

Soil Conservation

Objectives

After this lesson, students will be able to

G.4.3.1 Explain why soil is a valuable resource.

G.4.3.2 List ways that soil can lose its value.

G.4.3.3 Identify ways that soil can be conserved.

Target Reading Skill

Previewing Visuals Explain that looking at the visuals before they read helps students activate prior knowledge and predict what they are about to read.

Answers

Possible answers: **Where was the Dust Bowl?** (*The Dust Bowl was in western Oklahoma and parts of the surrounding states.*) **What caused the Dust Bowl?** (*Farming practices exposed the soil so that in times of drought the topsoil quickly dried out, turned to dust, and blew away.*)

All in One Teaching Resources

- Transparency G17

Preteach

Build Background Knowledge

L1

A Small-Scale Dust Bowl

Ask students to suggest an area in your community that consists of exposed soil, such as a construction site or a plowed field. Ask: **What happens when the soil is dry and the wind blows?** (*Fine sediment is blown into the air.*) **Why isn't soil picked up when the exposed land is wet?** (*Moisture helps the soil grains stick together.*)

Soil Conservation

Reading Preview

Key Concepts

- Why is soil a valuable resource?
- How can soil lose its value?
- What are some ways that soil can be conserved?

Key Terms

- sod
- natural resource
- Dust Bowl
- soil conservation
- contour plowing
- conservation plowing
- crop rotation

Target Reading Skill

Previewing Visuals Before you read, preview Figure 13, The Dust Bowl. Then write two questions that you have about the photo and map in a graphic organizer like the one below. As you read, answer your questions.

The Dust Bowl

Q. Where was the Dust Bowl?
A.
Q.

Prairie grasses and wildflowers ▼



Lab zone

Discover Activity

How Can You Keep Soil From Washing Away?

1. Pour about 500 mL of soil into a pie plate, forming a pile.
2. Devise a way to keep the soil from washing away when water is poured over it. To protect the pile of soil, you may use craft sticks, paper clips, pebbles, modeling clay, strips of paper, or other materials approved by your teacher.
3. After arranging your materials to protect the soil, hold a container filled with 200 mL of water about 20 cm above the center of the soil. Slowly pour the water in a stream onto the pile of soil.
4. Compare your pan of soil with those of your classmates.



Think It Over

Observing Based on your observations, what do you think is the best way to prevent soil on a slope from washing away?

Suppose you were a settler traveling west in the mid 1800s. Much of your journey would have been through vast, open grasslands called prairies. After the forests and mountains of the East, the prairies were an amazing sight. Grass taller than a person rippled and flowed in the wind like a sea of green.

The prairie soil was very fertile. It was rich with humus because of the tall grass. The **sod**—the thick mass of tough roots at the surface of the soil—kept the soil in place and held onto moisture.

The prairies covered a vast area. They included Iowa and Illinois, as well as the eastern parts of Kansas, Nebraska, and North and South Dakota. Today, farms growing crops such as corn, soybeans, and wheat have replaced the prairies. But prairie soils are still among the most fertile in the world.

Lab zone

Discover Activity

Skills Focus observing

L1

Encourage students to be creative in their arrangements.

Materials soil, pie plate, water, container, craft sticks, paper clips, pebbles, modeling clay, paper

Time 15 minutes

Tips Provide students with soil in measured amounts, or prepare each pie plate with 500 mL of soil before class.

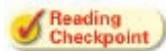
Expected Outcome Students will discover a variety of ways to prevent the soil from washing away.

Think It Over Answers will vary. Typical answers might suggest ways that protect the soil or bind it together.

The Value of Soil

A **natural resource** is anything in the environment that humans use. **Soil is one of Earth's most valuable natural resources because everything that lives on land, including humans, depends directly or indirectly on soil.** Plants depend directly on the soil to live and grow. Humans and animals depend on plants—or on other animals that depend on plants—for food.

Fertile soil is valuable because there is a limited supply. Less than one eighth of the land on Earth has soils that are well suited for farming. Soil is also in limited supply because it takes a long time to form. It can take hundreds of years for just a few centimeters of soil to form. The thick, fertile soil of the prairies took many thousands of years to develop.



Why is fertile soil valuable?

Soil Damage and Loss

Human activities and changes in the environment can affect the soil. **The value of soil is reduced when soil loses its fertility and when topsoil is lost due to erosion.**

Loss of Fertility Soil can be damaged when it loses its fertility. Soil that has lost its fertility is said to be exhausted. This type of soil loss occurred in large parts of the South in the late 1800s. Soils in which only cotton had been grown were exhausted. Many farmers abandoned their farms. Early in the 1900s in Alabama, a scientist named George Washington Carver developed new crops and farming methods that helped to restore soil fertility in the South. Peanuts were one crop that helped make the soil fertile again. Peanut plants are legumes. Legumes have small lumps on their roots that contain nitrogen-fixing bacteria. These bacteria make nitrogen, an important nutrient, available in a form that plants can use.

