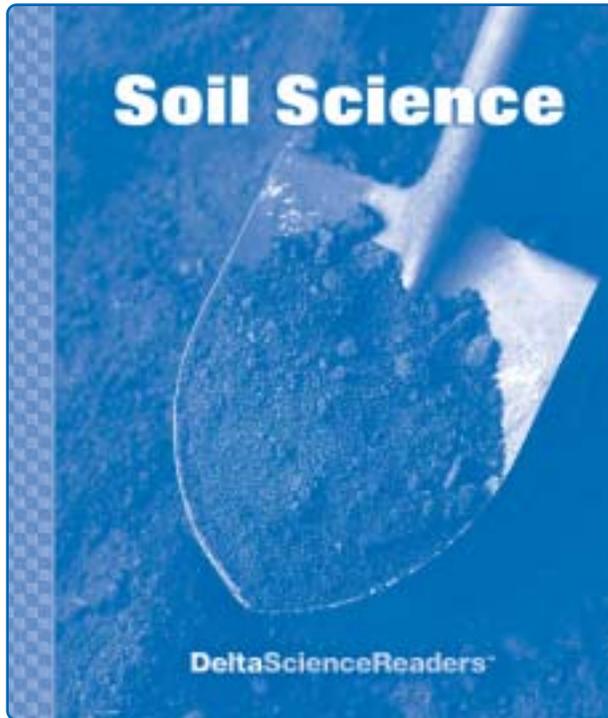


Soil Science



Delta Science Readers are nonfiction student books that provide science background and support the experiences of hands-on activities. Every **Delta Science Reader** has three main sections: *Think About . . .*, *People in Science*, and *Did You Know?*

Be sure to preview the reader Overview Chart on page 4, the reader itself, and the teaching suggestions on the following pages. This information will help you determine how to plan your schedule for reader selections and activity sessions.

Reading for information is a key literacy skill. Use the following ideas as appropriate for your teaching style and the needs of your students. The After Reading section includes an assessment and writing links.

OVERVIEW

In the Delta Science Reader *Soil Science*, students read about the composition and characteristics of different types of soil. They learn about the effects of weathering and erosion in producing and changing soil. They find out about ways that people both harm and protect this vital natural resource. Students also read about soil scientists and their work. Finally, students learn how earthworms keep soils rich and productive.

Students will

- ▶ identify the parts of soil
- ▶ recognize the effects of weathering and erosion
- ▶ compare and contrast different soil layers and types of soil
- ▶ draw conclusions about people's roles in soil pollution and conservation
- ▶ infer how earthworms help enrich soil
- ▶ examine nonfiction text elements such as table of contents, headings, and glossary
- ▶ interpret photographs and diagrams to answer questions
- ▶ complete a KWL chart

READING IN THE CONTENT AREA SKILLS

- Cause and effect
- Compare and contrast
- Critical thinking
- Draw conclusions
- Interpret graphic devices
- Main idea and supporting details
- Make predictions
- Sequence of events
- Summarize

NONFICTION TEXT ELEMENTS

Soil Science includes a table of contents, headings, photographs, diagrams, captions, boldfaced terms, diagrams, labels, and a glossary.

CONTENT VOCABULARY

The following terms are introduced in context and defined in the glossary: *bedrock, castings, clay, composting, conserve, contour plowing, decay, earthworms, erosion, glacier, humus, loam, minerals, natural resource, property, sand, silt, soil, strip cropping, subsoil, texture, topsoil, weathering*

Optional vocabulary: *decomposer*

BEFORE READING

Build Background

Access students' prior knowledge of soils by displaying and discussing the cover. Read aloud the title and ask, *What do you see in this photograph?* (a shovel or spade digging into soil) *What do you think the soil is made up of?* (Students may say dirt, leaves, mud, pieces of rock, sticks, and so on. Accept all answers at this time.) *Do you think all soil is alike? Why or why not?* (Accept all reasonable answers. Students will probably observe that soils in different places look or feel different.)

Read the title aloud, and invite students to share what they know about soil from their personal experiences and hands-on explorations in science. If possible, pass around a small container of ordinary soil. To stimulate discussion, ask questions such as these: *Have you ever looked closely at a handful of soil? What did you notice? Is the soil at a beach the same as the soil in your back yard or on the playground? How are they different? How do you think the soil gets there?*

Begin a KWL chart by recording facts students know about soil in the K column. You may want students to copy the KWL chart so they can maintain their own charts as they read.

