5.2 Soil

Reading Focus

Key Concepts

- What are the major components of soil?
- What are the most important factors in soil formation?
- How does soil vary with depth?
- What are three common types of soil?
- How do human activities affect the rate of soil erosion?

Vocabulary

- regolith
- soil
- soil horizon
- soil profile
- pedalfer
- pedocal
- laterite

Reading Strategy

Comparing and Contrasting Copy the table. After you read, compare the three types of soils by completing the table.

Soil Type	Where It's Found
Pedalfer	a. ?
Pedocal	b. ?
Laterite	c. ?

Soil, an important product of weathering, covers most land surfaces. Along with air and water, it is one of our most important resources. All life depends on a dozen or so elements that come from Earth's crust. Once weathering and other processes create soil, plants absorb the elements and make them available to animals, including humans.

Characteristics of Soil

Weathering produces a layer of rock and mineral fragments called **regolith,** which covers nearly all of Earth's land surface. **Soil is the part of the regolith that supports the growth of plants.** Three important characteristics of soil are its composition, texture, and structure.

Soil Composition

Soil has four major components: mineral matter, or broken-down rock; organic matter, or humus, which is the decayed remains of organisms; water; and air. The proportions of these components vary in different soils. Figure 10 shows that in a good-quality surface soil, mineral matter and organic matter make up half the total volume. The organic matter in soil, or humus, consists of the decayed remains of animal and plant life.The other half consists of pore spaces where air and water circulate.

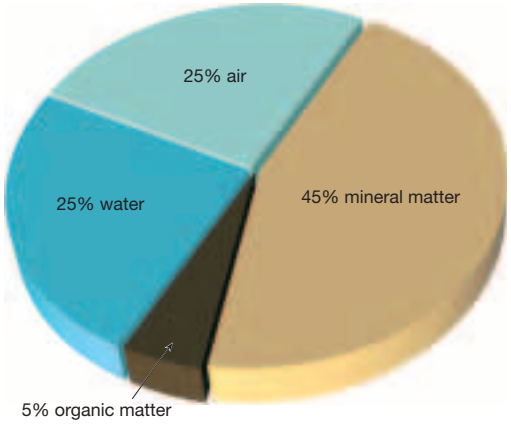


Figure 10 Composition by Volume of Good-Quality Soil
Using Graphs *What percentage of this soil consists of water and mineral matter?*

Section 5.2

1 FOCUS

Section Objectives

5.4 **Recognize** the major components of soil and **list** the most important factors in soil formation.
5.5 **Explain** how soil varies with depth.
5.6 **Compare and contrast** the three common types of soil.
5.7 **Demonstrate** how human activities affect the rate of soil erosion.

Reading Focus

Build Vocabulary L2

Paraphrase As you teach the text that pertains to a particular vocabulary word, have a volunteer read aloud the definition of the vocabulary word. Finish teaching the passage, then have students write the definition in their own words.

Reading Strategy L2

a. temperate, forested areas that receive more than 63 cm of rain each year
b. drier areas that have grasses and brush vegetation
c. hot, wet tropical areas

Answer to . . .

Figure 10 *70 percent*

2 INSTRUCT

Characteristics of Soil

Use Visuals L1

Figure 11 Give students several sample soil textures, and have them use the diagram to identify the corresponding soil type. For example, ask: **What type of soil consists of 60 percent clay, 20 percent sand, and 20 percent silt?** *(clay)*
Verbal

Teacher Demo

Water Absorption in Different Soils L2

Purpose Students will observe the ability of different soils to absorb water.

Materials sand, silt, clay, water, 3 plastic cups, nail, 250-mL beaker, paper towel

Procedure Use the nail to puncture a small hole in the bottom of each cup. Fill one cup halfway with sand. Fill another cup with silt and a third cup with clay. Place the cups on a paper towel. Ask students to predict which soil sample will absorb the most water. Then pour about 50 mL of water into each cup.

Expected Outcomes Students will correctly predict that the silt absorbs the most water. Water rapidly drains out of the sand and does not easily penetrate the clay.
Visual

Q&A

Q *I've seen photos of footprints left on the lunar surface by astronauts. Does this mean the moon has soil?*

A Not exactly. The moon has no atmosphere, water, or biological activity. So, the weathering processes that occur on Earth don't take place on the moon. However, the lunar surface is covered by a layer of gray debris called lunar regolith, which was ejected by meteorite impacts over a few billion years. Changes occur so slowly on the lunar surface that the footprints left by the *Apollo* astronauts will probably look fresh for millions of years.

The percentage of organic matter in soil varies greatly. Certain bog soils are composed almost entirely of organic matter. Desert soils may contain only a tiny amount. In most soils, organic matter or humus is an essential component. It is an important source of plant nutrients and increases the soil's ability to retain water. Poor soils can be enriched with the addition of humus.

The water and air components of soil are also vital for plant growth. Soil water provides the moisture needed for chemical reactions that sustain life. Soil water provides nutrients in a form that plants can use. Air is the source of the carbon dioxide plants use to produce sugar during photosynthesis.

Soil Texture Most soils contain particles of different sizes. Soil texture refers to the proportions of different particle sizes. To classify soil texture, the U.S. Department of Agriculture has established categories based on the percentages of clay, silt, and sand in soil. The diagram in Figure 11 shows how the percentages differ for each category. For example, point A, near the left-center part of the diagram, represents a soil composed of 40 percent clay, 10 percent silt, and 50 percent sand. Such a soil is called a sandy clay. In soils called loam, which occupy the central part of the diagram, neither clay, silt, nor sand is dominant.

Texture strongly influences a soil's ability to support plant life. Sandy soils may drain and dry out too quickly, while clay-rich soils drain very slowly. Plant roots often have difficulty penetrating soils that contain a high percentage of clay and silt. Loam soils are usually best for plant growth. They retain water better and store more nutrients than do soils composed mainly of clay or sand.

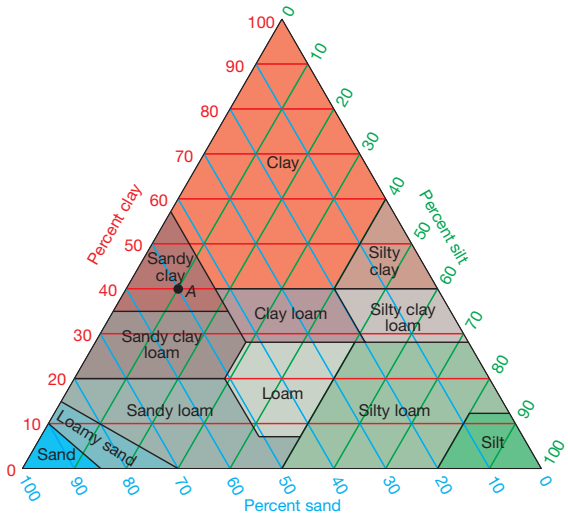


Figure 11 Soil-Texture Diagram The texture of any soil can be represented by a point on this diagram.
Interpreting Diagrams ***What type of soil consists of 10 percent clay, 60 percent silt, and 30 percent sand?***

Customize for Inclusion Students

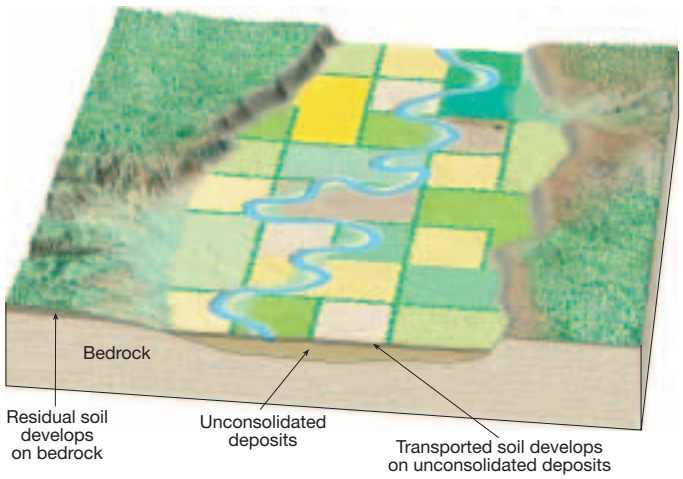
Learning Disabled Visuals often simplify and clarify key concepts. Take a few moments to ensure that all students correctly interpret photographs, tables, graphs, and diagrams. For example, you can have students plot the data in Figure 10 on p. 133 in a bar graph to assess their understanding of soil composition. You can make copies of Figure 11 on p. 134 and encourage students to draw intersecting lines on the soil-texture diagram, to identify soil type. If students still have difficulty interpreting Figure 11, use transparency 3D and pick a point on the diagram to represent a soil sample, then trace a path along the relevant lines to help students identify the percentages of clay, silt, and sand in the sample.

Soil Structure Soil particles usually form clumps that give soils a particular structure. Soil structure determines how easily a soil can be cultivated and how susceptible it is to erosion. Soil structure also affects the ease with which water can penetrate the soil. This, in turn, influences the movement of nutrients to plant roots.

Soil Formation

Soil forms through the complex interaction of several factors. **The most important factors in soil formation are parent material, time, climate, organisms, and slope.** Although these factors all interact, we'll examine them separately.

Figure 12 Parent Materials and Soils



Parent Material The source of the mineral matter in soil is known as the parent material. Notice in Figure 12 that parent material may be either bedrock or unconsolidated deposits, such as those in a river valley. The soil that forms on bedrock is called residual soil. The soil that forms on unconsolidated deposits is called transported soil. Its parent material was moved from another location by gravity, water, wind, or ice.

Reading Checkpoint

What is the difference between residual soil and transported soil?

Go Online NSTA SCILINKS

For: Links on soil
Visit: www.SciLinks.org
Web Code: cjn-2052

Soil Formation

Address Misconceptions L2

Show students a sample of soil. Ask them if they believe the soil has always existed in its present form. If they answer yes, students may have misconceptions about the formation of soil. Have them read the key concept sentence on p. 135. Point out that soil evolves over time. In addition, a mature soil may change in response to changes in climate, vegetation, and other factors. **Verbal**

Go Online NSTA SCILINKS

Download a worksheet on soil for students to complete, and find additional teacher support from NSTA SciLinks.

Answer to . . .

Figure 11 *silty loam*

Reading Checkpoint *Residual soil forms on bedrock. Transported soil forms on unconsolidated deposits.*

Integrate Biology

L2

Organic Matter The chief function of plants and animals is to furnish organic matter to soil. Certain bog soils are composed entirely of organic matter, while desert soils may contain only a tiny percentage of organic matter. Although the quality of organic matter varies substantially among soils, it is the rare soil that completely lacks it. After students have read the text on p. 136, ask them to explain why the interactions between organisms and soil can be thought of as a continuous cycle. *(Organisms die and decay, contributing to soil fertility. Fertile soils nourish organisms, which eventually die and decay, continuing the cycle.)*
Logical

Build Science Skills

L2

Observing Give small groups of students a hand lens and a different soil sample taken from your area. Try to obtain the samples from widely divergent areas, such as a garden, playground, and stream bank. Have students examine the samples and write reports describing the soils. Students should mention soil color, soil texture, and other distinguishing characteristics, such as particle size and the presence of organic matter.
Kinesthetic, Visual

The nature of the parent material influences soils in two ways. First, it affects the rate of weathering and the rate of soil formation. Because unconsolidated deposits are already partly weathered, they provide more surface area for chemical weathering. Therefore, transported soil usually develops more rapidly than residual soil develops. Second, the chemical makeup of the parent material affects the soil's fertility. Fertility influences the types of plants the soil can support.

Time The longer a soil has been forming, the thicker it becomes. The parent material largely determines the characteristics of young soils. As weathering continues, however, the influence of the parent material can be overshadowed by the other factors, especially climate.

Climate Climate has the greatest effect on soil formation. Variations in temperature and precipitation influence the rate, depth, and type of weathering. For example, a hot, wet climate may produce a thick layer of chemically weathered soil. In the same amount of time, a cold, dry climate might produce only a thin layer of mechanically weathered debris. The amount of precipitation also influences soil fertility by affecting the rate at which nutrients are removed from the soil.

Organisms The types of organisms and how many there are in a soil have a major impact on its physical and chemical properties. In fact, scientists name some soils—such as prairie soil, forest soil, and tundra soil—based on the soils' natural vegetation.

Plants are the main source of organic matter in soil. Animals and microorganisms also contribute. Microorganisms, including fungi, bacteria, and single-celled protozoans, play an active role in decomposing dead plants and animals. Because organic matter releases nutrients when it decays, it contributes to soil fertility.

Burrowing animals mix the mineral and organic matter in soil. Earthworms, for example, mix soil as they burrow through it and feed on the organic matter it contains. The holes made by burrowing animals also help water and air to penetrate into soil.

Some bacteria also aid soil fertility. In the nitrogen cycle, these bacteria convert nitrogen gas into nitrogen compounds that plants can use. Organisms require nitrogen in order to make amino acids, the building blocks of proteins. Nitrogen gas is common in the atmosphere. But most living things cannot use nitrogen gas in their cells.

Look at Figure 13 to follow the steps in the nitrogen cycle. Certain types of bacteria take up nitrogen from the atmosphere and produce ammonia. Ammonia provides nitrogen in a form plants can use. These nitrogen-fixing bacteria live both in soil and in the roots of legumes. (Legumes are plants such as peanuts, beans, and clover that have nitrogen-fixing bacteria in nodules on their roots.) But most ammonia is

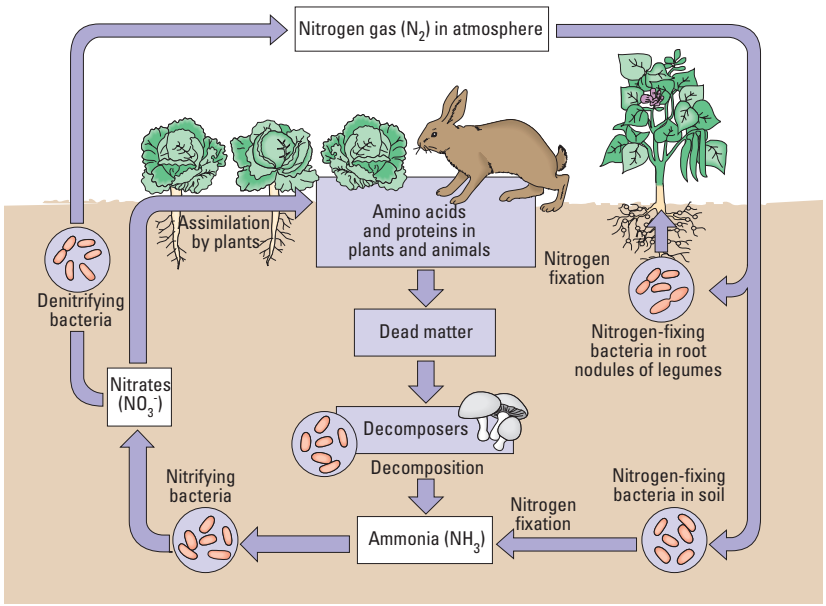


Figure 13 The Nitrogen Cycle As part of the nitrogen cycle, certain bacteria in soil and plant roots absorb nitrogen gas and produce compounds containing nitrogen that plants can use. **Predicting** ***How would planting legumes in a field affect the soil's fertility?***

consumed by other bacteria, called nitrifying bacteria. Nitrifying bacteria produce compounds called nitrites and nitrates, which are made up of nitrogen and oxygen. Nitrate is the most common source of nitrogen for plants.

Another type of soil bacteria, called denitrifying bacteria, continues the cycle. These bacteria break down nitrates and release nitrogen gas into the atmosphere.

Slope The slope of the land can vary greatly over short distances. Such variations can result in very different soil types. Many of the differences are related to the amount of erosion and the water content of the soil.

On steep slopes, erosion is accelerated. Little water can soak in, so the soil generally holds too little moisture for vigorous plant growth. As a result, soils are usually thin or nonexistent on steep slopes. In contrast, flat areas have little erosion and poor drainage. The waterlogged soils that form in flat areas are typically thick and dark. The dark color results from large amounts of organic matter.

The direction a slope faces also affects soil formation. In the temperate zone of the Northern Hemisphere, south-facing slopes receive much more sunlight than do north-facing slopes. Consequently, soils on south-facing slopes are usually warmer and drier.

Reading Checkpoint *Explain how the slope of the land affects soil thickness.*

Build Science Skills

L2

Activity

Measuring On a sunny day, take students outside and have them measure the temperatures of soils in south-facing slopes and north-facing slopes. If necessary, take along a small spade to loosen the soils. You may wish to insert a thermometer into the soils yourself to avoid breakage accidents. Have students record the temperatures. Students should find that soils in south-facing slopes are warmer than soils in north-facing slopes. If it is not feasible to conduct this activity outside, have students measure the temperatures of two piles of soils. One pile should be placed under a lamp to represent a south-facing slope. The other pile should be placed in the shade to represent a north-facing slope. **Kinesthetic, Visual**

Facts and Figures

When Earth is viewed as a system, soil is referred to as an interface, or common boundary where different parts of a system interact. This is an appropriate designation because soil forms where the solid Earth, the atmosphere, the hydrosphere, and the biosphere meet. Soil is a material that develops in response to complex environmental interactions among different parts of the Earth system. Over time, soil gradually evolves to a state of equilibrium or balance with the environment. Soil is dynamic and sensitive to almost every aspect of its environment. When environmental changes occur, such as climate, vegetative cover, or animal activity, the soil responds. Any such change produces a gradual alteration of soil characteristics until a new balance is reached.

Answer to . . .

Reading Checkpoint *Steep slopes have more erosion, so their soil is usually thin or nonexistent. Flat areas have little erosion, so their soils are typically thick.*

The Soil Profile

Use Visuals

L1

Figure 14 This diagram divides a soil profile into three general horizons. Tell students that soil scientists often use a more in-depth approach—they may divide a soil profile into five or more horizons. For example, a typical O horizon is made up of fresh and decomposing organic matter. The E horizon is the zone of leaching, where inorganic soil components are dissolved and carried into lower zones. Based on Figure 14 and the related text on p. 138, have students infer the location of the O horizon and the E horizon. *(The O horizon is the uppermost layer of soil. The E horizon is located between the A horizon and the B horizon.)*

Visual

Go Online active art

For: Soil Horizons activity
Visit: PHSchool.com
Web Code: czp-2051
Students interact with soil horizons illustration online.

Go Online active art

For: Soil Layers activity
Visit: PHSchool.com
Web Code: czp-2051

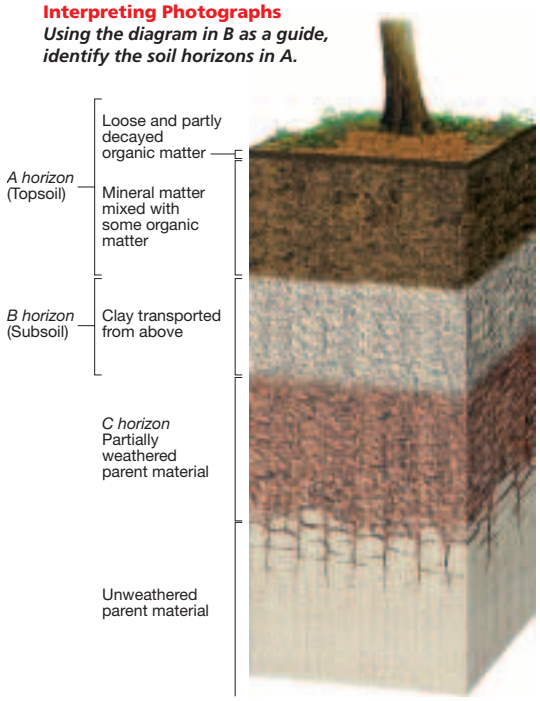
The Soil Profile

The processes that form soil operate from the surface downward. **Soil varies in composition, texture, structure, and color at different depths.** These variations divide the soil into zones known as **soil horizons.** A vertical section through all of the soil horizons is called a **soil profile.** In some soil profiles, the soil horizons blend gradually from one to another. In others, like the one shown in Figure 14A, the soil horizons are quite distinct. Mature soils usually have three distinct soil horizons, which are identified in Figure 14B. From the surface downward, these horizons are called the A, B, and C horizons.

A Horizon

The A horizon is commonly known as topsoil. Its upper part consists mostly of organic matter, including loose leaves and partly decomposed plant structures. It is teeming with insects, fungi, and microorganisms. The lower part of the A horizon is a mixture of mineral matter and organic matter.

