



# EDUCATORS GUIDE



## National Association of Conservation Districts

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# NACD

The National Association of Conservation Districts is the non-profit organization that represents the nation's 3,000 conservation districts, their state associations and the 17,000 men and women who serve on their governing boards. For almost 70 years, local conservation districts have worked with cooperating landowners and managers of private working lands to help them plan and apply effective conservation practices.

Conservation districts are local units of government established under state law to carry out natural resource management programs at the local level.

NACD's mission is to serve conservation districts by providing national leadership and a unified voice for natural resource conservation. The association was founded on the philosophy that conservation decisions should be made at the local level with technical and funding assistance from federal, state and local governments and the private sector. As the national voice for all conservation districts, NACD supports voluntary, incentive-driven natural resource conservation programs that benefit all citizens.

NACD maintains relationships with organizations and government agencies; publishes information about districts; works with leaders in agriculture, conservation, environment, education, industry, religion and other fields; and provides services to its districts. NACD is financed primarily through the voluntary contributions of its member districts and state associations.

The association's philosophy is that conservation decisions should be made by local people with technical and funding assistance from federal, state and local governments and the private sector. The association's programs and activities aim to advance the resource conservation cause of local districts and the millions of cooperating landowners and land managers they serve.

Visit [www.nacdnet.org](http://www.nacdnet.org) for additional information.

To find your local district contact information, go to: [www.nacdnet.org/about/districts/directory/index.shtml](http://www.nacdnet.org/about/districts/directory/index.shtml)

## Stewardship Week Information

NACD has sponsored Stewardship Week since 1955.

Education is a critical element of the conservation effort at the local, state and national levels. Educating youth ensures that the next generation will be wise stewards of America's natural resources. Helping today's adults understand the need for effective conservation practices builds on the conservation legacy. Through NACD's Stewardship and Education efforts, we help districts and communities extend the reach of their education programs.

Stewardship Week, celebrated annually between the last Sunday in April and the first Sunday in May, reminds us of our individual responsibilities to care for the natural resources upon which we all depend.



# Healthy Soil, Healthy Life Level 1, Grades K-1

## Booklet & Lesson Objectives

Students will:

- Describe patterns of what plants and animals (including humans) need to survive
- Recognize that soils are a habitat for plants and animals
- Animals and plants can change soils and the environment they live in
- Describe patterns of adaptations that animals have to live in the soil
- Use their understanding of these patterns to design a solution to a human problem

## NGSS Connections

*For full information on the standards, review Appendix A*

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none"><li>• Analyzing &amp; Interpreting Data</li><li>• Scientific Knowledge is Based on Empirical Evidence</li><li>• Constructing Explanations and Designing Solutions</li></ul>	<ul style="list-style-type: none"><li>• Organization for Matter and Energy Flow in Ecosystems</li><li>• Structure and Function</li><li>• Information Processing</li></ul>	<ul style="list-style-type: none"><li>• Patterns</li><li>• Structure and Function</li></ul>

## Vocabulary Words

**Adaptation** - a physical trait or behavior that helps an organism survive in their environment

**Agriculture** - growing crops, raising livestock and cultivating soil. Includes the field of study and occupations like farming.

**Farm** - an area of land or water where particular animals, birds, fish, or crops are raised for commercial purposes

**Habitat** - the place where an organism or community of organisms is found. Includes the other living and nonliving things that are found there.

**Mimic** - imitating the mannerisms, movements or coloration of another animal

**Organism** - living things capable of growth and reproduction. Examples include plants, animals, fungi and bacteria

**Ranch** - a large farm devoted to keeping a particular type of animal or growing a particular type of crop

**Soil** - the top layer of most of the Earth's land surface, consisting of the unconsolidated products of rock erosion and organic decay, along with bacteria and fungi

**Survival** - continuing to live and thrive in an environment

**Topsoil** - the layer of soil found on the surface of the ground, includes minerals and organic material. Many living organisms are found in this layer of the soil.