K What I Know	W What I Want to Know	L What I Learned	+ What I Want to Explore Further

Preview the Book

Tell students that one way to find out what a book is about is to *preview* the book. Explain that when students preview nonfiction, they should look at the title, the table of contents, headings, boldfaced words, photographs, diagrams, and captions.

Then preview the book with students. As you flip through the pages, call attention to the various nonfiction text elements and explain how they can help students understand and organize what they read. Ask questions such as these: *What do you see in this picture? What do you think this photograph is showing us about soil? What on this page might help you find out what this section is about? Why do you think these words are in darker type? How might these words help you predict what you will be reading about?* Explain that the words in boldface type are important words related to soil science. Point

out that these words are defined in the glossary. Choose one word and have students find its definition in the glossary.

Preview the Vocabulary

You may wish to preview some of the vocabulary words before reading rather than waiting to introduce them in the context of the book. Possibilities include creating a word wall, vocabulary cards, sentence strips, or a concept web.

For example, you might draw the following chart on the board. List vocabulary words in the first column. Briefly discuss what students already know about the word, and encourage them to predict the word's meaning. Record their responses in the "Before Reading" column. After students read the book, record their revised understandings of each word in the third column.

WORD	BEFORE READING	AFTER READING
soil	dirt	made of minerals, humus, air, and water

Set a Purpose

Discuss with students what they might expect to find out from the book, based on their preview. Record students' questions in the W ("Want to Know") section of the KWL chart. Encourage them to use the questions on the chart to set an overall purpose for reading.

GUIDE THE READING

Preview the book yourself to determine the amount of guidance you will need to give for each section. Depending on your schedule and the needs of your class, you may wish to consider the following options:

- **Whole Group Reading** Read the book aloud with a group or the whole class. Encourage students to ask questions and make comments. Pause as necessary to clarify and assess understanding.

- **Shared Reading** Have students work in pairs or small groups to read the book together. Ask students to pause after each text section. Clarify as needed and discuss any questions that arise or have been answered.
- **Independent Reading** Some students may be ready to read independently. Have them rejoin the class for discussion of the book. Check understanding by asking students to explain in their own words what they have read.

Tips for Reading

- If you spread out the reading over several days, begin each session by reviewing the previous day's reading and previewing what will be read in the upcoming session.
- Begin each text section by reading or having a volunteer read aloud the heading. Have students examine any illustrations or graphics and read accompanying captions and labels. Discuss what students expect to learn, based on the heading, illustrations, and captions.
- Help students locate context clues to the meanings of words in boldface type. Remind them that these words are defined in the glossary. Provide help with words that may be difficult to pronounce.
- As appropriate, model reading strategies students may find helpful for nonfiction: adjust reading rate, ask questions, paraphrase, reread, visualize.

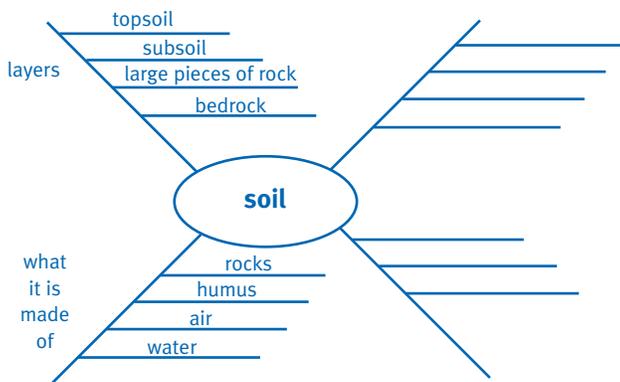
Think About . . . (pages 2–12)

Pages 2, 3 *What Is Soil?*

- Ask students if they have ever dug a hole in the ground. Briefly discuss students' prior experience with soil by asking questions such as, *What did the soil feel like? What did it look like? Did the soil have a smell?*
- Read aloud the heading on page 2 and ask volunteers to predict the answer to the

question, What Is Soil? Tell students that they can find out if their predictions are correct by reading pages 2 and 3.

- Read aloud page 2. Ask, *What is soil made of?* (rocks, humus, air, water) *What are rocks made of?* (minerals) *What are minerals?* (solid materials that form in nature) *Are minerals alive?* (no) *What makes humus?* (plants and animals that were once alive but are now dead and decayed)
- Ask students to look at the diagram on page 3. Point to the tree and ask, *What is this?* (a tree with roots growing down into soil) *What do you think this diagram shows?* (layers of soil underground) Read aloud page 3. Ask volunteers to point to each layer on the diagram as you say its name. Ask, *In what layers of soil are the tree's roots growing?* (topsoil and subsoil) *Why do you think the tree's roots don't grow in the layer with large pieces of rock or in bedrock?* (There is no humus in those layers.)
- You may wish to start a spider diagram to record students' responses and help them visualize the main idea and details of each section.



Pages 4–6 How Does Soil Form?

Pages 4, 5

- Ask a volunteer to read aloud the heading on page 4. Help students identify the photographs on pages 4 and 5. Then ask,

How might these pictures help us understand how soil is formed? (Accept all reasonable answers at this time.) Tell students they will find out as they read the next two pages.

- Read aloud pages 4 and 5. Ask, *What is weathering?* (rocks breaking down into smaller and smaller pieces) *What are some things that can cause weathering?* (rainwater, streams and rivers, wind, temperature changes, glaciers, living things such as plant roots) Discuss how each force breaks down rocks into small pieces that can form soil.
- Ask, *Does weathering happen quickly?* (No, weathering is a very slow process.) Tell students that it can take up to a thousand years to produce an inch of weathered material that will become soil.

Page 6

- Remind students that soil is made of rocks, humus, air, and water. Ask, *How do you think humus gets into the soil?* (Plants and animals die and decay.) Have students read to confirm their responses.
- Ask, *What kind of animals live in soil?* (Students may suggest worms, insects such as ants, moles, gophers, and so on.) *How do they help soil?* (They help change leaves to humus. They mix the materials in soil. They dig tunnels that let air and water into soil.)
- Have a volunteer read the caption for the photograph of the mushroom on page 6. Mushrooms break down dead things for food. Explain that mushrooms are not plants or animals. Mushrooms are fungi. Some people say that fungi, along with bacteria, are the world's smallest recyclers!

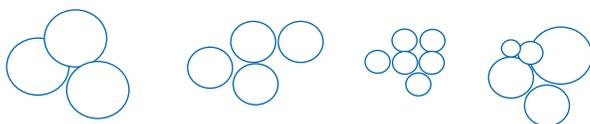
As appropriate, introduce the word *decomposer*. Explain that the word *compose* means “to put together,” as in “compose a paragraph.” Ask students to guess at the meaning of the prefix *de-* for this word. (undo) Tell students that

decomposers include worms, fungi such as mushrooms, and insects. These organisms decompose dead plants and animals into simple minerals and nutrients for use by living things. Decomposers recycle matter.

- Point out the photograph of the anthill on page 6. Ask, *Have you ever seen an anthill or an animal tunnel?* Give students an opportunity to share their experiences. Ask, *How do you think ants help soil?* Confirm students' responses by reading aloud the caption.

Pages 7, 8 *How Are Soils Different?*

- Have students look at the pictures on page 7. Ask, *What do these pictures show?* (three kinds of soils with different properties) *How are these soils alike? How are they different?* Allow students to briefly share their observations.
- Read aloud pages 7 and 8. Ask, *What are some ways that soils can be different?* (They can have different colors, different-sized grains, and different textures; some hold water better than others.)
- On the board, draw diagrams showing large, medium, small, and a mix of different-sized grains of soil. Ask volunteers to point out which diagram shows sand, silt, clay, or loam.



sand

silt

clay

loam

- Ask, *If you wanted to grow a garden, which type of soil would you rather have: sand, silt, clay, or loam?* (loam) *Why?* (It holds and drains water well and has more of the minerals that plants need to grow.)

Page 9 *What Is Erosion?*

- Ask students if they have ever heard the word *erosion* before. Briefly discuss their prior knowledge of the word or its verb form *erode*. Then read aloud page 9.
- Ask, *What is erosion?* (the moving of soil from one place to another) *What causes erosion?* (water and wind) *How can plants keep soil from being eroded?* (Their roots hold soil in place so water and wind cannot wash or blow it away.) *What happens if too much soil is carried away by erosion?* (Plants cannot grow.)

Further Facts

- You may wish to briefly discuss the effects of erosion during the Dust Bowl era of the 1930s. Explain that decades of poor farming practices in the central United States had replaced the native, drought-resistant grasses with wheat. In addition, a long drought in the Great Plains caused plants to die and soil to become dry. Without plants to hold the soil, strong winds created dust storms, which blew away massive amounts of soil, destroyed farms, and created health problems. People lost their farms, homes, and businesses. Many people had to move to find new jobs and feed their families.

