CHAPTER 10  Weathering and Soil Formation
SECTION 1  Weathering

BEFORE YOU READ

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

• What is weathering?
• What causes mechanical weathering?
• What causes chemical weathering?

What Is Weathering?
How do large rocks turn into smaller rocks? Weathering is the process in which rocks break down. There are two main kinds of weathering: mechanical weathering and chemical weathering.

What Is Mechanical Weathering?
Mechanical weathering happens when rocks are broken into pieces by physical means. There are many agents, or causes, of mechanical weathering. 

ICE

Ice is one agent of mechanical weathering. Cycles of freezing and thawing can cause ice wedging, which can break rock into pieces.

The cycle of ice wedging starts when water seeps into cracks in a rock. When the water freezes, it expands. The ice pushes against the cracks. This causes the cracks to widen. When the ice melts, the water seeps further into the cracks. As the cycle repeats, the cracks get bigger. Finally, the rock breaks apart.

Critical Thinking
2. Infer Would ice wedging happen if water did not expand as it froze? Explain your answer.
WIND, WATER, AND GRAVITY

As you scrape a large block of chalk against a board, tiny pieces of the chalk rub off on the board. The large piece of chalk wears down and becomes smaller. The same process happens with rocks. Abrasion is a kind of mechanical weathering that happens when rocks are worn away by contact with other rocks. Abrasion happens whenever one rock hits another. Water, wind, and gravity can cause abrasion.

Water can cause abrasion by moving rocks and making them hit each other. The rocks in this river are rounded because of abrasion.

Wind can cause abrasion when it blows sand against rocks. This rock has been shaped by blowing sand.

Gravity can cause abrasion by making rocks rub against each other as they slide downhill. As the rocks grind against each other, they are broken into smaller pieces.

PLANT GROWTH

Have you ever seen sidewalks and streets that are cracked because of tree roots? Plant roots may grow into cracks in rock. As the plants grow, their roots get larger. The growing roots can make the cracks in the rock wider. In time, an entire rock can split apart. Roots don’t grow fast, but they are very powerful!
ANIMALS

Did you know that earthworms cause a lot of weathering? They tunnel through the soil and move pieces of rock around. This motion breaks some of the rocks into smaller pieces. It also exposes more rock surfaces to other agents of weathering.

Any animal that burrows in the soil causes mechanical weathering. Ants, worms, mice, coyotes, and rabbits are just a few of the animals that can cause weathering. The mixing and digging that animals do can also cause chemical weathering, another kind of weathering.

What Is Chemical Weathering?

In addition to physical weathering, rocks can be broken down by chemical means. Chemical weathering happens when rocks break down because of chemical reactions.

Water, acids, and air are all agents of chemical weathering. They react with the chemicals in the rock. The reactions can break the bonds in the minerals that make up the rock. When the bonds in the minerals are broken, the rock can be worn away. ✓

WATER

If you drop a sugar cube into a glass of water, the sugar cube will dissolve after a few minutes. In a similar way, water can dissolve some of the chemicals that make up rocks. Even very hard rocks, such as granite, can be broken down by water. However, this process may take thousands of years or more.

Chemical Weathering in Granite

- Granite is made of many different minerals. Rain and air can contain chemicals that react with the minerals.
- Eventually, many of the minerals in the granite will be broken down. The small pieces of minerals that are left are called sediment.
- The chemicals in rain and air can break down the bonds in the minerals. Rain can dissolve some of the minerals in the rock and wash them away.

STANDARDS CHECK

ES 1k Living organisms have played many roles in the Earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

Word Help: role
a part or function; purpose

Word Help: affect
to change; to act upon

4. Describe How can earthworms cause weathering?

5. List What are three agents of chemical weathering?

6. Infer What do you think is the reason it takes a very long time for granite to break down?
ACID PRECIPITATION

Precipitation, such as rain and snow, always contains a little bit of acid. However, sometimes precipitation contains more acid than normal. Rain, sleet, or snow that contains more acid than normal is called acid precipitation.

