NACD

Healthy Soil Field Day Curriculum Guide

Sponsored by:

National Association of Conservation Districts

USDA United States Department of Agriculture

Natural Resources Conservation Service

WHAT IS A SOIL HEALTH FIELD DAY?

Hosting a Soil Health Field Day is a wonderful way to connect your school or organization to the natural world.

This guide will outline how to set up and host a Soil Health Field Day and includes a variety of activities for formal and informal learning environments.

In addition to providing more connections to nature, hosting a Soil Health Field Day is a great way to build relationships in the community with natural resource professionals, local colleges and universities, and your local conservation district.

WHAT IS A CONSERVATION DISTRICT?

Conservation districts are local units of government established under state law to carry out natural resource management programs at the local level. Districts work with millions of cooperating landowners and operators to help them manage and protect land and water resources on private and public lands in the United States. Districts also provide outreach to all ages, including youth, on natural resources topics.

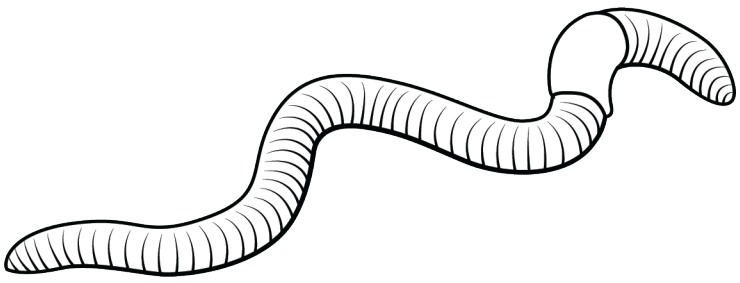
Find your district through this interactive map!

WHO IS NACD?

The National Association of Conservation Districts (NACD) is the nonprofit organization that represents America's 3,000 conservation districts and the 17,000 men and women who serve on their governing boards. NACD's mission is to promote the wise and responsible use of natural resources for all lands by representing locally-led conservation districts and their associations through grassroots advocacy, education and partnerships.

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 and other fields; and provides services to its districts. The association's programs and activities aim to advance conservation led by local districts and the millions of cooperating landowners and land managers they serve.



HOW TO USE THIS GUIDE

This guide to a Soil Health Field Day contains more than just instructions for hosting a great event. It's a complete guide, including pre- and post-activities, strategies for evaluation, and resources. Here's what you'll find inside:

Lesson Plans & Ideas

Included in the guide are pre- and post-Soil Health Field Day activities for grades K-8. The activities can be used in classrooms or informal learning settings. To make them easy to use in the classroom, each activity highlights alignment to the Next Generation Science Standards. Detailed information on standards can be found in the Appendices. Activities include background information, time involved and materials. Additionally, each activity includes evaluation and extension ideas.

Soil Health Field Day Stations & Implementation

Instructions for planning and implementing a Soil Health Field Day, including information on how to contact local professionals, station activities for a variety of ages, guidelines for implementation and more.

Extensions

If you enjoy your Soil Health Field Day experience, there are many ways to extend the fun! Learn about how to participate in community science efforts and more.

Supplementary Content

Student worksheets, including crossword puzzles and word searches, as well as additional content for parents and guardians to share information about the Soil Health Field Day and email templates for outreach are found in this section.

A Note on Environmental Education

Hosting a Soil Health Field Day is a great way to incorporate environmental education into your school day or educational program. "Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions." (US EPA)

Central to environmental education are hands-on experiences for discovery. The activities in this guide are designed to be inquiry-based, offering plenty of time for questioning and exploration. During the Soil Health Field Day, we encourage you to invite guests who will engage your students.

CORRELATIONS TO EDUCATION STANDARDS

The activities in this guide are meant to be used in both formal (classroom) settings as well as informal (museums, 4-H, scout groups) settings. For ease of use in a formal setting, all activities have been correlated to the Next Generation Science Standards and the Common Core. A Soil Health Field Day lends itself to exploring science, technology, engineering and math (STEM) concepts and has many connections to English language arts, reading, as well as local history and geography.

PRE-EVENT PLANNING

Planning and hosting a Soil Health Field Day can feel like a big task. However, there are likely professionals in your area who are willing to contribute their expertise to make this day a success.

The station activities listed in this guide can be used in an 'a la carte' manner - pick and choose the ones that will work best for the youth who will participate in the Soil Health Field Day. There is no correct number of stations to include, but note that each activity works best for a small group of up to 8-10 students.

