

# Science

## Grade 2

## Unit 2 SOILS (based on STC Kit)

### INTRODUCTION

Soils can easily be described by their color, texture and capacity to retain water. Understanding soils helps us to also understand how the growth of certain plants is supported or inhibited by where they grow and in what substance. Soils support the growth of many kinds of plants, including those in our food supply. Understanding the properties of soil enables us to better understand the environment in which we live.

### SCIENCE STANDARDS AND INDICATORS

**Content Standard 2.3:** Earth materials have varied physical properties which make them useful in different ways.

**A21: Sort different soils by properties, such as particle size, color and composition.**

**A22: Relate the properties of different soils to their capacity to retain water and support the growth of certain plants.**

**SCIENCE INQUIRY:** Scientific inquiry is a thoughtful and coordinated attempt to search out describe, explain and predict natural phenomena.

**SCIENCE LITERACY:** Science literacy includes speaking listening, presenting, interpreting, reading and writing about science.

**SCIENCE NUMERACY:** Mathematics provides useful tool for the description, analysis and presentation of scientific data and ideas.

### EXPECTED PERFORMANCES

**AINQ.2** Use senses and simple measuring tools to collect data

**AINQ.4** Read, write and speak about observations of the natural world.

**AINQ.9** Count, order and sort objects by their properties.

### **BIG IDEA**

Soil is made of three different things and supports plant life in different ways.

### LINKS TO OTHER STANDARDS

#### **LANGUAGE ARTS**

**1.2.b.** Interpret information that is implied in a text

**1.3.d.** Develop vocabulary through listening, speaking, reading and writing.

**3.2.d.** Research information from multiple sources for a specific purpose.

**Key Vocabulary:** soil, silt, clay, particles, properties, organic, textures, habitat, compost

## SCIENCE CONTENT STANDARD 2.3

CONCEPTUAL  
THEME:

*The Changing Earth - How do materials cycle through the Earth's systems?*

CONTENT  
STANDARD:

**2.3 – Earth materials have varied physical properties which make them useful in different ways.**

**GRADE-LEVEL CONCEPT 1:** ♦ Soils can be described by their color, texture and capacity to retain water.

**GRADE-LEVEL EXPECTATIONS:**

1. Soil is a mixture of pieces of rock (particles), living and once living things (humus), water and air. The components of soil can be separated using sieves and settlement tests.
2. There are different types of soil that vary from place to place. Soil properties can be observed and compared. Soils can be classified by properties such as color, particle size, or amount of organic material (humus). Digging a deep hole shows that soils are often found in layers that have different colors and textures.
3. The size of the particles in soils gives the soil its texture. Soils can be classified by how they feel: Sandy soils feel gritty, silty soils feel powdery, clay soils feel sticky, and soils with small rocks feel rough and scratchy.
4. The broken rocks that make up soils can be tiny (silt and clay), medium (sand), or large (pebbles). Soils can be classified by the size of their particles.
5. A soil's texture affects how it packs together; soils that pack together tightly hold less air and water than soils that stay loosely packed.
6. There are different types of soil that vary from place to place. Some soil types are suited for supporting the weight of buildings and highways; other soil types are suited for planting food crops or forest growth.

**GRADE-LEVEL CONCEPT 2:** ♦ Soils support the growth of many kinds of plants, including those in our food supply.

**GRADE-LEVEL EXPECTATIONS:**

1. Many plants need soil to grow. Soil holds water and nutrients that are taken in (absorbed) by plant roots.
2. Soil is a habitat for many living things. Some organisms live in the soil and others live on the soil. Worms and other underground animals create spaces for air, water and plant roots to move through soil.
3. Plants we eat ("crops") grow in different soil types. Plant height, root length, number of leaves, and number of flowers can all be affected by how much water, air and organic material the soil holds.
4. To support the growth of different plants, people can change the properties of soils by adding nutrients (fertilizing), water (irrigating) or air (tilling).

**KEY SCIENCE VOCABULARY:** soil, property, classify, mixture, particle, humus, sand, silt, clay, texture, nutrients

**CMT EXPECTED  
PERFORMANCES**

**A21**

Sort different soils by properties, such as particle size, color and composition.

