

**LESSON 34**

# Weeds are an Earthmoving Problem

**OBJECTIVES**

Students will be able to identify signs of erosion and explain the causes of erosion, how the natural diversity of plants in the landscape can help prevent erosion and how weed invasion can lead to an increase in soil erosion.

**METHOD**

Students will observe and record signs of erosion in the schoolyard, demonstrate erosion using a soil tray, and discuss how invasive plants can increase erosion.

**MATERIALS**

- ☞ Potted plant
- ☞ Soil
- ☞ Water
- ☞ Small rocks
- ☞ Aluminum pans
- ☞ Container for pouring water
- ☞ Buckets for waste water
- ☞ Newspapers
- ☞ Netted material, such as cheesecloth or old stockings
- ☞ Pictures or specimens of local native grasses, forbs, shrubs and trees (including roots) and locally found noxious weeds (see the **Resources** section of this guide)

**BACKGROUND**

When weeds invade an area many aspects of the environment are affected, including the soil. Erosion is a gravity driven process that moves soil and other material and deposits them elsewhere. It usually occurs due to transport by wind, water, or ice; by down-slope creep of soil and other material under the force of gravity; or by living organisms, such as burrowing animals. A 2006 study from Cornell University reports that the economic impact of soil erosion in the United States costs the nation about \$37.6 billion each year in productivity losses. The soil that is washed away ends up in rivers, streams and lakes, making waterways more prone to flooding and to contamination from soil's fertilizers and pesticides. Soil erosion also reduces the ability of soil to store water and support plant growth, thereby reducing its ability to support biodiversity. Erosion promotes critical losses of water, nutrients, soil organic matter and soil biota, harming forests, rangeland and natural ecosystems.

**Grade level:** 3-5**Subject Areas:** Earth science, life science, plant biology**Duration:**

Day 1: approx. 60 minutes

Day 2: approx. 30 minutes

**Setting:** Indoors/Outdoors**Season:** Fall or Spring**Conceptual Framework Topics:**

Plant ecology, impacts of invasive species on ecosystems, weed management, soil disturbance and site recovery

Plant diversity protects soil from erosion. Many of Montana's noxious weeds such as Russian knapweed, leafy spurge, and spotted knapweed reduce plant diversity of our native range lands, which can lead to an increase in soil exposure and subsequent erosion. Diverse native plant populations provide a variety of root systems and soil surface cover which hold soil in place and retain soil nutrients. When an invasive plant, such as spotted knapweed, invades an area its *allelopathic effects* (inhibition of growth in one species of plants by chemicals produced by another species) and ability to outcompete native plants for resources can decimate existing plant populations and kill the soil-stabilizing root systems. As a result the soil becomes more susceptible to erosion. Creek banks and steep slopes with moving surface water are particularly at risk of rapid erosion when weeds replace the native flora.

When the weeds are managed and restoration begins it can take a long period of time for the native vegetation to reestablish. To minimize soil loss during this period, mulching, grading to reduce slope, and temporary cover crops are a few of the management strategies that can be considered in order to help prevent erosion until the native plants are well-established.

In this lesson we will explore how invasive plant infestations can lead to increased soil erosion.

## PROCEDURE

### Day 1: Class demonstration (20 minutes)

1. Take a potted plant out of the pot, with soil intact. Discuss how the roots of the plant help to hold the soil in place. Ask what would happen if the plant was not in a pot, but in the ground where water often runs over the surface of the ground where it is planted. Introduce the term erosion and discuss how wind, water, and ice can contribute to erosion. Ask students if and where they have ever seen the effects of erosion.
2. Explain that the class is going to go out to the schoolyard to examine the effects of erosion. Ask students to remember how plants hold soil in place and to pay special attention to the placement of trees and shrubs on the school grounds. Students will be asked to take a pencil and journal or notebook to write and draw pictures about what they observe.

### Outside activity (25 minutes):

1. As a class, point out some of the more noticeable signs of erosion on the school grounds. Some good examples may be found near drains, drain pipes, and at the edges of the blacktop.