FIGURE 12
Restoring Soil Fertility
George Washington Carver (1864–1943) taught new methods of soil conservation. He also encouraged farmers to plant peanuts, which helped restore soil fertility.
Applying Concepts What nutrient do peanut plants add to the soil?



Instruct

The Value of Soil



Weathering and Soil Formation

Show the Video Field Trip to help students understand weathering and soil formation. Discussion question: **How do earthworms benefit prairie soil?** (*Earthworms mix humus into the soil, carry humus to the subsoil, and excrete soil as waste, which has many nutrients.*)

Teach Key Concepts

Soil Is a Natural Resource

Focus Have students suggest ways that people depend on soil. (*Answers include growing crops, lawns, trees, and flowers.*)

Teach Remind students that natural resources such as coal, oil, and natural gas are nonrenewable. Point out that Earth has a finite amount of soil, which takes time to form.

Apply Ask: **What are the consequences of losing too much topsoil?** (*The remaining soil will be less fertile and less capable of supporting plants.*) **learning modality:** logical/mathematical

Independent Practice

Teaching Resources

- Guided Reading and Study Worksheet: *Soil Conservation*

Student Edition on Audio CD

Differentiated Instruction

Less Proficient Readers

Making Pictograms Read aloud the text below *Soil Loss in the Dust Bowl* on the next page as students follow along. Then, ask students to make pictograms that communicate the same information. Have students work in small groups and refer to the text as needed. **learning modality:** visual

L1

Gifted and Talented

Writing Telegrams Challenge students to write telegrams about the Dust Bowl to be sent back East. You might suggest that students role-play farmers who lived in the Dust Bowl during the 1930s. Telegrams could be addressed to family members or to government officials. **learning modality:** verbal

L3

Monitor Progress

L2

Oral Presentation Have students explain how the planting of peanuts restored fertility to the soil.

Answers

Figure 12 Nitrogen



Fertile soil is valuable because there is only a limited supply of it.

Download a worksheet that will guide students' review of Internet resources on soil conservation.

Soil Damage and Loss

Teach Key Concepts

L1

Soil Can Lose Fertility

Focus Review what makes soil fertile.

Teach Ask: **What might happen if plants use nutrients faster than they are replaced?** (*Soil can become exhausted.*) **How can exhausted soil be improved?** (*Sometimes plants such as legumes can restore fertility.*)

Apply Ask students to identify common legumes. (*Peanuts and alfalfa*) **learning modality: logical/mathematical**

Help Students Read

L1

Summarizing Refer to the Content Refresher for guidelines on summarizing. Have students read the passage *Soil Conservation*. Then ask them to write separate sentences that explain how each method helps conserve soil.

Lab zone Build Inquiry

L2

Reducing the Loss of Soil

Materials soil, sod, water, 2 painter's pans, 2 buckets

Time 20 minutes

Focus Have students hypothesize about the effects of vegetation on soil erosion before performing the activity.

Teach Challenge students to test their hypotheses, using the materials provided. A typical experiment might compare the difference in the amount of soil runoff when water is poured on a slope of bare soil versus a slope of soil covered by sod.

Apply Ask: **How can what you learned be used to reduce erosion on natural slopes?** (*Grass and other vegetation can be planted on slopes.*) **learning modality: kinesthetic**

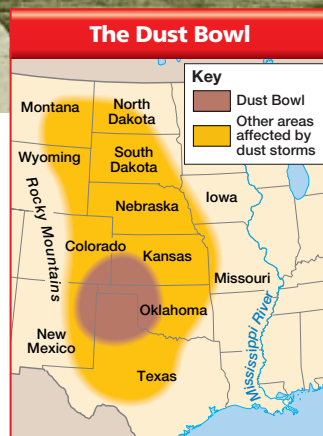


FIGURE 13
The Dust Bowl
The Dust Bowl ruined farmland in western Oklahoma and parts of the surrounding states. Wind blew dry particles of soil into great clouds of dust that traveled thousands of kilometers.

Loss of Topsoil Whenever soil is exposed, water and wind can quickly erode it. Plant cover can protect soil from erosion. Plants break the force of falling rain, and plant roots hold the soil together. Wind is another cause of soil loss. Wind erosion is most likely in areas where farming methods are not suited to dry conditions. For example, wind erosion contributed to the Dust Bowl on the Great Plains.

Soil Loss in the Dust Bowl Toward the end of the 1800s, farmers settled the Great Plains. The soil of the Great Plains is fertile. But rainfall decreases steadily from east to west across the Great Plains. The region also has droughts—years when rainfall is scarce. Plowing removed the grass from the Great Plains and exposed the soil. In times of drought, the topsoil quickly dried out, turned to dust, and blew away.