Figure 14 Soil Profiles A The A, B, and C horizons have different characteristics. **B** Three soil horizons are visible in this soil.
Interpreting Photographs
Using the diagram in B as a guide, identify the soil horizons in A.



A

B Horizon

The B horizon, or subsoil, contains fine clay particles washed out of the A horizon by water that filters through pore spaces. In some soils, the clay that accumulates in the B horizon forms a compact, impenetrable layer called hardpan. The B horizon is the lower limit of most plant roots and burrowing animals.

C Horizon

Between the B horizon and the unaltered parent material is the C horizon, which contains partially weathered parent material. While the A and B horizons barely resemble the parent material, the C horizon does.

B

Facts and Figures

In a detailed soil profile, the O horizon consists largely of organic material. Its upper portion is primarily plant litter and other recognizable organic debris. Its lower portion is made of humus. Organisms are plentiful in this horizon. The A horizon also is a zone of high biological activity and high levels of humus—up to 30 percent in some instances. Below the A horizon is the E horizon, a light-colored layer that contains little organic material. As water percolates downward through this zone, finer particles are carried away in a process known as eluviation. The moving water also dissolves soluble inorganic soil components and carries them to lower zones, a process known as leaching. Much of the material removed by eluviation is deposited in the B horizon, which is also known as the zone of accumulation. In contrast to the C horizon, which is made up of partially altered parent rock, the O, A, E, and B horizons together constitute solum, or true soil.

Soil Types

Recall that climate is the most important factor in soil formation. Climate also has a major effect on the type of soil that forms. **Three common types of soil are pedalfer, pedocal, and laterite.**

Pedalfer

Pedalfers usually forms in temperate areas that receive more than 63 cm of rain each year. This soil type is present in much of the eastern half of the United States, most often in forested areas. The B horizon in pedalfers contains large amounts of iron oxide and aluminum-rich clays, giving it a brown to red-brown color.

Pedocal

Pedocals are found in the drier western United States in areas that have grasses and brush vegetation. Because chemical weathering is slower in dry climates, pedocals generally contains less clay than pedalfers. Pedocals contain abundant calcite, or calcium carbonate, and are typically a light gray-brown.

Figure 15 The Temple at Angkor Wat, Cambodia This temple was constructed of laterite bricks between 1113 and 1150.

Laterite

Laterites form in hot, wet tropical areas. Chemical weathering is intense under such conditions. So laterites are usually deeper than soils that develop over a similar period in temperate areas. The large quantity of water that filters through these soils removes most of the calcite and silica. Iron oxide and aluminum oxide are left behind. The iron oxide gives laterite a distinctive orange or red color.

When dried, laterite becomes very hard and practically waterproof. For centuries, people in portions of South and Southeast Asia have made bricks by digging up laterite, shaping it, and allowing it to harden in the sun. Ancient structures built of laterite bricks, such as the one shown in Figure 15, are well preserved even today.

Soil Types

Build Reading Literacy

L1

Refer to **p. 124D,** which provides the guidelines for summarizing.

Summarize Ask students to read Soil Types on pp. 139–140. Tell them to carefully review the passage and identify main ideas. Clues to main ideas include headings, key concept statements, and vocabulary terms. List the main ideas on the board. Using the list as a guide, have students write brief summaries of the passage. Encourage students to repeat the procedure for the remainder of the section.
Verbal

Use Community Resources

L2

Contact a representative of your county extension agency or the local branch of the state soil conservation district. Ask the representative to discuss your area's soil types with students. He or she can bring in soil-testing kits and discuss ways to reduce soil erosion.
Verbal

Answer to . . .