# Surviving in the Soil Activity

## Time

Engage: 10-15 minutes

Explore: 15-20 minutes

Explain: 20-30 minutes

Elaborate: 20-45 minutes

Evaluate: 10-15 minutes

Total Time: 1 hour - 2hours, 15 minutes

## Materials

- Animal Cards: earthworm, ant, mole, termite, groundhog, armadillo, millipede, beetle, sowbug, shrew
- Soil is a Habitat Student Pages

## Background

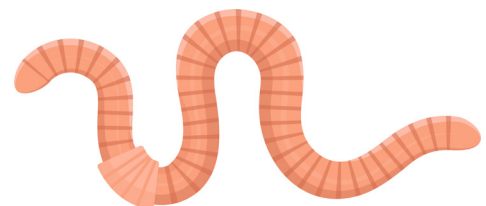
There is great diversity among the animals that are found living in soils. Some of these organisms are too small for the human eye to see and some are large and recognizable. Soil organisms can be classified into microfauna (protozoa), mesofauna (mites and nematodes), and macrofauna (earthworms, beetles, termites, etc.) The most common animals found in soils are the micro- and meso-fauna. This activity will focus on animals that can be seen without a microscope with easily distinguishable features.

Soils form a unique environment. Living underground may require animals to create burrows or tunnels, in addition to developing unique adaptations to survive in their surroundings. The animals that live in the soil may also help to contribute to soil health. For example, when earthworms tunnel in the soil, they create spaces for air and water. This allows water to flow into soils rather than running off and causing erosion.

## Engage

Begin by asking students what they think it's like to live in the soil. What do they think it would be like? How do they think it would feel - would it be dry or wet, would they have a lot of room to move around or would it be cramped? What do they think animals in the soil need to survive? Would they see lots of other creatures in the soil or would it feel empty? Do they think other creatures in the soil would be large or small? What other questions do they have? Write down student responses on a large sheet of paper or whiteboard.

Ask students if they learned anything new. Was there anything interesting they noticed? Tell students they are going to spend some more time identifying animals that live in the soil and that they are going to focus on animals that can be seen without a microscope.



# Surviving in the Soil Activity Cont.

## Explore

After you have gathered responses, tell students that they are going to spend some time exploring and learning about the animals that make the soil their home. There are a few short clips that you can watch to begin to investigate life beneath the soil. Before watching these videos, ask students to pay special attention to the features of the animals that are mentioned. What are their similarities or differences? How do they differ from animals that they are familiar with that may be found on Earth's surface?

[Soils Are Living](#) (Soil Science Society of America)

[What's It Like to Live Underground](#) (SciShow Kids)

[Soil is Alive!](#) (SciShow Kids)

Ask students if they learned anything new. Was there anything interesting they noticed? Tell students they are going to spend some more time identifying animals that live in the soil and that they are going to focus on animals that can be seen without a microscope.

## Explain

Have students examine the animal cards. On the student page, have them record their observations. What do they notice about each animal's features? Practice with one card together and then have students work in smaller groups.

Kindergarten students should focus on the question of how they think the features of these animals help them to survive and work on constructing an explanation based on what they know about life in the soil. Do any of these animals have common adaptations?

First graders should think about the adaptations they notice. Would any of these adaptations be helpful to humans?

