LESSON 19

Measuring the Competition

Grade level: K-5
Subject Areas: Biology, language arts, math
Duration: One 20-minute session to begin with, plus 10-minute sessions on several consecutive days to observe, measure and record plant growth.
Setting: Classroom
Season: Any
Conceptual Framework Topics: Species, classification, plant reproduction and growth, competition

OBJECTIVES

Students will understand how plants grow from seeds. They will be able to measure and record plant growth and know that different species of plants grow at different rates.

METHOD

Students grow 2 different species of plants from seeds. They measure and record their growth and compare the growth rates of different types of plants, and relate this to weed growth.

MATERIALS

- ✎ Some small treats (pieces of candy, cookies, or mini-toys); enough for each student, but with just a few in a small container to start with.
- ✎ **Lesson Data Sheet**
- ✎ Two different kinds of seeds that will sprout and grow at different rates, and that germinate easily. Good choices for fast-growing seeds are beans or peas, which also are large and easy to handle. Slower-growing choices include beet or spinach seeds. Or you might want to try a growing a mustard, *Brassica rapa* (also known as "Wisconsin Fast Plants" and used widely in school experiments) and a slower-growing native Montana plant such as *Gaillardia aristata* (blanketflower). See end of lesson for seed sources.
- ✎ Paper towels
- ✎ Small plant pots or paper or plastic cups (enough for each student to have 2) with holes poked into the bottom. (*Clear* plastic cups work nicely because students can also see and measure the growing roots.)
- ✎ Potting soil
- ✎ Sink or waterproof tray to have under plants when watering

BACKGROUND

Invasive plants are successful largely due to several evolutionary strategies that allow them to outcompete the native plants in their new environment. These usually include abilities to reproduce and/or grow rapidly. Producing lots of seeds, high germination rates, and rapid growth rates all help these plants get ahead of the competition for space, sunlight, water, and/or nutrients that other plants offer. Plant competition may take place aboveground, with stems and leaves, belowground, with roots, or both.

PROCEDURE

1. Begin by showing students the container with just a few treats in it (make sure there are not enough for every student). Ask them who would like to have one. Likely most or all will say yes! Now ask if there are enough for everyone. When they say no, ask what would happen if you put the treats in the front of the room and said whoever wanted one should take one. They will probably describe at least some kids rushing up to the candy and grabbing at it. Who will get it? Probably the fastest and/or biggest. Explain that this would be a *competition* for the candy. The students would compete to get there first. Ask if there are other ways they could compete for it. (They may mention such strategies such as tricking, tripping, or slowing their classmates.) Now show them the rest of the treats and explain, if necessary, that there are enough pieces for everyone. Ask if they would have to compete for one now. Explain that *competition only takes place when there are not enough of the items to go around.*

2. Now ask your students to imagine a small square of ground. (You may want to have students act this out.) There is only so much space, soil, and water in this square. Now imagine that there are lots of plant seeds in the soil from different kinds of plants. Do they think all those seeds can grow into plants in that small space? Why or why not? What happens when one plant shades another from getting sun? What about when one sucks up all the water in the soil? Explain that plants also compete for resources when there aren't enough to go around.

What do they think would allow some plants to do better than others? Brainstorm a list of traits or features that might allow one plant to get enough water, sun, etc. while others don't.

3. Now tell them that they are going to do an experiment to determine if different kinds of plants *germinate* (sprout) and grow at different rates. Give each student 2 seeds from the slow-growing plant and 2 from the fast-growing plant. Have them carefully examine the seeds and tell you what they notice about them. Explain that these are seeds from 2 different kinds of plants. Ask them to predict whether the seeds will all sprout at the same time or at different times. Now have each student take 2 seed pots and fill them most of the way with potting soil. With the pots in a sink or a waterproof tray, students should pour water into the pots until the soil is thoroughly wet. Now have them place one of each kind of seed in each pot, leaving about 1 inch of space between the seeds. (If using clear cups, place the seeds next to the side of the cup, so that the roots will be visible from the side). Write the type of seed on the cup or pot next to the seed so that when they grow they will be able to tell which plant is from which kind of seed. Have them wet paper towels thoroughly with water and place them over the seeds. This should keep the seeds moist overnight and help them germinate quickly.

4. Have each student put their name on their cup with a marker and leave the seeds overnight.

5. Each day, have students closely examine their seeds and write down their observations. They should note when each seed germinates (they will see it split open and stem and roots begin to emerge). After a seed has germinated, have the student carefully sprinkle more potting soil on top of the seeds, until they are covered completely with a thin layer of soil. Moisten the soil and leave the plants to grow in a warm, sunny spot. Don't forget to keep the soil moist, but not too wet!

6. When the stems have emerged from the soil, have students begin to measure and record their height every day, using the data sheet. If the roots are visible, also have them measure the roots from the outside of the cup, as best as they are able. Have them write down any other interesting information they notice as well. Continue this as long as you feel is valuable.

7. Discuss with your students whether one seed germinated and/or grew faster than the other kind. How do they think this might affect their ability to compete for resources? Did they notice differences in stem growth and in root growth? Why would we want to measure both? Could roots be involved in competition too? How?

Explain that many invasive plants or "weedy" species sprout and grow quickly, giving them a chance to use the resources that other plants need. That allows them to take over an area and crowd other plants out. Show them examples of fast-growing invasive plants in Montana, such as Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*), or sulphur cinquefoil (*Potentilla recta*).

Resources

Find native seeds and information at:
http://www.nativeideals.com
http://prairiekeepers.dbs.umt.edu/default.htm
http://www.mt.nrcs.usda.gov/technical/ecs/plants/pollinator/sources.html

Find Brassica seeds at:
www.carolina.com
www.enasco.com/farmandranch/Learning+Aids/Horticulture

Extensions

Have your students graph the growth rates of the different seeds. They can also plot the lengths of time to germination, and average the number of days to germination, or the sizes of the different plants at day 10.

Try the germination experiment under different conditions, such as leaving the soil fairly dry, or putting some in cool spots to see if this changes which seeds sprout and grow faster.

Try growing other kinds of seeds together. You can even collect and use your own weed seeds, but be sure to be very careful to dispose of the plants at the end so that they cannot continue to grow and reproduce! Remember that many invasive species can spread vegetatively, so they do not need to bloom to reproduce. Any plant parts and soil with seeds should be bagged before disposal in trash.

Explore other strategies invasive plants have for success. What kinds of traits would make plants grow, spread, and survive?

Name _____

Seed Germination Experiment

	Seed type:		**Seed type:**		**Seed type:**		**Seed type:**	
DAY	**Stem height**	**Root length**	**Stem height**	**Root length**	**Stem height**	**Root length**	**Stem height**	**Root length**
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Other interesting observations: