

Red Edition
Grade 3–4
reading level

Purple Edition
Grade 4–5
reading level

Objectives

- Describe the components of soil.
- Explore soil formation.
- Compare soil horizons.
- Describe four properties of soil.
- Compare soils in different places.
- Understand the importance of soil.
- Discuss soil conservation.

Reading Comprehension Skills

Preview the Book ♦ Compare and Contrast
Main Idea and Details

Skillbuilders are available for this title.

Supporting English Learners

Use Photographs and Other Visuals Develop background knowledge and support the development of new concepts and science vocabulary by using the photographs and other visuals in *Soils*. Point out and name objects in the photos, such as *ants* (page 5), *earthworms* (page 9), and *sediment* (page 13). Have students repeat after you.

Summary

The Delta Science Content Reader *Soils* first introduces students to the four main components of soil. Students then learn about the natural processes that lead to the formation of soil. They discover the properties and composition of different soils and factors that influence what type of soil forms in a particular environment. The book concludes by explaining soil's importance to people and introducing some methods of soil conservation.

Science Background

Although the composition of soil varies from one location to another, all soil is made up of four main parts—sediment (rock and mineral particles), humus (decayed organic matter), air, and water. Soil formation is a very slow process. It can take a thousand years for 2.5 centimeters of soil to form!

The first step in the process of all soil formation is weathering, the breaking down of rock into sediment. Weathering occurs through the actions of natural forces, mainly water, wind, temperature changes, and living organisms. For example, rocks can be broken down when they rub against one another in fast-moving water.

Without humus, soil would be lifeless, broken-down rock. The process by which dead organisms and their wastes are broken down and returned to the soil as humus is called decomposition. Decomposers are living things that help decompose plant and animal matter. The humus that results from decomposition adds nutrients to the soil.

Many characteristics differentiate one soil from another. They include texture, permeability, and the ability to support plant growth. The size of a soil's sediment particles highly influences these properties. Sediment is classified as sand, silt, or clay, in order of decreasing particle size. The best soil for most plants is called loam. Loam is fertile because it provides plants with the right amounts of water and nutrients. Almost all food chains on Earth begin with plants. Therefore, because most plants grow in soil, most plant and animal life on Earth depends on soil.



What Is Soil? (pages 2–9)

Before Reading

Discuss the Cover

Cover Image Discuss the photograph on the cover of *Soils*. Use the information on the inside front cover to support the discussion.

Science Statement Discuss the science statement. Ask: *What do you think weathered means?* (Answers will vary.) *What kinds of living things have you seen in soil?* (Possible answers: plants, insects)

Build Reading Skills (page 2)

Preview the Book Use Build Reading Skills on page 2 to review how to preview the book. Discuss the steps. Then model previewing the Table of Contents.

Think Aloud *The Table of Contents lists what is in the book. In this book, there are three main sections and a Glossary. I read the titles of the main sections and learn that I'm going to read about what soil is, how soils are alike and different, and why and how we should conserve soil. Each main section has smaller headings listed under it. The parts of the book under these headings must break the main idea of each main section into smaller parts.*

Guide students as they finish previewing *Soils*. Focus on nonfiction text features.

- Prompt them to look at the headings, photographs, captions, and diagrams. Ask questions such as *Why do you think that feature is there? How will it help you understand what you read?*
- Prompt them to look at the bold Vocabulary words. Guide the class in looking up a Vocabulary word in the Glossary.

Students can apply the skill in the Reflect on Reading activity on page 9.

K-W-L Chart Have students begin a K-W-L chart. They should add to it after each section.

What I K now	What I W ant to Learn	What I L earned
Plants grow in soil.	Where does soil come from?	

Make a Connection (page 3)

Make a Connection Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about soil. Encourage students to share examples they have seen of plants growing in cracks in rocks or sidewalks. (Possible answer: Soil has small pieces of rock in it. Maybe when rocks are broken down they become part of soil.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *Sediment* in the center. Have students add words and information about sediment's role in soil formation as they read.