Pages 10, 11, 12 *Soil Is a Resource*

- Have students look at the photographs and read the heading on page 10. Ask, *What do you think a natural resource is?* (something from Earth that people need or use) Invite students to name other natural resources they can think of. (Students may suggest such resources as forests, fresh water, wind, and sunshine.) Ask, *Why do we need soil?* (All living things need minerals, which soil provides. Plants grow in soil. We need plants for food. People eat plants and people eat animals that eat plants.)

(Plants get most of the substances they need to grow and make food—called

nutrients—from the soil. Soil provides thirteen of the sixteen nutrients essential for plant growth. The three most important are nitrogen, which helps leafy growth and gives dark green color to leaves; phosphorus, which encourages root growth and cell division so flowers and seeds can form; and potassium, which provides for strong stems and helps fight off diseases. These nutrients originate in the soil from minerals and from decaying plant and animal matter. They dissolve in water and are absorbed by plant roots. Plants also require carbon, hydrogen, and oxygen, which are found in spaces between soil particles.)

- Point out the photographs on page 10. Ask, *What do you think has happened to the soil in each of these pictures?* (It has eroded.) Have students read page 10 and the first paragraph on page 11 to find out about soil as a natural resource and how humans contribute to soil erosion. Ask, *What are some things people do that cause erosion?* (farming, building, cutting trees, mining)
- Before reading the rest of the section, ask students to suggest things that farmers and other people who use the land might do to help save soil. List students' suggestions on the board.
- Read aloud the rest of page 11. Point to the word *conserve* and ask, *What does this word mean?* Remind students that sometimes context, or words around an unfamiliar word, contains clues to a word's meaning. Reread the sentence containing the word *conserve* and have students use the context to figure out the word's meaning. Follow the same procedure for the words *contour plowing* and *strip cropping*. Have students check the glossary to confirm each word's meaning.
- Ask students, *How many of you have a garden or grow plants at home?* Allow students to briefly share their experiences. Tell students that the text on

page 12 will tell them about one way they can make the soil in their gardens good for growing.

- Ask, *What sorts of things might you put in a compost pile or bin?* (leftover scraps of fruits and vegetables, tea bags, coffee grounds, eggshells, grass clippings, raked leaves) *What happens to the things you put in a compost bin?* (They decay and become humus.) *Why is humus good for soil?* (It makes the soil rich and good for growing plants.)

Further Facts

- The four main ingredients of compost are “green” material, “brown” material, air, and water. Many recycling websites have compost recipes and instructions.
- Green materials are fresh, living things such as grass clippings, fruit and vegetable scraps, and weeds.
- Brown materials are dead, dried plants such as leaves, pine needles, and hay or straw.
- Don't use meat, fish, dairy products, or fats because they can attract pests and will smell bad as they decay. Also, avoid diseased plants or weeds you don't want to spread in your garden.
- When done, compost looks like dark, crumbly soil and has a sweet, earthy smell.

People in Science (page 13)

Soil Scientists

- Have students look at the photograph on page 13. Ask, *What do you think this person is doing?* (Accept all reasonable answers.)
- Read aloud page 13. Ask, *What are some things that a scientist might find out by studying soil?* (what kind of soil it is; how deep the different layers are; what kind of plants will grow well in the soil) *How*

might soil scientists use this information to help people? (They can tell farmers what kinds of plants grow best in different soils and how to prevent erosion. They can help plan ways to conserve soil.)

Further Facts

- Soil scientists perform a variety of tasks, both in the field and in the laboratory.
- In the laboratory, they analyze soils to determine their chemical and physical composition.
- In the field, soil scientists collect samples and compare soils in different environments. They study how soils react to different types of fertilizers, plowing techniques, and industry pollutants.
- Soil scientists who work for the government conduct soil surveys and use the information they collect to create maps of soil distribution.
- The information that soil scientists collect helps farmers plan what crops to grow and what cultivation methods to use to keep their soil healthy and productive. Soil scientists also advise engineers about the effects of building on different types of soils. They consult with industry and governmental officials about environmental problems that might be caused by pollutants or overuse of the land.

