Floods
3–5
Flood Science

LESSON PLAN 2

What Are Floods?

The relationship of floods to the hydrologic cycle, terrain and types of soil can help children understand the risk of flood.

Key Terms and Concepts

flash flood	flood plain	infiltration
flood	flood stage	runoff

Purpose

To help the students understand floods and their relationship to the hydrologic cycle, the terrain and the types of soil

Objectives

The students will—

- Use *You're the Scientist: Soil Science* to demonstrate and compare the different infiltration rates of soil; relate this experiment with infiltration rate and runoff that cause floods.
- Refer to *You're the Scientist: Soil Science* while testing soil samples from students' homes to find soils with the highest and lowest infiltration rates. (Home Connection)
- Create rain gauges to measure and compare amounts of rainfall and determine when the greatest rainfall probably occurs. (Linking Across the Curriculum)
- Calculate the total volume of water that fell on a playground during a rainstorm. (Linking Across the Curriculum)
- Use a stream table to illustrate the relationships among rain, soil, terrain and floods.
- Conduct research on the Internet to create slideshow presentations of flood information. (Linking Across the Curriculum)
- Write and perform a class choral reading that depicts with sound and words an image of a flood. (Linking Across the Curriculum)

Activities

"Soil Science"

"Stream Table"

American Red Cross

Visit the American Red Cross Web site at *www.redcross.org/disaster/masters*

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3–5

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Materials

- *You're the Scientist: Soil Science*, 1 copy per student

For each group:

- Areas of different soil types: sand, clay, peat moss, topsoil, humus
- Clock
- Pitcher
- Funnel
- Soil
- 8–16 oz. (250–500 ml) of water

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"Soil Science"

SET UP 40 minutes **CONDUCT** 45 minutes

Science: Earth Science; Mathematics: Measurement and Calculation

1. Explain to the class that water infiltrates different types of soil at different rates. Divide the class into small groups and distribute *You're the Scientist: Soil Science* and the needed materials to each group. Have each group test a different area of ground.

TEACHING NOTE If possible, assign groups of students to test different types of soil outdoors, such as sandy playground, flower or planted areas, grass or dry soil. Indoors, provide boxes or aquariums with different soil types.

2. After completing their experiments, the students will discuss their observations. Create a class graph to compare the infiltration rates of the different types of soil.

Wrap-Up

Direct the students to apply their observations to floods.

Is there a relationship between infiltration rate and floods? (Water infiltrates different types of soil at different speeds. Moreover, water infiltrates at different speeds depending on whether the soil is already saturated or is loosely or firmly packed. If there is a great deal of water and the soil cannot hold it, water can rise as floodwater or can run off quickly as a flash flood.)

Home Connection

This activity requires several pairs of magnifying glasses.
Have the students find the different types of soil around their homes with the help of their families, and ask them to bring in samples, if possible. As a class, compare the types: texture, color and moisture content. Use magnifying glasses to compare the composition of the different soils. Based on these observations, which soil is more likely to hold more water? Verify the answers using *You're the Scientist: Soil Science*. What does this mean with regard to the possibility of flash floods?

Floods
3–5

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What Are Floods?

Linking Across the Curriculum

Science: Earth Science; Mathematics: Measurement and Graphing

After creating a rain gauge, tell the class to measure and compare the amount of rain that falls.

An accurate rain gauge must—

- Collect a steady amount of rain.
- Have a flat bottom with vertical sides.
- Inhibit evaporation.
- Be calibrated to measure depth of water, not volume.
- Be placed so that rain falls directly into it.
- Be stable to prevent spills.

Based on these considerations, have the students bring in containers and funnels and use rulers, markers and tape to create, place and monitor their own rain gauges.

Have the students track rainfall over an extended period of time and record their observations on a graph or chart. Conduct the exercise in different months or seasons and ask the students to compare rainfall during different times of the year.

TEACHING NOTE A two-liter plastic soda bottle makes an excellent rain gauge. Cut off the top of the bottle at the point where the sides become vertical. Place stones or marbles in the bottle for stability. Fill the bottle with water past the point where the bottom of the bottle is irregular; mark this point as your starting point for measurements. Flip the cut-off top portion of the bottle over and place it into the bottle to use as a collecting funnel.

Mathematics: Measurement, Calculations

Have the students calculate the total volume of water that fell on the playground during a 24-hour period.

1. Collect the water in a rain gauge and measure the depth in inches.
2. Measure the length and width of the playground. Make sure to convert this number from feet to inches.
3. Multiply the depth of the water by the length and the width of the playground to figure the number of cubic inches of water that fell on the playground.
4. Divide that number by 231 (cubic inches of water in a gallon) to arrive at the number of gallons.

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Floods
3–5

LESSON PLAN 2

What Are Floods?

Materials

- Very large pan or plastic-covered storage box
- Soil
- Toy houses, buildings and cars (game-piece size)
- 2 or 3 spray bottles
- Water

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"Stream Table"

SET UP 20 minutes **CONDUCT** 45 minutes

Science: Earth Science

1. Help the students discover how water moves in our environment using a stream table. Fill the large pan with slightly moist soil. Have the students mold the soil into hills, valleys and dry streambeds. Place the toy buildings and cars into the stream table landscape to create a town.