During Reading

About Soil (page 4)

- Examples of minerals include quartz, mica, halite (rock salt), calcite, and feldspar.
- Ask: *What makes up the biggest part of most soil?* (rock and mineral pieces)
- Discuss the photographs on pages 4 and 5. Ask: *What living things do you see in the soil?* (Possible answers: plants, ants) *What differences do you see between the soil in the pictures?* (Possible answer: The soil in the picture with the shovel on page 4 looks dark. The soil in the picture with the ants on page 5 looks sandy.)

✓ **Checkpoint** (page 5) (rock, humus, air, water)

How Soil Forms (page 6)

- Ask: *How is sediment made?* (by weathering, the breaking down of rock)
- Ask: *What are some natural forces that can weather rock?* (Possible answers: water, wind, temperature changes, living things)
- Most substances on Earth expand when they are heated and shrink when they are cooled. However, when water gets cold enough to freeze, it acts in the opposite manner. When water freezes in cracks in rocks, it expands, splitting the rocks apart.

- Discuss the photograph of rushing water on page 7. Ask: *Why does the water look brown?* (It is carrying a lot of sediment.) *What is the movement of sediment called?* (erosion)
 - Ask: *What forces besides moving water can cause erosion?* (wind, glaciers, gravity)
 - Ask: *Why are earthworms so important to soil?* (Earthworms are important decomposers. They eat soil and decaying plants and animals. Some of the nutrients from these materials leave the earthworm's body in its wastes. The wastes become humus. Earthworms' tunnels let water and air move through the soil. The tunnels also make it easier for plant roots to push into the ground.)
- ✓ **Checkpoint** (page 9) (Weathering helps soil form because it breaks down rock into sediment, which becomes part of soil. Erosion moves sediment from one place to another. Decomposers break down dead plants and animals, which become humus, an important part of soil.)

After Reading

Reflect on Reading (page 9) (Possible answer: The picture of cliffs on page 6 helped me understand how ocean waves weather rock.)

Apply Science Concepts (page 9) This activity applies a concept from Find Out About on page 3. (Possible answer: A rock on the mountain could have been weathered by a stream. A piece of the rock could have broken off and the stream could have caused erosion by carrying it down the mountain. The stream could have flowed into a river, which flowed into an ocean. The piece of rock could have been tumbled as it moved, breaking it into sediment the size of grains of sand. Finally, an ocean wave could have picked up the sediment and washed it onto the beach.)

How Are Soils Alike and Different? (pages 10–17)

Before Reading

Build Reading Skills (page 10)

Compare and Contrast Use Build Reading Skills on page 10 to review how to compare and contrast. Discuss the tips. Then read aloud the third

paragraph on page 13 and model comparing and contrasting sand and silt.

Think Aloud *I read that one property of soil is the size of its sediment pieces, or grains. That must mean that different soils have different sizes of grains. Sand, silt, and clay are three sizes of sediment. How are sand and silt alike? Both are sediment, so both are pieces of rocks and minerals. How are they different? Sand grains are the largest sediment pieces in soil. They are about the same size as grains of table salt. Silt grains are smaller than sand.*

Guide students as they practice comparing and contrasting the permeability of sandy and silty soils on page 14. Students can apply the skill in the Reflect on Reading activity on page 17.

Make a Connection (page 11)

Make a Connection Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about how soils are alike and different. Before students answer, encourage them to compare soils they have seen in their area with the soil in the photograph. (Possible answer: Soil near the beach is light in color and feels sandy. So I think soils in different places might have different colors and feel different.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *Properties of Soil* in the center. Have students add words and information to the web as they read.

During Reading

Layers of Soil (page 12)

- Remind students that words can have different meanings in science than in everyday speech. Point out the word *horizon* in the term *soil horizon*. Ask: *What do we usually mean by the word horizon?* (the line between Earth and sky) Note that the word *horizontal* is related to the word *horizon*. Something that is horizontal goes from side to side, just as the horizon does. Ask: *What direction does a soil horizon go?* (side to side)

- Ask: *Describe what subsoil is like.* (Possible answer: Subsoil contains much less humus than topsoil does. It is often lighter in color than topsoil. It has few living things. Some deep tree roots may push down into the subsoil.)

