

Look Out, Below

Background

When you dig into the ground under the grass in your yard, you'll find soil. But what happens if you keep on digging? If you dug far enough, would you run out of soil? How far would you have to dig before you ran out? And what would you find there? If you dug far enough, you would hit solid rock. This is called bedrock. But before you got there you would have to dig through three different layers of soil. The first layer would be nothing but dark-colored organic materials. That is the layer formed by plants and insects that have died and dead leaves that have fallen. Just under that is the topsoil. The topsoil is the best place for plants to take root and grow. It is a mixture of air, water, organic material and minerals.

Minerals come from rocks. Minerals have several different ways of getting into the soil. Sometimes they come from the ashes of volcanoes that have erupted. Usually the minerals come from rocks that have been broken apart. Water from rain flows into the cracks of rocks. When the water freezes, it expands and causes the cracks in the rocks to get bigger and little bits of rock break off. Sometimes the roots of plants will grow into the rocks and cause them to break. Many rocks are broken apart by lichens — tiny plants that live on rocks. Sometimes water just keeps running over the rock until tiny particles start to wash away. We call all these processes “weathering.” Water and wind carry the tiny bits of rock along until they get trapped by the soil. It can take hundreds of years for rocks to break into pieces that are small enough to form soil. It takes between 200 and 500 years for just one inch of topsoil to form.

In most places the topsoil is between six and 20 inches thick. If enough of the topsoil blows or washes away, the farmer is left with subsoil. The subsoil is the layer below the topsoil. It is usually lighter in color and less productive than the topsoil. It is made mostly of clay or sand and has very little organic material. Plants have a hard time growing in subsoil. That's why farmers have to work so hard to conserve their topsoil.

Between the subsoil and the bedrock you will find a layer of small rocks that have started to break off the bedrock. This layer is called the parent material of the soil. That's because most of what makes up the soil was once part of the rock.

Science

1. Read and discuss background.
2. As a class, have students build a soil model in an aquarium or large jar.

P.A.S.S.

GRADE 3

Science Process—1.1,2;
2.2; 3.2,3

Earth Science—3.1,2

GRADE 4

Science Process—1.1,2;
2.2; 3.2,3

Earth Science—4.1

GRADE 5

Science Process—1.1,2;
2.2; 3.1; 4.4

Earth Science—5.1,2

GRADE 6

Science Process—1.2; 2.2;
4.5

Earth Science—1.1,2; 5.1

Materials

soil samples from various locations

plastic bags

magnifying glasses

clear containers

glue

heavy paper

clear plastic cups

breakfast cereal, some crushed, some whole

shredded coconut

1/2 gallon milk

plastic spoons

- Divide students into groups.
 - Assign each group responsibility for one of the soil levels described in the background information.
 - Have each group research the soil layer for which it is responsible before gathering the necessary materials. Students may gather their own materials or use materials you provide
 - shredded dry leaves or grass clippings, a bowl of gravel or small pebbles, sand and potting or garden soil.
3. Photocopy student worksheets on heavy construction paper, and hand them out to your students.
 - Provide students with a variety of media found in the classroom or the home to represent the layers of soil. For example, actual grass clippings and leaves may be used for the organic layer; shavings from the pencil sharpener might represent topsoil and rough textured cloth can represent bedrock.
 - Encourage students to come up with their own ideas for representing the different layers.
 4. Provide materials for students to build edible soil profiles.
 - Explain that the plastic cup represents the parent material, the whole cereal represents the subsoil and the crushed cereal represents the topsoil. Sprinkle coconut on top to represent grass or other plant material.
 - Students should wash their hands before making their own soil profiles.
 - As you pour milk, explain that water moves through the soil in much the same way that milk moves through the cereal.
 5. Have students grow a bean or some other hardy plant in soil that represents each of the three soil levels.
 - Use clean, cardboard milk cartons from the cafeteria, and fill one with garden or potting soil, one with sand or clay and one with gravel or stones.
 - Provide each plant with the same amount of water and light.
 - Have students record their observations.
 6. Divide students into groups and have each group pour a small amount of garden or potting soil onto paper.
 - Instruct students to spread the soil out and let it dry.
 - Provide each group with a hand lens, and have them separate the particles they find by size and color.
 - Have students write paragraphs about the activity in which they report what they learned about topsoil.
 7. Fill two jars half full with water.
 - Label one jar “water” and the second jar “carbon dioxide.”
 - Take a straw and blow air into the jar labeled “carbon dioxide.” Your breath will provide the carbon dioxide.
 - Fill a third jar half full with vinegar and label it “vinegar.”
 - Put a limestone rock in each jar and put one limestone rock

aside for a reference.

—Wait one day, and have students look at the jars and discuss what they see.

8. Soil needs air spaces in it for plants to grow well. The spaces let water and air move through the soil. Soil that is compacted has been pressed together so the soil does not have many air spaces and has become hard for plants to grow in.
 - Fill a coffee can or flower pot (large enough to get your fist in easily) with soil from the school yard.
 - Measure the number of inches from the bottom of the jar to the top of the soil. Write the number down.
 - Now take your fist and push the soil down hard. Measure the number of inches again.
 - Subtract the second number from the first to find how much air space you have removed by compacting the soil.

