

A Field View of Soil - Digging Around



Purpose

To understand that variations in the landscape can affect soil properties

Overview

Students investigate variations in the soils around their school to discover that soil properties like moisture, temperature, color, and texture exhibit considerable variability across a single landscape. They also identify factors such as slope, shade, plants, and compaction, which affect the appearance of soils and their ability to hold moisture.

Student Outcomes

Students will be able to characterize soils.

Students will be able to relate the five soil forming factors to soil properties.

Science Concepts

Earth materials are solid rocks, soil, water, biota, and the gases of the atmosphere.

Soils have properties of color, texture, structure, consistence, density, pH, fertility; they support the growth of many types of plants.

The surface of Earth changes.

Soils are often found in layers, with each having a different chemical composition and texture.

Soils consist of minerals (less than 2 mm), organic material, air and water. Water circulates through soil changing the properties of both the soil and the water.

Scientific Inquiry Abilities

Identify answerable questions.

Design and conduct an investigation. Use appropriate tools and techniques including mathematics to gather, analyze, and interpret data.

Develop descriptions and explanations, predictions and models using evidence.

Communicate procedures and explanations.

Time

Two class periods: the first for the field trip; the second to discuss findings and causal connections

Level

All

Materials and Tools

Small shovel or trowel
GLOBE Science Notebooks

Prerequisites

None

Background

Factors Affecting Soil Properties

The soil is unique for every place on Earth. What makes each soil unique is the way the five soil forming factors work together at any particular place. These five soil forming factors are 1. parent materials from which the soil formed, 2. the position on the landscape where the soil is found (or the topography of the site), 3. the types of plants and animals that live in the soil, 4. the climate for the area where the soil formed, and 5. the amount of time that the other 4 factors have been

interacting. As you look around your site, notice whether the effects of the five soil-forming factors are different on one part of the site versus another.

Some properties that you may notice that change from one soil to the other are:

- the color
- the type and amount of vegetation on the soil surface
- the amount of roots in the soil surface
- the shape of the soil particles when you look at them (called the soil structure)



- the way the soil feels (called the soil texture)
- the amount and size of rocks in the soil
- the number of worms or other animals in the soil
- how warm or cool, wet or dry the soil feels. (Wet soil will be sticky and clump together, moist soil will feel wet and cool, and dry soil will feel like it has no water in it.)



Factors Affecting Soil Moisture

Because each soil is unique, each soil will also hold a certain amount of water. The amount of water held in the soil may depend on many things. Among these are the speed at which precipitation (rain, snow, sleet, etc.) enters (infiltrates) the soil or runs off, the temperature, and the plants. If soil is tightly compacted, as on a well-trodden path, the water will not be able to enter the ground as easily as in less traveled areas. Nature may increase runoff in some areas. For example, in dry climates, “desert pavement” (small rocks laid tightly across the sand like a tile floor) may increase the amount of runoff.



Wind and water may help to form crusts on some soils that prevent the infiltration of water. Slope also increases the speed at which water runs off the land. Rain will quickly disappear on a steep slope, but collect in puddles on the flat ground. The roots of plants help to break up the soil, creating a porous medium in which water can pass. Sandy soils usually let water in faster than clay-rich soils.



You might think that there is little variation between soil temperatures on your site. However, there may be quite a bit of difference from one place to another. Shade causes cooler temperatures. Shade is not found just under trees. It may be cooler in the shade under a rock or on the side of a rock away from the sunlight. The soil may be drier in warm places, and wetter in cool, shady places.



Plants may also affect soil moisture. They may provide shade. They also use water.



What To Do and How To Do It

Begin by Asking:

1. In your part of the world, which side of a slope gets the most sunlight - the north or the south?
2. If you were going to hunt for fishing worms (or other soil dwelling invertebrates), where would you look? Why would you look there? Remember, animals need water, air and nutrients, which are found in various soils. In compacted soils, it is more difficult for animals to survive.
3. Do more types of plants seem to grow on slopes or in valleys? Why?

At the Study Site

1. Divide the class into groups of 3 to 5 students. Each group should have a small shovel or trowel, and their GLOBE Science Notebooks.
2. Have groups look for differences in soil properties at different places in the site by digging up a small amount of soil, looking at it, and feeling it. Have them record what they find in their GLOBE Science Notebooks.

Ask them to note types of plants, presence of rocks, roots, and soil animals (such as earthworms), how hard or easy it is to dig, distances to items on the landscape or other things they notice. See the box, the *Five Soil-Forming Factors (after Student Assessment below)*, for guiding questions. Have students list the areas they investigated from the wettest to the driest. Note how the moisture content is affected by the location, the type of plant cover, the position, or other things at the site.

Extensions

1. Have students make a sketch map of soil characteristics on their site.
2. Have students “landscape” their site. If this site was going to become someone’s yard, where would you plant things?

Student Assessment

Ask Students:

1. In which parts of the site would you expect soils to be most alike? Consider regions with similar soil forming factors.
2. Where would you locate the soil that is the most typical for your area? Look for large areas within your site which have common characteristics.
3. What things on the landscape affect soil-moisture?
4. What things should you consider when choosing your soil-moisture site in your area?

The Five Soil-Forming Factors

Climate: Is one part of the site more shaded or sunnier, cooler or warmer, drier or wetter? How would the temperature and moisture be different in a sandy soil than in a clayey soil? How would this affect the way plants grow?

Topography: Are there different slopes on different parts of the site? Where is it flat on the site? Are there areas that rise up or slope down? What are the different types of positions on the landscape (high spots, middle of the slope, low areas)? Where are the highest places; the lowest?

Plants and animals: How do the types of vegetation change on the site? Can you see evidence of animal life? What kinds of insects are present? How is the site used by humans (such as: is it a park, a field, a lawn, a forest, a plantation, an urban area)?

Parent material: From what kind of material was your site formed? Do you see rocks at the surface that can give you an indication? Are these rocks near a stream so that they may have been deposited by water? Could they have been deposited by wind (such as a sand dune), or by gravity down a hill, or by a glacier, or by a volcano? (You may need to do some research to determine the geology of your area).

Time: How long has this site been undisturbed? Is there a lot of organic material on the soil surface? Are there grasses, trees, crops, or other plants that have been growing for a long time without being disturbed? Has there been recent building or construction? If it is a field, has it been recently plowed? Have trees been removed from the site? Has there been a recent flood or other natural disturbance that may have affected the formation of the soil?