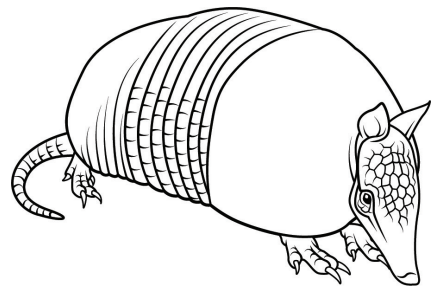
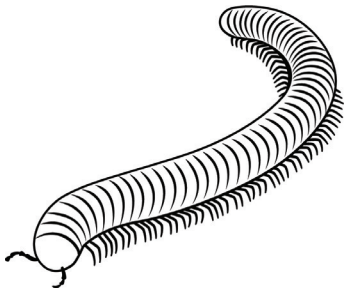
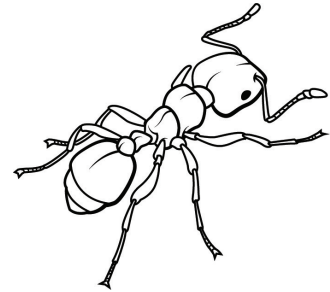
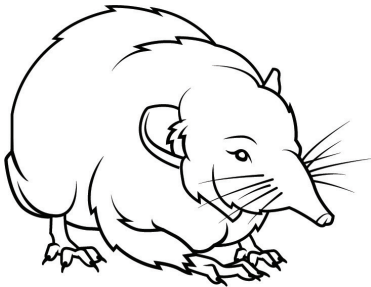
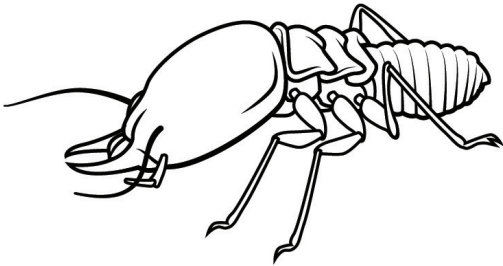
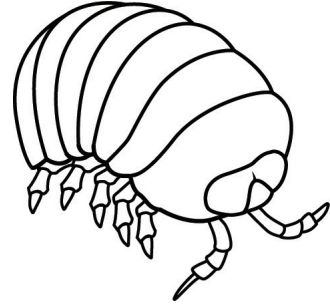
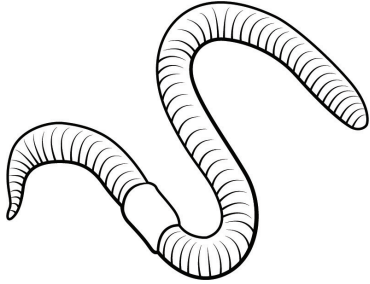
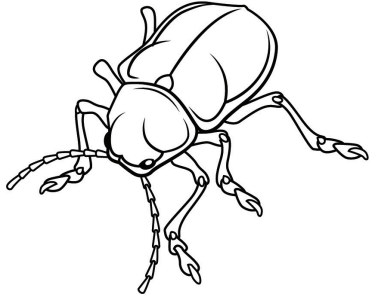
## Elaborate

Kindergarten students can create a poster featuring their favorite animal that lives in the soil. They should indicate the adaptations that help them to survive in their environment

First grade students can create a poster highlighting their favorite adaptation and explain how this adaptation may help humans solve a problem.

## Evaluate

Have students explain their reasoning for highlighting particular adaptations. Return to the questions from the beginning of the lesson. Would students change their answers? Were their original questions answered? Is there anything else they would like to know?



**GROUND HOG**

**BEETLE**

**SOW BUG**

**EARTH  
WORM**

**MOLE**

**TERMITE**

**ANT**

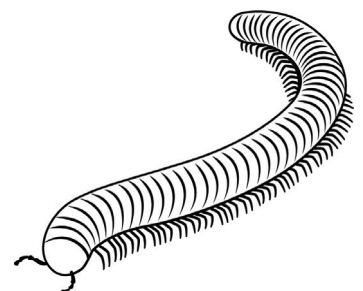
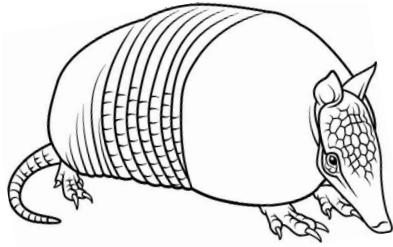
**SHREW**

**ARMADILLO**

**MILLIPEDE**



## Animals That Live in Soil: My Observations



# Healthy Soil, Healthy Life Level 2, Grades 2-3

## Booklet & Lesson Objectives

Students will:

- Describe characteristics of soil
- Use their senses to explore soil samples
- Discover the materials in soils
- Understand how soils support life

## NGSS Connections

*For full information on the standards, review Appendix A*

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none"><li>• Planning and Carrying Out Investigations</li><li>• Constructing Explanations and Designing Solutions</li></ul>	<ul style="list-style-type: none"><li>• Biodiversity and Humans</li><li>• Variation of Traits</li></ul>	<ul style="list-style-type: none"><li>• Patterns</li><li>• Cause and Effect</li></ul>

## Vocabulary Words

**Ecosystem** - living and nonliving organisms and their many interactions. Can vary in size and are found on land and in water. Examples can include school gardens and entire forests.

**Habitat** - the place where an organism or community of organisms is found. Includes the other living and nonliving things that are found there.

