



Design the Ultimate Invader

Grade

9 to 12 (adaptable for all grade levels)

Length

Part A: 40 minutes (including the presentations)
Part B: 20 minutes

Subjects

invasive species, biology, ecology, environmental sciences, social sciences

Topics

trophic levels, food webs, natural selection, evolution, and group problem solving*

OBJECTIVES

Students will:

- apply their current knowledge of biology and ecology to design the ultimate invasive species.
- apply knowledge gained of invasive species to critically evaluate and revise their ultimate invader.

INTRODUCTION

During this fun lesson, students will apply their knowledge of biology, ecology, and society to design the ultimate invasive species. Use this lesson as a stand-alone exercise. Or use it as an effective pre- and post-evaluation of a unit about species ecology.

In Part A, students will first design an invasive species using only their imaginations. After learning about invasive species biology and ecology, students will evaluate and redesign their ultimate invader in Part B to make it even more invincible.

BACKGROUND

Invasive species are organisms that are introduced from somewhere else and take over the environment. They cause problems for other plants, animals, and people. Invasive species often have physical traits that enable them to reproduce and spread rapidly and outcompete native species for resources. And invasive species often have physical traits that make them difficult to control.

MATERIALS

- Flip-chart paper
- Colored markers
- A sense of fun and plenty of imagination

PREPARATION

It is useful to gain some familiarity with invasive species topics before teaching this lesson. For more information, see the *AIS Resource Guide* or the Web site of the Union of Concerned Scientists (www.ucsusa.org/invasive_species/).

PROCEDURE

Part A. Design the ultimate invader

Divide students into teams (three to five students per team) and ask them to design, draw, and describe the characteristics of the *ultimate* invasive species. The species may be terrestrial, aerial, aquatic, cosmic, or any combination. Encourage students to be creative, unleash their imaginations, and use whatever knowledge they have about invasive species. If students need help getting started, here are a few questions they might consider:

- What are the characteristics of this species?
- What are the characteristics of its native habitat?
- How did it get here?
- How does it reproduce?
- Why was it brought into the United States?
- Who or what brought it to the United States?
- What is it capable of doing to make it invasive?
- What does it look like? (Draw a sketch.)
- Where does it live?
- What social setting does it live in?
- What does it consume?

**To address these topics, have students answer the What do you know? questions on the student page.*

Design the Ultimate Invader!

- What consumes it?
- Where does it come from?
- What would you name it?
- As its designer, can you control it?
- What might others try to do to control and compete or co-exist with it?
- Did any policies help to promote this invasive species?

Part B. Redesign the ultimate invader

After students have completed the unit about invasive species, have them gather into the same teams as before. Allow teams 15 minutes to redesign the *ultimate* invasive species. Students should:

- apply any additional knowledge they acquired and experiences they had with invasive species since designing their species the first time
- use a different approach to describe an invasive species

Have each team make a three-minute presentation to the class. Teams should talk about why their invader is unique and discuss, when appropriate, some elements of sociology, culture, economics, geography, math, engineering, science, transportation, and vocational skills in describing their ultimate invader.

EVALUATION

Use one or more of the following suggestions to evaluate students.

- Evaluate students on their imagination and ability to work as a team.
- Assign extra points if students can answer the following questions:

Can you describe the design process? For example, what did the team consider first? Did the team first make a list, or did you start drawing right away?

- Assess student knowledge of biology and ecology concepts. Have students list or describe the structure and the function of each of the characteristics that make their organism the ultimate invader. For example, an ultimate invader that can live in aquatic and terrestrial habitats may have special lungs that can function as gills. The structure might be called *gill-lungs*, and they would enable the organism to invade aquatic and terrestrial habitats.

- Test students' knowledge of concept in ecology and evolution by asking the presenters to address the following. (Option: Make copies of the student page and assign the questions as a homework assignment.)

