



Invasive Species: Coming to an Environment Near You

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Introduction: This lesson introduces students to invasive species and their effects on ecosystems by examining local examples. It also explores the problems associated with invasive species, how climate change is involved, and possible solutions to the problem.

Grade Level & Subject: Grades 9-12. Earth Science, Environmental Science, Biology, Civics, and Social Studies.

Length: One class period, with the option of a longer class project or guest speaker.

Objectives:

- Learn what constitutes an invasive species and find examples in the local environment.
- Examine the effects of an invasive species on a specific ecosystem.
- Determine what causes invasive species and how they can be stopped, including what students can do.

Assessment: Students will be assessed on participation in class discussions and on a written report. This report will cover a particular invasive species, its effect on the environment, the impact of climate change, and a policy proposal.

Standards:

- NS.9-12.1 Science as Inquiry
- NS.9-12.3 Life Science
- NS.9-12.4 Earth and Space Science
- NS.9-12.6 Personal and Social Perspectives
- NSS-EC.9-12.1 Scarcity
- NSS-EC.9-12.16 Role of Government
- NSS-G.K-12.5 Environment and Society
- NT.K-12.5 Technology Research Tools
- NT.K-12.6 Technology Problem-Solving and Decision Making Tools¹

Materials:

- Computers with internet access

Warm-up: Invasion!

Invasive species are species that are not native to an area and have no natural predators, resulting in overpopulation. Exotic species are not generally considered to be invasive until they begin to interfere with native species' access to food and ability to

¹ Education World (2008) *U.S. National Education Standards*. Retrieved March 3, 2008, from <http://www.education-world.com/standards/national/index.shtml>.

survive. Invasive species are typically introduced to an area by humans, historically through colonization, and presently as a result of increasing travel and trade. For example, European colonists brought horses, cattle, and seeds, to use in the new world. Unfortunately, their ships also brought unintentional species like black rats and European house mice. With each ecosystem having special interconnected relationships that have developed through millions of years, introducing a new species to that web of relationships often has unintended consequences, including extinction for some species. In fact, since early colonization, over 500 native North American species have gone extinct, and in a recent inventory of 20,000 native species by the Nature Conservancy and the National Heritage Network, one-third were found to be at risk of extinction.²

There are many foreign species that have “taken over” in North America, including house sparrows, domestic pigeons, European starlings, English Ivy and the Kudzu plant. The Kudzu plant, native to Japan, was first introduced in the U.S. south as an ornamental plant and to reduce soil erosion. The plant flourished in the humid weather, and, without natural predators to check its growth, quickly spread all over the Southern U.S. The Kudzu vine can grow up to sixty feet in a year, and now dominates the southern U.S. in residential neighborhoods and forests. It crowds out native species, and smother trees and houses.³ Growing 4,600 acres a day, this plant costs \$500 million each year in control costs and lost cropland.⁴

Affecting many parts of the world are the following invasive species: Africanized honeybees, brown tree snakes, cane toads, Asian longhorned beetle, Asian tiger mosquito, Dutch elm disease, water hyacinths, yellow crazy ants, and zebra mussels. Now, facilitate a discussion on the characteristics of an invasive species and why they can be so harmful to the ecosystem. Some points to include in your discussion are:

- What makes a species invasive?
- How do invasive species come to be in an area?
- How can the addition of an unnatural species impact an ecosystem?
- What ways can you suggest to help control invasive species? Consider both preventative measures and methods of removal.

Activity One: An Environment Near You

Step 1: The first step is for students to research invasive species in their surrounding communities. A good place to start is www.invasivespeciesinfo.gov. The sidebar on the left allows you to search for information by geography. If there is limited information in your area you may also research invasive species by region, i.e. Southeast, Western United States, etc.

Step 2: Have each student choose a local invasive species to research further. This should include where the species originated, where it has spread, how it was introduced, and what effects it has on other wildlife, humans, and the economy. A worksheet is provided at the end of this lesson to guide the research.

² National Environmental Education Foundation (2007). *Invasive Species Tips*. Retrieved March 3, 2008, from http://www.publiclandsday.org/managers/invasive_tips.htm.

³ Ball, D. M., Miller, J. H., Patterson M., & Everest, J. W. *Kudzu in Alabama*. Retrieved March 3, 2008, from <http://www.aces.edu/pubs/docs/A/ANR-0065>.

⁴ *Invasive Species Tips*.

Step 3: In this step, have the students re-evaluate the species they researched from a climate change perspective. If students are not already aware of potential climate change impacts in their area, ask them to explore this by visiting: <http://www.climate.org>.

Once the students have a firm understanding of the local impacts of climate change, have them evaluate how these changes may or may not interact with the ecosystems of the invasive species. Students should hypothesize impacts of rising temperature, more/less frequent precipitation, and an increase in extreme weather events such as drought and flooding on their particular invasive species. Their hypotheses should also include whether the species' spread would be impacted by climate change and how. For instance, the Kudzu vine should continue to expand across new areas of the U.S. given a continued rise in temperature.