**Inorganic Material** - materials from non-living sources, including rocks and minerals

**Organic Material** - materials from living sources found in natural environments

**Soil** - the top layer of most of the Earth's land surface formed from the weathering of rocks. Made up mainly of minerals, organic materials, air, water, and living organisms, all of which interact.

**Texture** - the feel or appearance of a surface or substance, for example, rough or smooth

# Surprising Soils

## Time

Engage: 10-15 minutes

Explore: 10-15 minutes

Explain: 25-30 minutes

Elaborate: 20-30 minutes

Evaluate: 10-15 minutes

Total Time: 75 minutes - 1 hour 45 minutes

## Materials

- Three soil samples from different areas.
- Sealed baggies containing soil samples from each area
- Cups with each sample (for educator)
- Pictures of each site where the soil
- Hand lenses or microscope (optional)
- Surprising Soils Student Page

## Background

Soil is composed of minerals, organic materials, air, water and living organisms. The particles in soil are different shapes and sizes, giving soils different textures depending on what they are composed of and where they are found. These can also be described as inorganic material in the soil. Also found in soil is organic material. This includes materials from living sources and can include the decayed remains of once-living plants and animals.

Soils form a habitat for living organisms, including plants, microorganisms and larger organisms like bugs and small mammals. Depending on the types of particles present, soils may be dry and sandy, or wet and sticky. The composition of soil will impact the types of plants that can grow and the organisms that are found in it. While soil can be a habitat, they are also an important part of ecosystems and important to all life on earth.

## Engage

Begin by asking students if they know what soil is. Where are soils found? Do they know what soils are made of? Are all soils the same? Do they think that people need soil? Ask students if there is anything they want to know about soils. Write answers on a large sheet of paper or in a place where they can be seen by all students.



# Surprising Soils Cont.

## Explore

After you have gathered responses, review them and go over the vocabulary.

Tell students that they are going to examine three different soil samples that have been collected from nearby. They will use these senses to explore these samples and describe how they are similar and different. Students will try to identify where the samples were collected and try to identify the type of environment the soils are from.

Show students the images where the samples were collected, but don't tell them which sample is from which location.

Review how to examine a sample in a bag using their senses. They can look, touch and even hear what kind of sound the sample makes. To smell each sample, they should visit the teacher who will let them smell the sample in a cup. Samples should not be tasted.

## Explain

Give each student a copy of the Student Page to record their observations. Working in three groups, each group should examine each soil sample using their sense of sight, touch, smell and hearing. Students will rotate to each station to examine the soil types and will make a prediction about where it was collected.

## Elaborate

Let students examine soil samples with hand lenses or a microscope.

Have students explain their reasoning about where each soil sample was collected. Look at the pictures from each place together and have students share what they see in each photo.

Go over the correct answer for each sample with reasoning.

## Evaluate

Return to the questions from the beginning of the lesson. Would students change their answers? Were their original questions answered? Is there anything else they would like to know?

# Surprising Soils

SAMPLE 1

SAMPLE 2

SAMPLE 3

# Healthy Soil, Healthy Life Level 3, Grades 4-5

## Booklet & Lesson Objectives

Students will:

- Recognize that soils are a habitat for plants and animals
- Describe that soils are made up of different particles that can be identified
- Articulate that soils vary based on their locations and conditions
- Describe that soils help to support the cycling of matter through ecosystems
- Understand and describe how humans interact with soils

## NGSS Connections

For full information on the standards, review Appendix A

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none"><li>• Constructing Explanations and Designing Solutions</li></ul>	<ul style="list-style-type: none"><li>• Earth Materials and Systems</li><li>• Cycles of Matter and Energy Transfer in Ecosystems</li></ul>	<ul style="list-style-type: none"><li>• Systems and System Models</li><li>• Cause and Effect</li></ul>

## Vocabulary Words

**Clay** - very fine particles with little organic material, often damp, sticky and hard

**Ecosystem** - living and nonliving organisms and their many interactions. Can vary in size and are found on land and in water. Examples can include school gardens and entire forests.

**Habitat** - the place where an organism or community of organisms is found. Includes the other living and nonliving things that are found there.

**Horizons** - the different layers of soils, including organic material, topsoil, eluviated horizon, subsoil, parent material and bedrock. Soils may include some or all of these layers.

