Blowing and Flowing

Summary

The affects of erosion from water and wind are explored on three types of ground: bare ground, ground with sparse vegetation, and ground covered with vegetation.

Time Frame

1 class periods of 45 minutes each

Group Size

Large Groups

Materials

For the Teacher:

- Erosion Chambers (see construction instructions linked below)
- 2 2-liter bottles with caps
- A water source
- Clock with a second hand or a timer

Background for Teachers

Erosion and deposition are opposite processes in geology. Erosion wears things down and deposition builds things up. Erosion is the wearing down and change of a landscape due to the effects of water, wind, or glaciers. Deposition is the end result of erosion. It is a partner of erosion because the eroded materials are deposited somewhere and affect the landscape. Deltas are an example of deposition. Erosion changes the landscape, sometimes dramatically. Wind erosion is usually a slow and barely noticeable change. Water erosion may be easier to detect. If the landscape is bare or lightly vegetated, the presence of flowing water may remove large amounts of soil. If the water streams down a hill quickly and carves channels and pathways, it is called gully or rill erosion. Glaciers are also powerful agents of erosion. The evidence of erosion left by glaciers can be seen in the Uinta and Wasatch Mountains. Glaciers erode valleys into a gentle "U" shape, as opposed to landscapes eroded by water, which create a "V" shaped valley. Erosion may gradually result from streams or rain or may occur abruptly due to flooding or landslide. The only natural protection against erosion is plant protection. Plants have root systems that provide strength and stability to the soil. The parts of the plant above the soil work as wind breaks and block the water as it runs in paths across the surface. Vegetation also protects the soil from the sun. Many bacteria that are vital to soil formation need the vegetation to thrive.

Intended Learning Outcomes

- Identify variables and describe relationships
- Collect, record and analyze data.
- Demonstrate scientific principles.

Instructional Procedures

Step 1: Place the erosion chambers on a visible table in the classroom. Tell the students that they will be conducting an experiment on water erosion. Have the students discuss each of the three sections of the erosion chamber and label them as (1) bare soil, (2) scarce vegetation, and (3) vegetated.
Step 2: Have the students sketch the apparatus and label the sections. Ask the students to predict and record what they think will happen when 2 liters of water are poured into each section. What will

the soil look like? What will the runoff look like? Will it make a difference if the water is poured on in a stream or "sprinkled?"
Step 3: Begin the experiment with the vegetated section. Have the students make observations about what the soil looks like as the water runs over the surface. How much water soaks in? How much runs off? Consider having students measure the time it takes for all excess water to run out of the chamber. Start the timer when the water is poured on the soil and stop the timer when there is no additional water draining from the pan. Discuss student observations. You may need to pour in 2 or 3 liters of water to see water draining from the end of the pan. The amount of water needed will depend upon the amount of moisture in the soil before you began the lab.
Step 4: Repeat the process in the other sections. Time each experiment and record the results in a journal. Invite students to think about an explanation for the results they recorded.
Step 5: When all three of the sections have received the same amount of water, measure the amount of water that was collected at the end of each chamber.
You may want to weigh the pans before and after the lab to show which pan absorbed the greatest amount of water.
Marking the soil level in each of the jars with a transparency pen at the conclusion of the lab will allow students to compare the amount of soil that eroded in each pan.
Compare the amount of time that water continues to drain from each pan. It is similar or different?
Step 6: Discuss the results of this activity. Soil erosion will be the greatest in the area with no vegetation, followed by the pan with scarce vegetation. There will be little erosion from the fully vegetated pan. It can take decades to millions of years to make new soil. Pose the following questions to the students.

Why is soil erosion a concern?

What can be done to prevent soil erosion?

Step 7: Ask the students, does gravity affect the rate of erosion? Would a steep hill be more likely to erode than a gentle hill? Why or why not? Change the angle of the apparatus to compare the amount of soil erosion on a gentle incline versus a steep incline.
Step 8: Wind is another factor in soil erosion. Consider taking the erosion chambers outside and experiment with the impact of wind erosion on the three pans. Use an electric fan and place it near the base of the apparatus. (The collection jars do not need to be attached for this.) Turn on the fan and note which of the sections is most effected by wind. Again, the bare area will have the most activity and lose the most soil.
Step 9: To illustrate the danger of erosion, you may want to share with your students the crisis of 1930. One of America's worst environmental disasters happened on the prairies of the southern Great Plains. The plains area is covered with grasses. These grasses have deep, stringy, finger-like root systems. During some years, much rain falls, and in others very little rain falls. There are strong winds on the prairie. When farmers began to farm this area they burned off the prairie grasses and plowed their fields. The farmers planted short root crops such as corn. Some years, they didn't plant anything and left the fields bare. In 1930, a drought began on the prairie. Hot winds blew across the plowed areas. The shallow crops couldn't hold the soil. Some of the area had no plants on it at all. This wind collected the soil and created a cloud of millions and millions of tons of topsoil. This cloud was so large and dense that it blocked out the sun for miles around. The topsoil was eventually dispersed and some blew as far as 1,500 miles from its original location. The topsoil dusted the entire East Coast of the United States. After the drought, many farmers lost their farms. An area about the size of Maryland and Connecticut put together was destroyed. The congress enacted the Soil Conservation Act in 1935, giving advice on wise land use.
Step 10: Ask students what other factors may influence soil erosion. If they do not mention the following factors, mention them to the students and ask them to predict how they would cause erosion.

ice [Water seeps into cracks and expands when it freezes, causing the cracks to get bigger.]
plants [Plant roots can grow in cracks. As the roots grow, the cracks enlarge.]
animals [Animals eat vegetation. Overgrazing removes plants from soil, allowing wind and water to erode it. Also animals walking on fragile soils can destroy microbial colonies that keep soil in place, again allowing water and wind to erode soil.]
abrasion [Rocks rubbing against each other will cause bits of the rocks to break off.]

Step 11: Have students write a summary of the activity, citing the reasons they believe soil erosion is important to understand. Have students design other experiments to study erosion and its effects. Students might also look for other areas of the community that are suffering from soil erosion and compile suggestions for the problem areas.

Extensions

Encourage students to perform the experiment they designed in Step 11.

Assessment Plan

Use the Rubric for Blowing and Flowing to evaluate the report students wrote in Step 11.
Ask the students to predict how the following erosional factors change the Earth's surface:

- wind
- water
- plants
- animals
- gravity
- ice
- abrasion

Rubrics

Rubric for Blowing and Flowing

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