

PLANT INVASION

(This activity and associated worksheet is an adaptation of the Weed Invasion lesson developed by the Bureau of Land Management and Oregon State University from Invasives: Plants on the Move at www.weedinvasion.org.)

Grade: 9th to 12th

Time: 60 to 120 minutes

Supplies:

- Magnifying glass (per student if possible)
- Variety packet of seeds
- Plant Invasion worksheet (per student)
- Calculators
- White board

INTRODUCTION

Humans often unintentionally carry invasive plant species to new areas by car, truck, bike, clothing, and pets. With the ease of air and ship travel, we can transport non-native species thousands of miles in just a few hours, and the new habitat might be vulnerable to an invasion. As the human population increases and more people access fields and forests more often, the opportunities for seeds and plants to travel to new areas also increase. Students will learn how their actions and the actions of others can contribute to the spread of invasive plants.

BACKGROUND

Land development and recreational activities are the two most significant factors that contribute to the redistribution of plant species. During development, humans remove or disturb native flora and fauna to make way for our needs. Disturbed environments are especially vulnerable to invasion by plant species.

Invasive plant species have developed adaptations that enable them to survive in a wide range of environmental conditions. Invasive species are the second leading cause of reduced biodiversity in the United States. Invasive species have the ability to easily adjust to and take over in an environment that is new for the species. As we continue to develop and disturb more land, invasive plants will continue to spread.

One adaptation invasive plants possess is the ability to produce an enormous number of seeds. Seeds that do not germinate immediately remain viable over many years in a wide range of environmental conditions. Environmental factors, such as temperature, moisture, and soil types, and time have little impact on some seeds. When the seeds eventually germinate, the plant invades the area. When humans carry seeds of an invasive plant to a new area, especially a disturbed area such as a roadside, we contribute to the problem.

Another adaptation some invasive plants have is the ability of their seeds to live in the soil for many years before germinating. This can make it almost impossible to eradicate invasives without yearly treatment to affected area.

Invasive plants like cheat grass begin growing in the winter. In the spring they take in soil moisture, such as from snow melt, before other plants have the opportunity to germinate and grow.

Some invasive plant species are classified as noxious weeds and are toxic to animals, plants, and humans in the area. This is one way invasives can decrease local biodiversity. More commonly, though, invasives decrease biodiversity by competing with native flora and fauna for limiting resources. Limiting resources for plants include factors such as soil nutrients, water, carbon dioxide, and sunlight. Invasive plants out-compete native plants for these resources, and begin to take over an area. As limiting resources are used by invasive species, the native species population densities and carrying capacities decrease. Native plant population densities decrease while the invasive plant population density rises rapidly. This lesson will show students how rapidly invasive population density grows. With fewer resources available the environment can no longer support as many organisms of native species populations, thus their carrying capacity decreases. When the population density and carrying capacity become so low that there are not enough organisms to reproduce successfully or enough resources to sustain the life of offspring, native species will become extinct.

Activity #1

1. Have students think about what activities they do that might contribute to the spread of invasive plants. Hold a discussion to learn the ways your class might be spreading invasive plants.
2. Open the variety packet of seeds and pass it around so that students can see examples of the various sizes and shapes of seeds.
3. Lead your class outside to a parking lot or bike rack and have them use the magnifying glasses to inspect tires, gears, bumpers, etc. of bicycles and vehicles for seeds and pieces of plants. Please remind them to be respectful of others' property.
4. After they return to the classroom, have them discuss their findings.

Discussion Ideas

Did cars, trucks, or bicycles have more plant material and seeds on them?

What part of the vehicles had more plant pieces and seeds on them?

Does the presence of seeds and plant material on vehicles explain the problem with invasive plants growing along roadsides? Are there any other explanations for this issue? (Lead them towards soil disturbance and heavy machinery from roadside construction as a problem.)

Activity #2

1. Record the various ways student themselves might have contributed to the spread of invasive plants on a white board.
2. Give each student a copy of the *Plant Invasion* worksheet.
3. Read the following story, *Plant Invasion*, to students. Tell students to listen carefully and record important numbers, because they will have to calculate the extent of the invasion.

Plant Invasion

A tract of land was cleared some time ago. The tract is now overgrown with weeds and brush. Spotted knapweed is present on the tract. (spotted knapweed is on Colorado's Noxious Weed List.)

This tract of land separates an urban neighborhood from the nearby national forest land. A national park is located a few miles beyond the national forest land. This tract of land is private property, but several trails cross it. People who live nearby use the tract to access the forests beyond.

Members of a local mountain bike club received permission from the owner of the tract to cross the tract to reach the forest trail system. By crossing the tract, bikers do not need to drive their vehicles from town to the trail system. With permission, the bike club organized a 50-mile City To The Park benefit

ride to advertise their new club, bring business to their town, and promote mountain biking, a popular recreational activity in the nearby national park.

The event was a success. However, 150 bicyclists cut across the weeded tract of land, and they carried broken bits of seed-bearing knapweed branches that caught in the gears of their bikes and knapweed seed that caught in the deep lugs of their tires. After a few miles of riding along the forest trails, 300 seeds were dislodged. Assume that 50% of the seeds will germinate and grow to maturity. A mature plant can develop 1,000 seeds.

How many plants grew after the event?

How many seeds will be produced for the seedbank?

How many plants will appear in the forest the following year?

4. Ask students to record their calculations and answers on the worksheet.
5. Instruct students to plot the results of their calculations for a five year period on a graph. If available, graph the exponential growth using computer software.
6. Ask students to think about the recreational activities they mentioned at the beginning of this lesson. Divide students into teams of two and ask students to write similar story problems that take the following factors into consideration:
 - Recreational activities in which students participate (boating, hiking, biking, riding ATVs and horses, hunting, fishing, picnicking)
 - Seed production numbers of actual invasives in your community – Have students conduct research on local invasive plant species, or provide the information for them.

The stories may be as complex as students can imagine, but the stories must be based on

realistic scenarios. Students must create story problems that explain how their own recreational activities could lead to a plant invasion in their neighborhood.

Plants that grew after the event:
300 seeds x 50% germination = 150

Seeds for the seedbank:
150 mature plants x 1,000 seeds per plant = 150,000

New knapweed plants:
150,000 seeds x 50% germination = 75,000

Plants that grew in the forest the following year: 75,000 new knapweed plants + 150 mature plants after the race = 75,150

Number of plants for the following year:
75,150 plants x 1,000 seeds per plant x 50% germination = 37,575,000 plants + 75,150 plants from the year prior (spotted knapweed is a perennial) = 37,650,150 plants

The story, *Plant Invasion*, uses a high rate of germination to produce a dramatic effect. Under some conditions, a germination rate of 50% may be possible. The story does not include a factor for seedling survival. Like germination rates, seedlings have survival rates based upon local environmental conditions.

Students may continue the calculations for a five-year period, and plot the results on a graph. Explain that the rapidly rising plot line on the graph represents exponential growth. See the end of the activity for a graph that shows exponential growth over a three-year period.

Conclusion and Evaluation

Conclude the lesson by having students exchange and solve each other's story problems. Evaluate students based on whether their story problem is realistic, the complexity of math skills, their ability to work in partnership to create the story, and the completeness of their notes and calculations on the *Plant Invasion* worksheet.

Independent Practice and Related Activities

Have students obtain lists of plants and seed viability data. This information is available from local weed districts and Web sites, such as <http://plants.usda.gov>.

Use the realistic stories to raise awareness of the invasive plant problem among members of the community.

Growth of Spotted Knapweed Plants over a Three-Year Period