**Microorganism** - small organisms that can only be seen with a microscope. Includes bacteria, algae, protozoa and fungi.

**Organic Material** - materials from living sources found in natural environments

**Organism** - living things capable of growth and reproduction. Examples include plants, animals, fungi and bacteria

**Sand** - granular (tiny) material from the disintegration or erosion of rocks, coarser than silt

**Silt** - rock particles that are 1/20 millimeter or less in diameter

**Soil** - the top layer of most of the Earth's land surface, consisting of the unconsolidated products of rock erosion and organic decay, along with bacteria and fungi

**Survival** - continuing to live and thrive in an environment

**Topsoil** - the layer of soil found on the surface of the ground, includes minerals and organic material. Many living organisms are found in this layer of the soil.

# Soil Layers Activity

## Time

Engage: 5-15 minutes

Explore: 5-15 minutes

Explain: 30-45 minutes, up to 48 hours for full experiment observation

Elaborate: 10-15 minutes

Evaluate: 10-15 minutes

Total Time: 60 - 105 minutes for lesson, plus up to 48 hours for full experiment observation

## Materials

- Quart jars with lids - you'll need one jar for each sample collected
- Dish soap
- Rulers
- Materials to label jars (masking tape and markers or permanent markers)
- Soil samples. You'll need at least two. Soil samples should be dry. They can come from locations like a garden, flowerbed, field, roadside, etc. If you are only gathering two samples, they should be from different locations (garden vs. roadside, for example.)
- Plastic baggies for soil samples
- Water
- Measuring spoons (tablespoon and teaspoon)
- Soil Layers Student Pages

## Background

Soils are made up of a variety of particles. Sand, silt and clay are present in soils in varying amounts. These give the soil its texture and characteristics.

**Sand:** The largest type of soil particle. You can feel individual grains of sand with your fingers and see them with your eyes, but they are still pretty small! An individual sand particle can range from 0.05 to 2.0 mm.

**Silt:** Time to grab a magnifying glass! You'll need it to identify a silt particle since they are 0.002 and 0.05 mm wide. Silt is fine and feels powdery.

**Clay:** The smallest particle of them all! Clay particles are less than 0.002 mm in diameter.

For this activity, students will be examining the topsoil. This layer is the outermost layer of soil. It has the highest concentration of organic matter and microorganisms.

One tool that can be used to determine soil composition is the soil triangle. When you know what types of particles are present in the soil, you can use them to determine what type of soil is present and its characteristics.

## Engage

Begin by asking students what they know about soils. Do they think soil is all one uniform layer or does it have multiple layers? Is soil the same all around the world? What about in their communities? What questions do they have about soil? Record responses in a place where everyone can see them.

## Soil Layers Activity Cont.

### Explore

Tell students that soil does have multiple layers and today they will be exploring the topsoil. Have students refer to the page in their student booklet that reviews the horizons found in soils and the particles that make up soil. Ask students if they have any questions about this section.

Ask students if they think they could identify the different particles in soil. How would they do it? Would they need a microscope or could they use tools from around the house or classroom?

Tell students that they are going to work with topsoil samples collected in different locations to identify the particles that are found in each sample.

### Explain

Have students work in small groups. Give each group a soil sample, jar, dish soap and materials to label jars.

Give each group a soil sample in a plastic baggie. Have them record their observations about their sample on their student page. What does it feel like? Does it have a smell? Is the soil sample damp or dry? What color is the sample? Where do they think it was collected?

Have students crush any dried soil clumps and remove any rocks, roots and litter from the samples.

Students should add their soil sample to their jars, filling the jar no more than  $\frac{1}{4}$  full. Then, students should slowly add water to the jar using the tablespoon until it is filled half-way. Finally, add 1 teaspoon of dish soap to each jar.

After the students add the mixture of topsoil, water and dish soap to the jar, have them record their observations. Tell them that they will secure the lid on the jar and shake it for a few minutes. What do they think will happen?

After shaking the jars, set them on a table and observe them. Students should begin to notice particles settling to the bottom of the jar. Allow students to look at other samples during this time. Students should measure the layers and record the data on their sheet.

Observe the jars at 30 minutes, 24 hours and 48 hours. After two days, sand should have settled at the bottom, followed by silt, with clay on the top. Any additional organic matter may be floating at the top.

