Just Passing Through

Plants and soils slow me down, and lakes, ponds and wetlands can hold me—but only for a while. Wherever I am, I'm just passing through. What am I?

Grade Level
Upper Elementary, Middle School

Subject Areas
Earth Science, Environmental Science, Ecology

Duration
Preparation time: Part I: 30 minutes; Part II: completed in Part I; Part III: 20 minutes
Activity time: Part I: 20 minutes; Part II: 20 minutes; Part III: 30 minutes

Setting
Large space

Skills
Analyzing information (comparing and contrasting); Interpreting (relating, summarizing); Applying (designing)

Charting the Course
"The Thunderstorm" is included in Part I to begin the simulation. In "Get the Ground Water Picture," students are introduced to how water moves through soil. Students explore the role of their schoolyard in a watershed in "Rainy-Day Hike." In "Color Me a Watershed," students learn how changes to a watershed affect stream discharge. In "Sum of the Parts," students recognize how surface runoff and ground water can transport both point and nonpoint source pollutants.

Vocabulary
anaerobic, aerobic, organic, wetlands, erosion, sediment, Best Management Practices, vegetation, floodplain, delta, watershed manager, nonpoint source pollution, catch basin, riparian

Summary

In a whole-body activity, students investigate how vegetation affects the movement of water over land surfaces.

Objectives

Students will:

- compare the rates at which water flows down slopes with and without plant cover.
- identify Best Management Practices that can be used to reduce erosion.

Materials

Warm Up

- *Copies or overhead transparencies of* ***Slope Comparison*** *or*
- *Copies or overhead transparencies of photographs of hillsides with and without plant cover*

Part I

- *Yarn or rope* (the length of the playing field)

Part III

- *Tray of soil*
- *Container of water* (to be poured on tray of soil)
- *Planting pot containing only soil*
- *Container of water, including shredded paper*

Making Connections

Children have observed how water flows downhill and how it often transports litter or sediment. When watering plants, students have seen how soil and plant matter absorb and hold water. Understanding how vegetation affects water's movement across and through a site promotes student appreciation of the relationship between water quality and landscape.

Background

As it flows over and through soil, water filters through spaces among particles, and around plant roots and vegetative matter. This process slows the movement of water. Sediment (soil and other natural materials carried by water) may be removed from the water as it is captured and stored by vegetation, lakes, ponds and wetlands. Vegetation also helps to hold soil in place. When vegetation is removed (by human or natural causes), soil particles are more likely to be dislodged and carried away by water. This is called erosion.

Soil being carried by water is a natural, ongoing process. Erosion has occurred since water appeared on the planet. (Consider the formation of the Grand Canyon or the gradual leveling of the Appalachian Mountains.) When soil and organic matter are carried by water from one location to another, the destination site may be enriched and its surface area increased (e.g., the floodplain of a river or delta). However, the effects of erosion are not always desirable. Erosion of topsoil decreases the fertility of soil, and sediment build-up in streams and lakes can harm aquatic life.

Ensuring that the condition of a land area does not promote deleterious erosion and other water resource problems involves the use of Best Management Practices (BMPs). Watershed managers rely on BMPs that reduce erosion and diffuse, or nonpoint source (NPS), pollution problems. (According to the U.S. Environmental Protection Agency [EPA], NPS pollution is "caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.") BMPs that prevent erosion include: landscaping areas to promote plant cover; replanting areas cleared by logging; monitoring water that enters and leaves cut areas; building terraces, catch basins, and natural filters to mitigate sediment deposition in lakes, streams, etc.; and leaving a green or planted zone in riparian areas.

Procedure

Warm Up

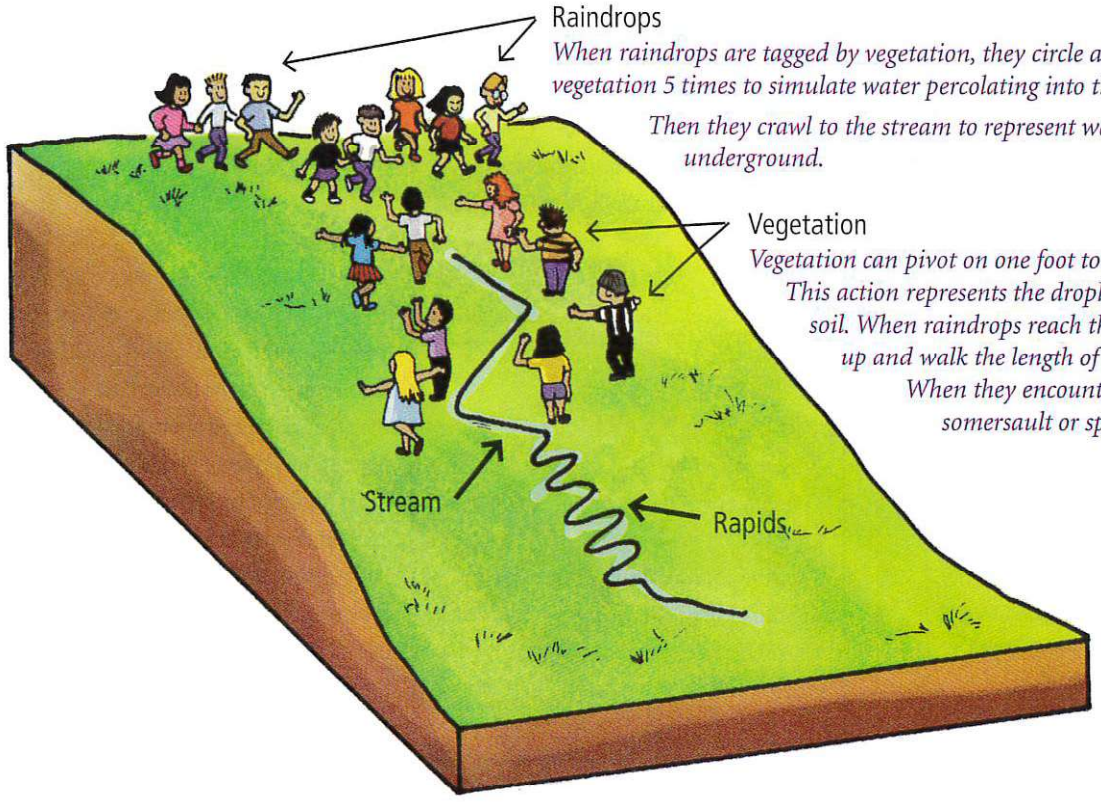
- Show students the pictures on ***Slope Comparison*** or other pictures of hillsides that are covered with vegetation. What do they think would happen to the water?
- Now, show photographs of hillsides with barren slopes. How would rainfall affect these areas, compared to the previous sites?

