

Lesson Title: Stop that Sediment!

Ohio Standards Connection:

Standard(s): Earth Science

Benchmark(s): (grades 3-5) B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Indicator(s):

Grade(4) 8. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas, glacial moraines).

Benchmark(s): (grades 6-8) C. Describe the interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g. water cycle, weather and pollution).

Indicator(s):

Grade(7) 1. Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air)

2. Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) change the environmental quality depending on the length of time involved (e.g, global warming).

4. Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life.

Lesson Summary: The student will list soil conservation methods; identify sediment as a result of soil erosion and a water supply problem; demonstrate contour farming, windbreaks, and terracing as erosion prevention methods.

Estimated Duration: class period

Background: When it rains or when snow thaws, the water in a river becomes muddy. The water is carrying sediment. Sediment is picked up by the water on its way over the land and through the stream channels. Water is in contact with the soil nearly everywhere. Some times and in some streams, the water carries more sediment than at other times or in other streams due to varying amounts of precipitation and varying land slopes. Sediment is a water supply problem because when water is to be used for municipal supply or for industry, sediment in it must be removed and disposed of.

Erosion is the carrying of soil from one place to another by water and wind. It is a natural process but people have accelerated its pace. Much erosion results from the removal of vegetation from the land. For example, forests can be completely removed to make room

for farms or to harvest timber or firewood (people in many developing countries depend on wood for heat and cooking).

In developing countries, erosion is a growing problem because there is pressure to develop and people lack the knowledge and means to implement environmentally sound agriculture practices. The resulting lack of vegetative cover (with spreading roots to help hold soil) increases the loss of topsoil by wind and water. To slow soil loss by wind erosion, farmers can put rows of trees — windbreaks — between their fields. Farming methods can prevent erosion. For example, plowing up and down a slope causes erosion. A better method, called contour farming, is to plow horizontally across the face of a slope. Another method is called terracing, in which a farmer builds a series of level plots in step-like fashion on the slope. Contour farming and terracing slow runoff and allow water to soak into the soil.

Across the world, topsoil is being lost at a yearly rate of up to 10 times the rate at which new soil forms.

Instructional Procedures:

ADVANCE PREPARATION

A. Prepare three plastic lined boxes ahead of time. (Empty soda boxes [that hold 24 cans] lined with plastic garbage bags work well.) Half fill each box with soil. (Use regular topsoil, not commercial potting soil.) These will be used by the students to demonstrate contour farming, windbreaks, and terracing as methods of erosion prevention.

B. Have enough sphagnum moss for each team to successfully complete its project. You may have the students sow rye grass seed if you wait about a week for it to sprout.

C. Make a transparency of the teacher sheet, “Soil Conservation.” If this isn't practical, each team should have a copy for reference.

D. To demonstrate sediment, fill the quart (liter) jar with water and have the “sediment samples” (one handful each of pea gravel, sand, and soil) nearby. Your students may be able to see it better if you use a 3-liter bottle.

E. You will need to fill, or ask a student to fill, the three 1-liter bottles with water. Spray bottles of water are more efficient in the demonstrations and less messy, but are expensive and will need to be purchased if not available. (Suggestion: Have parents lend them from home. Wash them out carefully before letting the students use them.)

I. Setting the stage

A. Ask the students the following questions:

1. Where have you ever seen muddy water? (puddles, rivers, streets, etc.)
2. What do you believe causes the water to become muddy? (Soil washed into it.)
3. How would soil get washed into a water source? (rain, etc.)

4. B. Show the quart (liter) jar of water.
5. Explain that this jar represents one of the water sources they mentioned.
6. Explain that soil washed into the water is called sediment.
 - a. Put in the “sediment samples” as you explain this (the water will become muddy).
 - b. Shake it vigorously and set it down (the soil particles will begin to settle).
 - c. Observe that large particles settle first and finer particles settle slowly. Wait a few minutes to allow settling that is noticeable, then ask the students to describe the settling.
 - d. Note that the process of settling took place while the water was still.
 - e. Shake the jar again. Explain that in a moving stream, the motion of flow keeps stirring up the water and the sediment.

C. Ask the students the following questions:

1. In what ways would sediment in a flowing water source be good? (new fertile land like the Mississippi Delta or along the Nile River) Have the students point these places out on a world map or globe.
2. In what ways would sediment in a flowing water source be a problem? (drinking water, loss of depth in shipping and barge channels, flooding, clogging of streams, loss of fish and other aquatic life).