Have students record data for their sample, and allow them to observe other samples. Which particles of soil settled where and why? What difference do they notice between the samples? Where do they think they were collected?

### Elaborate

Tell students where the samples were collected. Is this the same as their hypothesis? What did they notice about the soil that led them to this explanation?

If students were planning on growing a garden, which soil sample would they use and why?

### Evaluate

Return to the questions from the beginning of the lesson. Would students change their answers? Were their original questions answered? Is there anything else they would like to know?



## Soil Layers Observations

Record your observations about your soil samples here. You can write or draw pictures.

# Healthy Soil, Healthy Life Level 4, Grades 6-8

## Booklet & Lesson Objectives

Students will:

- Identify soil science as an area of study and potential career path
- Understand soil types and be able to identify them based off of the types of soil particles present in a sample
- Explain that soil is a natural resource and a habitat
- Describe how humans interact with the soil, with the ability to cause both positive and detrimental outcomes, and explain how these negative outcomes can be avoided.
- Identify soils where they live and explain their characteristics

## NGSS Connections

*For full information on the standards, review Appendix A*

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none"><li>• Analyzing and Interpreting Data</li><li>• Engaging in Argument from Evidence</li></ul>	<ul style="list-style-type: none"><li>• Interdependent Relationships in Ecosystems</li><li>• Human Impacts on Earth's Systems</li></ul>	<ul style="list-style-type: none"><li>• Cause and Effect</li></ul>

## Vocabulary Words

**Agriculture** - growing crops, raising livestock and cultivating soil. Includes the field of study and occupations like farming.

**Habitat** - the place where an organism or community of organisms is found. Includes the other living and nonliving things that are found there.

**Horizons** - the different layers of soils, including organic material, topsoil, eluviated horizon, subsoil, parent material and bedrock. Soils may include some or all of these layers.

**Natural Resource** - something found in nature that can be used by humans that are considered valuable in their natural form. These include light, air, water, soil, minerals, and fossil fuels.

**Organism** - living things capable of growth and reproduction. Examples include plants, animals, fungi and bacteria

**Soil** - the top layer of most of the Earth's land surface formed from the weathering of rocks. Made up mainly of minerals, organic materials, air, water, and living organisms, all of which interact.

**Soil Science** - the branch of science that studies the formation, nature, ecology, and classification of soil.

**Survival** - continuing to live and thrive in an environment

**Topsoil** - the layer of soil found on the surface of the ground, includes minerals and organic material. Many living organisms are found in this layer of the soil.

# Sustaining Soils & People Activity

## Time

Engage: 10-15 minutes

Explore: 10-20 minutes

Explain: 20-30 minutes

Elaborate: 10-20 minutes

Evaluate: 10-15 minutes

Total Time: 60 - 100 minutes

## Materials

- Sustaining Soils & People Cards
- Sustaining Soils & People Student page

## Background

Humans have the ability to modify environments to meet their needs. This may include developing land for agricultural purposes, building homes and retail spaces and more. However, humans share the land with many other organisms that provide important ecosystem services. Occasionally, this causes conflict when it comes to development. However, we can work together to find solutions that balance the needs of people with the natural world.

## Engage

Begin by asking students what they know about land use. Who gets to make decisions about how land is utilized? What are some of the uses of land? Can they think of some of the impacts of turning unused land into farmland, or land used for agriculture? (These can be both positive and negative outcomes) What do they think are some of the things we can do to mitigate negative impacts? What other questions do they have? Write down student responses in a place where everyone can see them.

## Explore

Ask students if they think that all land can be used for agriculture. Why or why not? Have students conduct research online to find the answer.

Ask students to record their findings and sources on the student page. Is agricultural land distributed evenly around the globe? What about where they live? Tell students that for land to be suitable for agriculture it needs to have fertile soils, adequate precipitation and temperatures suitable for growing food.

## **Sustaining Soils & People Activity Cont.**

Ask students to record their findings and sources on the student page. Is agricultural land distributed evenly around the globe? What about where they live? Tell students that for land to be suitable for agriculture it needs to have fertile soils, adequate precipitation and temperatures suitable for growing food.

### **Explain**

Tell students that individuals working in agriculture need to make decisions about what crops they plant and how they work the land. It's not always as easy as just growing food. Farmers need to make sure that the land is cared for, so they can support food production and keep the land intact, avoiding scenarios like the Dust Bowl.

