

Non-Native Species: English Ivy – Landscape Plant or Deadly Killer

Teachers: This lesson contains two classroom activities with discussion questions related to the AFG video clips about the effects of competition from invasive species on biodiversity. These parts may be used individually or together, depending on the needs of your class.

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

Grade Level: 9-12

Background Information

Biodiversity is simply the variety of life in an area. It includes all types of plants, animals, fungi, and microorganisms. A wide variety of organisms are necessary to maintain a healthy ecosystem and most organisms in an ecosystem are dependant on each other (interdependence). According to the Sierra Club, 'the "ecological services" provided by biodiversity include the supply of oxygen to the atmosphere, water purification, the prevention of floods and soil erosion, nutrient recycling, and pollination. Nearly half of all medicines used today originally came from wild organisms.'

(<http://www.sierraclub.ca/national/biodiv/biodiv/biodiv.html>)

Biodiversity is currently being reduced by a number of human activities including agriculture, development, and the introduction of non-native species. Non-native species are plant or animal species that do not naturally occur in an area. These might be introduced by a number of different means. Some, such as Kudzu and English Ivy, are brought to an area as landscape plants. Others, such as cheat grass, were brought to western regions to help feed cattle. Still others come to an area without knowledge of people, as did the zebra mussel, which colonized ships and eventually overran the great lakes.

Organisms compete for resources in the ecosystem. Some of these resources include nutrients, space, water, and sunlight for plants. When non-native species are introduced into an ecosystem, they often don't have any natural predators or diseases and thus there is nothing to control their spread. When climatic conditions are right for them, they tend to out compete native species, taking more of the resources for themselves and leading to a decrease in diversity.

This activity will allow students to compare the biodiversity of areas that have been overrun by invasive species with more natural areas using tools that ecologists might use.

Related National Standards

This lesson addresses the following National Content Standards found at:
<http://books.nap.edu/html/nses>

Content Standard C:

As a result of their activities in grades 9-12, all students should develop understanding of

- Interdependence of organisms

American Field Guide Student Handout: Invasive Species

Access this lesson plan online at: www.pbs.org/americanfieldguide/teachers

Content Standard F:

As a result of their activities in grades 9-12, all students should develop understanding of

- Natural and human-induced hazards

Extension websites from PBS

- **Scientific American Frontiers – Mediterranean on the Rocks**
http://www.pbs.org/whatson/press/winspring/saf_medontherocks.html
and http://www.pbs.org/safarchive/4_class/45_pguides/pguide_1004/44104_invader.html
This is a good site that describes problems due to another real world invasive species, an alga in the Mediterranean, which escaped from an aquarium and has no natural predators. The second link is a teacher resource with a related activity.
- **Scientific American Frontiers – Backyard Science: How Ecosystems Work**
http://www.pbs.org/safarchive/5_cool/galapagos/g52e_ecosystems.html
This is an excellent activity applying similar techniques to the real world and connecting to the tropic pyramid.

For sites with examples of research and species counts related to biodiversity, try the following two sites:

- **The Living Edens – Kakadu**
<http://www.pbs.org/edens/kakadu/seasons.html>
Lists species in an area in Australia with high biodiversity.
- **Journey to Amazonia - Powerful Plants**
<http://www.pbs.org/journeytoamazonia/plants.html>
This site contains a description of a study of biodiversity in the Amazon. In it, scientists use similar techniques to the ones students will use in this activity.

Activity 1: English Ivy – Landscape Plant or Deadly Killer**Time allotted:**

One 45 minute class period

Materials

- Photocopy the grid (attached) on to overhead transparencies or tracing paper. One grid per group.
- Photocopies of each of the attached forest floor photos. One copy of each per group.
- Another option is to download the "SpeciesMap.doc" MSWord file from the Teacher Resources section of the AFG website (www.pbs.org/afg/teachers/birds/birds_sum.html). You can use this file to do the activity on your computer. Simply grab the grid and drag it on top of the photo.

Objectives:

- Students will be able to describe differences in flora between an area overrun by invasive species and one with native species.
- Students will understand how competition for resources is affected by invasive species through a quantitative species count.
- Students will learn how to measure percent cover and diversity of different species.

**Watch the AFG Video Segment: "Restoring Wildlife Habitat"**

Watch this video to introduce the concept of biodiversity. Start the video at 'While the Halsey's wetland is a success, this forest presents a real predicament.' and stop after hearing 'we have no mosquito problems, not at all, not at all.'

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

Discussion Questions for Video Segment

Douglas Fir forests are a natural ecosystem in the Pacific Northwest where the Halsey's ranch is located. Why do you think they might be willing to cut it down in favor of oak savanna? Think in terms of regional biodiversity.

Classroom Activity

The purpose of this activity is to have students calculate the percent cover and diversity of species in an area that has been overcome by English Ivy and one that hasn't (you may want to change the directions and the maps to represent species found in your own area, for instance Kudzu in the southeast has similar coverage patterns as English Ivy has in the Northwest). Diversity is the total number of plant species in an area while percent cover is how much of the land is covered by each species. Areas with higher diversity can provide for a richer ecosystem. However, since other factors such as rainfall and temperature also have an impact, diversity alone cannot account for ecosystem health. In this activity students will compare two squares from the same ecosystem.

