Digging Dirt

Summary

Students use a variety of techniques to define the characteristics of the soil in the schoolyard.

Grade Levels: 3-8; K-2

Time: 30-45 minutes
(1 class period)

Subjects: Science, Language Arts

Skills: Classification, comparison, description, generalization, observation, research

Learning Objectives:
Students will be able to:

- Define soil and identify the two main ingredients of soil, humus and rock particles
- Compare different types of soil
- Identify soil as a habitat that supports many forms of life
- Explain how soil characteristics affect the species that can live there

Materials:

- 3 samples of different soils (1 quart to 1 gallon of each soil depending on class size and whether activities are done individually, in groups or as a class)
- Ziploc bags
- Water
- Measuring cups
- Journals
- Pencils
- Clear jars with lids (1 per group)
- Small trowel or large metal spoon
- 3 plastic cups per group
- Plastic pipettes or turkey baster (1 per group)
- Distilled water
- Red litmus paper
- Blue litmus paper

Background

Earth's land surfaces are covered with a thin layer of soil – a mix of small pieces of rock and organic material. Organic material is called humus and is made up of the mineral-rich remains of dead animals and plants. Humus also retains water so that it remains accessible for plants.

Soil provides the water and minerals plants need to grow. Soil is essential to life on Earth since all animals depend on plants for food directly or indirectly. It takes thousands of years to form a mature soil, which forms layers. On the surface is topsoil, which is dark and filled with humus and is the layer plants in which plants grow. Below that layer is the subsoil, which is lighter in color, made up mostly of clay and contains less humus. A layer of partly broken-down rock lies underneath the subsoil. A layer of intact bedrock forms the bottom layer.

Water and air in the soil is essential for plants but also for numerous small animals that live in the soil. Air allows the decay of dead plants and animals, which provides minerals and other nutrients to others in the soil habitat, particularly plants. Plants also require a small amount of oxygen to survive.

Fertile soils, where plants grow well, contain minerals and water. Minerals can be depleted from soil, especially on crop lands used for years and years to grow a single crop. These poor soils can be improved by adding fertilizers or humus to the soil to replace minerals taken up by plants.

Soils can be characterized by texture, color, ingredients, the amount of air pores in the soil, chemistry (acidic or alkaline) and other factors. Plants absorb water and air from the soil, as well as important minerals that help them grow. For plants then, the texture of the soil is key in determining whether water and air will be available for roots to absorb. While some soils let water flow through them, like a sieve, other soils hold water in the topsoil, keeping it available for plant roots. (Generally the more humus or clay in the soil, the better it holds onto water.) Wet, acid soil harbors fewer critters than alkaline soil, which holds more minerals that support both plant and animal life in the soil. Loam soils, which contain equal amounts of clay, silt and sand, are considered the most fertile soils.

Knowing a little bit about the soils in your area will help in determining what kinds of plants to use for a Schoolyard Habitats project.

Preparation

1. Collect soils from your local area. Try to get examples of each soil type of varying particle size such as sand (largest), silt (medium) and clay (smallest). Be sure they are not from a polluted area and they do not smell unusual. Although different soils will make this activity most interesting, if it is not possible to collect three different-looking natural samples from the outdoors, use one from the schoolyard, one from store-bought potting soil and one from a mix of equal amounts of sand, potting soil, backyard soil and clay (use a very small amount of clumping kitty litter instead if no natural clay soil can be found). Place a cup or two of each type of soil in a Ziploc bag and seal.

Alternatively, have your students do the soil collecting after you have identified several good locations from which to sample.

2. Dry out soil samples on a newspaper in the sun or in the oven (use a baking sheet) at 250 degrees F for one hour.

3. Buy litmus paper, which tests for acidic or alkaline soils, at drugstores, school supply stores or through a biological or chemical supply house such as Carolina Biological Supply, www.carolina.com, or 800-334-5551