Have students work in small groups to read the scenarios on the Sustaining Soils & People Cards. How would they solve each of the problems presented?

### **Elaborate**

If time allows, have students research their questions and to see if their solutions are viable. Is there anything they would change or modify?

### **Evaluate**

Have students explain their reasoning for the solutions they presented. Return to the questions from the beginning of the lesson. Would students change their answers? Were their original questions answered? Is there anything else they would like to know?

## Scenario Cards

You are responsible for overseeing a farm that is located on a waterway that is prone to erosion. How would you maintain the farmland and keep the waterway clear?

Your farm is located in an area that typically receives a lot of rain. This year is very dry and you are concerned about future years. What actions would you take?

Your farm is located in an area that typically receives very little rain. This year is very wet and you are concerned about future years. What actions would you take?

You are a farmer and you are interested in creating more habitat for native wildlife on your farm. What management strategies would you use?

You have noticed a decrease in pollinators on your farmland. What actions would you take to help pollinator populations, like bees and other insects, thrive?

You are concerned about how runoff from your farm is impacting nearby waterways. What actions would you take?

# Appendix A - NGSS Connections

## K-1 NGSS Correlations:

K-LS1-1 Use Observations to describe patterns of what plants and animals (including humans) need to survive [Clarification statement: Examples of patterns could include that animals need to take in food but plants to not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water]

1-LS1-1: Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow and meet their needs. [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills, and detecting intruders by mimicking eyes and ears.]

## 2-3 NGSS Correlations

2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification statement: Emphasis is on the diversity of living things in each of a variety of different habitats.][Assessment boundary: Assessment does not include specific animal and plant names in specific habitats.]

3-LS3-2: Use evidence to support the explanation that traits can be influenced by the environment. [Clarification statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

## 4-5 NGSS Correlations

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification statement: Emphasis is on the idea that matter is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.][Assessment boundary: Assessment does not include molecular explanations.]

5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or the atmosphere interact. [Clarification statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.][Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

## 6-8 NGSS Correlations

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

## Appendix B - Literature Connections

Book Name	Age	ISBN	Author
From Garbage to Compost	4 - 7	978-1512412994	Lisa Owings
Dirt Don't Hurt	4 - 7	978-1480817166	Vikki Franklin
From Soil to Garden	4 - 7	978-1512413021	Mari Schuh
The Simple Science of Dirt	4 - 8	978-1515770923	Emily James
Dig In!: Learn about Dirt	4 +	978-1602535077	Pamela Hall
Celebrating Soil	5 +	978-0998629438	Aaron William Perry
How Do Animals Make Soil?	5 - 8	978-1627248358	Ellen Lawrence
Little Lily and Eddie the Earthworm	5 - 8	978-1517297770	Chad Currin
Up in the Garden and Down in the Dirt	5 - 8	978-1452161365	Kate Messner
Is Soil All the Same? (Down & Dirty)	5 - 8	978-1627248365	Ellen Lawrence
Exploring Soils: A Hidden World Underground	6 +	978-1486305001	Samantha Grover
Curious About Worms (Smithsonian)	6 - 8	978-0451533692	Kate Waters
Seed Soil Sun	6 - 8	978-8179936443	Sandhya Rao
In the Soil (Garden Squad!)	7 - 10	978-1499409758	Dave Mack
Explore Soil!: With 25 Great Projects	7 - 10	978-1619302952	Kathleen M. Reilly
What's in the Soil?	7 +	978-1474706087	Martha E H Rustad
Rocks and Soil	8 - 11	978-1499431537	Peter Riley
Worms Eat My Garbage	8 +	978-1612129471	Mary Appelhof
Under the Microscope : Earth's Tiniest Inhabitants	8 +	978-1541940208	Baby Professor
Dirt or Soil: What's the Difference?	8 - 12	978-1627248334	Ellen Lawrence
You Wouldn't Want to Live Without Dirt!	8 - 12	978-0531224380	Ian Graham
Soils (Do-It-Yourself Experiments)	8 - 12	978-1489652904	Gina Hagler
Soil, Sun, and Seeds	9 - 12	978-1541903548	Baby Professor
Wonder Waste: A Book on Composting	9 - 12	978-8179936528	Tirna Ray

## Appendix C - Vocabulary

**Adaptation** - a physical trait or behavior that helps an organism survive in their environment

**Agriculture** - growing crops, raising livestock and cultivating soil. Includes the field of study and occupations like farming.