The Activity

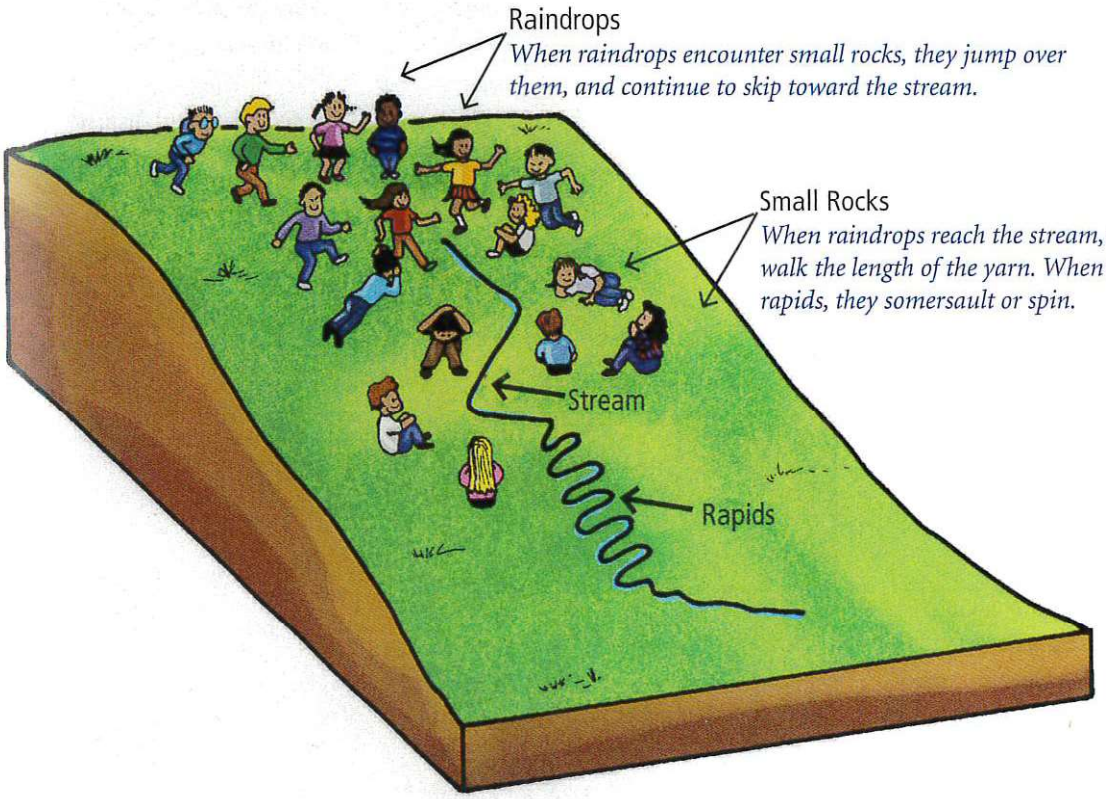
Part I

1. **Inform students they are going to act out the role of water as it flows through a site (down a slope and into a stream). Arrange the playing field according to the diagram *Slope with Plant Cover*.** Lay yarn or a piece of rope down the middle portion of the field to indicate the stream. (A section of the yarn can be crumpled up to represent rapids.) Have half of the class assemble at one end of the playing field. These students represent "raindrops." The remaining students represent "vegetation" and should position themselves somewhere between the raindrops and the stream.
2. **To begin, have students participate in *Part I* of the activity, "The Thunderstorm." At the height of the storm, raindrops move into the site and take the most direct route to the stream (walking swiftly).** This represents water falling on and flowing over the land's surface.