✓ **Checkpoint** (page 12) (topsoil—A horizon, subsoil—B horizon, large pieces of rock—C horizon)

Properties of Soil (page 13)

- Discuss that a soil's color is usually determined by its minerals.
- Discuss the photograph of reddish brown soil on page 13. Ask: *What gives this soil its color?* (iron minerals)
- Discuss that when water passes through soil, it seeps through the spaces between sediment particles. Generally, larger particles such as sand also have larger spaces between them and are more loosely packed together. This is why sandy soils have high permeability.
- Ask: *What are some properties that make loam so fertile?* (Possible answers: It has the right amount of water and nutrients. It is neither too dry nor too wet because the mix of grain sizes gives it good permeability. The humus in loam is rich in nutrients. Some minerals in loam are important plant nutrients, too.)

✓ **Checkpoint** (page 15) (Possible answers: Color: black soils are rich in humus; Size of sediment pieces: sand, silt, or clay; Texture: how it feels; Permeability: how well it holds water; How good it is for growing plants: soils that are good for growing plants are called rich or fertile)

Soils in Different Places (page 16)

- Discuss some of the factors that affect the type of soil in an area. For example, an area with a lot of living things is likely to have fertile topsoil because of all the plant and animal matter that may decompose there. Because of the shape of the land, soil at the bottom of a hill is typically thicker than soil at the hilltop. Also, older soils are generally thicker than younger soils.
- Ask: *Why do you think desert soils are not fertile the way forest and grassland soils are?* (Possible answer: They are dry and contain little humus.)

✓ **Checkpoint** (page 17) (Many things affect the type of soil in an area, including the kind of rocks and minerals in the area, the climate—or average weather—in the area, the living things in the area, the shape of the land in the area, and the length of time the soil has been forming.)

After Reading

Reflect on Reading (page 17) Have students review the information about soil horizons on page 12 before creating their Venn diagrams. (Possible answer: Topsoil: dark mix of sediment and humus, has many plants and animals, has plant roots; C horizon: made of large pieces of rock, no plant roots or animals; Both: layers of soil)

Apply Science Concepts (page 17) This activity applies a concept from Find Out About on page 11. (Possible answer: Sandy soil: large sediment grains, feels gritty, is dry and has high permeability; Loam: mix of sediment grain sizes, feels soft, is neither too dry nor too wet and has good permeability)

Why and How Should We Conserve Soil?

(pages 18–23)

Before Reading

Build Reading Skills (page 18)

Main Idea and Details Use Build Reading Skills on page 18 to review identifying main idea and details. Discuss the tips. Then model identifying the main idea in the third paragraph on page 21.

Think Aloud *I know the main idea is in the topic sentence of a paragraph. The topic sentence is often the first sentence. The first sentence of this paragraph says that plants can help reduce erosion in two ways. That sounds like the main idea. I'll read on to look for details about what these two ways are.*

Guide students as they identify details in the paragraph that support the main idea. Students can apply the skill in the Reflect on Reading activity on page 23.

Make a Connection (page 19)

Make a Connection Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about soil conservation. (Possible answer: Farmers can make sure that the soil they grow crops in always has the things that make soil rich, such as the right mix of sand, silt, clay, and humus.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a T-chart on the board with the headings *Soil Conservation by Reducing Erosion* and *Soil Conservation by Reducing Pollution*. Have students suggest examples as they read.