**Clay** - very fine particles with little organic material, often damp, sticky and hard

**Ecosystem**- living and nonliving organisms and their many interactions. Can vary in size and are found on land and in water. Examples can include school gardens and entire forests.

**Farm** - an area of land or water where particular animals, birds, fish, or crops are raised for commercial purposes

**Habitat** - the place where an organism or community of organisms is found. Includes the other living and nonliving things that are found there.

**Horizons** - the different layers of soils, including organic material, topsoil, eluviated horizon, subsoil, parent material and bedrock. Soils may include some or all of these layers.

**Inorganic Material** - materials from non-living sources, including rocks and minerals

**Microorganism** - small organisms that can only be seen with a microscope. Includes bacteria, algae, protozoa and fungi.

**Mimic** - imitating the mannerisms, movements or coloration of another animal

**Natural Resource** - something found in nature that can be used by humans that are considered valuable in their natural form. These include light, air, water, soil, minerals, and fossil fuels.

**Organic Material** - materials from living sources found in natural environments

**Organism** - living things capable of growth and reproduction. Examples include plants, animals, fungi and bacteria

**Ranch** - a large farm devoted to keeping a particular type of animal or growing a particular type of crop

**Sand** - granular (tiny) material from the disintegration or erosion of rocks, coarser than silt

**Silt** - rock particles that are 1/20 millimeter or less in diameter

**Soil** - the top layer of most of the Earth's land surface formed from the weathering of rocks. Made up mainly of minerals, organic materials, air, water, and living organisms, all of which interact.

**Soil Science** - the branch of science that studies the formation, nature, ecology, and classification of soil.

**Survival** - continuing to live and thrive in an environment

**Texture** - the feel or appearance of a surface or substance, for example, rough or smooth

**Topsoil** - the layer of soil found on the surface of the ground, includes minerals and organic material. Many living organisms are found in this layer of the soil.



## Appendix D- Resources

*The following resources provide additional information and ideas for expanding lessons in the classroom. To learn more about what is happening in your Conservation District, visit: <https://www.nacdnet.org/general-resources/conservation-district-directory/>*

Ag in the Classroom: <https://www.agclassroom.org/>

Junior Master Gardener Program: <https://jmgkids.us/>

Nutrients for Life Foundation: <https://nutrientsforlife.org/>

NACD: <https://www.nacdnet.org/>

My American Farm: <http://www.myamericanfarm.org/>

Soil Science Society of America: <https://www.soils.org/>

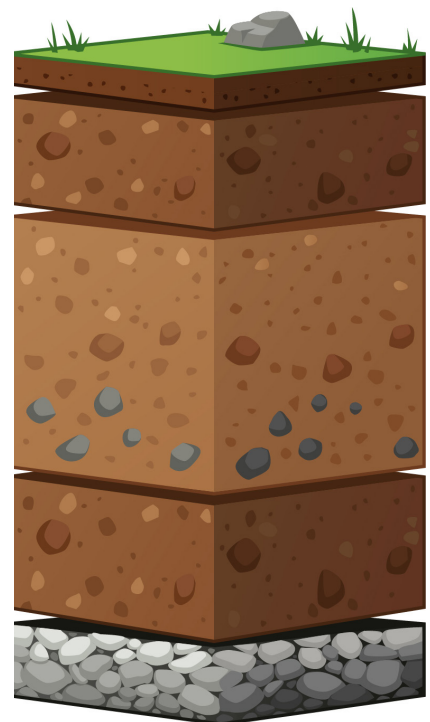
Soil Stories: [https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2\\_054316](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054316)

National Agriculture Statistics Service: <https://www.nass.usda.gov/>

National Agricultural Library: <https://www.nal.usda.gov/main/>

4-H Virtual Farm: <https://4-h.org/about/4-h-at-home/design-your-own-farm/>

USDA Know Your Farmer, Know Your Food: [https://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=nrcs142p2\\_037679](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=nrcs142p2_037679)





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