CONSERVATION PARTNERSHIPS

Bringing in community partners is a great way to add additional content to your Soil Health Field Day and to introduce youth to natural resource professionals. Here are a few ideas for agencies that you can reach out to where you live:

Conservation District

Every state has conservation districts. Depending on your state, they may be called a soil and water conservation district, soil conservation district, resource conservation district or something similar. No matter the name, each district coordinates assistance from all available sources - public, private, local, state and federal - to develop locally-driven solutions to natural resources concerns. The National Association of Conservation Districts is the nonprofit organization that represents these districts.

To find your local conservation district, visit: https://www.nacdnet.org/general-resources/conservation-district-directory/

State Natural Resource Agency

Another great community connection is your state natural resource agency or department. These governmental agencies manage and protect the state's natural resources.
Working with your state's natural resource agency is a great way to introduce youth to careers and individuals working in natural resources.

USDA: Natural Resources Conservation Service

Through the United States Department of Agriculture, the Natural Resources Conservation Service (NRCS) helps farmers, ranchers and forest landowners conserve the nation's soil, water, air and other natural resources. With NRCS staff across the United States, the agency fulfills its mission through offering conservation planning, technical assistance and financial assistance to landowners.

For more information, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/about/

Additional Partners

There are many other organizations that may be willing to partner with you on your Soil Health Field Day. Consider reaching out to local farmers and ranchers, community garden organizations, natural history museums, zoos and aquariums, colleges and universities, and local nonprofits that have conservation in their mission.

ORGANIZATION AND SET-UP

Logistics & Location

A Soil Health Field Day can be hosted outdoors or in an indoor location with adequate space, like a gymnasium.

Each station requires the materials listed and a surface for the activity. This can be a 6' x 3' rectangular table or an 8' round table, or whatever is handy at your school or organization. There should be enough space for up to 8-10 students to engage in an activity comfortably. Depending on the location of your Soil Health Field Day, activities can also occur in separate rooms or spaces.

Station activities are approximately 10-15 minutes in length. While you are planning the schedule for the day, ensure that students have enough time to rotate between stations. This time will depend on the setting for your event. In a gymnasium or outdoor space, this may be 1-2 minutes, with a longer break halfway through the event, or up to 5 minutes if students need to move between rooms.

Ensure that all participant groups and station facilitators know the schedule for the day and which groups to expect at what time. This will ensure that your Soil Health Field Day runs smoothly and that all students have the time they need at each station.

Building Community Relationships

Reaching out to community members, including individuals from conservation districts, state agencies and local farmers and ranchers as you are developing your Soil Health Field Day will make your event a collaborative and meaningful experience. You will likely find that many community members enjoy sharing their expertise with youth. Additionally, this highlights the variety of natural resource careers available where you live.

In the Appendices, you will find a sample letter to help you reach out to community members to ask them to be involved in your Soil Health Field Day. Ensure that you are reaching out to community members at least two months in advance of your Soil Health Field Day to give individuals and organizations enough time to get involved.

Another benefit of collaborating with community members on your Soil Health Field Day is the possibility of a continuing relationship. For example, you may decide to take your event further by doing a project at your school or organization. Many of these community members may be able to assist you with these efforts.

Facilitator Training

In addition to working with community members who are natural resource professionals, you may want to work with volunteers who are interested in youth education or environmental education, or who are simply just interested in increasing awareness about soil health. The involvement of other educators and parents who are involved at your school or organization will also help to make your Soil Health Field Day a success.

You will likely be working with a variety of individuals. It's a good idea to offer a short (around 1-hour) training ahead of your Soil Health Field Day so that all involved will understand the schedule for the day and what is expected of them at their station. If you are unable to offer a training in person, don't fret! Send information regarding the schedule and expectations well in advance of your Soil Health Field Day so all volunteers and station facilitators are prepared and know what to expect.

DAY OF EVENT

Your Soil Health Field Day is here! Here are a few tips and pointers to help ensure your event runs smoothly.

Ensure that all facilitators and individuals working with student groups have the schedule of their rotations.

If your event is outdoors, you may want to ensure that each table is under a canopy or pop-up tent. You can ask community members and organizations to bring their own. You will also want to remind facilitators, volunteers and students to bring sunscreen, hats, water, and/or a jacket, depending on the location and time of year you are hosting your Soil Health Field Day.

Have participants group up ahead of the event. A fun way to keep groups together is by giving them an organism that lives in the soil as a name or mascot.