2. To simulate steady rain, the students will fill the spray bottles with water and spray the water onto the stream table. Have them discuss what happens when the water hits the ground.

For example:

- Does the water infiltrate the soil? (Yes, until the soil is saturated.)
- Would different soils have slowed or accelerated the flooding process? Why? (Yes. Water infiltrates different types of soil at different speeds. Some soils will speed the flooding process; others will allow time for the water to infiltrate the soil and even stop the flooding process.)

3. After a few minutes, have the students simulate heavier rainfall by enlarging the openings on the nozzles of the spray bottles and pouring a larger amount of water onto the landscape. Discuss what happens now.

For example:

- What happens when any type of soil reaches its saturation point? (Water runs off the soil and floods rivers and streams.)
- What happens to the streams and streambeds? (Water rises over their banks.)
- What different flood stages can you identify? (Smaller streams may flood first. As water continues to rise, it floods the lowest lying areas and may continue to higher ground.)
- Where does the runoff go on the stream table? (It floods across the landscape.)
- What areas of the simulated landscape would represent the floodplain? Why? (Those areas in which the rising waters begin to gather most quickly. Usually these areas are low-lying and adjacent to the streams and riverbeds.)
- What areas accumulate runoff water? (Low-lying areas in the floodplains.)
- Where would be the safest place to build? Why? (On high ground farther from the streams and riverbeds so that the rising water cannot reach the building.)

Floods
3–5

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Wrap-Up

Have students discuss how the stream table demonstrates flooding in the real world.

Why do floods occur? What could make them happen with little warning? (Soil that is saturated will cause runoff and floodwater that rises over stream banks and riverbanks. Floods occur when there is more water than the soil, streams and riverbeds can hold. Heavy precipitation added to already saturated soil, melting snow or water dammed downstream can cause a flood with very little warning.)

Linking Across the Curriculum

Social Studies: Geography; Science: Earth Science and Technology

The National Center for Atmospheric Research and the University Corporation for Atmospheric Research have created an excellent Web site for delving further into the subject of floods.

Watersheds: Connecting Weather to the Environment
http://www.meted.ucar.edu/broadcastmet/watershed/l5_shell.htm

Divide the class into small groups and have each research one of the areas of interest on the site: "Flood Types," "When Floods Happen," "Will It Flood?" and "Where and Why." Then, have them share their knowledge via their own interpretation using a slideshow presentation.

Language Arts: Vocabulary and Writing; Fine Arts: Drama

As a class, compile a list of words that mean or describe water. Instruct the students to say the words—many words—in a fast-paced choral reading that both describes a flood and replicates its sounds. Perform your "flood" with different students taking different parts and working at several different speeds.

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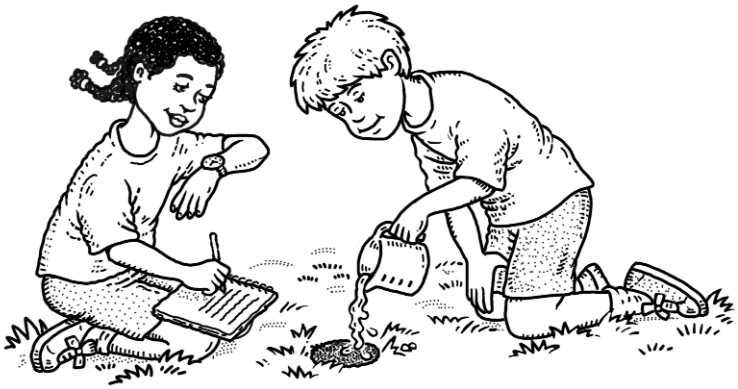
You're the Scientist: Soil Science

Name _____

Directions: The rate that water infiltrates soil demonstrates why and how floods can occur. Follow the steps below to find the infiltration rates for different types of soil.

What you need—

- Soil type: Sand, clay, peat moss, topsoil or humus
- Clock
- Pitcher
- Funnel, 8–16 oz.
- Water (8–16 ounces [250–500 ml], depending on the size of the funnel)
- Pencil



What you do—

1. Choose an area of soil and record its type.

2. Bury the funnel so that the large, top opening is level with the surface of the ground.

3. Note the time and pour the water into the funnel.

   Start time: _____ Amount of water: _____

4. Observe to measure the amount of time it takes for the water to drain through the funnel.

   End time: _____

   Time elapsed: _____ Amount of water: _____
   (This is the infiltration rate.)

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You're the Scientist: Soil Science

5. Repeat Steps 3 and 4 using the same amount of water:

   Start time: _____ End time: _____ Time elapsed: _____

   Start time: _____ End time: _____ Time elapsed: _____

   - What can you tell about the infiltration rate once the ground is saturated?

   - What does this illustrate about heavy rains and water accumulation and runoff?

6. Report your findings to your fellow scientists to compare different types of soil.