Procedure

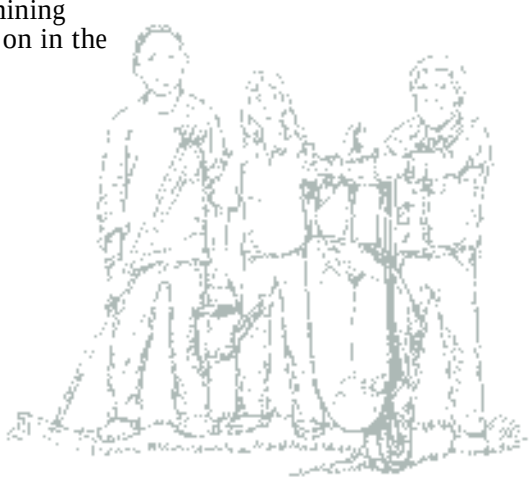
1. Tell students that today they will study a part of habitats they do not often see – the soil. Create a learning chart with the class about soil, discovering what they know and what they want to know about soil. ***What questions do they have about soil?*** Generate a list. Discuss these questions. ***How could the students think of finding out the answers?***

2. Like climate, soil types vary around the world and play a role in determining the kinds of plants that can live in different areas. ***How do they vary?*** Find out by investigating. Pass out three Ziploc bags, each filled with a soil sample. Have them feel soil textures and observe color differences, using these directions:

- ❏ Feel the soil through the plastic bag. Is it sandy? Squishy? Spongy? Sticky? Does the soil feel uniform in texture, or are there clumps or pebbles in it? What word would you use to describe it? Tell the students that the quality of the soil on the schoolyard will be an important factor in determining what they can plant on in the Schoolyard Habitat.
- ❏ What color is the soil? What does it remind you of – chocolate, caramel, beach sand, a camel's fur? Write down an analogy to describe the color of the soil in your journal.
- ❏ Pour a small amount of each soil onto a piece of white paper. View the soil through a magnifier. Describe different soil ingredients in journal.

3. Have participants write how the three samples are different in a chart in their journals.

4. Divide students into small groups. Provide each group with a cup of each type of soil sample and a measuring cup with water. Have students measure exactly one cup of soil of each type into another cup. Then, have them measure exactly two cups of water. Students should add water slowly to each soil sample. After all the water has been added to each sample, ask students to measure how much water is left on top (not absorbed). ***How much water was each sample able to absorb?*** Record this information in notebooks.



5. Another characteristic of a soil is whether it is acidic or alkaline. Many plants grow better in alkaline soils, while some plants are adapted to living in acidic soil. For all three samples, do the following experiment to see whether the soils are acidic or alkaline.

- ❑ Put a spoonful of soil into a jar with a lid. Smooth soil with spoon so there are no lumps.
- ❑ Fill the jar about halfway with distilled water. Put lid on tightly and shake gently. Leave jar on a table for 5 minutes until the soil settles out of the water.
- ❑ Collect a small amount of the (clearer) water that's just above the soil on the spoon handle. Dab the sample of water from the spoon onto pieces of red and blue litmus paper. The paper strips should absorb water.
- ❑ One of the litmus papers should change color where the water was placed. The color change tells you if the soil is acidic or alkaline. If the red litmus turns blue with water, the soil is acidic. If the blue litmus turns red with water, the soil is alkaline.
- ❑ Have students record in the journals what they find for each soil sample. What does this mean about the kind of plants that can grow in this soil?

Modifications for Younger Children

1. Define soil and describe how soil forms. Take students outside to pick up soil and examine it. ***What do they notice?*** Draw a soil profile on the board and explain the different layers.

2. Compare three soil samples to identify soil layers and main ingredients. Fill a lidded jar halfway with soil and 3/4 with water. Have students shake jars and leave them on a flat surface for 10 minutes. Have students observe the different layers and try to identify humus, small soil grains and larger grains. Keep jars on surface overnight and observe the layers again the next day, when most particles have settled out.

3. Discuss each sample's ingredients and how they were formed. Ask: *Which soil layer do plants grow in?*

Extensions

✔ Look at a map of the world that shows vegetation and soil types. Where are most crops grown? In what kinds of soil?

✔ What plants grow well in the soil at the schoolyard? Purchase soil kits to sample the schoolyard and/or borrow soil charts from your local cooperative extension agency to look up soil types on your schoolyard. Then start the search by looking in guides to local, native plants and/or talking with expert gardeners in the neighborhood or at a local nursery or arboretum about what will grow best there.

✔ Explore composting. Why do gardeners add the results of composting to their gardens? What does it supply for plants and soil creatures? How is it done?

✔ Soil erosion threatens to remove precious topsoil from farms, rendering them unable to support plants. Research techniques that help farmers conserve soil.

Assessment

✔ Have students draw a soil map of the schoolyard, labeling where they think different soil types can be found. This information will help them in planning for their Schoolyard Habitat.