Acid precipitation forms when small amounts of certain gases mix with water in the atmosphere. The gases come from natural sources, such as active volcanoes. They are also produced when people burn fossil fuels, such as coal and oil.

The acids in the atmosphere fall back to the ground in rain and snow. Acids can dissolve materials faster than plain water can. Therefore, acid precipitation can cause very rapid weathering of rock.

ACIDS IN GROUNDWATER

In some places, water flows through rock underground. This water, called groundwater, may contain weak acids. When the groundwater touches some kinds of rock, a chemical reaction happens. The chemical reaction dissolves the rock. Over a long period of time, huge caves can form where rock has been dissolved.

TAKE A LOOK

8. Explain Caves like the one in the picture are not found everywhere. What do you think controls where a cave forms?

This cave formed when acids in groundwater dissolved the rock.
ACIDS FROM LIVING THINGS

All living things make weak acids in their bodies. When the living things touch rock, some of these acids are transferred to the surface of the rock.

The acids react with chemicals in the rock and weaken it. The different kinds of mechanical weathering can more easily remove rock in these weakened areas.

The rock may also crack in the weakened areas. Even the smallest crack can expose more of the rock to both mechanical weathering and chemical weathering.

AIR

Have you ever seen a rusted car or building? Rusty metal is an example of chemical weathering. Metal reacted with something to produce rust. What did the metal react with? In most cases, the answer is air.

The oxygen in the air can react with many metals. These reactions are a kind of chemical weathering called oxidation. Rust is a common example of oxidation. Rocks can rust if they have a lot of iron in them.

Many people think that rust forms only when metal gets wet. In fact, oxidation can happen even without any water around. However, when water is present, oxidation happens much more quickly.

Oxidation can cause rocks to weaken. Oxidation changes the metals in rocks into different chemicals. These chemicals can be broken down more easily than the metals that were there before.

<table>
<thead>
<tr>
<th>Factor</th>
<th>How does it cause chemical weathering?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td></td>
</tr>
<tr>
<td>Acid precipitation</td>
<td></td>
</tr>
<tr>
<td>Acids in groundwater</td>
<td></td>
</tr>
<tr>
<td>Acids from living things</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td></td>
</tr>
</tbody>
</table>

9. Explain How can acids from living things cause weathering?

TAKE A LOOK

10. Describe Fill in the blank spaces in the table to describe how different factors cause chemical weathering.
Section 1 Review

SECTION VOCABULARY

**abrasion** the grinding and wearing away of rock surfaces through the mechanical action of other rock or sand particles

**acid precipitation** rain, sleet, or snow that contains a high concentration of acids

**chemical weathering** the process by which rocks break down as a result of chemical reactions

**mechanical weathering** the process by which rocks break down into smaller pieces by physical means

**weathering** the natural process by which atmospheric and environmental agents, such as wind, rain, and temperature changes, disintegrate and decompose rocks

1. **List** What are three things that can cause abrasion?

2. **Explain** Fill in the spaces to show the steps in the cycle of ice wedging.

   - Water seeps into cracks in the rock.
   - The cracks expand.

3. **Identify** How can acids cause chemical weathering?

4. **Compare** How is mechanical weathering caused by ice wedging similar to mechanical weathering caused by plant roots?
What Is Differential Weathering?

Hard rocks, such as granite, weather more slowly than softer rocks, such as limestone. **Differential weathering** happens when softer rock weathers away and leaves harder, more resistant rock behind. The figures below show an example of how differential weathering can shape the landscape.

1. **Before you read**
   - What is differential weathering?
   - What factors affect how fast rock weathers?

2. **What is differential weathering?**
   - Hard rocks, such as granite, weather more slowly than softer rocks, such as limestone. Differential weathering happens when softer rock weathers away and leaves harder, more resistant rock behind.

