

teacher exercise: **What Is Soil?**

overview

Soil is the unconsolidated mineral or organic material on the surface of the Earth that serves as a natural medium for the growth of plants. The soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics.

background information

1. What factors affect soil formation?

Use the resource links for a sample step-by-step process every gardener should practice and use:

Five factors that affect soil formation are climate, parent material, time, organisms, and topography. Each of these factors interacts with the others during the processes of soil formation.

- **Climate:** Soil formation processes are directly linked to the climate in which the soil forms. Climate strongly influences the rate of the weathering of rocks and soil. The amount of precipitation in a region controls the amount of water that enters the ground, which greatly affects the rates of chemical and physical weathering.
- **Temperature** also influences the formation of soil; in warm climates, soils weather more rapidly than in cooler climates. The combined influence of temperature and precipitation is also significant. For example, if precipitation is abundant but temperatures are cool, the processes of decomposition and weathering are much slower than if temperatures are

warm. In the tropics, where it is warm year-round and rainfall is abundant, soil weathering occurs very rapidly.

- **Topography:** Topography refers to the shape and direction of the land surface, and its slope. This factor regulates how water will travel through a landscape, and affects the ability of the soil to resist erosion by water. Erosion will move soil from higher to lower elevations, causing soils at the bottom of a hill to get more water than soils on the slope of a hill. Soils tend to be thicker on flat, low-lying land and thinner on steep slopes. South-facing slopes tend to be warmer than slopes that face north because they receive more sunlight. Because of this, soils on south-facing slopes will tend to be more weathered and drier at any given time.
- **Time:** Time addresses how long the other factors of soil formation have been at work weathering the parent material. Younger soils tend to be less developed.
- **Parent Material:** Parent material is the geologic and organic material from which soil is formed. The kind of soil that forms in a particular location depends largely on the properties of the parent material, and how the minerals it contains react to temperature, pressure, erosion, and weathering. One important kind of parent material is bedrock, which could consist of igneous, sedimentary, or metamorphic rock. Sediment is another kind of parent material, and water, wind, glaciers, volcanoes, and other means can deposit it.

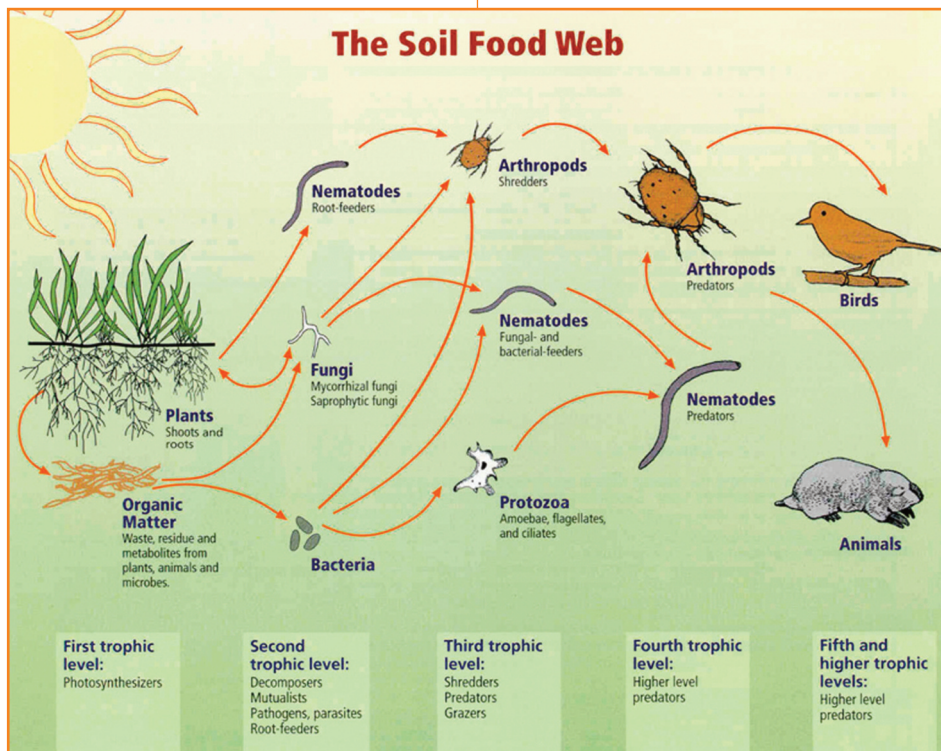
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■ **Organisms:** Plants, animals, and other organisms, whether alive or dead and decomposing, have a considerable influence on soil formation because they introduce nutrient-rich organic matter to the soil. Plants in particular have a profound influence on the amount of organic matter incorporated into the soil. If vegetation is scarce, as it is in the desert, there will be less organic matter. Animals, such as insects and earthworms, burrow in the soil, introducing water and air, and bringing subsoil material to the surface, and topsoil down. As earthworms feed, for example, they break down decaying plant matter and eliminate it in their waste, which both enriches the soil and makes it more porous. Also present in soil are microorganisms that

contribute to the recycling of nutrients by decomposing plant and animal remains. Weak acids produced by some microorganisms can even dissolve nutrients in rocks. In this way, certain fungi and bacteria release phosphorous and calcium from minerals in rocks and are important rock-weathering agents.

2. What are soil horizons?

As you drive along highways, you are likely to pass places where the roadway cuts through soil. Have you noticed layers in these road cuts? During soil formation, inorganic materials (e.g., minerals) and organic materials (e.g., decaying plants and animals) are transformed and, with the flow of water through the soil, settle downward which creates layers called soil horizons.

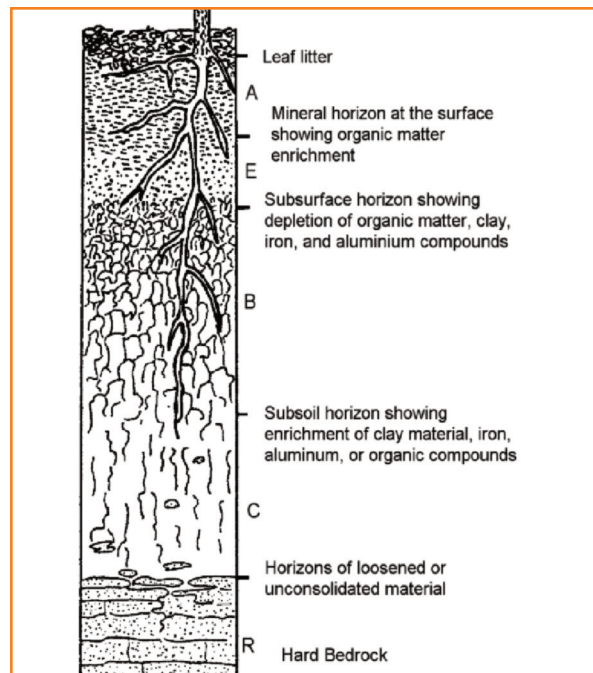


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An established method for describing soil horizons labels them, from the surface down, O, A, E, B, C, and R. There can be subdivisions of the major horizons in some soil profiles. Also, not all of the soil horizons are represented in any given location; the presence or absence of these layers helps to classify soil types.

3. What are the characteristics of different soil horizons?

- **O Horizon:** The O, or organic, horizon is found in soils formed under forest vegetation. It is composed mostly of vegetation that has fallen to the ground and the remains of animals such as insects, causing it to be dark in color.
- **A Horizon:** Below the O horizon lies the A horizon, which is commonly called topsoil. It is the first soil horizon made mostly of minerals from the weathering of the underlying parent material, but it can also contain decomposed organic material, which gives it a dark color.
- **E Horizon:** In areas that are or once were forested, there can sometimes be an E horizon beneath the A horizon. E stands for “eluviation,” which is the movement of dissolved or suspended material out of a horizon. Water entering the soil moves downward through the O and A horizons, and dissolves various soil materials (iron and aluminum oxides, clay particles, and organic matter) before carrying them to the E horizon, and then on to deeper levels. This process of leaching creates the E horizon’s white or grayish color. It is lighter in color than the layers above or below it.
- **B Horizon:** The B horizon is commonly called subsoil. The B horizon is where the soil material that has been leached out of the upper horizons accumulates. In highly weathered soils, the B horizon is commonly rich in clay, iron, or aluminum, and is often colored yellow or red by the iron oxides that are transported down from above. B horizons can be very thick and can be broken down into multiple layers within the horizon.
- **C Horizon:** Directly below the B horizon is the C horizon. It consists of the “raw” or “parent” material from which the soil was created. This includes partially weathered bedrock, materials that were deposited by the wind or water, volcanic material, organic matter, glacial deposits, and other materials.
- **R Horizon:** If unaltered bedrock is within a few feet of the surface, it is called the R horizon.



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Interesting Soil Facts

- Soil makes up the outermost layer of our planet.
- Topsoil is the most productive soil layer.
- Soil has varying amounts of organic matter (living and dead organisms), minerals, and nutrients.
- Five tons of topsoil spread over an acre is only as thick as a dime.
- Natural processes can take more than 500 years to form one inch of topsoil.
- Soil is formed from rocks and decaying plants and animals.
- An average soil sample is 45 percent minerals, 25 percent water, 25 percent air, and five percent organic matter
- Different-sized mineral particles, such as sand, silt, and clay, give soil its texture.
- Fungi and bacteria help break down organic matter in the soil.
- Plant roots and lichens break up rocks, which become part of new soil.
- Roots loosen the soil, allowing oxygen to penetrate. This benefits animals living in the soil.
- Roots hold soil together and help prevent erosion.
- Five to 10 tons of animal life can live in an acre of soil.
- Earthworms digest organic matter, recycle nutrients, and make the surface soil richer.

- Mice take seeds and other plant materials into underground burrows, where this material eventually decays and becomes part of the soil.
- Mice, moles, and shrews dig burrows, which help aerate the soil.

What is found in some potting soils?

- **Compost:** adds minerals and organic matter to the soil
- **Perlite:** allows for water flow through the soil, and helps prevent soil compaction
- **Peat moss:** semi-compactable and promotes water retention
- **Sand:** allows for water drainage
- **Vermiculite:** non-compactable and retains air in the soil

Soil Composition by Volume

