Soil

Earth & Space Science | Lesson Guide

4th Grade

Photo Description

This image shows a cross-section of soil with distinct layers visible. At the top is dark, crumbly topsoil mixed with grass and plant roots. Below that is a lighter-colored layer, followed by a darker reddish-brown layer deeper down. The different colors and textures show how soil changes as you dig deeper into the ground.

Scientific Phenomena

Anchoring Phenomenon: Soil is made up of different layers, each with different characteristics and compositions.

Why This Happens: Soil forms over many years as rock breaks down into tiny pieces and mixes with dead plants and animals (organic matter). Gravity pulls heavier materials downward, so larger rock pieces and denser materials settle at the bottom, while lighter organic matter stays near the top. This natural sorting creates distinct layers called soil horizons. Each layer has a different job—the top layer holds nutrients for plants, the middle layers store water, and the bottom layer is mostly broken-down rock.

Core Science Concepts

* Soil Composition: Soil is made of three main ingredients—mineral particles (bits of rock), organic matter (dead plants and animals), and living organisms (bacteria, worms, insects).

* Soil Layers (Horizons): Different depths of soil have different colors, textures, and amounts of organic matter because of how soil forms over time.

* Weathering and Decomposition: Rock breaks into smaller and smaller pieces through weathering, and dead plant and animal material breaks down, both contributing to soil formation.

* Plant-Soil Relationship: Plant roots grow into soil to find water and nutrients, and when plants die, they return nutrients back to the soil.

Pedagogical Tip:

Before showing this image, have students make predictions about what they think is underground. Ask: "What do you think soil is made of?" This activates prior knowledge and creates curiosity. Then reveal the image to confirm or challenge their thinking—this approach increases engagement and deeper learning.

UDL Suggestions:

Provide multiple means of representation: Show the soil layers image alongside a labeled diagram with vocabulary highlighted. For students who need extra support, provide a simplified diagram with only 2-3 layers. For advanced learners, include a more detailed scientific illustration showing the complete soil profile (O, A, B, C, and R horizons). Allow students to choose whether they learn best through visual diagrams, physical soil samples to handle, or verbal descriptions.

Discussion Questions

1. What do you notice about the different colors and textures in each soil layer? (Bloom's: Observe | DOK: 1)

2. Why do you think the top layer of soil is darker and has more plant material than the layers below it? (Bloom's: Analyze | DOK: 2)

3. How might the soil be different in 100 years from now, and what do you think would cause those changes? (Bloom's: Evaluate | DOK: 3)

4. If we removed all the organic matter (dead plants and animals) from soil, what problems might plants have growing in that soil? (Bloom's: Synthesize | DOK: 3)

Extension Activities

Activity 1: Build a Soil Layer Model
Students create a layered soil model using a clear jar or plastic bottle filled with different materials: sand (bottom), small pebbles, soil, compost, and dead leaves (top). They observe and sketch the layers, then write labels explaining what each layer contains and why. This tactile experience reinforces the concept of soil horizons.

Activity 2: Soil Sample Investigation
Collect soil samples from different locations around the school (garden, playground, shaded area, sunny area). Students examine each sample using hand lenses, note the color and texture, identify visible organic matter, and compare the samples. Create a class chart showing similarities and differences—this introduces the idea that soil varies by location.

Activity 3: Decomposition Observation
Place dead leaves, grass clippings, and small food scraps in a clear container with moist soil. Students observe and record changes weekly over several weeks, sketching how the organic matter breaks down. This directly shows the decomposition process that creates fertile soil and reinforces that decomposition is part of the soil-building cycle.

NGSS Connections

Performance Expectation: 4-ESS2-1. Make observations and measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Disciplinary Core Ideas:
- 4-ESS2.A Earth Materials and Systems
- 4-LS1.A Structure and Function

Crosscutting Concepts:
- Systems and System Models
- Stability and Change

Science Vocabulary

* Soil: The top layer of Earth made up of rock pieces, dead plants and animals, water, and air that plants grow in.

* Organic Matter: Dead plants, dead animals, and other material that once was alive and is breaking down in the soil.

* Weathering: The slow process of rocks breaking into smaller and smaller pieces over time due to water, wind, ice, or other forces.

* Soil Horizon: A layer of soil that is different from the layers above and below it in color, texture, and what it is made of.

* Decompose: When dead plants and animals break down into smaller pieces and turn into nutrients that can be used again.

* Nutrient: A substance that living things need to survive and grow, like nitrogen or phosphorus found in soil.

External Resources

Children's Books:
- The Magic School Bus Inside the Earth by Joanna Cole (explores Earth's layers, including soil)
- Who Lives in the Garden? by Marianne Berkes (focuses on soil organisms and their roles)
- Dirt: The Scoop on Soil by Elaine Landau (age-appropriate overview of soil science)

YouTube Videos:
- "How Does Soil Form?" by Amoeba Sisters (4:34 minutes; explains weathering and soil formation with clear animations) — https://www.youtube.com/watch?v=dVjGiO1h1-4
- "What is in Soil?" by National Geographic Kids (3:45 minutes; engaging overview of soil components with real images) — https://www.youtube.com/watch?v=xUvGt2HuVQ0