During Reading

Importance of Soil (page 20)

- Discuss that without soil, we would have no food to eat. Emphasize that this would be the case even if people ate only animal products. Animals need plants for food. Animals that do not eat plants directly eat animals that have eaten plants, so they too rely on plants and thus also rely on soil.
 - Students may be curious about soils that are used to make things. Explain that clay that is fired in a kiln to make bricks or pottery is the same kind of clay found in soil.
 - Ask: *What is a natural resource?* (something on Earth that living things need or use) *Why is soil called a nonrenewable resource?* (It takes a long time to form, so it cannot easily be replaced.)
 - You may wish to provide other examples of renewable and nonrenewable resources—Renewable: sunlight, wind, water; Nonrenewable: fossil fuels, such as coal, oil, and natural gas.
- ✓ **Checkpoint** (page 20) (Possible answer: Soil is an important natural resource because we use it to grow plants for food and for many other purposes, such as for cotton and wood. Houses, schools, and roads are built on soil. Certain soils are used to make bricks, glass, and pottery.)

Soil Conservation (page 21)

- Discuss the photograph of the field that has been contour plowed on page 21. Ask: *How does contour plowing reduce erosion?* (It makes water flow downhill more slowly. Less soil is carried away.)
 - Ask: *Why is soil easily washed or blown away after plants have died because of overgrazing?* (Plants reduce erosion. Plant roots hold soil in place. Plants also cover and protect soil.)
 - Discuss the following example of crop rotation. Bean plants put the nutrient nitrogen into the soil, while onion plants remove a lot of nitrogen. Rotating these crops keeps the nitrogen supply in the soil in balance.
- ✓ **Checkpoint** (page 23) (Possible answer: People can reduce erosion, such as by planting windbreaks. They can reduce pollution, such as by recycling plastic and glass. They can replace nutrients, such as by adding compost to soil.)

After Reading

Reflect on Reading (page 23) Remind students that a part of a book can have one main idea. Students will need to find the main idea of the part of the book on pages 21–23 in order to fill in their concept webs. (Possible answers: Main idea: Because soil is so important, people must protect it and use it wisely. Details: Plants cover and protect soil. Cutting down fewer trees in a place can reduce erosion. Controlling weeds and pests in safe ways can reduce pollution. Crop rotation can replace nutrients.)

Apply Science Concepts (page 23) This activity applies a concept from Find Out About on page 19. You may wish to take students on a tour of school grounds to look for evidence of erosion. (Possible answer: On my walk home from school I pass by a vacant lot. When it rains, mud flows onto the sidewalk. When it is dry and windy, dirt flies everywhere. Those are both signs of erosion. If people planted grass and trees in the lot, the roots would hold the soil in place and the trees would block the wind. This would help stop erosion.)

➡ **Continued on last page**

Name: _____

Date: _____

Test: Soils

Part A: Vocabulary

conservation	deposition	erosion	humus
nonrenewable resource	pollution	sediment	weathering

Choose the correct vocabulary word for each sentence. Write the word on the line.

1. When the remains of living things break down, or decay, they become _____.
2. Broken-down rock and mineral pieces are called _____.
3. Many natural forces cause _____, the breaking down of rocks and minerals into smaller pieces.
4. One example of _____ is when ocean waves pick up and move sand.
5. It is called _____ when wind drops sand after slowing down.
6. Soil is one _____ we use. It takes a long time to form, so it cannot easily be replaced.
7. The protection of a natural resource is called _____.
8. People cause _____ when they add harmful materials to soil, water, or air.

Part B: Science Concepts

Mark the best answer to each question.

9. What four main materials make up every kind of soil?
(A) fungi, water, humus, bacteria (C) iron, salt, calcium, rocks
(B) nutrients, sand, air, casts (D) sediment, humus, air, water
10. The smallest grains in soil are called _____.
(A) clay (C) sand
(B) compost (D) silt

Test: Soils (continued)

11. What properties make the soil called loam so fertile?

- (A) medium permeability, very little humus
- (B) medium permeability, lots of nutrients
- (C) low permeability, lots of calcium
- (D) high permeability, very little silt

12. What is one way to reduce soil pollution?

- (A) add compost
- (B) cut down trees
- (C) recycle plastic and glass
- (D) get rid of earthworms

Write the answer.

