



Design the Ultimate Invader!

Grade

4th–12th (adaptable for all grade levels)

Length

Part A: 25 minutes for preparation, 15 minutes presentation; **Part B:** 15 minutes of group time, 15 minutes presentation

Subjects/strands

Invasive species, biology, ecology, environmental sciences, social sciences

Topics

Trophic levels, food webs, natural selection and evolution, group problem solving, language arts

LEARNING OBJECTIVES

Part A: Students apply their current knowledge of biology and ecology to design the ultimate invasive species.

Part B: Students apply knowledge gained of invasive species to critically evaluate and revise their ultimate invader.

Parts A and B: Students communicate their creative process and identify characteristics that make their design the ultimate invader.

INTRODUCTION

During this creative lesson, students will apply their knowledge of biology, ecology, and society to design the ultimate invasive species. Use this lesson as a standalone exercise, or use the lesson 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 imagination. 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 introduced from somewhere else that successfully dominate an ecosystem. They cause problems for other plants, animals, and people. Invasive species often have physical traits that enable them to reproduce, spread rapidly, and outcompete native species for resources.

VOCABULARY

Allelopathy, terrestrial, ecosystem, biological control, biotic, abiotic, invasive species, native species, nonnative species.

MATERIALS NEEDED

- Flip-chart paper or large drawing paper or board for each group
- Colored markers
- Freedom to be creative and adventurous

PREPARATION

It is useful to gain some familiarity with invasive species topics before teaching this lesson. For more information, see the introductory chapters of the *Menace to the West Curriculum*, available in the toolkit or at <http://seagrant.oregonstate.edu/invasive-species>

PROCEDURE**Part A. Design the ultimate invader**

Divide students into teams (3 to 5 students per team) and ask teams 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:

- 1 **What are the characteristics of this species?**
- 2 **What are the characteristics of its native habitat?**
- 3 **How did it get here?**
- 4 **Who or what brought it, and why was it introduced?**

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- 5 What is it capable of doing to make it invasive?
- 6 What does it look like? (draw the invader)
- 7 Where does it live?
- 8 What social setting does it live in?
- 9 How does it reproduce?
- 10 What does it consume?
- 11 Where does it come from?
- 12 What are its predators or other weaknesses?
- 13 What would you name it?
- 14 As its designer, can you control it?
- 15 What might others try to do to control, compete, or coexist with it?
- 16 Did any policies help to promote this invasive species?

Present your ultimate invader!

Have each team make a 3-minute presentation to the class. Teams should talk about why their invader is unique, and as each team presents, students in the audience will listen for and record key information about the ultimate invader on the student handout, “Presenting the Invader.”

Part B. Redesign the ultimate invader

After students have completed the unit about invasive species, have them gather into the same teams as before to redesign the ultimate invader and present the redesign to the class. Allow teams 15 minutes to redesign the ultimate invasive species and 3 minutes for each presentation. In their presentations, students should

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

Each team should discuss, when appropriate, some elements of sociology/culture, economics, geography, math, engineering, science, transportation, and vocational skills in describing their ultimate invader.

ADDITIONAL ACTIVITIES

Ecology Benchmark Questions

Have students address two or more of the following questions (answers follow questions). The student pages include a handout with these questions. **Option:** Make copies of the student page and assign the questions as a homework assignment (30–40 minutes).

- 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/vectors, size (small has advantages), adaptations for multiple modes of transport, attractive attributes, etc.

Answer will depend on student’s ultimate invader.

- 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 an invasive species and a noninvasive native species hybridize?

Hybridization between invasive and native species is a problem because the offspring are usually sterile and it reduces the ability of the native species to maintain viable populations. One example is the invasive brook trout in Oregon that can hybridize with the federally endangered bull trout and reduce the bull trout’s ability to create viable offspring and recover as a population.

- 4 What role does your invader play in the food web?

*Students should use terms such as **primary producer** (synthesize organic material from inorganic materials), **primary consumer** (consumes on autotrophs or decaying matter), **secondary consumer** (feeds largely on primary consumers), or **decomposer** (recycles nutrients as it feeds on dead/decaying organisms). If the invader is a consumer, is it **herbivore** (plants), **carnivore** (animals), or **omnivore** (plants and animals)?*

- 5 Is your invader an autotroph or heterotroph? Explain.

Answer will vary depending on the student.

- 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 characteristic a good one for an ultimate invader? Why or why not?

No, because it would eventually run out of the resources it needs to survive and its population would decline.

- 7** Why is eradication of a species almost impossible with biological control?

Biological control relies on introducing a predator to eat the invasive species. The biological control and the invasive prey tend to form a cyclical predator-prey relationship in which the predator cannot completely eradicate its prey because there are so few that it cannot find them all.