**A22**

Relate the properties of different soils to their capacity to retain water and support the growth of certain plants.

## **ESSENTIAL KNOWLEDGE:**

- Soil is a mixture of pieces of rock (particles) living and once living things (humus), water, and air. The components of soil can be separated using devices and settlement tests.
- There are different types of soil that vary from place to place. Soil properties can be observed and compared. Soils can be classified by properties such as color, particle size, and amount of organic material. Digging a deep hole shows that soils are often found in layers that have different colors and textures.
- The size of the particles in soil gives the soil its texture. Soils can be classified by how they feel; sandy soils feel gritty, silt feels powdery, clay feels sticky and soils with small rocks feel rough and scratchy.
- The broken rocks that make up soils can be tiny (silt and clay), medium (sand), or large (pebbles). Soils can be classified by the size of their particles.
- A soil's texture affects how it packs together; soils that pack together tightly hold less air and water than soils that stay loosely packed.
- There are different types of soil that vary from place to place. Some soil types are suited for supporting the weight of buildings and highways; other types are suited for planting food crops or forest growth.
- Many plants need soil to grow because it holds water and nutrients that are taken in by plant roots.
- Soil is a habitat for many living things. Some organisms live in the soil, while others live on the soil. Underground organisms adapt the soil to their needs.
- Plants that we eat grow in different soil types. Plant height, root length, number of leaves and flowers can all be affected by how much water air and other organic materials the soil holds.
- To support the growth of different plants, people can change the properties of soil by adding nutrients (fertilizing), water (irrigating) or air (tilling).

## **CONCEPTS**

- Soil contains particles of different sizes.
- Soil may contain animals, plants and their remains.
- Over time, dead plants become part of soil.
- Composting, especially with worms, is an effective way to recycle old plants and other discarded organic matter.
- Sand, clay and humus are three basic components of soil.
- Every soil component has unique properties that can be identified using simple tests.
- Different soils absorb water at different rates.
- Many factors, including soil, effect plant and root growth.

## **SKILLS:**

- Performing simple tests to describe and identify soil components.
- Observing, recording, and organizing test results.
- Interpreting test results to draw conclusions about soil components.
- Reflecting on test results to predict how plants will grow in different so
- Assembling laboratory materials for soil experiments.
- Communicating results and ideas through writing, drawing and discussion.
- Applying previously learned concepts and skills to analyze unfamiliar soil samples.

# **ESSENTIAL QUESTIONS TO GUIDE INSTRUCTION AND ASSESSMENT:**

- What is soil?
- What is soil made of?
- What are the properties of different soils?
- Why do different plants grow differently in different soils?
- How does soil hold water?
- How does soil support plant life?
- What factors regarding soil affects plant and root growth?

## **MATERIALS AND SUPPLIES**

- STC Soils Kit

## **OBJECTIVES AND GOALS (as summarized from STC Kit, “Soils”)**

### **LESSON ONE**

#### **What is in Soil?**

- Students share what they show about soil and what they want to find out.
- Students discuss the difference between a prediction and an observation.
- Students predict what they will find in a sample of garden soil.
- Students observe soil with a hand lens.
- Students compare and record observations of garden soil.

### **LESSON TWO**

#### **Where do dead plants go?**

- Students brainstorm where dead plants might go.
- Students set up a five-week composting project using garden soil, worms and plant remains.
- The class sets up a compost bag without worms for comparison (control).
- Students predict what will happen to the organic matter in their compost bags.
- Students describe and record observations of their organic matter.

### **LESSON THREE**

#### **Introducing Sand, Clay and Humus**

- Students discuss what they already know about sand, clay and humus.
- Students examine sand, clay and humus with a hand lens.
- Students touch, smell and listen to the three samples.
- Students compare and discuss their observations.
- Students record their observations through writing and drawing.