Slope with Plant Cover



Barren Slope



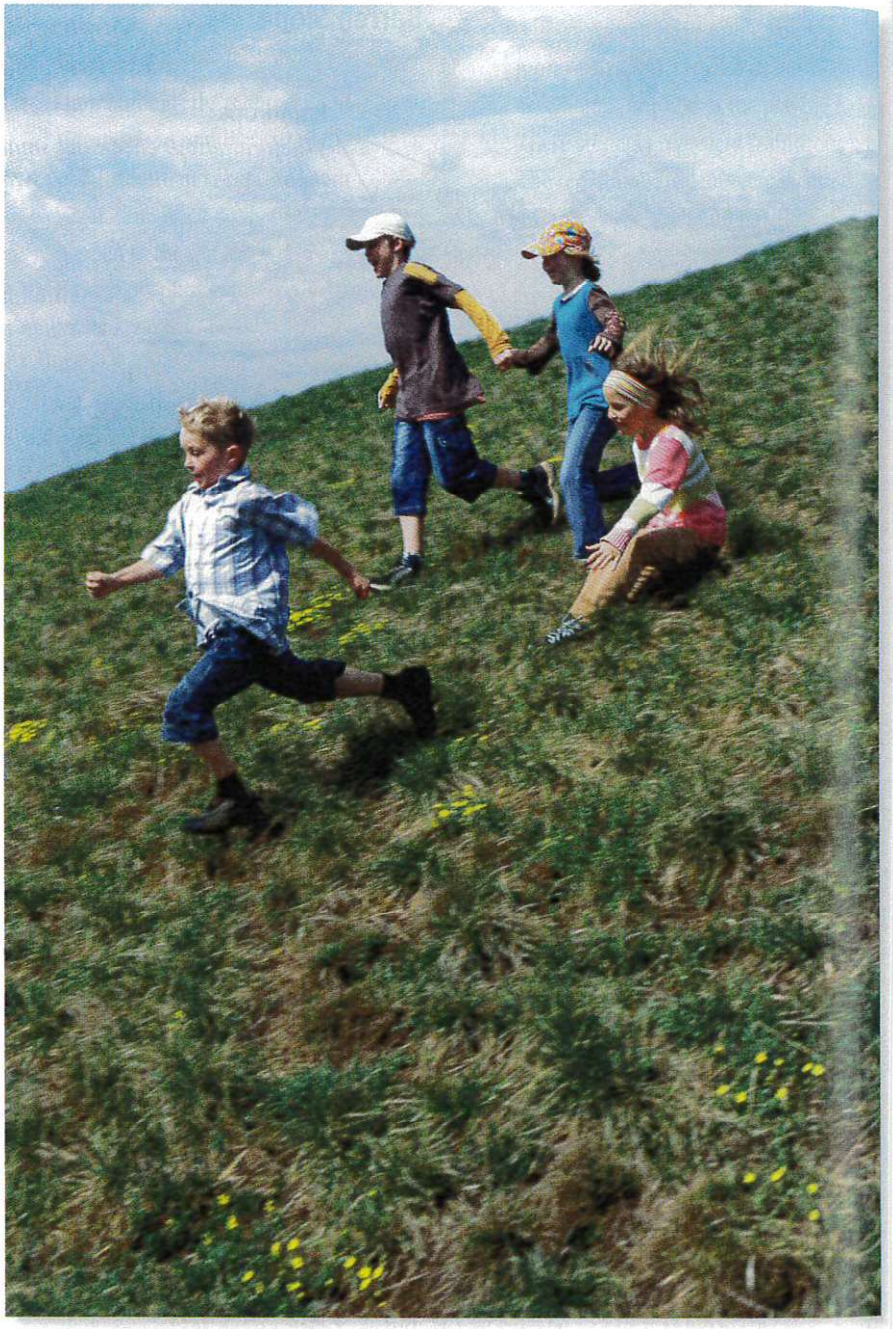
3. **Vegetation on the slope slows the flow of water. To show this, students representing vegetation try to tag the raindrops. Vegetation must keep one foot in place, but can pivot and stretch their arms (representing roots trapping water).**
4. **If a raindrop is tagged, the student simulates filtering into the ground by circling five times around the vegetation. To represent water moving underground toward the stream and passing through spaces among soil particles, raindrops should crawl toward the yarn.** (In reality, this process can take many days, weeks or months, depending on rock material and gradient.) Raindrops cannot be tagged a second time.
5. **Once raindrops reach the stream, they stand up and walk the length of the yarn.** If they encounter rapids, they can spin about or do forward rolls to represent water spilling over rocks. At the end of the stream, they should wait for the rest of the raindrops.
6. **Record the time it takes all the raindrops to pass through the site.** Students can exchange roles and repeat the simulation.
7. **Discuss the results of the activity. Ask students to describe water's movement.** Help students to understand how vegetation slows the rate of flow, which allows time for water to percolate into the soil.