Figure 14 *The dark horizon at the top is the A horizon. The lighter horizon below it is the B horizon. The horizon below that is the C horizon.*

Integrate Biology

L2

Erosion and Plant Roots The clearing of a rain forest not only removes the supply of plant nutrients from laterite soils, it also leads to accelerated erosion. When vegetation is present, its roots anchor the soil while its leaves and branches provide a canopy that protects the ground from the full force of frequent heavy rains. Removal of the vegetation also exposes the ground to strong direct sunlight. When baked by the sun, laterites can harden and become nearly impenetrable to water and crop roots. Ask students to summarize how the clearing of a rain forest affects laterite soils. *(The clearing of a rain forest removes the supply of nutrients from the soil, accelerates soil erosion, and exposes laterites to strong direct sunlight.)*
Verbal

Soil Erosion

Build Science Skills

L2

Activity

Observing Take students outside for the following activity. Place a large pile of soil in a plastic container. Obtain a spray bottle with an adjustable tip. Allow students to take turns using the bottle to observe how water erodes soil. Encourage students to experiment with different spray settings to simulate different types of rainfall. A fine mist, for example, would represent a light rain and cause little erosion. A full spray would represent a heavy rainfall and cause heavy erosion.
Visual, Kinesthetic

Figure 16 Clearing a Tropical Rain Forest in Borneo The laterite soil cannot support agriculture for more than a few years.

Plants that die in a tropical rain forest decompose rapidly because bacterial activity is high in hot and wet climates. As a result, laterite contains almost no organic matter. The roots of living rain forest plants quickly absorb the nutrients released during decomposition. So, even though the vegetation may be dense, the soil itself contains few available nutrients. Most of the nutrients in a tropical rain forest are present in the plants themselves.

Today, large areas of tropical rain forest are being cleared for timber and to provide land for agriculture, as shown in Figure 16. However, laterite is one of the poorest soils for agriculture. Because laterite contains little organic matter and few nutrients, it cannot nourish crops. The nutrients it does have are soon washed out by the plentiful rainwater that filters through the soil. In only a few years, the soil in a freshly cleared area may be completely useless for growing crops. Without trees or crop plants to anchor the soil and shield the ground from the full force of heavy rains, the soil erodes quickly.

Reading Checkpoint

Why is the soil in a tropical rain forest poorly suited for agriculture?

Figure 17 Soil Erosion by Raindrops A raindrop can splash soil particles more than a meter away from where it strikes the soil.

Soil Erosion

Soils are just a tiny fraction of all Earth materials, yet they are a vital resource. Because soils are necessary for the growth of rooted plants, they are the foundation of the human life-support system. However, soils are among our most abused resources. The loss of fertile topsoil is a growing problem as human activities disturb more of Earth's surface.

How Water Erodes Soil Soil erosion is a natural part of the constant recycling of Earth materials known as the rock cycle. Water, wind, and other agents move soil from one place to another. Every time it rains, raindrops strike the soil surface with surprising force. As Figure 17 shows, each drop acts like a tiny bomb, blasting soil particles off the surface. Water flowing across the surface then carries away the dislodged particles. Because thin sheets of water move the soil particles, this process is called sheet erosion.

140 Chapter 5

After flowing as a thin sheet for a short distance, the water forms tiny streams called rills. As more water enters the rills, they erode the soil further, creating trenches known as gullies, like those shown in Figure 18. Although most dislodged soil particles do not move far during each rainfall, large quantities eventually make their way downslope to a stream. The stream transports these soil particles, which are now called sediment, and eventually deposits them.

Figure 18 Gullies The unprotected soil in this field in southern Colombia is deeply eroded.

Rates of Erosion In the past, soil eroded more slowly than it does today because more land was covered by trees, grasses, and other plants. **However, human activities that remove natural vegetation, such as farming, logging, and construction, have greatly accelerated erosion.** Without plants, soil is more easily carried away by wind and water.

Scientists can estimate the rate of erosion due to water by measuring the amount of sediment in rivers. These estimates indicate that before humans appeared, rivers carried about 9 trillion kg of sediment to the oceans each year. In contrast, the amount of sediment currently transported to the sea by rivers is about 24 trillion kg per year.

Wind generally erodes soil much more slowly than water does. During a prolonged drought, however, strong winds can remove large quantities of soil from unprotected fields. That's exactly what happened during the 1930s in the part of the Great Plains that came to be known as the Dust Bowl.

The rate of soil erosion depends on soil characteristics and on factors such as climate, slope, and type of vegetation. In many regions, including about one-third of the world's croplands, soil is eroding faster than it is being formed. This results in lower productivity, poorer crop quality, and a threatened world food supply.