Make sure that groups are small in size (no more than 8) to ensure all students get to engage in the activity. If possible, groups should be comprised of students of similar ages or grade levels.

Ensure that you have enough materials and supplies for each station. You may want to have a few extra of each type of supply on hand, just in case.

Plan ahead to have extra supplies like water, sunscreen and snacks.

Set expectations for students before the event begins. Some of these expectations may be site-specific but could include behavioral expectations like making sure that they are walking from station to station and are staying together, or content-specific, like making sure they engage fully at stations and learn 3 to 5 new things about soil based on their prior knowledge.

If facilitators are guiding students through an activity, ensure they have had time to practice the activity ahead of the event, either at a facilitator training or before the Soil Health Field Day begins.

Let all facilitators know the locations of bathrooms, first aid kits and where they can find an event coordinator if they are in need of assistance during the event.

Remind facilitators of the time they have to facilitate their activity during the event. If you're able, ask volunteers or adults paired with groups to help keep time. Let the facilitator know when they have 5, 3 and 1 minute(s) left.

If you are allowing facilitators to take photos during the event, ensure all students have signed a photo release or that facilitators are taking photos in such a way to ensure the privacy of young students.

After the event, send thank you notes and/or follow up with event facilitators via email to show your appreciation and share outcomes. Some community partners will need to keep track of the number of students they reached for outreach or may want to share images with their supporters.

BACK-UP PLANNING

At an event like a Soil Health Field Day, it's a good idea to expect the unexpected! Here are a few scenarios that you may run into and a few ways to solve them

Inclement weather • If you are planning on hosting your Soil Health Field Day outdoors, keep your eye on the weather and have a back-up location planned. All of the Soil Health Field Day activities can be held indoors and outdoors. If you don't want to worry about relocating due to the weather, you can always plan for your event to occur indoors.

Station Facilitator Cancellation • If a station facilitator has to cancel, try to ensure that you have an additional staff member on hand to facilitate the activity. If you can't do this, don't worry! If you need to remove the activity, see if you can adjust the schedule to accommodate a short break or game.

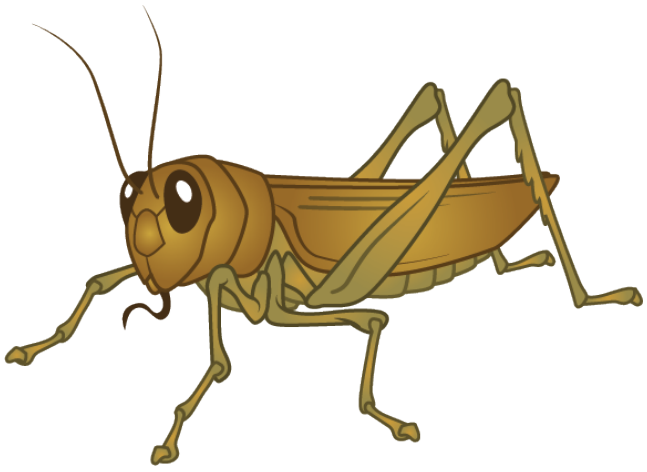
Community Partner Cancellation • If a community partner is bringing their own activity and needs to cancel, see if you can add an additional activity station facilitated by a volunteer. If you are unable to, again, don't worry! See if you can adjust the schedule to accommodate a short break or game.

Volunteer Cancellation • All participant groups should have at least one adult to help guide and move groups from station to station. If you are relying on volunteers to help, you may want to schedule an extra volunteer or two to help with this task in case of a cancellation.

Supplies and Materials • If you are starting to run low on supplies or materials for a station or were short to begin with, have students collaborate so everyone has a similar experience.

Station Goes Over Time • If a station goes over time, make sure that the group quickly rotates to the next station. Any station that begins late will need to wrap up at the time indicated on their schedule. Ensure this is communicated to all facilitators, volunteers and adults with groups of students. For example, if a 15-minute station goes over by five minutes, the arriving group and the group that arrives late to their next station will only have 10 minutes to complete the activity. This will keep the rest of the event on time.

Extra Time • Provide a few ideas for a quick game (it doesn't necessarily need to be related to soil health) to your facilitators and volunteers.



CONSIDERATIONS

The Pre-Soil Health Field Day Lessons are designed to provide background information on soil ecology and activities for a variety of grade levels. While a grade level is indicated for each activity, they can be adapted for use with a variety of ages and settings.