3. **Study tip**
   - Apply concepts: After you read this section, think about how the different factors that control weathering can affect objects that you see every day. Discuss your ideas in a small group.

4. **Say it**
   - Discuss: In a small group, share your ideas about how some different landscape features formed because of differential weathering.

5. **Take a look**
   - 1. Infer: Imagine that the rock on the outside of the mountain was much harder than the cooled magma. How might Devils Tower look today? Explain your answer.
How Does a Rock’s Surface Area Affect Weathering?

Most chemical weathering takes place only on the outer surface of a rock. Therefore, rocks with a lot of surface area weather faster than rocks with little surface area. However, if a rock has a large volume as well as a large surface area, it takes longer for the rock to wear down. The figure below shows how the surface area and volume of a rock affect how fast it wears down.

Imagine a rock in the shape of a cube. Each side of the rock is 4 m long. The volume of the cube is $4 \times 4 \times 4$ m = 64 m$^3$. Each face of the rock has an area of $4 \times 4$ m = 16 m$^2$. Because there are six faces on the rock, it has a surface area of $6 \times 16$ m$^2 = ____$ m$^2$.

Now imagine eight smaller rocks that are shaped like cubes. Each small rock’s side is 2 m long. The volume of each small rock is $2 \times 2 \times 2$ m = 8 m$^3$. The total volume of all 8 rocks is $8 \times 8$ m$^3 = 64$ m$^3$, the same as the large rock. Each face of each small rock has an area of $2 \times 2$ m = 4 m$^2$. Each small rock has six faces, and there are eight rocks total. Therefore, the total surface area of all eight small rocks is $8 \times 6 \times 4$ m$^2 = ____$ m$^2$. This is twice as big as the surface area of the large rock.

Over time, the rock weathers. Its volume and surface area get smaller. In the same amount of time, the smaller rocks weather more and become much smaller. They lose a larger fraction of their volume than the larger rock.

More time passes. The large rock is weathered even more. It is now much smaller than it was before it was weathered. In the same amount of time, the small rocks have completely worn away. They took much less time to wear away than the large rock. Even though their volume was the same, they had more surface area than the large rock. The large surface area allowed them to wear away more quickly.
How Does Climate Affect Weathering?

The rate of weathering in an area is affected by the climate of that area. Climate is the average weather conditions of an area over a long period of time. Some features of climate that affect weathering are temperature, moisture, elevation, and slope.

**TEMPERATURE**

Temperature is a major factor in both chemical and mechanical weathering. Cycles of freezing and thawing increase the chance that ice wedging will take place. Areas in the world that have many freezes and thaws have faster mechanical weathering than other regions do.

High temperatures can also speed up weathering. Many chemical reactions happen faster at higher temperatures. These reactions can break down rock quickly in warm areas.

**MOISTURE**

Water can interact with rock as precipitation, as running water, or as water vapor in the air. Water can speed up many chemical reactions. For example, oxidation can happen faster when water is present.

Water is also important in many kinds of mechanical weathering. For example, ice wedging cannot happen without water. Abrasion also happens faster when water is present.

**ELEVATION AND SLOPE**

Elevation and slope can affect how fast weathering occurs. Elevation is a measure of how high a place is above sea level. Slope is a measure of how steep the sides of a mountain or hill are. The table below shows how elevation and slope affect weathering.

<table>
<thead>
<tr>
<th>Factor</th>
<th>How the factor affects weathering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>Rocks at high elevations are exposed to low temperatures and high winds. They can weather very quickly. Rocks at sea level can be weathered by ocean waves.</td>
</tr>
<tr>
<td>Slope</td>
<td>The steep sides of mountains and hills make water flow down them faster. Fast-moving water has more energy to break down rock than slow-moving water. Therefore, rocks on steep slopes can weather faster than rocks on level ground.</td>
</tr>
</tbody>
</table>

**READING CHECK**

5. Identify What is one way that temperature affects mechanical weathering?

6. Explain Why do rocks on the sides of mountains weather faster than rocks on level ground?
Section 2 Review

SECTION VOCABULARY

differential weathering the process by which softer, less weather resistant rocks wear away at a faster rate than harder, more weather resistant rocks do

1. Identify What are four factors that affect how fast weathering happens?

2. Explain Why does it take less time for small rocks to wear away than it does for large rocks to wear away?

3. Describe Imagine a rock on a beach and a rock on the side of a mountain. How would the factors that control weathering be different for these two rocks?