Activity Two: Halting the Invasion

Step 1: Have students determine which method of control is used locally to manage their assigned invasive species. Is this method effective and ecologically sound?

To give students ideas, discuss the following methods:

- **Mechanical control** involves removing the species either by hand or with a machine. This method is viable only for small populations and for targeting a specific species. This technique minimizes the damage to the surrounding environment. Mechanical control is labor intensive, requiring detailed work over a long period of time. Oftentimes, multiple efforts are required to ensure proper control. For plant species, removal methods include mowing, burning, and hand pulling. For animal species, common techniques include trapping, hunting or using physical barriers such as nets and fences.
- **Chemical control** uses chemical compounds to control invasive species. While this method is useful for both small and large areas, it is not target-specific and can contaminate nearby land and water resources, threatening the health of plants, animals and humans in the area. Another difficulty with chemical control is that target species may develop a resistance to the chemical compound, thereby rendering this method ineffective. Chemicals used to control invasive plant species are called herbicides and can be applied directly on the target plant species, around the soil on the plant's base, or in the soil before the seeds of the plant fertilize. Pesticides are chemicals used to control animal species by either killing the species or preventing reproduction. Attractant pheromones, another form of chemical control, are typically used to draw mate-seeking species into a trap.
- **Biological control** refers to a specific species being released into the environment to control an invasive species. It is a chemical-free method and can be environmentally friendly. Without proper research and planning, the introduced control species can become an invasive species itself, exacerbating the original problem. On the other hand, biological controls may have difficulty surviving their new settings and controlling the invasive species. Invasive plants can be controlled by predatory insects called weed feeders. These plants can be intentionally infected with fungi, bacteria or viruses that reduce the reproductive capacity of the plant or kill it. For invasive insects and fish, sterile species can be

introduced to mate with the invasive species and produce eggs that will either not develop or produce sterile offspring. Predatory animals can control the invasive population, but there is a risk that they will prey on native animals as well.

- **Prevention** is often the best method for controlling invasive species. This requires the work of government agencies and the public joining forces to address the problem. Agencies can limit the introduction and spread of invasive species by inspecting incoming vessels and packages. The public can participate by educating themselves on invasive species and by taking steps to control the spread of species in their communities through volunteering to mechanically eradicate them and pressing their local governments for action. Given the potentially harmful effects of climate change on the spread of invasive species, the public may also encourage and participate in steps to reduce greenhouse gas emissions in their communities.⁵

Step 2: Create a policy proposal for controlling their selected invasive species by identifying the best method(s) of eradication. Students should evaluate cost, feasibility, effectiveness, and side effects of their policy. The final results can be presented to the class. The report should demonstrate the student's understanding of the issues surrounding invasive species and should reflect consideration of the different areas impacted by the species and their recommended policy. A format for the policy proposal is included at the end of the lesson plan.

Assessment: Students should be assessed on the quality and originality of their written assignments from Activities One and Two.

Civic Engagement (Optional): Follow up this project by having a speaker present to your class on invasive species. City Council Representatives, urban planners, parks and recreation officials, and other city employees typically work on invasive species issues in your area. They can be an excellent resource for the class to learn more about invasive species in one's area. You could also visit professionals in the field who have to control invasive species as their job. Alternatively, host a field trip to the schoolyard or local park, or a volunteer service project, where students can engage the impact and control of an invasive species.

Conclusion: Students should now have an understanding of what is an invasive species, how it affects the ecosystem and human life, the possible impacts of climate change on invasive species, and the current practices of management and control.

For more information about invasive species and climate change, look online at <http://news.mongabay.com/2005/1013-invasive.html>.

⁵ National Park Service, U.S. Department of the Interior. *Invasive Species and the National Parks*. Retrieved March 3, 2008 from, <http://www.nps.gov>.

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Name _____

Date _____

Activity One: An Environment Near You

You will be asked to research a local invasive species. In order to guide your research, please answer the following questions.

1. What is your invasive species? What are its physical and behavioral characteristics?

2. Is your species harmful to the local environment? If so, how?

3. What kind of environment does your invasive species originally come from? Where is it found? What are the similarities and differences in the new environment?

4. When and how did your invasive species get introduced in its current location?

5. Does your invasive species have any natural predators in its native location? What about its new location?

6. How will climate change impact the non-native territory of your invasive species?

7. How will the species be affected by local climate change? Will the effects be adverse or beneficial for this species? Will it continue to spread or leave for a better climate zone?

Activity Two: Halting the Invasion
Format for Policy Proposal

To: Who would their proposal be addressed to?

From: Students name.

Statement of Problem: What issue are they addressing?

Proposed Solution: How do they propose to solve it?

Benefits of Proposed Solution: What are some of the other options, and why is this solution better than those?

Major Obstacles to Proposed Solution: What are the challenges, and some suggestions for overcoming them?

Major Costs to Proposed Solution: What will be the biggest expenses for this solution? There is no need for exact numbers, just understanding.

References: Where did this information come from? For instance, a successful public policy change led by students is Earth Day Network's National Civic Education Project.⁶

⁶ National Civic Education Project. <http://ww2.earthday.net/~earthday/node/12>.