

Why is soil important for water quality?

Time: 2 class periods

National Benchmarks: Benchmarks 5A: Diversity of Life; 5D Interdependence of Life; 5E: Flow of Matter and Energy; 9B:Symbolic Relationships; 9D:Uncertainty; 12B:Computation and Estimation; 12D:Communication Skills; 12E:Critical-Response Skills.

National Science Content Standards: *Science as Inquiry: A; Life Science: C:* Biological Evolution; The Interdependence of Organisms; Matter, Energy, and Organization in Living Systems; *Science and Technology: E:* Abilities of Technological Design; Understandings about Science and Technology; *Science in Personal and Social Perspectives: F:* Population Growth; Natural Resources: Environmental Quality; Natural and Human-induced Hazards; Science and Technology in Local, National, and Global Challenges

New York State Standards: 1, 2, 3, 4, 5, 6, 7

Objective: Students will know the importance of soil as a water filter, and be able to construct a filter from different materials.

Lesson Outline:

1. Students discuss the importance of soil
2. Students receive materials to design a water filter
3. Students conduct experiment and discuss results

Materials:

Per group, for experiment:

- 6 Paper cups or plastic bottles (or coffee cans with holes punched in the bottom)
- soil: sand, gravel, dirt
- graduated cylinder
- water
- food coloring
- stopwatch

Engage: Hold up a cup of soil, and ask students to work in pairs to list the reasons why soil is important. Most students will not think about soil, or permeable surfaces, as important to water quality. Encourage students to think about the connections between land use and water, especially flooding.

Explore: Students will design an experiment that determines the importance of pervious surfaces. Provide students with the necessary materials and allow them time to develop an experimental set-up. Approve experiments before students begin. Three easy ways to create a 'filter' are outlined below.

1. Use paper cups: first cup is larger than the second. Punch holes in the bottom of the larger cup, and place inside the second, smaller cup (use a paper clip or toothpick to create a small space between the two cups so that the air doesn't act as a vacuum seal). The sand/soil/clay mixture can be added to the cup with the holes in the bottom.

2. Use plastic bottles: cut the bottom off of a regular water bottle, and invert the bottle. Place a cotton ball over the neck of the bottle, and add the sand/soil/clay mixture above the cotton ball. The plastic bottle can be suspended inside of another plastic bottle from which the top has been cut off.
3. Use coffee cans: Punch holes in the bottom of metal coffee cans, and line the bottom with mesh screen. The cans are filled with the soil sample and then are held above a graduated cylinder to capture the water.

Encourage students to create different types of soil mixtures-however, with only dirt used, it will be difficult to tell the color of the filtered water due to the soil particles. An ideal set-up would be three filters: one with just sand, one with sand and soil, and one with sand, soil, and clay. Students will also need a control (no soil mixture). You can also provide different types of food coloring which will help students understand that soil 'captures' pollution. A mixture of blue and red food coloring works well; clay, being negatively charged, will attract the blue food coloring as it passes through.

Explain: Soil acts as a natural filter for many substances found in water, including some bacteria. When the soil contains many layers, it will slow down water runoff and larger particles become trapped. However, soil can also become contaminated by human activities, which then reduces the soil's ability to act as a filter.

Extend: Students could research the different ways that we filter water at our water treatment plants. Most treatment plants use some form of sand and coal to clean the water.

Evaluate: Collect students' worksheets on which they have answered the questions and written down the data from their experiment.

Comments: