

From Bedrock to Soil

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What is soil?
- How do the features of soil affect the plants that grow in it?
- What is the effect of climate on soil?

National Science Education Standards

ES 1c, 1e, 1g, 1k

Where Does Soil Come From?

What do you think of when you think of soil? Most people think of dirt. However, soil is more than just dirt. **Soil** is a loose mixture of small mineral pieces, organic material, water, and air. All of these things help to make soil a good place for plants to grow.

Soil is made from weathered rocks. The rock that breaks down and forms a soil is called the soil's **parent rock**. Different parent rocks are made of different chemicals. Therefore, the soils that form from these rocks are also made of different chemicals.

Bedrock is the layer of rock beneath soil. Because the material in soil is easily moved, the bedrock may not be the same as the soil's parent rock. Soil that has been moved away from its parent rock is called *transported soil*.

In some cases, the bedrock is the same as the parent rock. In these cases, the soil remains in place above its parent rock. Soil that remains above its parent rock is called *residual soil*.

 **STUDY TIP**

Summarize in Pairs Read this section quietly to yourself. Then, talk about the material with a partner. Together, try to figure out the parts that you didn't understand.

 **READING CHECK**

- Explain** Why are different soils made of different chemicals?
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The soil is weathered from bedrock.
The bedrock is the same as the parent rock.

The soil is carried in from another place.
The bedrock is not the same as the parent rock.

TAKE A LOOK

- Identify** Fill in the blanks with the terms *residual soil* and *transported soil*.

SECTION 3 From Bedrock to Soil *continued*

What Are the Properties of Soil?

Some soils are great for growing plants. However, plants cannot grow in some other soils. Why is this? To better understand how plants can grow in soil, you must know about the properties of soil. These properties include soil texture, soil structure, and soil fertility.

SOIL TEXTURE

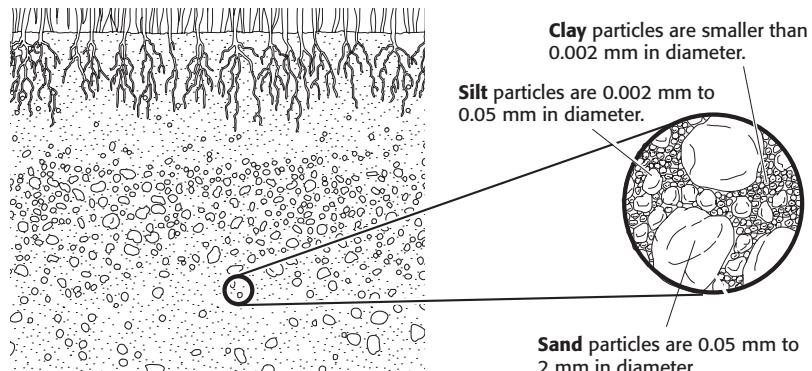
Soil is made of particles of different sizes. Some particles, such as sand, are fairly large. Other particles are so small that they cannot be seen without a microscope.

Soil texture describes the amounts of soil particles of different sizes that a soil contains.

Soil texture affects the consistency of soil and how easily water can move into the soil. *Soil consistency* describes how easily a soil can be broken up for farming. For example, soil that contains a lot of clay can be hard, which makes breaking up the soil difficult. Most plants grow best in soils that can be broken up easily.

 **READING CHECK**

3. Define What is soil texture?
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Soil contains particles of many different sizes. However, all of the particles are smaller than 2 mm in diameter.

Math Focus

4. Calculate How many times larger is the biggest silt particle than the biggest clay particle?
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SOIL STRUCTURE

The particles in soil are not always evenly mixed. Sometimes, particles of a certain kind of material will form clumps in the soil. **Soil structure** describes the arrangement of particles in a soil.

SECTION 3 From Bedrock to Soil *continued***SOIL FERTILITY**

Plants need to get nutrients from soil in order to grow. Some soils are rich in nutrients. Other soils may have few nutrients or may be unable to give the nutrients to plants. The ability of soil to hold nutrients and to supply nutrients to plants is called *soil fertility*.

