

Lesson 10:  
What's in Soil?



## Time Allotted

60 Minutes

## Target Audience

Grades 1-8

## Objectives

- Students will analyze soil samples and identify the five components of soil
- Students will predict how organic matter breaks down to form healthy soil
- Students will assemble “ingredients” and create the beginnings of soil

## Materials

- Pie tins, small bowls or plastic gallon sized bags (one per every 3-5 students)
- Hand lenses or magnifying glasses
- Soil samples from garden or schoolyard (about 1/2-1 cup per every 3-5 students)
- Hand trowels or shovels
- White paper
- Large mixing bowl
- Cloth or cover for large mixing bowl

## Summary

Students will examine soil samples to determine the components of soil and attempt to make their own soil using their findings.

## Background

The word “soil” is often used interchangeably with the word “dirt,” but the two do not actually refer to the same thing. Dirt is simply the small, brown pile of mud or dust particles we may hold in our hand. Soil, however, is a complex material composed of organic matter (decaying remains of plants and animals), minerals (sand, silt, clay), water, and air. Earthworms, beetles, and other small animals are often found in the soil. Lastly, soil contains many microorganisms (organisms too small to see with the naked eye alone) such as bacteria that help break down organic matter. Students will explore the components of soil using a soil sample from the garden or schoolyard.

Soil is formed through a complicated process involving multiple factors. Soil begins with parent material—various types of sediment left by glaciers or volcanoes—which is then broken into finer particles through a combination of temperature, water, and wind over a long period of time. As plants and animals die, their remains are added to this material, and as they decay, their nutrients are added. Water and air infiltrate the soil as it is moved by wind and living organisms. Eventually, healthy subsoil and topsoil are formed, but this process takes hundreds of years. This lesson asks students to consider the processes that form soil, paying special attention to the length of time required for those processes to be complete.

Many human practices damage the soil that requires so much time to form. For example, housing development and urban expansion have caused significant erosion of our topsoil since the roots of trees and other plants have been removed or disturbed and can no longer hold the soil in place. Unsustainable agricultural practices, including pesticide-based farming and the use of monoculture crops, has added harmful chemicals to and depleted much of our land's topsoil of valuable nutrients. Farmers, who cannot always afford to remediate their soil by replenishing lost nutrients may simply move to another plot of land, or spray more chemicals to help their plants grow. Because soil is an invaluable resource that cannot be quickly replaced, these harmful practices decrease the amount of fertile soil available for safe and healthful food production.

## Method

1. Divide students into small groups of 3-5. Pass out magnifying glasses, a tin/bowl/bag, and a hand trowel to each group. Instruct the students to collect a cup of soil, taking care not to disturb surrounding plants or creatures when doing so. Go outside and collect soil from the schoolyard or garden space, placing the soil sample into the containers.

2. Have students dump their samples onto white paper to examine it with their hand lenses. Have students separate the different materials they find: rocks, leaves, roots, insects, etc. Have each group come up with a label for the different categories of materials they found. As a class, come up with a master list of ingredients that make up soil. Be sure to include such items as: rocks, sticks, dirt or sand, grass and worms.
3. Announce to the students that they will now be making their own soil. Assign the ingredients from their "soil ingredient list" to different groups. Have groups collect their assigned ingredient(s).
4. Double check the list to be sure all items are present. One-by-one, have each group add their ingredient to the bowl, when all ingredients are inside, cover it with the cover or cloth. Either have the students repeat the following chant: "alla-kazaam...alla-ka-zoil...turn this mixture...into soil!" or gently agitate the bowl while they count down from ten.
5. Pull the cloth off and ask the students whether they've created soil or not (they have not). Ask them what ingredients may be missing—think of other natural elements that may be present in nature and what they may contribute to the creation of soil (sun, water, nutrients, bacteria).

**Ask:** If we added these ingredients, would the resulting mixture be soil?

6. Have the students compare their soil samples to the contents in the bowl.

**Ask:** What did the soil from the garden have that our mixture did not? Think of other processes of transformation (plant life cycle, human life cycle, seasons, cooking, transport, etc.). Are there any similarities that may help us discover the missing ingredient(s)?

Students should conclude that the missing ingredient is time. It takes a long time for bacteria and other decomposers such as earthworms to break down all these ingredients and to create rich, healthy soil. In fact, it takes 50-100 years to develop one inch of topsoil.

## Extensions

- Have students begin a discussion on the damage that is being done to topsoil throughout the world because of harmful agricultural practices and urban/suburban development (such as the use of pesticides and chemical fertilizers that kill both harmful and helpful microorganisms and contribute to erosion). Ask students to think about the effects of harmful agricultural practices and their relation to the production of new topsoil. How do you think this affects overall soil health? Quality of things grown in the soil? Health of those consuming products grown in "damaged" soil?
- Have students research decomposers such as earthworms. Have them create posters or diagrams of different decomposers and describe how their form (size and shape) is suited to their function (breaking down organic matter).
- Take a field trip to Chicago's Field Museum to see its permanent exhibit "Underground Adventure". Get a bug's-eye view of the world when you magically "shrink" to 1/100th of your actual size — smaller than a penny — to explore an immersive environment of worm tunnels and soil chambers. This exhibition reveals soil to be home to an incredible diversity of living things, and shows how not a single plant or animal could survive without it. After regaining your regular size, become a soil scientist to investigate how life above ground connects to life below. <http://fieldmuseum.org/happening/exhibits/underground-adventure>

## Sources

Parella, Deborah. Project Seasons: Hands-On Activities for Discovering the Wonders of the World. Shelburne Farms. 1995.