchecked, a leafy spurge infestation can push out native grasses and other plants in a relatively brief time.

More Information
The nearest university agricultural department, your local county or state extension service office, or the internet all may be able to provide you with more information about this invasive plant.

U.S. Fish & Wildlife Service 1 800/344 WILD http://www.fws.gov

Leafy Spurge/USFWS

Melaleuca

What You Shold Know

The melaleuca tree is a hardy, fast-growing species from the coastal wetlands of Papua New Guinea, and northern Australia. It found favor as an agricultural windbreak and soil stabilizer in Florida in the 1920s and 1930s. Melaleuca seeds were even air-dropped in 1936 on the Everglades as part of a private campaign to forest and eventually drain the area. Unfortunately, it thrives too well: the tree takes the "wet" out of wetlands, displaces native vegetation and can spread across the landscape at the rate of 50 acres a day. It is also established in California and Hawaii.

How To Control This Invasive Pest

Control efforts today employ the chainsaw and a lethal herbicide. A melaleuca tree can be destroyed by cutting it down and applying poison to the stump, or even by chopping at it with a poison-laced axe. An eradication project at the Arthur C. Marshall Loxahatchie Wildlife Refuge is eliminating the tree at the rate of an acre a day, but even this rate of success is not enough to keep pace with the tree's aggressive regeneration.

The Invasion

The melaleuca tree was originally introduced intentionally in Florida as a windbreak and soil stabilizer and as a plant to help dewater the Florida Everglades.

What Can I Do?

If you live in an affected state, you can help remove the trees by either of the methods referred to in the second paragraph of this fact sheet. (Make certain that use of the herbicide has been approved for use in your area.)

Background

Free of natural controls of its native range, the melaleuca tree has infested more than 500,000 acres of South Florida wetlands, further damaging an already seriously threatened ecosystem. The tree draws water at a rapid clip, fueling its own steady march across the land while denying it to other plants and dramatically altering the wetlands landscape.

More Information

For more information about the melaleuca tree, visit the U.S. Fish and Wildlife Invasive Species Program at: http://www.fws.gov/invasives/

U.S. Fish & Wildlife Service 1 800/344 WILD http://www.fws.gov

Melaleuca tree/USFWS

Round Goby

What You Should Know
Round gobies are aggressive bottom feeders that continue to spread throughout the Great Lakes consuming the eggs of bass, walleye, and perch. Once established, gobies rapidly become dominant. Because they are believed to absorb toxic contamination such as PCBs, the fish pose some risk to human health as they are in turn consumed by other fish that eventually become food for humans.

The Invasion
Gobies, which are native to Europe, were transported to the Great Lakes in the ballast hold of ocean-going freighters. Just 8 years after the round goby was first discovered near Detroit, the fish are now found in all of the Great Lakes.

How To Control This Invasive Pest
Scientists continue to research a number of approaches to the ballast water problem, with some measure of success. Individual anglers can help as well–see the guidelines listed under "What Can I Do?"

What Can I Do?
Scientists continue to research eradication programs, but individual anglers can help: learn to identify the round goby and if you catch one, contact the U.S. Fish and Wildlife Service Fishery Resource Office in Ashland, Wisconsin at 715-682-6185; never use gobies as bait; always drain water from your boat, livewell or bilge before leaving any waterway; always empty bait buckets on land and never in open water; never clean your bait bucket in open water and never dump live fish from one body of water into another.

Background
Besides posing a potential threat to human health, gobies upset the ecological balance in waters where they take hold. They threaten sport and commercial fisheries in a significant way.

More Information
For more information about round gobies, visit the Aquatic Nuisance Species Task Force at: **http://www.anstaskforce.gov**

The Great Lakes Commission at: http://www.glc.org.