### **LESSON FOUR**

#### **When Soils Get Wet**

- Students describe the feel and appearance of moistened sand, clay and humus.
- Students compare wet and dry samples, discussing similarities and differences.
- Students discuss the results of rolling the moist samples between their fingers.
- Students record their observations about moist samples.

## **LESSON FIVE**

### **More About Wet Soils**

- Students conduct a smear test on sand, clay and humus.
- Students record and discuss the results of the smear test.
- Students observe and discuss changes in the clay balls made in the last lesson.
- Students crush and moisten the dried clay balls and discuss the changes.
- Students read about everyday uses for sand and clay.

## **LESSON SIX**

### **How Quickly Do Soils Settle in Water?**

- Students predict what will happen when they separate soil and components by settling.
- Students observe and describe the results of the settling test.
- Through drawing, students record their test results.
- Students compare and discuss the results of settling for the three samples.

## **LESSON SEVEN**

### **More Settling a Few Days Later**

- Students observe further settling of sand, clay and humus.
- Students discuss and record their observations of settled materials.
- Students compare how the settled materials look now with how they looked during the last lesson.
- Students observe the compost bags they set up in Lesson 2.

## **LESSON EIGHT**

### **What is Your Mystery Mixture?**

- Students conduct soil tests on an unfamiliar mixture.
- Students compare their test results with those from their previous tests on sand, clay and humus.
- Students describe the properties of the new mixture.
- Using their data, students infer which soil components their mystery mixture contains.
- Students create a “mystery mixture” book with their record sheets.

## **LESSON NINE**

### **Growing Plants in Different Soils**

- Students discuss their ideas about plant growth in different samples.
- Students plant seeds in sand, clay or humus and their local soil.
- Students begin a logbook of their plants’ progress.

## **LESSON TEN**

### **Why Do Plants Have Roots in Soil?**

- Students brainstorm what the roots of a plant do.
- Students plant seeds in clear tubes filled with sand, clay and humus.
- Students monitor the growth of roots in each tube, watering them regularly.
- Students observe and discuss changes in the materials in their compost bags.
- Students read about earthworms and their connection to plant roots and soil.

## **LESSON ELEVEN**

## **Can Soil Hold Water?**

- Students brainstorm a device to observe how water moves through humus.
- Students compare the quantity of water added to humus with the quantity that filters through.
- Students deduce where the missing water went.
- Students discuss how rain soaks into the ground.
- Students observe their planting cups and record plant growth.
- Using a hand lens, students observe and compare root growth in sand, clay, and humus.

## **LESSON TWELVE**

### **How Water Moves through Sand and Clay**

- Students pour water simultaneously over samples of sand and clay.
- Students observe, compare, and record how water moves through the two samples.
- Students brainstorm how their experiment resembles the effect of rain on soil.
- Students observe their planting cups and record further plant growth.
- Using a hand lens, students observe and compare root growth in sand, clay and humus.

## **LESSON THIRTEEN**

### **Opening the Compost Bags**

- Students observe, discuss, and record changes that have occurred inside their compost bags.
- Students compare their predictions and findings from earlier lessons to their observations today.
- Students compare the results of composting with and without worms.
- Students read about making compost outdoors.
- Using a hand lens, students observe and discuss root growth in sand, clay and humus, comparing results among the three samples.

## **LESSON FOURTEEN**

### **Exploring Your Local Soil**

- Students review previous soil tests and their results.
- Students examine the local soil and predict which components it might contain.
- Students run tests on the local soil.
- Students discuss and record their findings.
- Students compare their test results today with those from previous tests on sand, clay and humus.
- Students observe their planting cups and record further plant growth.

## **LESSON FIFTEEN**

### **More About Your Local Soil**

- Students conduct additional tests on their local soil.
- Students compare their current test results with those from previous lessons.
- Students record their findings and share them with the class.

## **LESSON SIXTEEN**

### **What is Your Local Soil?**

- Students compare and record plant growth in sand, clay humus and local soil.

- Students complete their plant logbooks.
- Students make a class chart to compare plant growth in the same kind of sample.
- Students observe and discuss differences in seedlings grown in the same kind of sample.
- Students summarize their investigation of local soil.
- Students create a local soil book with their record sheets.