American Field Guide Student Handout: Invasive Species

Access this lesson plan online at: www.pbs.org/americanfieldguide/teachers

Students may work in groups of 2 or 3.

Hand out the maps and grids (one set includes a copy of each map and 1 grid). Or, sign out a computer lab and download the photographs and grids as described above.

Have students:

1. Place the grid over the map. Note that the grid provided is smaller than the photos. Students should place the grid so that it fits somewhere entirely on the map. Each group will place it slightly differently so that they have slightly different results. This is meant to simulate some of the conditions that students would encounter when working in the field. You can use this activity to discuss with your students how scientific research is conducted.
2. Look at each place on the grid where two lines cross and note which type of plant is there or if there is forest floor. Students can try to identify species if you want them to. Otherwise, the activity is written so that they just need to recognize the same species for counting.
3. Make a data table that shows how many occurrences of each species there are in the area represented (a meter square) for instance:

Species	Salal	Sword Fern	Forest Floor	Ivy
Number	2	4	2	17
Percent cover	8%	16%	8%	68%

(note: this is only an example)

4. Calculate the percent cover for each species. This should be the number counted divided by 25 (the total number of crosses).
5. Repeat for the second map.
6. You may want to have students make a bar graph or a pie chart showing percent cover for each of the two maps.
7. Answer the analysis questions on the Student Instructions sheet (attached).



Watch the AFG Video Segment: "Protecting the Karner Blue Butterfly"

To help students answer the analysis questions, watch the video on the Karner Blue Butterfly. Start at the beginning and end after hearing 'which of course does not include wild lupin and nectar plants.'

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

Assessment

Plants present on the native forest floor map include: bracken fern, trailing raspberry, vine maple, ducksfoot, and clematis.

The only plant present in the Ivy map is ivy.

Answer key to Analysis Questions:

1. In the ivy desert, ivy accounted for most of the cover. Amounts might vary slightly by group depending on placement of grid.
2. Percent cover measures how much sun each species receives.
3. It's called an ivy desert because not much is growing there besides ivy. Some groups also use the term 'ivy wasteland' since deserts do have their own rich biodiversity. The term is to imply the sterility and monotony that occur when a single species dominates an area. (www.noivyleague.com)
4. Almost no forest floor is visible in the ivy desert meaning that other species haven't got a chance to gain a foothold unless they can grow without sunlight.
5. Ivy will continue to grow and kill trees and other native plants in the area. The park may become a giant ivy desert.
6. Ivy reduces the biodiversity of the area.
7. If there is lower diversity of flora, then fauna will start to decrease too. Some organisms are dependant on particular plant species; if these disappear then the other organisms will disappear too (see video clip on the Karner Blue Butterfly).
8. The "ecological services" provided by biodiversity include the supply of oxygen to the atmosphere, water purification, the prevention of floods and soil erosion, nutrient recycling, and pollination. Nearly half of all medicines used today originally came from wild organisms. (from the Sierra Club)
9. Remove the ivy, replant native species, stop human interference with the ecosystem.
10. Counting each plant is too time consuming. If a scientist makes these kinds of measurements, he or she will get the basic picture although they might miss a few details.



Watch the AVG Video Segment: "Kudzu"

Ask students to make note of how fast kudzu spreads and to look at what happens to other species caught in its way.

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

Classroom Activity

Measure the size of your classroom. At the rate kudzu grows, how long would it take to fill your classroom assuming it was lined up along one edge ready to grow?

Discussion Question for Video Segment

- What do you think happens to the plants covered by the kudzu? Why?

Activity 2: Measuring Biodiversity in Your Own Backyard

Note: If you chose not to do Activity 2, you may wish to skip to the video clips at the bottom of activity two as they address methods of controlling invasive species.

Time Allotted:

One and a half 45 minute class periods

Materials:

- Examples of invasive species and native species from your local area
- Plant I.D. books
- Meter square quadrants (see attached directions)

Objectives:

- Using ecologist's tools, students will compare diversity in the field.
- Students will understand how greater plant biodiversity leads to greater animal biodiversity.
- Students will learn how to fight back against native species.

Classroom Activity

Take students outside to measure diversity and percent cover in your area. You can make a grid for measuring out of PVC pipe or wood and string (see directions attached). If there are no natural areas near your school, try measuring the diversity in a lawn compared to the diversity in a less manicured area such as under a tree or in a more native meadow. Or try comparing diversity in a chemically controlled lawn with that in a more naturally growing lawn.

**Watch the AVG Video Segment: "Eradicating Non-Native Species from Milwaukee Parks"**

Start at the beginning and stop after hearing '...able to displace them almost entirely.'

**Watch the AVG Video Segment: "War on Weeds"**

Start at the beginning and stop after hearing 'the loosestrife treatment is working.'

