

Weathering and Erosion Splashdown

Science Standard III

Objectives 2 & 3

Connections

Science Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 2:

Explain how the processes weathering and erosion change and move materials that become soil.

Objective 3:

Observe the basic components of soil and relate the components to plant growth.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning.

Background Information

Rocks and other materials on Earth's surface are constantly subjected to the powerful forces of weathering, erosion, transport, and deposition. *Weathering* is the breakdown of rock and other materials into smaller pieces. *Erosion* is the removal of those smaller pieces of rock and soil. *Transport* moves these pieces, and *deposition* is the dropping off or depositing of those materials in a new location.

Rocks can be broken down by physical or chemical weathering. *Physical weathering* is the cracking, breaking up, and grinding down of rocks into smaller pieces while maintaining the same mineral composition. This type of weathering is caused by a number of different factors. Changing temperatures cause rocks to crack and flake, ice splits rocks open, living things dig or pry open rocks, gravity causes rocks to fall and shatter, and abrasion breaks down rocks with solid particles like sand.

Chemical weathering is the breakdown of rocks as a result of a change in their mineral composition. In this type of weathering, minerals can either be added to or removed from rocks. Water and acids are the major destructive agents of chemical weathering because they can dissolve minerals that hold rocks together by chemically changing the rock and causing it to crumble. Acid rain, plant acids, carbonation, and oxidation can cause chemical weathering. Erosion, the transportation of weathered materials, and deposition, the deposit of these materials in a new location, are processes that often occur together. Erosion and deposition can be caused by various factors. Gravity pulls rocks down slopes, wind and running water pick up and carry loose materials, waves fragment the shoreline, and glaciers erode and carve away land as they move.

Weathering and erosion are two of the most important concepts in geology. They affect the landscape that we live on and are important in the formation of soil.

Over time, humans have learned techniques to minimize the effects of these three forces of nature to preserve land formations and soil, which is a valuable resource. Soil erosion can be slowed down by plant growth covering bare soil. This is accomplished in two ways: 1) the roots hold the soil in place, and 2) the vegetation absorbs the impact of the water hitting the ground, lowering the velocity with which the water enters the soil.

Invitation to Learn

Ask: What is soil erosion? How does soil move? What can be done to help keep it where it is needed?

Instructional Procedures

1. Divide the students into small learning groups (four to five students) and distribute the materials.
2. Instruct the students to place the soil in the center of their *Splashdown Target* (p. 5-10).
3. One student in each group should fill a pipette with water. Holding the pipette approximately two to three centimeters above the soil, drop ten droplets of water onto the soil.
4. Count the number of droplets that have splashed into outlying zones on the target. Record this number on a tally sheet.
5. Pass the pipette to another student in the group. The new student will hold the pipette approximately five to six centimeters above the soil (or twice the height as before) and drop ten droplets of water onto the soil.
6. Observe and record the number of splashes on a tally sheet.
7. Pass the pipette to the next student, who drops water from twice the height of the previous drop. Record the results.
8. Once again, pass the pipette to the remaining one or two students in the group, holding the pipette twice as high as the previous student. Drop ten droplets of water on the soil. Observe and record the results.
9. Ask each group to answer the following questions in a journal:
 - a. What did you observe happening?
 - b. What color are the droplets of water and why are they that color?

Materials

- Splashdown Target*
- Soil
- Pipettes
- Cups for water
- Tally sheet
- Ruler
- Grass plugs

- c. What results were observed as the pipette was raised?
 - d. Write a hypothesis about what they believe will happen if the pipette is raised even higher.
 - e. Write a hypothesis about what they think happens when a raindrop falls onto the soil.
10. Wash the *Splashdown Targets* and place a grass plug in the center of the target.
 11. Repeat steps #3 to 9.
 12. Discuss with the class the following information:
 - None of the water splashed off the dry soil when the first water droplets were dropped.
 - The soil needed to become saturated before any splashes occurred. When the soil became saturated and could hold no more water, the droplets started to splash onto the target.
 - The drops were brown because some of the soil was being carried away with the water. This is erosion.
 - As the water was dropped from a higher point, the splashes became more prolific, covering a larger area. This is because of the increased velocity of the water droplets. Raindrops hit with a great velocity because of the speed they are able to obtain as they fall through the atmosphere.
 - The grass plug helped slow the process of erosion in two ways:
 1. the roots helped hold the soil in place, and
 2. the blades of grass absorbed the force of the falling water droplet, allowing the water to trickle into the soil instead of blasting it.

Possible Extensions/Adaptations/Integration

Math

Measure the splashes to the nearest centimeter. Make a graph showing the results of the number of splashes in each zone at each height.

Social Studies

Identify local areas that are prone to soil erosion.

Assessment Suggestions

- Each student should have completed a journal answering the five questions in procedure #9 for the soil water drop and the grass plug water drop. S/he should be able to communicate two ways in which plants help slow the process of erosion.

Family Connections

- Encourage students to survey their yards and surrounding neighborhoods for signs of soil erosion. Have them discuss with family members ways in which vulnerable areas could be protected.

Additional Resources

Video

Erosion and Rocks and Soil, by Bill Nye

Web sites

Dirtmeister's Science Reporters: Erosion

<http://teacher.scholastic.com/dirtrep/erosion/index.htm>

What better place to learn about erosion, soil, and “Dirt” than with The “Dirtmeister” himself! On this Dirtmeister’s Science Reporters page, children investigate one way that erosion shapes your neighborhood and report on it. As always, there is an informative background section on the causes and impacts of erosion, and a Teacher’s Guide to make lesson planning a breeze!

The Start of Utah and Its National Parks

<http://www.scs.wsu.edu/~mschoenm/Utah/back.html>

If you’re looking for the effects of long-term erosion, then this is a great place to start! While the state of Utah may not have the Grand Canyon, it has three truly great places that display some rather spectacular erosional topography. From this introductory page, you can zoom into Zion, Bryce Canyon, and Arches National Parks, and learn about how they developed and what forces are still at work today. Your students can discover for themselves how “hoodoos” form and what makes a “natural bridge.” By comparing the features at the different parks, students can develop a good understanding of how the forces of erosion shape Earth!

Name _____

Splashdown Target