Components that you will find in each lesson include: Next Generation Science Standards alignment (however, lessons can be used in informal settings), time to complete, materials needed, background information and the lesson itself. Lessons utilize the 5 E model (engage, explore, elaborate, extend, evaluate) and include ideas for lesson extensions, and student pages.

You can find more information on the 5 E model here:
http://cbm.msoe.edu/teacherWorkshops/mspResources/documents/day1/5eSummary.pdf

General Pre-Evaluation

Prior to these lessons and your Soil Health Field Day, take a few moments to find out what students know about soil health by asking the following questions. You can record responses to reflect on the knowledge you gained after the lesson and your Soil Health Field Day.

- What do you know about soil?
- What do you know about organisms that are found in the soil?
- Do you think it's important for soil to be healthy? What do you think this means?
- Do you know where your food comes from?
- What do you think would happen if the Earth's soil disappeared?
- Is there anything that people can do to help soil health?
- Is there anything you'd like to learn about soil?

K-2 Lesson : How Does Your Garden Grow?

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Analyzing & Interpreting Data • Scientific Knowledge is Based on Empirical Evidence • Constructing Explanations and Designing Solutions	• Organization for Matter and Energy Flow in Ecosystems • Structure and Function • Information Processing	• Patterns • Structure and Function

CONSIDERATIONS

K-2 Lessons Continued

Time:

Engage: 15-20 minutes
Explore: 30-45 minutes to set up experiment, providing 10-15 minutes per day for observation
Explain: 15-30 minutes
Extend/Elaborate: extensions may take multiple days, following the pattern of this lesson
Evaluate: 15-30 minutes

Materials

- For growing seeds: potting soil, sand, soil sample from outdoors
- Seeds (beans work great!)
- Cups, jars or buckets to grow seeds in
- Shovels or spoons
- How Does Your Garden Grow Student Pages

Background Information

Soils form a unique environment for animals to live and for plants to grow. While soil may seem static, it is teeming with life, including organisms that are too small to see with the naked eye. Soil itself is made up of particles. 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. 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. In addition to its role as a habitat, soil also is an important part of ecosystems and vital to life on Earth.

Different plants need different soils to survive, in addition to water, air and sunlight. People also need plants! We eat fruits and vegetables that are grown in the soil and we breathe air that is produced by plants. We may also find joy in the flowers that we grow in our gardens. If plants don't have the proper conditions, they need to grow, they won't survive.

In this activity, students will explore different types of soil samples and make predictions about if seeds will grow in a particular type of soil.

Students Will...

- Describe and define soil
- Recognize that soils are a habitat for plants and animals
- Be able to make predictions about the conditions that plants need to grow
- Communicate that plants need air, soil, water and sunlight to grow, and describe the importance of soil to plants
- Use their understanding of these patterns to design further experiments to test the conditions under which plants grow

LESSON (5 E MODEL)

Engage

Begin by asking students what plants need to survive. Responses may include air, water and sunlight. Ask students if plants need anything else to grow. Remind students that plants grow in the ground and that they also need soil to survive. Ask students what they know about soil. Where do they think soil is found? Do they think that all soils are the same? Do they think that other animals may 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 they can be seen by all students.

Explore

After you have gathered responses, review them. You may also want to cover any vocabulary terms that come up.

Tell students that they are going to make some predictions about whether seeds will grow in different types of soil samples. Students will start by examining the soils outside and the soil samples that have been brought into the classroom.

If possible, begin by going outside and observing different plants that grow nearby. If you are able, dig a small hole to let students observe the type of soil that is in their community or neighborhood. Ask students what they notice about the soil - how does it look, feel and smell. Is it wet or dry? Is there anything else they notice?

Next, have students explore the other soil samples, including potting soil and sand. If you don't go outdoors, bring in a soil sample from somewhere nearby. Again, ask students what they notice about the soil - how does it look, feel and smell. Is it wet or dry? Is there anything else they notice?

Have students help to plant seeds in the different samples using the shovels or spoons. Once the seeds are planted, give them the same amount of water and sunlight so that students are only exploring the impact of the soil on the growth of the seeds. Ask students to make predictions about which soils they think the seeds will grow in.

Observe the growth over the next few days to see which seeds begin to germinate. Allow students to conduct observations and make predictions about what will happen next on their student page.

LESSON (5 E MODEL)

Explain

Have students come together to share their observations about the growth of the seeds. Which ones sprouted? Which ones didn't grow?

Explain to students that there are many different types, or species, of plants in the world and there are many different types of soils. Plants may require certain conditions to grow - some may need soils that are very wet, and some need dry, sandy soils. Ask students what type of soil they think these seeds need to grow, based on their observations.