## Significant Task

### Post Unit Assessment

**Overview:** This post-unit assessment is matched to the pre-unit assessment. In Lesson 1, students developed two lists, “Soil” and “Questions about Soil.” Now they again will refer to these questions and may discover realizations and conclusions though what they have done.

**Materials:** For each student there should be a Science Journal  
 For the class there should be 2 sheets of newsprint, the Soil and Questions Charts from Lesson 1, markers and tape

**Procedure:** Be sure the old charts are not visible at first in this assessment. Label one of the blank sheets “Soil” and the other “Questions about Soil” and date them.

- 1) Have students repeat what they have done in Lesson 1. They also should write down what they now know about soil in their science journals. Allow plenty of time for writing and drawing. Assist students in making recollections and connections to the experiments they have done.
- 2) Students will compare these journal activities with those from lesson one, noticing recurring ideas or answers to posed questions.
- 3) Students will share new journal entries with the class. Record their responses on the blank “Soil” char.
- 4) Post the old “Soil” chart. Point out the similarities and differences and how they have learned answers to many of the questions.
- 5) Post the original “Questions about Soil” and ask students which of these questions they now know answers to.
- 6) Finally, ask students if there are still pending questions they have about soil, and post these on the BLANK “Questions about Soil” chart. Let them know that in science, it is acceptable to have unanswered questions and that at times, finding answers can lead to new curiosities.

### RUBRIC (can be used if desired):

Name: \_\_\_\_\_

Teacher: \_\_\_\_\_

Date : \_\_\_\_\_

Title of Work: \_\_\_\_\_

	Criteria				Points
	1	2	3	4	
<b>Final Assessment: Soils</b>	Student responses show little to no understanding of main concepts regarding soils, the components of soil and how soils effect growth of plants; responses are unclear and do not cite examples to support ideas.	Student responses show some understanding of main concepts regarding soils, the components of soil and how soils effect growth of plants; responses may be unclear and cite few examples to support ideas.	Student responses adequate understanding of main concepts regarding soils, the components of soil and how soils effect growth of plants; responses are clear and cite some examples to support ideas.	Student responses show mastery of concepts taught. Students use vocabulary properly, show understanding of soils, the components of soil and how soils effect growth of plants. Students also show ability to cite examples to support points of view and can verbalize understandings clearly.	—
				<b>Total----&gt;</b>	—

### Teacher Comments:

### Common Misconceptions:

- Weathering and erosion are synonymous. Weathering is caused by weather changes. Erosion is caused by wind, water or friction.
- Still showing up in some popular garden literature is the notion that "day-watering can burn plants." The notion says that sunlight is "magnified by the water drop on the leaf to cause a leaf burn.
- Soil appears out of nothing. No, it doesn't just appear out of nowhere. A magician doesn't wave a magic wand and...poof!... soil shows up. And it's not made in a soil factory. Soil comes from broken up pieces of rock and dead leaves, tree limbs, and dead bugs-those kinds of things.
- Soil is brown. Actually, not true, soils can come in black, red, yellow, white, brown, and gray.

## Sample Literacy Component

### What's the difference between soil and dirt?

Dirt is what you find under your fingernails. Soil is what you find under your feet. Think of soil as a thin living skin that covers the land. It goes down into the ground just a short way. Even the most fertile topsoil is only a foot or so deep. Soil is more than rock particles. It includes all the living things and the materials they make or change.

**Ground level:** Plants grow and animals live here. A thick cover of plants can keep the soil cool and keep it from drying out. Decomposers, or living things that use dead plants and animals for food, recycle dead plants and animals into



humus.

**Topsoil:** Plants grow and animals live on top of the soil. This is sometimes called the organic layer. Organic matter are things in the soil that are living or were once living. A thick cover of plants can keep the soil cool and keep it from drying out. Once again, the decomposers recycle dead plants and animals into humus.

**Subsoil:** This is a mix of mineral particles and some humus near the top. Subsoil is very low in organic matter compared to the topsoil. This is the layer where most of the soil's nutrients are found. Deep plant roots come here looking for water. Clays and minerals released up above often stick here as water drains down.