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

Discussion Questions for Video Segments

- What are some strategies that allow non-native species to outcompete the native species?
- How do you think you might fight back against non-native species?
- Think of at least two methods, other than biological controls, that people might use to try to get rid of invasive weeds? Are these better or worse than biological controls?
- Why do we have to be very careful before releasing a new insect into the ecosystem.

Extension Activities

- Research an invasive species from your area. You might start by looking at the following website which has a map of the US that will help you identify some invasive species in your area. It also has a pretty comprehensive index of species and control methods.
<http://tncweeds.ucdavis.edu/index.html>
- Or check out this site produced by the Forest Park Ivy Removal Project for information about invasive species and ideas for research projects.
http://www.noivyleague.com/Pages/english_ivy.html
- Conduct research on biodiversity and farming practices. How do monocultures (single species crops) affect biodiversity? How does genetic engineering affect biodiversity?

English Ivy: Landscape Plant or Deadly Killer

Student Instructions

Background

Biodiversity is simply the variety of life in an area. It includes all types of plants, animals, fungi, and microorganisms. A wide variety of organisms are necessary to maintain a healthy ecosystem and most organisms in an ecosystem are dependant on each other (interdependence). According to the Sierra Club, 'the "ecological services" provided by biodiversity include the supply of oxygen to the atmosphere, water purification, the prevention of floods and soil erosion, nutrient recycling, and pollination. Nearly half of all medicines used today originally came from wild organisms.'

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Biodiversity is currently being reduced by a number of human activities including agriculture, development, and the introduction of non-native species. Non-native species are plant or animal species that do not naturally occur in an area. These might be introduced by a number of different means. Some, such as Kudzu and English Ivy, are brought to an area as landscape plants. Others, such as cheat grass, were brought to western regions to help feed cattle. Still others come to an area without knowledge of people, as did the zebra mussel, which colonized ships and eventually overran the great lakes.

Organisms compete for resources in the ecosystem. Some of these resources include nutrients, space, water, and sunlight for plants. When non-native species are introduced into an ecosystem, they often don't have any natural predators or diseases and thus there is nothing to control their spread. When climatic conditions are right for them, they tend to out compete native species. When these organisms are highly successful, they may cause other species to dwindle or even become extinct. Depending on the species, this may cause a chain reaction in the whole ecosystem because other species may have depended on that species for food or shelter.

The following activity will teach you one way that ecologists might assess the health of an ecosystem. You will calculate the diversity and percent cover of organisms in two areas from a State Park in West Linn, OR. One of the areas is what is called an Ivy Desert while the other closely approximates the native ecosystem.

Materials

- Two photos of the plants in Mary S. Young State Park in West Linn, OR
- A transparent grid (you can use the attached grid to make a copy on to a transparency for this activity).
- Another option is to download the "SpeciesMap.doc" MSWord file from the Teacher Resources section of the AFG website (www.pbs.org/afg/teachers/birds/birds_sum.html) You can use this file to do the activity on your computer. Simply grab the grid and drag it on top of the photo.

Directions

1. Take one of the maps and fit the grid over the top of the map.
2. At every point where the lines on the grid cross, note what plant is there. Make a quick sketch of the plant and give it a name (Your teacher will tell you if you should name the species or not)
3. You may notice that the grid does not cover the entire picture. You are collecting a statistical representation of the species present. This is a similar challenge that you would face if you were taking the same measurements in the field.
4. Place your results in a data table (see example below)

Species	Sword fern		
Number	5		
Percent cover	20%		

5. Once you have counted all the different species in the area, calculate **percent cover**. To do this, determine the total number of individuals of each species and divide by 25 (the total number of points counted). For instance, if you counted five sword ferns, then $5/25$ is 20%. Place these results in your data table.
6. Repeat 1-5 with the second map.
7. To calculate diversity, simply count the total number of different species found on each map.

Analysis

1. How did percent cover and diversity for the Ivy Desert compare with those for the native species site?
2. Ivy is successfully competing for resources in this ecosystem. Competition for which resource does percent cover represent?
3. Why do you think experts call areas such as Map B an Ivy Desert?
4. How much forest floor was visible in the ivy desert? In the native forest? How do you think the amount of forest floor affects other organisms that try to get a foothold in the area?
5. If the ivy is allowed to grow unchecked, what do you think Mary S. Young State Park might look like in 10 years?
6. What is the impact of ivy on plant biodiversity in this area?
7. If the ivy is allowed to continue growing, what do you think the effect on the rest of the organisms in the ecosystem will be? (think about what you learned from the video on the Karner Blue Butterfly and wild Lupin).
8. Why is diversity of species important?
9. What can be done to recreate the natural biodiversity of this area?
10. Why do you think scientists use this method instead of counting each plant in an area?

Maps and Grid for English Ivy Activity

Picture 1 : Native Forest Floor



Picture 2: Area Overcome by Ivv



Grid for Measuring Percent Cover

Instructions for Making a Quadrant

To make a quadrant, use PVC pipe or wood for the frame. A meter square is a good size. Then tie string every 20 centimeters to make a grid. Students should note species at each point where the string crosses, thus getting a statistical representation of what plants lie in that meter square.