Explain to students that when soil is healthy it can help to support plant life. Healthy soils provide an important habitat for plants and animals. We also need healthy soils to grow the crops that we depend on for food.

Once students know what type of soil their seeds need to grow, have them write out instructions for how to grow their seed, including detailed information about what soil it needs on their student page.

Extend/Elaborate

You can continue to conduct this experiment, changing one variable at a time. For example, you can keep all the soil samples the same, but alter the amount of sunlight or water provided to each sample.

Once students have determined what type of soil the seeds will grow in, plant some additional seeds and watch them grow. If possible, you can begin growing seeds inside and then move them outdoors to a garden. Students can continue observing the growth of their new plants.

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?

How Does Your Garden Grow?

Soil Observations What Did I Notice?

The soil was _____

The sand was _____

The potting soil was _____

Seed Observations

I think the seeds planted in _____ will grow because _____

I think the seeds planted in _____ won't grow because _____

Here's what I observed! _____

3-5 LESSON : WET & WONDERFUL SOILS!

Alignment to NGSS

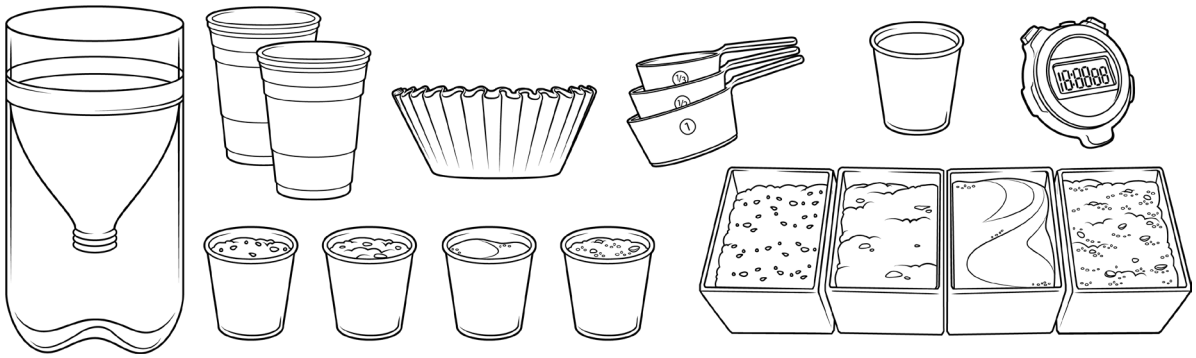
Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Developing and Using Models • Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena	• Cycles of Matter and Energy Transfer in Ecosystems • Earth Materials and Systems	• Systems and System Models

Time:

- Engage: 10-15 minutes
- Explore: 1 hour
- Explain: 20-30 minutes
- Extend/Elaborate: 1 hour
- Evaluate: 10-15 minutes

Materials

- 2-liter bottles cut in half. Turn the top of the bottle upside-down and place it inside the bottom of the bottle so that water can be caught in this half.
- Filter paper - coffee filters that are flat on the bottom work best
- At least 4 soil samples, representing all soil types (sand, silt, and clay), potting soil. You can collect samples from nearby or in your community. You'll need 2 cups of each.
- Plastic cups
- Measuring cups
- Water
- Stopwatch or timer (a phone works in a pinch!)
- Wet and Wonderful Soils Student Page



3-5 LESSON : WET & WONDERFUL SOILS!

Background Information

Soils are composed of sand, silt, and clay. These inorganic particles can be found in soils in different proportions, allowing us to classify different soil types.

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.

Water moves through each of these particles differently. Water moves through sand very quickly. Silt is often found in places where a lot of water has been present and has dried out. Water has a hard time moving through closely packed clay particles.

To thrive, plants need to be in soils that retain some water. In sand, water may move through too quickly for the plant to access. Clay does a great job at retaining water, but this means that the water is being held by the clay and the plant's roots can't access it. Soil that has a combination of sand, silt and clay, along with organic matter, provides a good environment for plants to grow. The additional organic matter, created by the decomposition of plants and animals, acts like a sponge, helping the soil retain water.

This combination of sand, silt, clay, and organic material also helps to form good soil structure. This means that the particles can stick together. When the particles stick together it helps to form space in the soil, allowing for air, water, and the roots of plants to move through the soil. Animals like earthworms can also help to create air and water pockets in the soil. A healthy soil will allow water to move through it at a rate where it can be absorbed by plants.