1. If an invader is not outwardly aggressive, what novel characteristics allow it to outcompete other species? For example, some "novel weapons" might include allelopathy, multiple hosts or vectors, size (small has advantages), adaptations for multiple modes of transport, cute, attractive, etc.
2. What biotic or abiotic factors may limit the growth of your population of invaders? (Biotic factors include population density, competition, and predation. Abiotic factors include moisture, temperature, weather/climate, wind, sunlight, soil, topography, geographic location, and nutrients.)
3. What might happen when two different invasive species hybridize? What might happen when an invasive species and a non-invasive species hybridize? Can the two species hybridize?
4. What role does your invader play in the food web? (Students should use terms such as *primary producer*, *primary consumer*, *secondary consumer*, or *decomposer*, etc. If the invader is a consumer, is it herbivore, carnivore, or omnivore?)
5. Is your invader an autotroph or a heterotroph?
6. Some invaders could be too successful for their own good. The invader may reproduce at such a rapid rate that it eats itself out of house and home. Is this a good characteristic for an ultimate invader?
7. Why is eradication of a species almost impossible with biological control?
8. Other species your invader interacts with may have to adapt to the presence of your invader to survive. Choose a characteristic of your invasive species that will affect native species and describe the process by which a native species could evolve to live with your invader. (Students should describe the process of natural selection. For example, if an invader outcompetes a native species that is a specialist by eating the entire sole food source for the native species, the native species may evolve to become a generalist rather than a specialist.)

9. Pretend that a subset of your invader evolves into a new species that is even more invasive than before. Describe the process by which this evolution occurs. (Students' answer should include geographical barriers, ecological (including seasonal) isolation, behavioral isolation, or polyploidy.) What characteristic evolved with the new species? (Students may invent the characteristic!)

RESOURCES

Statesman Journal series on "Invasive Species of Oregon."

Available at www.InvasiveSpeciesOfOregon.com.

The *Statesman Journal* series on Invasive Species of Oregon features nutria and other species. This Web site has a comprehensive database of invasive species in Oregon, video, photos, and forums to discuss invasive species.

Oregon Public Broadcasting documentary *Silent Invasion*

Available from: www.opb.org/programs/ofg/

episodes/view/403. *Silent Invasion* is an OPB documentary about invasive species in Oregon. The Web

site includes many short video segments about specific invasive species or case studies.

The following educational tools are useful for teaching K–12 students about aquatic invasive species:

National Invasive Species Information Center

Available from: www.invasivespeciesinfo.gov/aquatics/education.shtml

Nab the Aquatic Invader

Available from: www.sgnis.org/kids/index.html

EDUCATION STANDARDS





WHAT DO YOU KNOW?

Instructions: Use your knowledge of biology, ecology, and evolution to answer the following questions about your ultimate invader. You may use your text book as a reference.

- 1 If an invader is not outwardly aggressive, what novel characteristics allow it to outcompete other species? For example, some “novel weapons” might include allelopathy, multiple hosts or vectors, size (small has advantages), adaptations for multiple modes of transport, cute, attractive, etc.
- 2 What biotic or abiotic factors may limit the growth of your population of invaders?
- 3 What might happen when two different invasive species hybridize? What might happen when an invasive species and a non-invasive species hybridize? Can the two species hybridize?
- 4 What role does your invader play in the food web?
- 5 Is your invader an autotroph or a heterotroph?
- 6 Some invaders could be too successful for their own good. The invader may reproduce at such a rapid rate that it eats itself out of house and home. Is this a good characteristic for an ultimate invader?
- 7 Why is eradication of a species almost impossible with biological control?
- 8 Other species your invader interacts with may have to adapt to the presence of your invader to survive. Choose a characteristic of your invasive species that will affect native species and describe the process by which a native species could evolve to live with your invader. (For example, if an invader outcompetes a native species that is a specialist by eating the entire sole food source for the native species, the native species may evolve to become a generalist rather than a specialist.)
- 9 Pretend that a subset of your invader evolves into a new species that is even more invasive than before. Describe the process by which this evolution occurs. What characteristic evolved with the new species? (Invent the characteristic!)

Design the Ultimate Invader!

STRUCTURES AND FUNCTIONS OF YOUR ULTIMATE INVADER

Instructions: Fill out the following table according to your Ultimate Invader!

Characteristic of your Ultimate Invader	Physical structure	Function in the environment	How it helps your invader to successfully invade