**Weathered parent material:** This layer can be very deep. There's no organic matter here at all. There are no living or once living organisms down here. It's all rock particles, full of minerals.

The entire soil profile used to look like this all the way to the surface. Physical weathering broke the parts of soil into small pieces. Don't be fooled! This layer may contain rock particles that are different from the bedrock below. A river or a glacier might have brought it from somewhere else.

**Bedrock:** We finally found solid rock! The bedrock formed before the soil above it. It will wait here until erosion or an earthquake exposes it to the surface. Then some of it will be weathered to become the next batch of soil parts. The soil-making process will start all over again.

Taken from [http://school.discovery.com/schooladventures/soil/down\\_dirty.html](http://school.discovery.com/schooladventures/soil/down_dirty.html)

## Strand Questions for Use with “What’s the Difference Between Dirt and Soil”

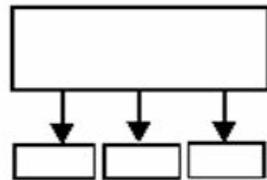
**A1 – What is the section of the article called “Bedrock” mainly about?**

**A2 – The first paragraph is mostly a description of \_\_\_\_\_.** Finish the sentence and show details from the text that support your answer.

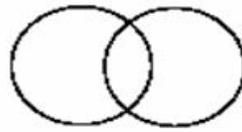
**A3 – Briefly summarize the main points of the article in the order that they occur.**

**A4 – If the author added another section to this article, what would it most likely be about?**

**B1 – Which of these graphics below best shows how this article is organized?**



a. Main idea/support



c. Compare/contrast



b. Cause/effect



d. Sequence of events

**B2 – What is the author’s purpose in writing this article?**

**B3 – Do you think soil can be described as living? Use information from the article to support your answer.**

**C1 – If the author of this passage visited your school, what would you like to ask him or her and why?**

**C2 – Which part of this article is the most important? Use information from the article and your own life to explain why you chose that part.**

**D1 – Choose two words or phrases from the paragraph called “topsoil” that help you FEEL/TOUCH what the author is explaining.**

**D2 – Using information from the story, write a journal entry that may have appeared in the diary of naturalist John Muir as he studied soils and plants.**

**D3 – Why do you think the author chose this topic to write about?**

## **RESOURCES**

### Web Sites

- <http://soil.gsfc.nasa.gov/index.html>
- <http://www.pedosphere.com/volume02/main.html>
- <http://www.stormloader.com/geocoop/soils.htm>
- <http://www.metla.fi/info/vlib/soils/old.htm>
- <http://www.hintze-online.com/sos/soils-online.html>
- <http://soil.gsfc.nasa.gov/env.htm>

- [http://science.nasa.gov/headlines/y2006/28dec\\_truefake.htm](http://science.nasa.gov/headlines/y2006/28dec_truefake.htm)

## Literacy Books

- Recycle: A Handbook for Kids by Gail Gibbons
- City Green by Dyanne DiSalvo-Ryan (Illustrator)
- Cactus Hotel by Brenda Z. Guiberson
- Growing in the Garden: Outdoor Classrooms for Young Gardeners
- Dirt Made My Lunch by Banana Slug String Band
- Secrets of the Soil by Peter Tompkins, Christopher Bird
- Winter Wheat by Brenda Z. Guiberson, Megan Lloyd (Illustrator)

## Extension Activities

- Studying organisms that you may find in soil, Appendix B
- Sand Paintings, Appendix C

## Field trips

- Edgerton Park Greenhouse
- Local Farm
- Local restaurant that uses a compost bin

## Links to United Streaming – [www.unitedstreaming.com](http://www.unitedstreaming.com)

[Getting to Know Soil](#) (23:00)

[Dr. Dad's PH3: Episode Eleven: Soil and Agriculture](#) (14:52)

[Geologist's Notebook: How to Make Mud Pie](#) (11:00)

[Worm Farm](#) (01:02)

[Rocks: The Solid Earth Materials #1](#) (20:00)