4. Apply Concepts Two rivers run into the ocean. One river is very long. The other is very short. Which river probably drops the smallest rock pieces near the ocean? Explain your answer.
CHAPTER 10
Weathering and Soil Formation

SECTION 3
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?

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

1. Explain Why are different soils made of different chemicals?

TAKE A LOOK

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

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?

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.
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.

What Are the Different Layers in Soil?

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

<table>
<thead>
<tr>
<th>Horizon name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>The O horizon is made of decaying material from dead organisms. It is found in some areas, such as forests, but not in others.</td>
</tr>
<tr>
<td>A</td>
<td>The A horizon is made of topsoil. Topsoil contains more humus than any other soil horizon does.</td>
</tr>
<tr>
<td>E</td>
<td>The E horizon is a layer of sediment with very few nutrients in it. The nutrients in the E horizon have been removed by water.</td>
</tr>
<tr>
<td>B</td>
<td>The B horizon is very rich in nutrients. The nutrients that were washed out of other horizons collect in the B horizon.</td>
</tr>
<tr>
<td>C</td>
<td>The C horizon is made of partly weathered bedrock or of sediments from other locations.</td>
</tr>
<tr>
<td>R</td>
<td>The R horizon is made of bedrock that has not been weathered very much.</td>
</tr>
</tbody>
</table>

5. Define What is humus?

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?
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.

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.
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.

<table>
<thead>
<tr>
<th>Type of climate</th>
<th>Description of climate</th>
<th>Features of the soil in this climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tropical climates</td>
<td>warm temperatures</td>
<td>has little humus</td>
</tr>
<tr>
<td></td>
<td>a lot of rain</td>
<td>poor in nutrients</td>
</tr>
<tr>
<td>Deserts and arctic climates</td>
<td>medium amount of rain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>temperature changes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>often</td>
<td></td>
</tr>
</tbody>
</table>

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?

TAKE A LOOK

11. Describe  Fill in the chart to show the features of soils in different climates.
Section 3 Review

SECTION VOCABULARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>bedrock</td>
<td>the layer of rock beneath soil</td>
</tr>
<tr>
<td>humus</td>
<td>dark, organic material formed in soil from the decayed remains of plants and animals</td>
</tr>
<tr>
<td>leaching</td>
<td>the removal of substances that can be dissolved from rock, ore, or layers of soil due to the passing of water</td>
</tr>
<tr>
<td>parent rock</td>
<td>a rock formation that is the source of soil</td>
</tr>
<tr>
<td>soil</td>
<td>a loose mixture of rock fragments, organic material, water, and air that can support the growth of vegetation</td>
</tr>
<tr>
<td>soil structure</td>
<td>the arrangement of soil particles</td>
</tr>
<tr>
<td>soil texture</td>
<td>the soil quality that is based on the proportions of soil particles</td>
</tr>
<tr>
<td>soil</td>
<td>a loose mixture of rock fragments, organic material, water, and air that can support the growth of vegetation</td>
</tr>
</tbody>
</table>

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.
CHAPTER 10  Weathering and Soil Formation

SECTION 4  Soil Conservation

BEFORE YOU READ

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

• Why is soil important?
• How can farmers conserve soil?

Why Is Soil Important?

You have probably heard about endangered plants and animals. Did you know that soil can be endangered, too? Soil can take many years to form. It is not easy to replace. Therefore, soil is considered a nonrenewable resource.