Part II

1. **Ask students how the results of the activity will differ when vegetation is removed. Have students perform the second version of the activity. (See diagram, *Barren Slope.*) Half of the class simulates raindrops and the other half represents "small rocks."** Students representing small rocks should sit or lie down, curling themselves into tight balls. When raindrops move near a rock, they can walk around or jump over it, continuing to flow down the slope.
2. **Compare the time required for raindrops to flow through sites with and without plant cover. Discuss the implications of water racing down a barren slope.**

Part III

1. **Prior to the third simulation, demonstrate what happens when raindrops dislodge and transport soil and other materials.** Sprinkle water on a tray of soil to demonstrate how falling and flowing water can loosen soil and other materials (e.g., pieces of wood, decaying matter and litter). Water can transport the loosened soil great distances. Help students to recognize how soil acts like a filter. Pour water containing shredded paper (representing sediment) into a pot of soil and note the water that drains out the bottom. Students should see that most of the sediment has been removed.
2. **Set up the playing field as in *Part I*. As raindrops flow through the site, they pick up sediment (pebbles, twigs, dead leaves or other biodegradable items scattered by the instructor). If tagged, raindrops percolate or filter into the ground. They drop all the tokens they have collected (symbolizing soil filtering raindrops and removing sediment).** Once raindrops are tagged, they circle five times around vegetation and crawl to the stream. (They do not pick up any more sediment.) Remind students about gravity; raindrops must keep moving as they bend down to collect materials.
3. **After raindrops make it through the site, have them count the number of items that they are still holding.**
4. **Arrange the activity as in *Part II* and have raindrops flow through the site, picking up sediment.** At the conclusion, students should find that a larger amount of sediment has been collected by the raindrops than in the previous simulation.
5. **Discuss problems associated with erosion and unchecked transport of sediment. Introduce Best Management Practices that can be used to control erosion.** Remind students that erosion is a natural process (necessary for adding minerals to streams and creating landscapes). However, because a large amount of sediment is being removed within a short period of time, this simulation (***Part III***, step 4) represents erosion that could be harmful.



Children running down a slope.

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▼ *Wrap Up*

Have students inventory their school grounds or community, looking for land areas that compare to those demonstrated in the activity. During a rainfall, students can observe the area's runoff and the amount of sediment carried by the water. Students can plant trees or landscape a garden to improve an area that has erosion problems.

Project WET Reading Corner

Burns, Loree Griffin. 2007. *Tracking Trash: Flotsam, Jetsam, and the Science of Ocean Motion.* Boston, MA: Houghton Mifflin Books for Children.

Learn how man's trash ends up in the oceans and follow it as it's picked up and transported by the currents.

Prager, Ellen J. 2006. *Sand.* Washington DC: National Geographic Children's Books.

Describes the formation of sand from materials, such as coral, rock or crystals, and shows how erosion can move it through water, wind and ice.

Stewart, Melissa. 2004. *Down to Earth.* Minneapolis, MN: Compass Point Books.

Introduces students to the components of soil, patterns of change and erosion.

Stille, Darlene R. 2005. *Erosion: How Land Forms, How It Changes.* Mankato, MN: Compass Point Books.

Learn about erosion and its effects not only from natural but also manmade sources.

Wermund, Jerry. 2003. *Earthscapes: Landforms Sculpted by Water, Wind, and Ice.* Buda, TX: Rockon Publishing.

Author Jerry Wermund uses poetic descriptions of landforms, such as glaciers, canyons and alluvial fans, as well as the forces that shape them.

Assessment

Have students:

- demonstrate how water flows down a slope and into a stream (***Part I***).
- compare water's movement through sites that have and that lack plant cover (***Part II***, step 2 and ***Part III***, steps 4 and 5).
- inventory their school grounds or community to assess areas likely to have erosion problems (***Wrap Up***).
- design a landscape using BMPs to control erosion (***Wrap Up***).

