RUNOFF

SUBJECT:
Biology, Geology

TIME:
1-2 class periods

MATERIALS:
county map / state map of your area
student notebooks
plastic box or pan at least one foot by two feet
sandbox sand, enough to fill half the box
two 250 mL cups
65 mL chocolate syrup
one 20 cm by 20 cm square of sod or several smaller grass plugs
a metric measuring cup
water
bucket or pot
teacher sheet

OBJECTIVES

The students will do the following:

1. Define surface water, runoff, drainage basin, permeable, and impermeable.
2. Identify factors affecting runoff in a drainage basin.
3. Perform an experiment on drainage basins.

BACKGROUND INFORMATION

Water found above the ground is called surface water. That is because it is located or seen on the Earth's surface. Oceans and rivers are examples of natural surface water bodies. Most surface water bodies are natural; however, there are many bodies of surface water that are made artificially.

The area where water drains off the land into a river or lake is called a drainage basin. Water that drains off the land into the basin is called runoff. Many things determine the runoff in a drainage basin. Water moves slowly along flat land or a gently sloping hill. When the water moves more slowly, it can evaporate or soak into the ground. A steep slope will cause water to flow more quickly into a surface water body. That is why drainage basins with steep slopes often flood.

Vegetation such as plants, trees, and grass help slow the water flowing through a basin. Trees and other plants also help to hold water on or above the ground. By doing so, they allow the water time to soak into the ground or to evaporate. Different kinds of soil have differing abilities to hold water. Water moves more quickly and easily through layers of sand and gravel than through clay. This is because clay is not as permeable as sand or gravel. Permeability is how fast water can flow through an object. Because clay particles fit tightly together, water does not flow through clay very easily. Clay is said to be impermeable. The next time it rains, watch what happens to the water running off the sidewalk or street near your home, then watch the water that falls on ground covered with trees, grass, or other plants. Notice which type of surface has the faster-flowing water. Rainwater that runs off a paved surface and does not soak into the ground is called storm water runoff. This water usually flows into the nearest body of water.

Terms

surface water: precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration. It is stored in streams, lakes, rivers, ponds, wetlands, oceans, and reservoirs.

drainage basin: an area drained by a main river and its tributaries.

runoff: water (originating as precipitation) that flows across surfaces rather than soaking in; eventually enters a water body; may pick up and carry a variety of pollutants.

permeable: passable; allowing fluid to penetrate or pass through it.

impermeable: impassable; not permitting the passage of a fluid through it.

storm water runoff: surface water runoff that flows into storm sewers or surface waters.

ADVANCE PREPARATION

A. Study the background information so it may be presented to the class in an organized manner.

B. Write the vocabulary words on the board so the students may view the words that will be covered in this lesson.

C. Have materials ready for the experiment.

PROCEDURE

I. Setting the stage

A. Have materials set out on a table in the front of the room. Tell the students that they will be learning about surface water and will be performing an interesting experiment.

II. Activity

A. Discuss the background information with the students.

B. Ask the following questions:

1. What is water above the ground called?

2. What makes water drain from one area to another?

3. What does permeable mean?

4. Through what soils does water move quickly?

5. Why does water move slowly through clay?

6. What does storm water runoff mean?

7. Name some examples of things storm water can pick up as it travels over land.

8. Where might storm water runoff go in rural areas?

C. Have the students perform the following experiment.

1. Fill the box or pan half full of sand. Diagonally, from the top corner of the box to the bottom corner, make a surface water (river) channel. Scoop sand from the middle of the box up onto the sides to form river banks. Make a steep slope on one side of the river and a gentle slope on the other side.

2. Place the sod square or several grass plugs on the side with a gentle slope. This represents wetlands vegetation.

3. Place bucket or pot under opening.

4. Position one student on each side of the “river” holding the 8-ounce cups of water. These students will make it “rain” on the river. Very slowly and at the same time, have one student pour water on the sandy side, while the other pours water on the grassy area. Observe which runoff flows faster and drains into the “river” first.

D. Repeat Step C, using 65 mL of chocolate syrup. The syrup represents storm water pollution. Observe what happens.

E. Repeat Step C, again, pouring 125 mL of water on the syrup. Observe what happens.

F. Ask the following questions:

1. Which side of the river had the fastest runoff?

2. What effect did the grass or sod have on storm water runoff? On pollution?

3. Did you see anything in this experiment that would help you decide whether the sand is permeable or impermeable? If so, what?

