

# Soil Lessons



## Type of Lesson

Hands-on

## Materials Needed

- 3 plastic bottles of the same size (2 liter bottles work well)
- Soil (enough to fill bottles)
- 3 clear cups
- 2 wire hangers
- Cups or blocks to support your bottles
- Scissors or utility knife (utility knife works better)
- Mulch
- Sprinkling-style watering can, spray bottle, or rain simulator
- Grass seed or sod
- Tape (or other materials to build your supports)

## NGSS Standards

- ESS2.A
- ESS2.C
- ESS3.B
- ESS3.C

[www.soils4teachers.org](http://www.soils4teachers.org)

## Erosion and Ground Cover Demonstration

Even though erosion is a natural phenomenon, human interference into natural systems have created erosion that is much higher than the average geological erosion rate. Erosion is a threat to sustained agricultural production. Soil erosion is a process of moving soil by water or wind - when the soil particles are detached and transported to a different location. This is a natural process that has occurred for eons of time. Water, wind, ice, and gravity are involved in moving soil materials.

Humans, however, have often caused accelerated erosion by our manipulation of the soil for agriculture or construction use. When soils are left bare even for a short period (such as when fields are tilled for planting), the soil can be picked up and moved. These bare soil drops are exposed to the energy of the raindrops and wind. The finer particles of soil are eroded first, taking with them most of the natural fertility and production potential. However, with plant cover, the roots bind the soil particles together and lessen erosion.



Erosion involved three processes: detachment (from the ground), transportation (via water or wind), and deposition. The deposition is often in places we don't want the soil such as streams, lakes, reservoirs, or deltas. And, of concern is that the topsoil is often the most fertile and when it erodes away, the subsoil is less productive.

### Erosion Model Setup:

1. Cut off one side of each bottle. Fill with soil (if you intend on growing grass, plant grass in one bottle now and wait for it to sprout or gather some turf from outdoors).
2. Add mulch or dead leaf cover to one of the non-grass bottles, leave the last bottle of soil bare.
3. Suspend the bottles over the 3 cups at a 25 to 40 degree angle with the spouts facing downward. Get creative in finding ways to accomplish this. As you can see in the photo, we stacked cups. Some people cut notches into wood blocks. How they're held is unimportant as long as they're angled.
4. Run water over the top of the soil in each bottle. (If your soil hasn't had time to settle, you should discard the first few centimeters from each cup.)

Use your rain simulator (or watering can) to apply equal amounts of water to each bottle.



## Erosion and Ground Cover

This demonstration shows the effect ground cover has on Soil Erosion.

### Discussion Points:

- Before applying the water have student guess what the water will look like in the cups.
- Have the students compare the differences in the clarity (and turbidity) of the water in each cup.
- Have the students make observations of the soil surface before, during and after the “rain event”

### Why is it important to conserve soil on the surface?

**Soil Quality**—most of the nutrients needed to sustain plant and animal life are in the top layer (or horizon) of soil. If we lose this layer, this area will become useless to farmers and native plants.

**Water Quality**—large amounts of sediment in lakes and rivers can negatively impact the plants, fish, and insects that live in the water.

### What are the implications?

**Tillage**—Farmers who practice no-till or another type of conservation tillage leave more cover on the ground minimizing soil erosion on their farm.

**Gardens, Yards**—In areas that have been dug up or where grass won't grow, putting down mulch or allowing fallen leaves to stay on the ground can help protect the soil. (Bonus: mulch can also help suppress weeds in a garden.)

**Recreation**—Plants and grass that are maintained along riverbanks can help keep the water clean which makes for better swimming and fishing.

### Helpful Vocabulary (from the [www.soils4teachers.org](http://www.soils4teachers.org) glossary):

**Erode (Erosion)**—To wear away, or remove, rock or soil particles by water, ice, and/or gravity

**Horizon**—A layer of soil with properties that differ from the layers above or below it

**Humus**—Organic matter such as highly decomposed leaves

**No-till**—A way of growing crops that doesn't disturb the soil surface minimizing soil erosion

**Sediment**—Any particle of soil or rock that has been deposited by water, wind, glaciers, or gravity

**Sedimentation** - tendency for particles in suspension to settle out of fluid

**Slope**—A landscape, or surface, that is tilted or inclined

**Suspension**—a fluid containing solid particles that are large enough for sedimentation

**Topsoil (A horizon)**—Mostly weathered minerals from parent material with a little organic matter added, the horizon that formed at the land surface

**Turbidity**—The cloudiness of a liquid caused by individual particles suspended in the liquid

Learn more at: <https://www.soils4teachers.org/erosion>