Humans can aid this process. In the garden or on the farm, the addition of organic material can help to make soils more porous. This allows rain or snowmelt to be readily absorbed, reducing erosion. Since organic matter can help soils retain water, they are especially helpful in places that may not get much rain.

Students Will...

- Define sand, silt, and clay, and describe how the presence of these particles allows us to categorize soils.
- Explain that healthy soils contain a balance of these particles and organic matter.
- Explain that soils may contain air or water
- Describe how humans can impact soil health and what that many mean for plants, animals and humans.

LESSON CONTENT • 5 E MODEL

Engage

Begin by asking students what they know about soil. Where is soil found? Do they think that all soils are the same? What is it made of? What lives in the soil? Record these responses.

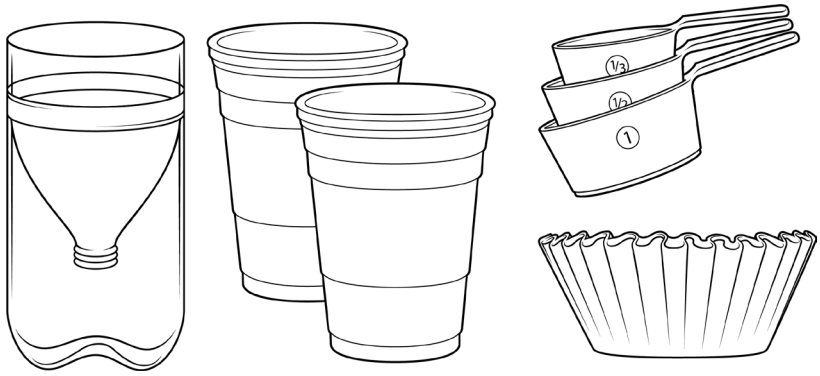
Ask students if they have ever observed soil in the rain? What did they notice? Where did the water go? Ask students if there is anything they want to know about soils. Write answers on a large sheet of paper or in a place they can be seen by all students.

Explore

After you have gathered responses, review them. You may also want to cover any vocabulary terms that come up.

Tell students that they are going to conduct an experiment to understand different types of soils and how water moves through them. Divide the students into groups of no more than four. Give each group the following materials:

- Funnel
- 2 filters
- Soil sample in a cup (labeled, with either the soil type or location it was collected. No potting soil should be used in this part of the experiment)
- Measuring cup
- Water



Allow students to make some quick observations of their soil sample. Including how it feels (wet, dry, gritty, smooth) before starting. Have students place one filter into the funnel. Using the measuring cups, students should add a cup of their soil sample into the filter. Cover the sample with the other filter.

Before adding water into the funnel, allow students to make a prediction about what they think will happen when they begin adding in the water. Once they have made their predictions, have students slowly add one cup of water to the funnel

Each group should observe how long it takes for water to drain from their soil sample - you can use a timer or a phone to collect this data. For some groups, this may happen quickly! While waiting for all of the soil samples to drain, you can have students record their observations. Once everything is drained, have students measure the water that landed in the bottom of their funnel. Students should also record this information.

LESSON CONTENT • 5 E MODEL

Students will now duplicate this experiment with the addition of potting soil. Have students make a prediction about what they think will happen, in addition to recording a few observations of the potting soil. Students will need:

- Funnel
- 2 filters
- Soil sample in a cup (labeled, with either the soil type or location it was collected.)
- Potting soil
- Measuring cup
- Cup of, or access to, water.

Have students start by mixing together a ½ cup of soil and a ½ cup of potting soil in a cup. Then, students place one filter into the funnel and add the soil/potting soil mixture. Cover the sample with the other filter.

Before adding water into the funnel, allow students to make a prediction about what they think will happen when they begin adding in the water. Once they have made their predictions, have students slowly add one cup of water to the funnel.

Like before, each group should observe how long it takes for water to drain from their soil sample - you can use a timer or a phone to collect this data. Once everything is drained, have students measure the water that landed in the bottom of their funnel. Students should also record this information.

Explain

Share with students the background information about soil and soil types. Have each group share aloud their soil type and how long it took to drain with and without the addition of the potting soil. Based on the information from the experiment and the information that was shared, do the students think their sample has more sand or clay? Why or why not? Have students record their response on the student page.

Ask students why they think some soils are better at holding on to water than others. Would a farmer want to have a more sandy soil or soil with more clay on their farm? Why or why not? Explain that crops need water to grow, but too much or too little might have an impact on the growth of crops. How could a farmer help to improve the soils on their farms to ensure they are healthy?