4. List several things that determine the speed of runoff in a drainage basis.

III. Follow-Up

A. Have the students list examples of surface water bodies in their county and state. Let your students see how many water bodies they can name before posting the maps.

B. Have the students determine where the school's storm water runoff drains.

1. Are there steep or gentle slopes around the school yard?

2. What types of pollution would this storm water pick up as it drains from the school yard?

IV. Extensions

A. Ask students to find out the average rainfall for their city or county.

B. Have students bring in various types of soil and design their own experiments to test which soils are permeable or impermeable.

C. Have students do research in the library to locate information on how to make a rain gauge.

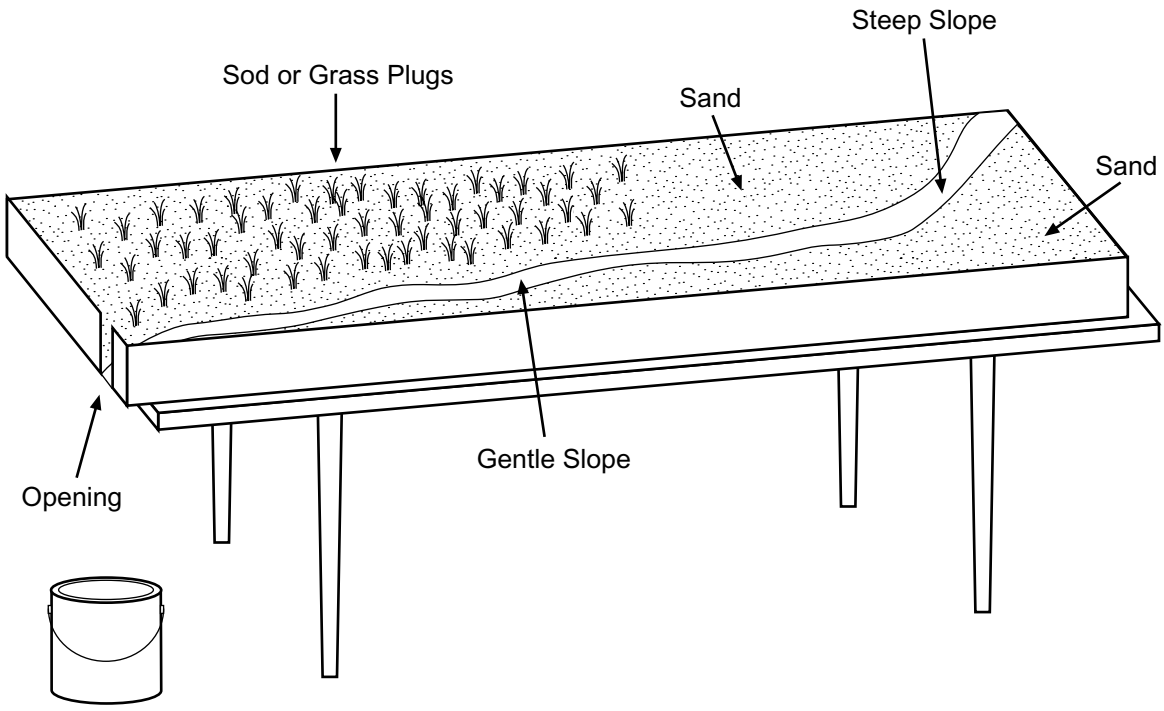
1. Help students make their own rain gauges and have them keep track of rainfall amounts for one month in their waterways notebook.

2. Have them design a bar graph to show rainfall totals. Have students do this at home and then compare their findings with others in their class. Sometimes it will rain on one side of the street and not on the other.

D. Contact the local office of the Natural Resources Conservation Service (formerly known as the Soil Conservation Service, or SCS) to request a guest speaker on the "soil profile" of your area. Ask the SCS representative for more information and experiments on soil types.

RESOURCE

Johnson, C., Waterways: A Water Resource Curriculum, St. John's River Management District, Jacksonville, FL, 1991.


Steep Slope
Sod or Grass Plugs
Sand
Sand
Gentle Slope
Opening