Extra Reading

Brendler, Carol, and Ard Hoyt, *Winnie Finn, Worm Farmer*, Farrar, Straus and Giroux, 2009.

Gardner, Robert, *Super Science Projects About Earth's Soil and Water*, Enslow, 2007.

Lindbo, David, *SOIL! Get the Inside Scoop*, American Society of Agronomy, 2008.

Nardi, James B., *The World Beneath Our Feet: A Guide to Life in the Soil*, Oxford, 2003.

Vocabulary

bedrock—the solid rock lying under surface materials (as soil) that are not in layers

clay—an earthy material that is sticky and easily molded when wet and hard when baked

hue—a particular variety of a color

humus—a brown or black product of partial decay of plant or animal matter that forms the organic portion of soil

layer—one thickness or fold over or under another

lichen—any of numerous plantlike living things made up of an alga and a fungus growing together on a solid surface (as a rock or a tree)

material—the elements or substance of which something is made or can be made

mineral—a naturally occurring substance (as ore, petroleum, or water) obtained usually from the ground

organic—of, relating to, or obtained from living things

Port silt loam—the state soil of Oklahoma, reddish in color due to the weathering of reddish sandstones, siltstones, and shales of the Permian geologic era. The name comes from a small community (Port near Washita County, OK) and the texture of the top soil (silt loam).

sand—loose material in grains produced by the natural breaking up of rocks

silage—fodder (as hay or corn) fermented (as in a silo) to produce a rich moist feed for livestock

silt—very small particles left as sediment from water; also : a soil made up mostly of silt with little clay

soil—the loose surface material of the earth in which plants grow

subsoil—a layer of weathered material that lies just under the surface soil

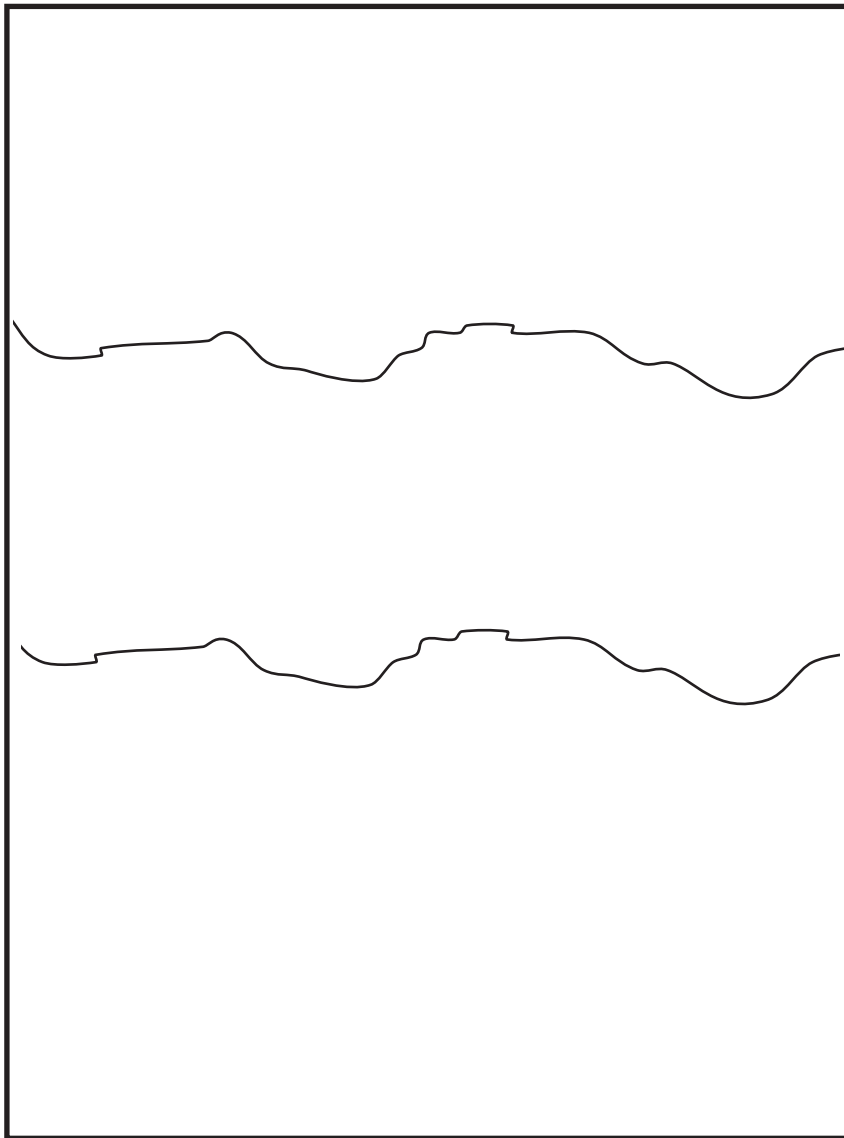
surface—the outside of an object or body

topsoil—surface soil usually including the rich upper layer in which plants have most of their roots and which the farmer turns over in plowing

weathering—the action of the forces of nature that changes the color, texture, composition, or form of exposed objects; especially the physical and chemical breakdown of earth materials at or near the earth's surface

Name _____

Look Out, Below



1. _____

2. _____

3. _____

4. _____