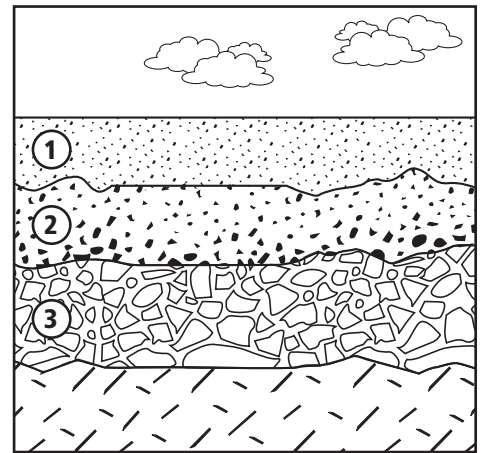
13. Label the layers in this picture of soil horizons.

Then tell what lies below the soil.

1 _____

2 _____

3 _____



14. Grasslands have many plants. Deserts have few plants. Explain how this difference helps cause the soils in these places to be different.

15. A farmer uses strip cropping and crop rotation. Describe how this helps to conserve soil.

Let's Review

(inside back cover)

Have students complete their K-W-L charts before answering these questions. Possible answers are shown.

- 1. Cover Connection** (To make soil, rock must be broken down into sediment. The breaking down of rock into sediment is called weathering. Many natural forces, such as water and wind, can cause weathering. When dead plants and animals break down, they become humus, a part of soil.)
- 2.** (Soil is the loose material that covers much of Earth. Soil is made of four main materials—sediment, humus, air, and water. Soil can begin to form whenever rock is weathered into sediment. After sediment forms, plants may start to grow in it. The plants attract animals. Animal wastes and the remains of dead plants and animals become humus.)
- 3.** (A horizon: topsoil, where plants and animals live; B horizon: subsoil, usually lighter in color than topsoil; C horizon: large pieces of rock)
- 4.** (Plant roots hold soil in place. Plants also cover and protect soil. A row of trees blocks the wind and helps keep soil from blowing away. In strip cropping, grasses cover and protect the soil.)
- 5. Main Idea and Details** (Main idea: Soils in different places have different properties. Details: One property of soil is color. Most soils have a mix of sand, silt, and clay grains. Soils that are good for growing plants are called rich or fertile.)
- 6. Write** (Persuasive letters will vary but should state

that soil is an important natural resource, so people must protect it. Information on composting can be found on the Environmental Protection Agency's [EPA] Web site.)

Try It! Students should observe that each shaking breaks down the sugar cubes into smaller pieces. They should understand that this is like the weathering of rocks because solid rock is weathered into large chunks, which are then further broken down into smaller and smaller rock pieces.

Science at Home Have students do this activity at home with their families. Students should explain that plant-based foods depend on soil because plants need the water and nutrients in soil to live and grow. Animal-based foods depend on soil because animals need plants for food.

Answers to Test

(Teacher's Guide pages 6–7)

1. humus **2.** sediment **3.** weathering **4.** erosion **5.** deposition
6. nonrenewable resource **7.** conservation **8.** pollution **9.** D **10.** A
11. B **12.** C **13.** 1: topsoil (A horizon); 2: subsoil (B horizon);
3: large pieces of rock (C horizon); the solid rock of Earth's surface, called bedrock **14.** Because many plants grow in grassland soils, these soils have a lot of humus. The humus comes from the broken-down roots of grass plants. The humus makes the topsoil dark. Because few plants grow in desert soils, they contain little humus and are usually light in color. **15.** Using strip cropping reduces erosion. The rows of grasses planted between the rows of crops cover and protect the soil. Using crop rotation replaces nutrients. Each crop helps the soil in a different way.

ADDITIONAL ASSESSMENT OPPORTUNITIES Use the Checkpoints, Reflect on Reading, and Apply Science Concepts features and Let's Review questions as additional assessment opportunities.

Delta Science Content Readers are 24-page nonfiction student books with informative, engaging text and full-color photos and illustrations. The readers present key science content and vocabulary found on state tests, present key reading skills and strategies useful for reading informational text, support and extend the experiences and content of hands-on activities, promote scientific inquiry, and serve as a home-school link. They are available in two editions: Red Edition for Grades 3–4 and Purple Edition for Grades 4–5.

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