Soil is important for many reasons. Soil provides nutrients for plants. If the soil loses its nutrients, plants will not be able to grow. Soil also helps to support plant roots so the plants can grow well.

Animals get their energy from plants. The animals get energy either by eating plants or by eating animals that have eaten plants. If plants are unhealthy because the soil has few nutrients, then animals will be unhealthy, too.

Soil also provides a home, or habitat, for many living things. Bacteria, insects, mushrooms, and many other organisms live in soil. If the soil disappears, so does the habitat for these living things.

Soil is also very important for storing water. It holds water that plants can use. Soil also helps to prevent floods. When rain falls, the soil can soak it up. The water is less likely to cause floods.

What does soil provide? Why is it important?

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Why it is important?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat</td>
<td></td>
</tr>
<tr>
<td>Water storage</td>
<td></td>
</tr>
</tbody>
</table>

If we do not take care of soils, they could become unusable. In order to keep our soils usable, we need to conserve them. Soil conservation means protecting soils from erosion and nutrient loss. Soil conservation can help to keep soils fertile and healthy.
How Can Soil Be Lost?

Soil loss is a major problem around the world. One cause of soil loss is soil damage. Soil can be damaged if it is overused. Overused soil can lose its nutrients and become infertile. Plants can't grow in infertile soil.

Plants help to hold water in the soil. If plants can't grow somewhere because the soil is infertile, the area can become a desert. This process is known as desertification.

EROSION

Another cause of soil loss is erosion. Erosion happens when wind, water, or gravity transports soil and sediment from one place to another. If soil is not protected, it can be exposed to erosion.

Plant roots help to keep soil in place. They prevent water and wind from carrying the soil away. If there are no plants, soil can be carried away through erosion.

How Can Farmers Help to Conserve Soil?

Farming can cause soil damage. However, farmers can prevent soil damage if they use certain methods when they plow, plant, and harvest their fields.

CONTOUR PLOWING

Water that runs straight down a hill can carry away a lot of soil. Farmers can plow their fields in special ways to help slow the water down. When the water moves more slowly down a hill, it carries away less soil. Contour plowing means plowing a field in rows that run across the slope of a hill.

READING CHECK

3. Describe How do plant roots prevent erosion?

4. Identify Fill in the blank line in the figure to explain how contour plowing reduces erosion.
TERRACES
On very steep hills, farmers can use terraces to prevent soil erosion. Terraces change one very steep field into many smaller, flatter fields.

Terraces keep water from running downhill very quickly.

Critical Thinking
5. Infer What do you think is the reason farmers use terraces only on very steep hills?

NO-TILL FARMING
In no-till farming, farmers leave the stalks from old crops lying on the field while the newer crops grow. The old stalks protect the soil from rain and help reduce erosion.

The stalks left behind in no-till farming reduce erosion by protecting the soil from rain.

COVER CROPS
Cover crops are crops that are planted between harvests of a main crop. Cover crops can help to replace nutrients in the soil. They can also prevent erosion by providing cover from wind and rain.

Critical Thinking
6. Apply Concepts How can crop rotation affect the number of plants that soil can support?

CROP ROTATION
If the same crop is grown year after year in the same field, the soil can lose certain nutrients. To slow this process, a farmer can plant different crops in the field every year. Different crops use different nutrients from the soil. Some crops used in crop rotation can replace soil nutrients.
### Section 4 Review

**SECTION VOCABULARY**

| **erosion** | the process by which wind, water, ice, or gravity transports soil and sediment from one location to another |
| **soil conservation** | a method to maintain the fertility of soil by protecting the soil from erosion and nutrient loss |

1. **Define**  Write your own definition for soil conservation.

2. **Identify**  Give three things that soil provides to living things.

3. **Compare**  How is weathering different from erosion?

4. **Identify**  What are two causes of soil loss?

5. **List**  What are five ways that farmers can help to conserve soil?

6. **Explain**  How does no-till farming help to reduce erosion?