Extensions

How does a lake affect the movement of water through a site? Make the playing field similar to that in ***Part I***, but add a lake (a large circle of yarn or rope at the end of the stream). Have raindrops move through the playing field. When a student enters the lake, he or she cannot leave until four more raindrops enter the area. (They can stand in line and make a "wave," moving their arms up and down in a waving motion.) How did the lake affect the rate of water movement? Students may respond that after moving quickly through the stream, they were slowed by the lake.

To introduce how lakes can be affected by surrounding areas with and without plant cover, try the following. Show students a clear glass of water and pour in some sand or soil. Note how materials begin to settle out. Explain that this happens when water is standing in a lake as well. Arrange the playing field as in ***Part II*** and have raindrops pick up sediment as they move toward the stream. When a student enters the lake, he or she waits for the fifth student to enter. Raindrops discard their sediment before leaving the lake. Discuss how a lake could be affected by an accumulation of sediment. (If stream sediment continues to be deposited in the lake, over time the lake could become shallow or even fill. High levels of sediment can adversely affect aquatic plants and animals.) What could be done to decrease the quantity of sediment flowing into the lake? Students may want to repeat this simulation, but with a playing field similar to that in ***Part I*** (site with plant cover) and compare sediment levels.

Teacher Resources

Journals

Coffey, Patrick and Steve Mattox. 2006. "Take a Tumble: Weathering and Erosion Using a Rock Tumbler." *Science Scope*, 29 (6), 33-37.

Holiday, Susan. 2003. "A Native Species Restoration Project." *Science Scope*, 27 (2), 24-27.

Kennedy, Ann, Tamil L. Stubbs, and Jeremy C. Hansen. 2006. "This Land Is Your Land." *Science and Children*, 44 (4), 22-26.

Mamo, Martha, Timothy Kettler, and Dann Hussman. 2005. "Learning Style Responses to an Online Soil Erosion Lesson." *Journal of Natural Resources and Life Sciences Education*, 34, 44-48.

Monnes, Colleen. 2004. "The Strongest Mountain." *Science and Children*, 42 (2), 35-37.

Smith, Rebecca. 2007. "Saving the Dust Bowl: 'Big Hugh' Bennett's Triumph over Tragedy." *History Teacher*, 41 (1), 65-95.

Websites

United States Environmental Protection Agency. What is Nonpoint Source Pollution? This site provides definitions for Point and Nonpoint Source Pollution. http://water.epa.gov/polwaste/nps/whatis.cfm. Accessed March 19, 2011.

Compare these photos of slopes with and without plant cover.

Barren slopes.

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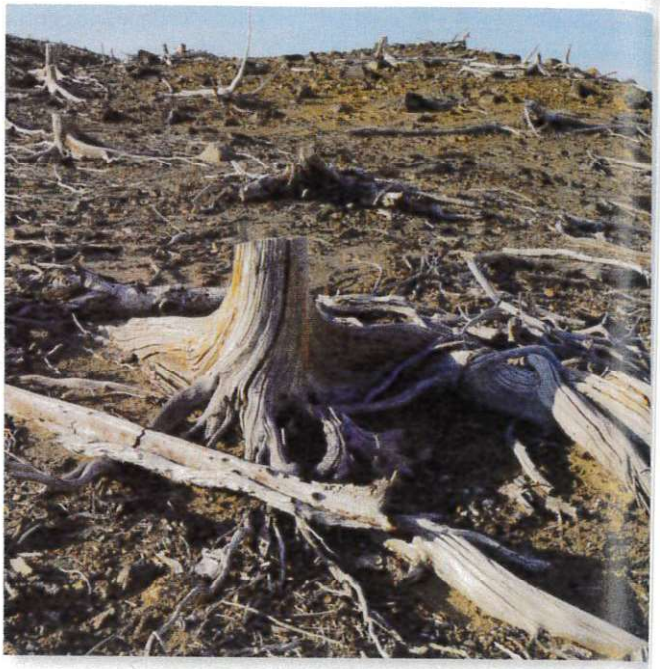

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Vegetated slopes.

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