U.S. Fish & Wildlife Service 1 800/344 WILD http://www.fws.gov

Round Goby/USFWS

U.S. Fish & Wildlife Service

Volunteers and Invasive Plants

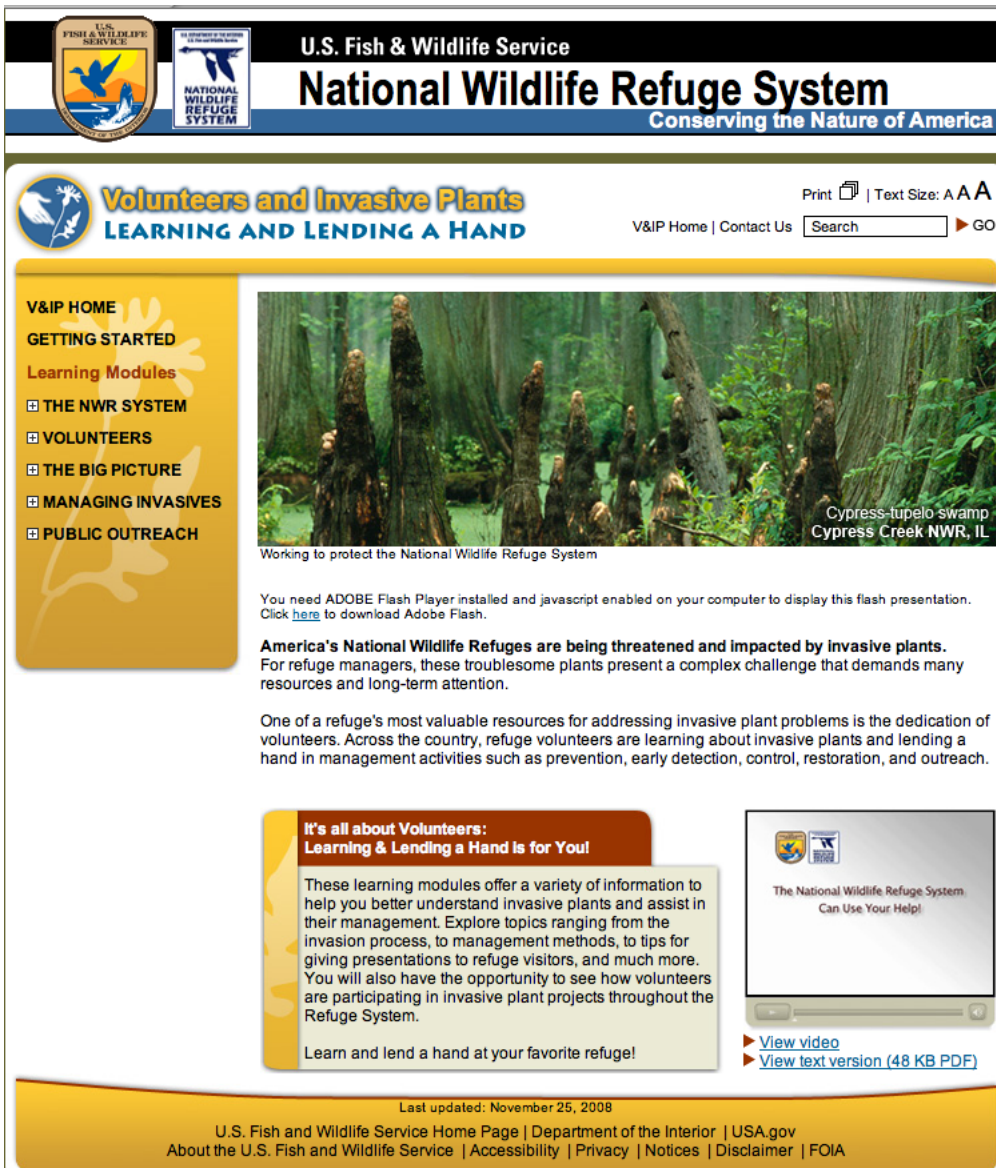
Learning and Lending a Hand

Online Invasive Plant Training Program for Volunteers

The U.S. Fish and Wildlife Service and the Center for Invasive Plant Management announce Volunteers and Invasive Plants: Learning and Lending a Hand, an e-learning website aimed at engaging volunteers and the public in invasive plant issues and management.

Designed for National Wildlife Refuge volunteers and Friends groups, the website provides science-based, introductory information that is suitable for anyone interested in learning about invasive plants. The five self-study modules address the purpose and history of the Refuge System, how volunteers help with invasive management, how refuges manage invasive plants, and tips for community outreach. Each module contains a quiz and web-based resources that enable learners to explore topics more thoroughly.

The website is part of a larger program carried out by the U.S. Fish and Wildlife Service in conjunction with partners, such as the National Wildlife Refuge Association, to engage volunteers in managing invasive species on National Wildlife Refuges.



The Volunteers and Invasive Plants training module provides a variety of information and resources to help National Wildlife Refuge System volunteers better understand invasive plants and assist in their management.

www.fws.gov/invasives/volunteersTrainingModule

May 2012

Naturalist's Journal

Sample page

	My Visit to a National Wildlife Refuge	
	Name:	
	Weather Conditions:	
	Refuge Name:	
	General description of the habitat here:	
	The birds and animals I saw during my visit:	
	Name/Type	Description
	These are the sounds I heard:	

The National Wildlife Refuge System

A National Wildlife Refuge is a great place to visit with your class, and chances are there's one within a short drive of your school. Here are some guidelines and tips to help you plan a successful trip.

During Your Visit

1. Take along binoculars, notebooks, and pencils.
2. Be sure to stop at visitor centers or visitor contact stations.
3. Interview the refuge manager, a naturalist, or other employee.
4. When hiking, walk slowly and look carefully. Stop frequently and look around. Listen carefully, too. What do you see and hear?
5. Take a close look at what makes and keeps a wild place wild. Make note of new things you learn, sights and sounds that are particularly striking, and new questions. Make sketches!

U.S. Fish & Wildlife Service
http://www.fws.gov

June 2012