By 1930, almost all of the Great Plains had been turned into farms or ranches. Then, a long drought turned the soil on parts of the Great Plains to dust. The wind blew the soil east in great, black clouds that reached Chicago and New York City. The erosion was most serious in the southern Plains states. This area, shown in Figure 13, was called the **Dust Bowl**. The Dust Bowl helped people appreciate the value of soil. With government support, farmers in the Great Plains and throughout the country began to take better care of their land. They adopted methods of farming that helped save the soil. Some methods were new. Others had been practiced for hundreds of years.

Soil Conservation

Since the Dust Bowl, farmers have adopted modern methods of soil conservation. **Soil conservation** is the management of soil to prevent its destruction. **Soil can be conserved through contour plowing, conservation plowing, and crop rotation.**

In **contour plowing**, farmers plow their fields along the curves of a slope. This helps slow the runoff of excess rainfall and prevents it from washing the soil away.

In **conservation plowing**, farmers disturb the soil and its plant cover as little as possible. Dead weeds and stalks of the previous year's crop are left in the ground to help return soil nutrients, retain moisture, and hold soil in place. This method is also called low-till or no-till plowing.

In **crop rotation**, a farmer plants different crops in a field each year. Different types of plants absorb different amounts of nutrients from the soil. Some crops, such as corn and cotton, absorb large amounts of nutrients. The year after planting these crops, the farmer plants crops that use fewer soil nutrients, such as oats, barley, or rye. The year after that the farmer sows legumes such as alfalfa or beans to restore the nutrient supply.



How does conservation plowing help conserve soil?

FIGURE 14

Soil Conservation Methods
This farm's fields show evidence of contour plowing and crop rotation. **Predicting** How might contour plowing affect the amount of topsoil?



Section 3 Assessment

Target Reading Skill Previewing Visuals Compare your questions and answers about Figure 13 with those of a partner.

Reviewing Key Concepts

- a. Defining** What is a natural resource?
b. Explaining Why is soil valuable as a natural resource?
- a. Listing** What are two ways in which the value of soil can be reduced?
b. Explaining Explain how topsoil can be lost.
c. Relating Cause and Effect What caused the Dust Bowl?
- a. Defining** What is soil conservation?
b. Listing What are three methods by which farmers can conserve soil?
c. Problem Solving A farmer growing corn wants to maintain soil fertility and reduce erosion. What conservation methods could the farmer try? Explain.

Writing in Science

Public Service Announcement

A severe drought in a farming region threatens to produce another Dust Bowl. Write a paragraph about soil conservation to be read as a public service announcement on radio stations. The announcement should identify the danger of soil loss due to erosion. It should also describe the steps farmers can take to conserve the soil.

Lab zone Chapter Project

Keep Students on Track Make sure that students check their bean plants daily; water them as needed; and record the number of seeds that sprout, the height of each plant, the number of leaves, and the leaf color. Ask students what they think their data show about the fertility of the different materials. Encourage students to begin drawing conclusions and developing ways to present their data.

Writing in Science

Writing Skill Persuasion

Scoring Rubric

- Exceeds criteria in some way; for example, by referencing the Dust Bowl of the 1930s
- Meets criteria but does not go beyond requirements
- Includes only brief description of required elements
- Is incorrect and incomplete

Soil Conservation

Teach Key Concepts

L1

Comparing Conservation Techniques

Focus Remind students about the Discover Activity that they conducted at the beginning of this section. Tell them that farmers face the same problem.

Teach Ask: **In which soil conservation method are plant stalks used to protect the soil?** (*Conservation plowing*) **In which method are fields tilled across the slope to slow the flow of water?** (*Contour plowing*)

Apply Ask: **Why is so much effort used to save soil?** (*Topsoil is best for plant growth. Saving topsoil increases crop yields.*)

learning modality: logical/mathematical

Monitor Progress

L2

Answers

Figure 14 It prevents excess rainfall from washing the soil away.



A combination of overplowing and drought



The previous year's crop residue protects the soil.

Assess

Reviewing Key Concepts

- a.** Anything in the environment that humans use **b.** All living organisms depend, either directly or indirectly, on soil to live and grow.
- a.** Loss of fertility and loss of topsoil **b.** Topsoil is lost because of erosion by wind and water. **c.** A combination of overplowing and drought turned the soil in the Great Plains to dust.
- a.** The management of soil to prevent its destruction **b.** Contour plowing, conservation plowing, and crop rotation **c.** A combination of conservation plowing to reduce erosion and crop rotation to maintain soil fertility

Reteach

L1

Ask students to make a cause-and-effect chart to show what caused people to leave the Great Plains in the 1930s.

Teaching Resources

- Section Summary: *Soil Conservation*
- Review and Reinforce: *Soil Conservation*
- Enrich: *Soil Conservation*