II. Activity

A. Divide the class into three teams.

B. Write the word “erosion” on the board. Define erosion as the transport of soil from one place to another by water and wind.

1. Ask the students what kinds of actions might result in erosion. (cutting away trees, farming, heavy rains, etc.)
2. Tell the students to think of the box of soil in their group as barren land.
3. Tell the students to blow on one end of the box to show how wind blows away the top layer.
4. Explain that the top layer of soil is called topsoil and is very important to grow vegetation.
5. Ask the students to brainstorm ways to prevent wind erosion.
6. Tell the students to have two people elevate one end of the box to represent a slope.
7. Tell each team to have one student SLOWLY and carefully pour or spray a little water from their bottle across the end (from left to right) to show water erosion. Ask the students to brainstorm ways to prevent water erosion.

C. Show the overhead transparency of the teacher sheet “Soil Conservation” (or pass out copies to each team). Explain the method used in each picture.

D. Assign one of the methods used to each team. (NOTE: You may take the students outside for this activity.)

1. Tell Team One to construct a windbreak across their field using the sphagnum moss.

2. Tell Team Two to construct patterns of contour farming using rows of sphagnum moss and tilting their box to demonstrate a slope.
3. Tell Team Three to build terraces with the soil and “plant” sphagnum moss on each one. (NOTE: The team may need to moisten the soil to perform this task.)

E. After each team completes its task, ask them to again blow across the “field” to simulate wind erosion. (NOTE: Team Three should blow from the top to the bottom of their terrace.)

F. Ask each team to SLOWLY and carefully pour water from their liter bottle to simulate water erosion. (NOTE: Team Three should pour water from the top to the bottom of their terrace.)

G. Observe the differences in runoff.

H. Ask each team to report on its results.

III. Follow-Up

A. Have the students demonstrate their knowledge of soil conservation by performing the following tasks.

1. Explain how water sources get muddy. (water erosion; open, bare fields; etc.)
2. Define sediment. (tiny bits of rocks, soil, and other materials washed into water sources)
3. Name some problems associated with sediment. (flooding, contaminated water supplies, etc.)
4. Define erosion. (the transport of soil from one place to another by water and wind)
5. Name three ways to prevent soil erosion. (windbreaks, contour farming, and terracing)

B. Have the students write a paragraph in which they tell of a terrible rainstorm and a community’s resulting problems with muddy water. Tell them to choose one particular problem (e.g., bad taste, dirtying of laundry) that would occur and let them make up the source of the eroded soil and what could be done to stop the soil loss. (Review paragraphing with them first.)

IV. Extensions

A. Invite a soil conservation representative to discuss methods of preventing erosion.

B. Ask the students to draw pictures showing soil conservation and non-conservation farming methods.

C. Have the students research areas of their state where sedimentation in a water source has created problems and present their findings to the class.

D. Ask the students to find articles in magazines and newspapers concerning erosion, sediment, or soil conservation. Create a bulletin board with the articles.

RESOURCES

Cohen, Michael R., *Discover Science (Grade 3)*, Scott Foresman, Glenview, Illinois, 1991, pp. 214-215.

Hurd, Dean, *General Science: A Voyage of Exploration (Grade 5)*, Prentice-Hall Publishers, Englewood Cliffs, New Jersey, 1989, pp. 536-539.

Materials and Resources:

- 1 quart (liter) jar or 2 liter bottle
- sand
- topsoil
- pea gravel
- world map or globe
- acetate sheet
- overhead projector
- teacher sheet (included)
- three plastic-lined boxes
- sphagnum moss (or rye grass seed)
- three 1-liter plastic bottles or large spray bottles

Vocabulary:

contour farming: plowing horizontally across the face of a slope.

erosion: the wearing away of the earth's surface by running water, wind, ice, or other geological agents; processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is removed from the earth's surface.

sediment: insoluble material suspended in water that consists mainly of particles derived from rocks, soil, and organic materials; a major nonpoint source pollutant to which other pollutants may attach.

terracing: a series of level plots in step-like fashion on a slope.

topsoil: the rich upper layer of soil.

windbreak: rows of trees between fields to prevent loss of soil by wind.