Extend/Elaborate

Have students conduct this experiment again with samples from the school yard or school garden, making predictions about the soil based on what they learned from the initial experiment.

Invite a local farmer or rancher to come to the classroom to talk about how they manage the soil to keep it healthy.

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?

Wet and Wonderful Soils

Our Soil Sample: _____

My observations: _____

My predictions for what will happen when we add water:

_____

_____

_____

My observations:

_____

_____

_____

Amount of water drained: _____

My observations:

_____

_____

_____

My predictions for what will happen when we add water to the potting soil:

_____

_____

_____

Amount of water drained: _____

My observations:

_____

_____

_____

6-8 LESSON: HEALTHY SOIL: HEALTHY HABITAT

Alignment to NGSS

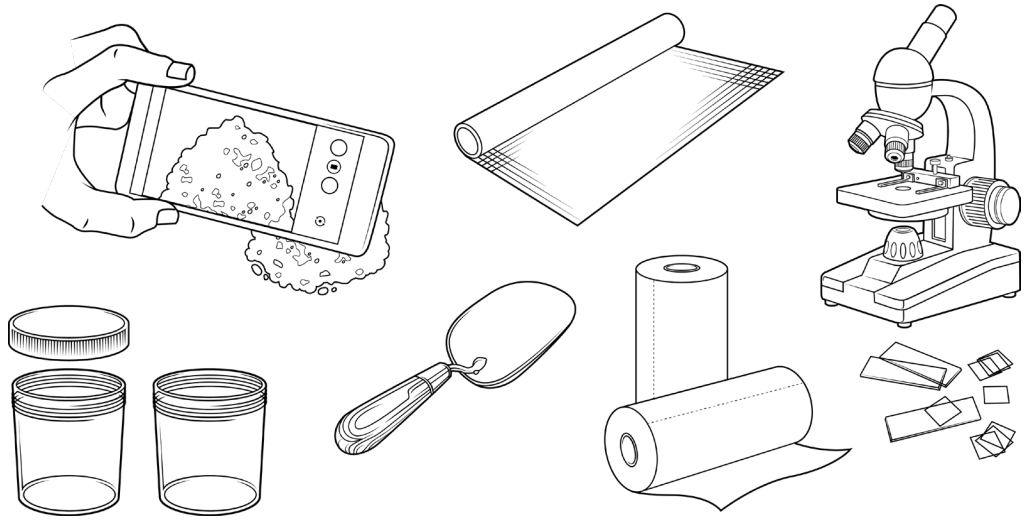
Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Analyzing & Interpreting Data • Scientific Knowledge is Based on Empirical Evidence • Constructing Explanations and Designing Solutions	• Organization for Matter and Energy Flow in Ecosystems • Structure and Function • Information Processing	• Patterns • Structure and Function

Time:

- Engage: 10-20 minutes
- Explore: 30-90 minutes (longer if you are collecting samples with students)
- Explain: 15-20 minutes
- Elaborate/Extend: 60-90 minutes
- Evaluate: 15-20 minutes

Materials

- Shovels or trowels
- Camera (digital or camera on your phone)
- Small jars
- Window screen or cheese cloth (to provide airflow to soil samples)
- Soil samples
- Paper towels
- Microscope
- Slides and cover slips



6-8 LESSON: HEALTHY SOIL: HEALTHY HABITAT

Background Information

We may not spend a lot of time thinking about life underground, but a healthy habitat in the soil is necessary for life on earth. Just like on the surface of the earth, a complex food web can be found underfoot.

While we may not be able to see them, the soil is teeming with small organisms that can't be observed with the naked eye. Bacteria and fungi in the soil feed off of carbohydrates that are produced by the roots of plants through photosynthesis. In turn, these bacteria and fungi are consumed by nematodes and protozoa. Bigger organisms, like millipedes and earthworms, consume them. At the top of the soil food web are organisms like moles. Finally, many decomposers are also found in the soil. Decomposers feed on dead and decaying material that is found in the soil.

Plants depend on this food web to release nutrients in the soil through decomposition. Additionally, some plants may also need organisms like fungi to help them absorb these nutrients and even water.

Because these processes remain unseen, we may not realize the impact they have in our garden or on farms. Ensuring that the soil stays healthy means ensuring that this food web stays intact. It can be disturbed by the application of insecticides or fungicides, or even too much tilling. Having an understanding of this food web and the soils we live and work on ensures their health, as well as human health and well-being.