Did You Know? (pages 14–15)

About Worms and Soil

- Have students identify the picture of the earthworm at the bottom of page 14. Ask, *Have you ever seen or handled an earthworm in real life?* Briefly discuss students' prior experiences with worms. Tell students that they will learn more about earthworms on the next two pages.
- Point to the diagram of an earthworm on page 15. Ask, *What is this?* (an earthworm) Point to and read aloud the labels on the diagram. Ask, *Where is the earthworm's*

mouth? (in the front segment) *Does this earthworm have eyes or ears?* (no) *Does it have legs?* (no) *How do you think it moves?* (Accept all answers at this time.)

- Ask a volunteer to read aloud the caption at the top of the page. Have students point to the section of the worm labeled *segments*. Ask, *How might the segments of a worm's body help it move?* (The earthworm moves by stretching its segments. Students may also suggest that the segments allow the worm to wiggle back and forth.) Point out that an earthworm may have 100 or more body segments.
- Point to the large diagram on pages 14 and 15. Ask, *What does this diagram show?* (a worm's underground tunnels) *How does a worm make tunnels?* (It eats the soil in front of it.)
- Read aloud the text on page 14. Have students point to the plants in the diagram. Ask, *How do earthworms help plants to grow?* (They make tunnels that fill with air and water, which the roots of plants need. They eat the dead leaves and animals in soil and leave castings, which are full of minerals and other things plants need to grow.)

Further Facts

- There are about three thousand species of earthworms in the world. As many as 1 million earthworms may live in an acre of soil.
- As invertebrates, earthworms have no backbones. Most have soft bodies.
- Although earthworms have no eyes or ears, they are sensitive to light, heat, and touch, and they can feel vibrations in the ground.
- Earthworms have no lungs or gills; they breathe air from the soil through their moist, slimy skin. It is a common misconception that worms come to the

surface after a rain to avoid drowning when the air spaces in soil fill with water. That is not true. Worms can survive for several weeks under water if the water has enough oxygen in it. Scientists think worms come to the surface after a rain because the moisture allows them to move around without drying out.

- An earthworm has five hearts, which are located in the first few segments of its body. Most of the rest of the body is filled with intestines, in which soil is digested and excreted as castings.
- The thick band around an earthworm's middle is called a *clitellum*. It contains both male and female reproductive organs. During reproduction, the clitellum makes a cocoon, which protects the eggs.
- Each segment of a worm's body has tiny hairs called *bristles*. A worm moves using its bristles to grip the soil around it. By stretching and contracting its muscles, it lengthens the front part of its body and then pulls up the back part.
- The largest earthworm found to date was from South Africa and measured almost 7 m (22 ft) long.

AFTER READING

Summarize

Complete the KWL chart you began with students before reading by asking them to share the answers to their questions. Call on volunteers to retell each text section. Then have students use the information in the KWL chart to write brief summary statements.

Discuss with students how using the KWL strategy helped them understand and appreciate the book. Encourage them to share any other reading strategies that helped them understand what they read. Direct attention to the fourth column of the chart and ask, *What questions do you still have about soil science? What would you like to explore further?* Record students'

responses. Then ask, *Where you do think you might be able to find this information?* (Students might mention an encyclopedia, science books, and the Internet.) Encourage students to conduct further research.

Review/Assess

Use the questions that follow as the basis for a discussion of the book or for a written or oral assessment.

1. What are the four parts that make up soil? (rocks, humus, air, water) What is humus? (dead plants and animals that have decayed) Why is humus helpful to plants? (It has minerals that plants need to grow.) How does humus get into soil? (Insects, worms, mushrooms, and other living things break down the dead plant and animal matter. Animals that live in soil dig tunnels that mix the humus into the soil.)
2. How does weathering make soil? (It breaks rocks into tiny bits.) What are two things that can cause weathering? (Possible answers include water, wind, temperature changes, glaciers, and plants.)
3. Are all soils alike? (no) How are they different? (They have different colors and different textures. They are made of different kinds and sizes of rock particles. Some hold water better than others.)
4. What happens when soil erodes? (Wind or water carries it away.) What are some ways that people cause erosion? (plowing, building, cutting trees, mining) What are some things that people can do to conserve soil? (contour plowing, strip cropping, composting)

Writing Links/Critical Thinking

Present the following as writing assignments. Provide help as needed.

1. Have students imagine they are soil scientists who help farmers. Have students create a brochure that gives farmers information about choosing crops and conserving soil.