2. Pair students and ask them to examine the rest of the area (let students know what the boundaries are for exploring) to look for other signs of erosion. Ask students to describe the examples of erosion they find and draw a labeled rough sketch in their journals or notebooks, including plants growing in the eroded areas.

Closing discussion (15 minutes):

After students are back in the room, ask them to share what they have recorded. Ask if anyone noticed the placement of trees and shrubs. Were the trees and shrubs placed in particular areas to help stop the effects of erosion? Did they notice any differences in erosion where there was more or less vegetation? What kinds of areas had the most erosion? Do they have any ideas why they might have seen the patterns they did?

**Day 2:** Classroom review (10 minutes)

1. Review the term *erosion* and how plants help prevent erosion.
2. Discuss erosion found on the school grounds, and if they think water was a factor.

Follow-Up Activity (20 minutes):

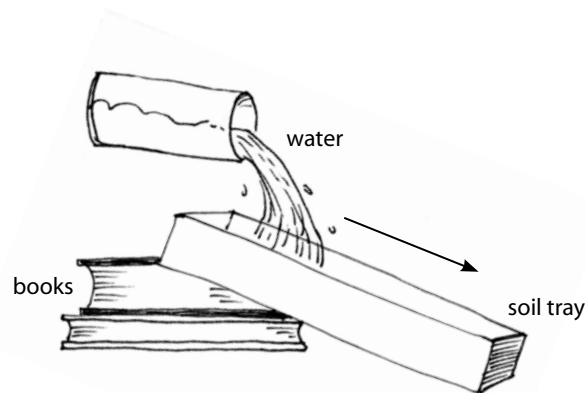
1. Divide the class into pairs of students. Provide each pair of students with a disposable aluminum baking tray, enough soil to fill the tray about halfway full, water, small container, newspapers, some net-like material and some small rocks. Cover each working area with newspapers.
2. Instruct students to fill their tray halfway with soil. Firmly position the rocks into the soil. For each tray, cover about a quarter of the surface of the soil with the netted material, holding the edges down with rocks and tucks into the soil. Add a thin layer of soil over the top of the netting. Pat firmly down on the soil surface of the entire tray.
3. Place the narrow side of the tray filled with soil and rocks on one or two books, so as to place the tray on a slant.
4. Next have one of each pair of the students pour little drops of water, starting at the highest part of the tray, so the water can run down the soil.
5. Ask students to notice if any changes are taking place in their trays. See if the soil or rocks are moving out of position.
6. Direct the other student to pour larger amounts of water at the highest part of the tray, pouring off the water that collects each time the lower end of the tray becomes full of water into a waste water bucket for later disposal outdoors (do

### Extensions

Have students design and conduct a comparative study in the soil tray using different slopes to see how erosion increases or decreases in relation to the angle of slope. Discuss how the results relate to local sites where erosion has occurred.

Visit a local site that is being restored to native plants and help pull weeds, mulch, plant natives or conduct other restoration activities that prevent erosion and restore the natural ecosystem. See **Lesson 41: Pulling Together** and **Lesson 44: The Cycle of Restoration** found in this guide for more ideas.

not allow to overflow). Repeat several times to observe what happens to the material in the tray. Ask the students to describe what changes are taking place in the tray. Are they seeing signs of erosion? Have them check the net-covered area of the soil and see whether or not the soil stayed in place underneath it. How is this similar to a plant's root system holding soil in place on sloping ground?



7. Show students examples of native plant root systems (photos, drawings, pressed specimens, live plants or models of plants) including a locally found native grass, forb (small flowering plant), shrub and tree. Indicate that there are a variety of root system sizes and shapes, and this relates to their function. Ask students how a variety of kinds of roots in the landscape helps hold the soil in place (like a puzzle, the pieces fitting together to form a protective mat).
8. Ask students what would happen if a local natural area was invaded by a noxious weed, such as leafy spurge or spotted knapweed (or select a local noxious weed to your area as the example), eventually replacing the native plants. What would happen to the diversity of the root systems? Would you expect to find an increase in the erosion of soil? If so, why?