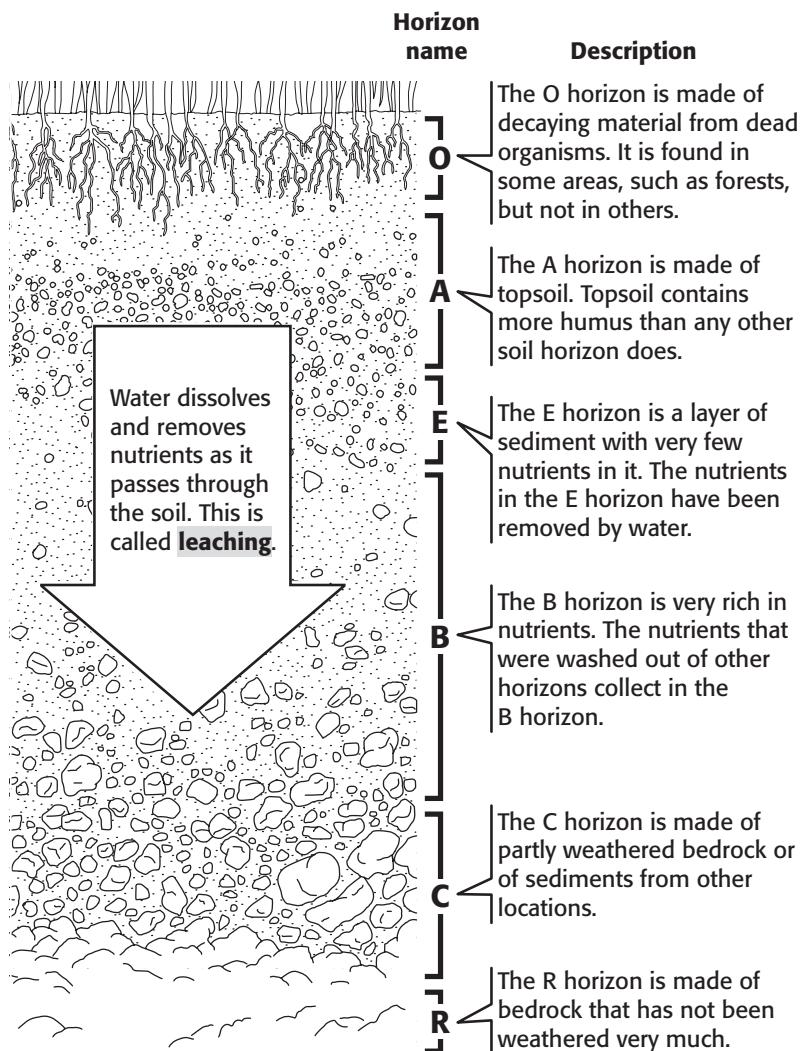
Some of the nutrients in a soil come from its parent rock. Other nutrients come from **humus**. Humus is the organic material that forms in soil from the remains of plants and animals. These remains are broken down into nutrients by decomposers, such as bacteria and fungi. It is humus that gives dark-colored soils their color.

 **READING CHECK**

- 5. Define** What is humus?
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What Are the Different Layers in Soil?

Most soil forms in layers. The layers are horizontal, so soil scientists call them *horizons*.

**STANDARDS CHECK**

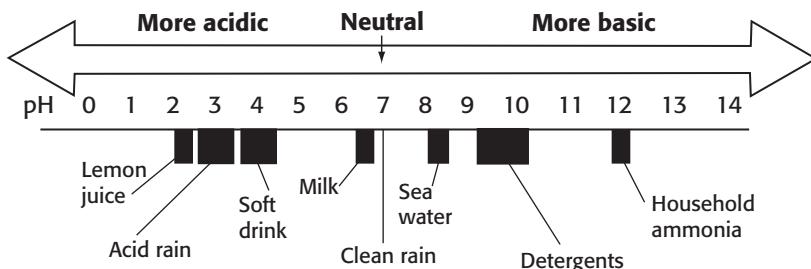
ES 1e Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers, with each having a different chemical composition and texture.

Word Help: **layer**
a separate or distinct portion of matter that has thickness

- 6. Identify** Which three soil horizons probably contain the most nutrients?
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SECTION 3 From Bedrock to Soil *continued***Why Is the pH of a Soil Important?**

The *pH scale* is used to measure how acidic or basic something is. The scale ranges from 0 to 14. A pH of 7 is a *neutral* pH. Soil that has a pH below 7 is *acidic*. Soil that has a pH above 7 is *basic*.

