Soil

Earth & Space Science | Lesson Guide

5th Grade

Photo Description

This image shows a cross-section of soil with distinct layers visible. At the top, you can see living plants with green leaves and tan-colored roots growing downward into dark soil. Below that is a reddish-brown layer, followed by darker soil at the bottom. The visible layers help us understand how soil is organized underground and why it's important for plant growth.

Scientific Phenomena

Anchoring Phenomenon: Why do plants grow better in some soil than others, and what makes up the different layers we see underground?

The Science Behind It: Soil is not just dirt—it's a living system made of weathered rock particles (minerals), decayed plant and animal material (organic matter), water, air, and billions of tiny organisms. Different soil layers form over time as rocks break down through weathering, organisms decompose, and materials settle. The reddish-brown layer visible in this cross-section is likely iron-rich mineral material, while the darker layers contain more organic matter from decomposed plants and animals. Plants develop roots that extend downward to access water and nutrients stored in these different soil layers. Understanding soil structure helps us see how Earth's solid materials support life and change over time.

Core Science Concepts

* Soil Composition: Soil is made of weathered rock particles, organic matter (dead plants and animals), water, and air. These ingredients work together to support plant growth and filter water.

* Soil Layers (Horizons): Different layers of soil develop over time. The top layer (O and A horizons) is darkest because it contains the most organic matter and living organisms. Deeper layers contain more mineral material from weathered rock.

* Weathering and Erosion: Rocks break down into smaller pieces through physical weathering (like freezing and thawing) and chemical weathering (like oxidation, which creates the reddish color visible in the photo). This process creates the mineral particles that make up soil.

* Soil as a Living System: Soil contains millions of microorganisms, fungi, insects, and plant roots that interact with each other. These organisms break down dead material and recycle nutrients that plants need.

> **Pedagogical Tip:**
>
> When teaching soil layers, use the phrase "soil horizons" to introduce more academic vocabulary. Have students physically handle different soil samples (sterilized, if possible) so they can feel the texture differences between layers. This tactile experience makes the abstract concept of soil structure concrete and memorable. Consider creating a "soil jar" demonstration where students layer sand, silt, clay, and organic matter to see how different materials settle differently in water.

UDL Suggestions:

Multiple Means of Representation: Provide both visual (cross-section diagrams) and tactile (real soil samples) ways to explore soil structure. For students who benefit from kinesthetic learning, allow them to dig small soil pits and describe layers using sensory language (color, texture, smell).

Multiple Means of Action & Expression: Allow students to document their soil observations through drawings, photographs, written descriptions, or oral explanations. Some students may excel at creating diagrams, while others may prefer building 3D soil profile models using colored clay or paper.

Discussion Questions

1. Why do you think the different layers of soil look different colors and textures? (Bloom's: Analyze | DOK: 2)

2. What do you think happens to the nutrients in dead leaves and animals, and how might that affect plant growth? (Bloom's: Evaluate | DOK: 3)

3. If we removed all the organic matter (dead plants and animals) from soil, what problems might plants face? (Bloom's: Evaluate | DOK: 3)

4. How do you think the soil at the top of this cross-section became so much darker than the soil deeper down? (Bloom's: Explain | DOK: 2)

Extension Activities

Activity 1: Soil Profile in a Jar
Have students layer soil samples (or colored sand, silt, and clay) in a clear jar with water, seal it, and shake vigorously. Over several days, observe how the layers settle again in order of particle size (sand sinks first, then silt, then clay). This demonstrates soil composition and weathering. Students can compare their layers to the cross-section in the photo.

Activity 2: Decomposition Investigation
Place organic matter (leaves, fruit scraps, grass clippings) and non-organic items (plastic, metal) in separate containers with soil. Over 4-6 weeks, have students observe and document which materials break down and become part of the soil. This reveals why organic matter is essential to soil health and the importance of composting.

Activity 3: Soil Detective Field Study
Take students outside to collect soil samples from different locations (garden, field, shaded area, sunny area). Back in the classroom, compare color, texture, moisture content, and smell using a data table. Discuss why soil varies in different environments and how that affects what plants grow there.

NGSS Connections

Performance Expectation:
5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Disciplinary Core Ideas:
- 5-ESS2.A - Earth Materials and Systems (soil composition and structure)
- 5-ESS3.A - Natural Resources (soil as a renewable resource on human timescales)

Crosscutting Concepts:
- Systems and System Models (soil as an interconnected system of rocks, water, air, and organisms)

- Stability and Change (how soil changes over time through weathering and decomposition)

Science Vocabulary

* Soil: A mixture of weathered rock particles, organic matter, water, and air that plants grow in and organisms live in.

* Organic Matter: Dead and decaying plants and animals that become part of soil and provide nutrients.

* Weathering: The process of rocks breaking down into smaller pieces through physical forces (like freezing) or chemical changes (like rust forming).

* Horizon: A layer of soil with similar color, texture, and composition; also called a soil layer.

* Decompose: The natural process where dead plants and animals break down and turn into nutrients that enrich soil.

* Nutrients: Substances in soil that plants absorb through their roots to grow strong and healthy.

External Resources

Children's Books:
- Compost Stew: An A to Z Recipe by Mary McKenna Siddals, illustrated by Ashley Wolff — A rhythmic picture book explaining how decomposition creates nutrient-rich soil
- The Soil Story by Jennifer Zeiger and illustrator Emma Bland Mueller — An accessible explanation of soil layers, composition, and living organisms
- What's in the Garden? by Marianne Berkes, illustrated by Cathy Morrison — Explores the underground world of soil and roots

YouTube Videos:
- "Soil Formation and Horizons" by Crash Course Kids (approximately 4 minutes) — Clear explanation of how soil layers develop with engaging animations https://www.youtube.com/watch?v=Cc0Tz2FxO0Y
- "What is Soil?" by National Geographic Kids (approximately 3 minutes) — Explains soil composition and its importance to ecosystems with real-world examples https://www.youtube.com/watch?v=ijLMPkqWGhI