- 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 a realistic 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 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' answers should include geographical barriers, ecological (including seasonal) isolation, behavioral isolation, or polyploidy.

What characteristic evolved with the new species?

Students may invent the characteristic!

Peer review of student presentations

Presenting the Invader. Have students fill out the chart as other student presentations are being made.

Vocabulary Worksheet

Define vocabulary words and write a sentence using each word.

- **Allelopathy:** The suppression of growth of one plant species by another due to the release of toxic substances
- **Terrestrial:** Living on or in or growing from land
- **Ecosystem:** The complex of a community of organisms and its environment functioning as an ecological unit
- **Biological control:** The control of destructive organisms through the use of other organisms, such as natural predators of the pests
- **Biotic:** Of or having to do with life or living organisms
- **Abiotic:** Nonliving
- **Invasive species:** Nonnative species disrupting and replacing native species
- **Native species:** Species that normally lives and thrives in a particular ecosystem. This can include any species that developed with the surrounding habitat, and can be assisted or affected by a new species
- **Nonnative species:** Species living outside captivity that did not historically occur in a particular area

RESOURCES

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

The Silent Invasion

Oregon Public Broadcasting, in partnership with the Oregon Invasive Species Council and The Nature Conservancy

Documentary by OPB and partners focusing on invasive species in Oregon. The site includes several short video segments about specific invasive species and case studies (56:06; originally aired on April 22, 2008).

www.opb.org/programs/invasives/

National Invasive Species Information Center

USDA National Agricultural Library

Educational resources for all levels.

www.invasivespeciesinfo.gov/aquatics/education.shtml

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Nab the Aquatic Invader! Be a Sea Grant Super Sleuth

Indiana-Illinois Sea Grant College Program,
Wisconsin Sea Grant Institute, and New York Sea
Grant Institute.

*National education site on invasive species, developed
in collaboration with education and outreach staff of all
seven Great Lakes Sea Grant programs.*

www.iisgcp.org/NabInvader/

STANDARDS ADDRESSED

Common Core Standards

Writing

- Text Types and Purposes 4.2, 5.2, 6.2, 7.2, 8.2, 9.2, 10.2, 11.2, 12.2

Speaking and Listening

- Comprehension and Collaboration 4.1, 5.1, 6.1, 7.1, 8.1, 9.1, 10.1, 11.1, 12.1
- Presentation of Knowledge and Ideas 4.4, 5.4, 6.4, 7.4, 8.4, 9.4, 10.4, 11.4, 12.4

Next Generation Science Standards

From Molecules to Organisms: Structures and Processes

- 4-LS1-1, 5-LS1-1, MS-LS1-4, MS-LS1-5, MS-LS1-6

Ecosystems: Interactions, Energy, & Dynamics

- MS-LS2-1, MS-LS2-2, MS-LS2-4, HS-LS2-2, HS-LS2-6

Biological Evolution: Unity and Diversity

- 5-LS2-1

EVALUATION

	Novice	Beginning	Intermediate	Advanced	Expert
Participation in design process	Students work individually – not as a team	One student leads and the others follow	Students share ideas and one or two students decide; basic description of design process	All students contribute and decide together and can describe the design process	Students seek input from other team members and contribute equally and can describe the design process
Presentation	Students share only drawing and/or limited description; only 1 or 2 students present	Share drawing and more-detailed description; more students present	Share labeled drawing, detailed description; all students present	Share labeled drawing; address how, when, where, why, and impacts; team presents equally	Prior steps plus students engage and answer audience's questions
Characteristics that enable the species to be the ultimate invader	Identifies 1 characteristic and importance of that characteristic	Identifies 2 characteristics and importance of those characteristics	Identifies 3 characteristics and importance of those characteristics	Identifies 4 characteristics and importance of those characteristics, and provides names for newly described structures	Identifies 5 or more characteristics and importance of those characteristics, provides names for newly described structures, and provides reference to information
Ecology	Discusses novel weapons to compete with other species	Previous steps, plus discusses role in the food web	Previous steps, plus discusses impacts on native species and ecosystem in general	Previous steps, plus discusses impact on both biotic and abiotic components of ecosystem; whether invader is a specialist or not	Previous steps, plus discusses control efforts, prevention, eradication, natural selection, and process and impact of hybridization or evolution of the species
Listening	Students record name of projects that are shared and one adaptive characteristic	Students record name of project, 2–3 adaptive characteristics, and purposes of those characteristics	Students actively listen, record name of project, adaptive characteristics, and describe use of characteristics	Previous steps, plus describe impacts on the ecosystem	Previous steps, plus ask relevant questions