Reading Checkpoint *How do human activities affect rates of erosion?*

Use Visuals

L1

Figure 18 Ask: **What caused the gullies to form?** *(water erosion)* **Based on what you have read about clearing tropical rain forests, what can be done to the Colombian field to reduce soil erosion?** *(plant vegetation)*
Visual

Answer to . . .

Reading Checkpoint *The soil is usually laterite, which contains little organic matter. Its few nutrients are quickly washed out by the plentiful rainwater.*

Reading Checkpoint *Human activities have greatly accelerated erosion.*

Integrate Social Studies L2

The Dust Bowl In the 1930s, the Great Plains experienced a prolonged drought which, combined with the agricultural practices of that era, led to widespread soil erosion. Numerous families were displaced from their farms and emigrated west. Have students research and report on one aspect of the Dust Bowl. For example, they might discuss how much soil was lost or how farmers responded to the crisis by implementing new agricultural techniques.
Verbal

3 ASSESS

Evaluate Understanding L2

Have students sketch and label a soil profile showing A, B, and C horizons, along with parent rock.

Reteach L1

Have students make tables summarizing the three soil types discussed in this section. Tables should include characteristics of each soil type and the climate in which it is found.

Connecting Concepts

A hot, wet climate favors chemical weathering, which hastens soil formation. Therefore, the soil that forms in this climate is usually thick. There is little chemical weathering in a cold, dry climate, so soil forms slowly and is usually thin, consisting mostly of mechanically weathered debris.

Sediment Deposition Another problem caused by excessive soil erosion is the deposition of sediment. Rivers that accumulate sediment must be dredged to remain open for shipping. As sediment settles in reservoirs, they become less useful for storing water, controlling floods, and generating electricity.

Some sediments are contaminated with agricultural pesticides. When these chemicals enter a river or lake, they endanger organisms that live in or use the water, including humans. Sediments also contain soil nutrients, which may come from natural processes and from added fertilizers. Excessive nutrient levels in lakes stimulate the growth of algae and plants. This can accelerate a process that eventually leads to the early death of the lake.

Controlling Erosion Although we cannot completely eliminate soil erosion, we can significantly slow it by using soil conservation measures. You have seen how a misunderstanding of the composition of rain forest soil has led to the destruction of millions of acres leaving only severely leached, unproductive land. Conservation measures include steps taken to preserve environments and protect the land. These measures include planting rows of trees called windbreaks, terracing hillsides, plowing along the contours of hills, and rotating crops. Preserving fertile soil is essential to feeding the world's rapidly growing population.

Section 5.2 Assessment

Reviewing Concepts

1. List the four major components of soil.
2. How does climate affect soil formation?
3. Describe the contents of the three soil horizons found in most mature soils.
4. What climates are usually associated with pedalfer, pedocal, and laterite?
5. How can an activity such as road construction affect the rate of soil erosion?

Critical Thinking

6. **Relating Cause and Effect** A gardener notices that rain showers usually produce long-lasting puddles on the soil in her garden. Is it more likely that the soil contains too much sand or too much clay? Explain.
7. **Predicting** Which activity would cause more sediment to be deposited in a river that flows through a gently sloping valley—cultivating the valley or cultivating the hills that surround the valley? Explain.

Connecting Concepts

Weathering and Soil Using what you learned about chemical weathering in Section 5.1, explain why the soils formed in a hot, wet climate and a cold, dry climate are different.

Section 5.2 Assessment

1. mineral matter; organic matter, or humus; water; air
2. Climate influences the rate, depth, and type of weathering, the rate at which nutrients are removed from the soil, and the types of organisms that live on and in the soil.
3. The A horizon, or topsoil, contains a mixture of mineral matter and organic matter, as well as many insects, fungi, and microorganisms. The B horizon, or subsoil, contains fine clay particles washed out of the A horizon. The C horizon contains partially weathered parent material.
4. pedalfer—temperate climate with more than 63 cm of rain per year; pedocal—dry climate; laterite—hot, wet tropical climate
5. Such activities may accelerate erosion by removing natural vegetation, allowing soil to be carried away more easily by wind and water.
6. too much clay, because sandy soils drain quickly, while clay-rich soils drain slowly
7. cultivating the hills that surround the valley, because erosion is accelerated on slopes, and erosion leads to sediment deposition