**TAKE A LOOK**

- 7.** Identify Which is more acidic, lemon juice or a soft drink?

READING CHECK

- 8.** List What are three things that affect soil pH?
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The pH of a soil affects how nutrients dissolve in the soil. Many plants are unable to get certain nutrients from soils that are very acidic or basic. The pH of a soil therefore has a strong effect on soil fertility. Most plants grow best in soil with a pH of 5.5 to 7.0. A few plants grow best in soils with higher or lower pH.

Soil pH is determined partly by the soil's parent rock. Soil pH is also affected by the acidity of rainwater, the use of fertilizers, and the amount of chemical weathering.

How Does Climate Affect Soil?

Soil types vary from place to place. The kinds of soils that develop in an area depend on its climate. The different features of these soils affect the number and kinds of organisms that can survive in different areas.

TROPICAL CLIMATES

Tropical rain forests receive a lot of direct sunlight and rain. Because of these factors, plants grow year-round. The heat and moisture also cause dead organisms to decay easily. This decay produces a lot of rich humus in the soil.

Even though a lot of humus can be produced in tropical rain forests, their soils are often poor in nutrients. One reason for this is that tropical rain forests have heavy rains. The heavy rains in this climate zone can leach nutrients from the topsoil. The rainwater carries the nutrients deep into the soil, where the plants can't reach them. In addition, the many plants that grow in tropical climates can use up the nutrients in the soil.

READING CHECK

- 9.** Explain Why are many tropical soils poor in nutrients?
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SECTION 3 From Bedrock to Soil *continued***DESERTS AND ARCTIC CLIMATES**

Deserts and arctic climates receive little rainfall. Therefore, the nutrients in the soil are not leached by rainwater. However, the small amount of rain in these climates makes weathering happen more slowly. As a result, soil forms slowly.

Few plants and animals live in deserts and arctic climates. Therefore, most soils there contain very little humus.

Sometimes, desert soils can become harmful, even to desert plants. Groundwater can seep into the desert soil. The groundwater often contains salt. When the water evaporates, the salt is left in the soil. The salt can build up in the soil and harm plants.

TEMPERATE FORESTS AND GRASSLANDS

Most of the continental United States has a temperate climate. Because the temperature changes often, mechanical weathering happens quickly in temperate climates. Thick layers of soil can build up.

Temperate areas get a medium amount of rain. The rain is enough to weather rock quickly, but it is not enough to leach many nutrients from the soil.

Many different kinds of plants can grow in temperate soils. Therefore, they contain a lot of humus. The large amount of humus makes the soils very rich in nutrients. The most fertile soils in the world are found in temperate climates. For example, the Midwestern part of the United States is often called the United States' "breadbasket" because of the many crops that grow there.

Critical Thinking

10. Apply Concepts As in deserts, groundwater in arctic climates can contain salt. Salt does not build up in arctic soils as quickly as in desert soils. What do you think is the reason for this?

Type of climate	Description of climate	Features of the soil in this climate
Tropical climates	warm temperatures a lot of rain many living things	
Deserts and arctic climates		has little humus poor in nutrients
	medium amount of rain temperature changes often	

TAKE A LOOK

11. Describe Fill in the chart to show the features of soils in different climates.

Section 3 Review

NSES ES 1c, 1e, 1g, 1k

SECTION VOCABULARY

bedrock the layer of rock beneath soil**humus** dark, organic material formed in soil from the decayed remains of plants and animals**leaching** the removal of substances that can be dissolved from rock, ore, or layers of soil due to the passing of water**parent rock** a rock formation that is the source of soil**soil** a loose mixture of rock fragments, organic material, water, and air that can support the growth of vegetation**soil structure** the arrangement of soil particles**soil texture** the soil quality that is based on the proportions of soil particles**1. Summarize** What are three properties of soil?

2. Compare What climate feature do arctic climates and desert climates share that makes their soils similar?

3. Analyze How can flowing water affect the fertility of soils?

4. Identify How does soil pH affect plant growth?

5. Explain What determines a soil's texture?

6. Identify Name three things that are found in soils.