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

LESSON CONTENT (5 E MODEL)

Engage

Begin by asking students what they know about soil. Where is soil found? Do they think that all soils are the same? What is it made of? Record these responses. Then, ask students what lives in the soil? Generate a list of as many organisms as you can.
Ask students if there is anything they want to know about soils. Write answers on a large sheet of paper or in a place they can be seen by all students.

Explore

Tell students that they are going to collect soil samples to better understand the organisms that live there. Ask if they have any predictions about what they might find.

Depending on your location or where you are delivering this lesson (in-school or out-of-school-time program), you have a few options for collecting soil samples. You can collect samples near your location, or have students collect their own sample from near their home or community. You can also collect a few samples in advance to ensure a diversity of samples. Be sure to have at least one sample from a location with thriving plant life, and one from an area without plants.

Samples should be collected in jars, using spoons or trowels. The samples should be exposed to air, you can cover them with the window screen or cheese cloth.

As you are collecting samples be sure to include the following information on the student page:

- General observations about the sample
- Where it was collected
- Observations about the collection site, including if any plants are growing, does it get watered, etc.
- If possible, take a few photos of the sample site.

Once soil samples have been collected, bring them back to the classroom or site for further investigation.
To begin, have students work in pairs or small teams to explore the samples one at a time. You can pour the sample onto a paper towel or surface and gently spread it out using a plastic spoon. Have students make note of any organisms they find and record this information on the student page. If necessary, students should use the internet or field guides to help identify organisms.

After students have identified organisms that can be easily seen, allow them to look at a few soil samples under a microscope. Record observations on the student page.

Have students make a prediction about their soil sample. Do they think their sample is from healthy soil? Why or why not?

Explain

Bring students together to discuss their results. What did they notice? Were there any samples that were similar?

Discuss the background information with students, explaining that soil is home to a complex food web that supports multiple organisms, including trees and other plants. After providing this explanation, ask students to revisit the question of if they think their sample is from healthy soil. Why or why not?

LESSON CONTENT (5 E MODEL)

Elaborate

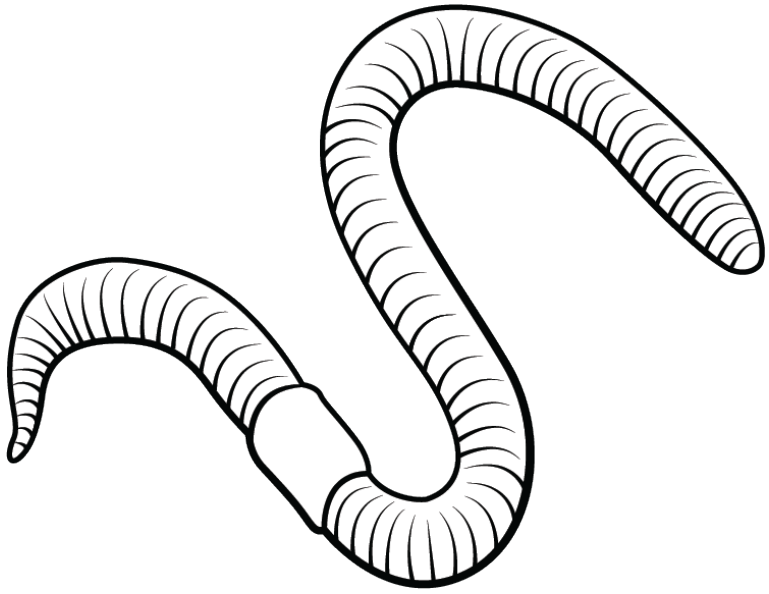
Get permission to collect soil samples from areas that are highly managed (like a golf course or a farm) and an area that is minimally impacted. Students should make predictions about how these samples will differ using knowledge they gained from this lesson.

Invite a farmer, rancher or soil scientist to come to your classroom or site to talk about soil health.

Ask students to imagine that they are a farmer or rancher. How would they design a farm that would support soil health and growth of crops?

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?



Healthy Soil: Healthy Habitat

What I noticed about my soil sample:

Where it was collected:

Observations about the collection site, including if any plants are growing, does it get watered, etc.

Additional observations:

Organisms I identified:

This sample made me wonder:

GUIDE FOR STATION FACILITATORS

Soil Health Field Day facilitators are crucial to the implementation of a successful Soil Health Field Day. To ensure that the event runs smoothly, we have included a sample FAQ for each facilitator to review prior to and on the day of the event. While the FAQ is as inclusive as possible, you may want to add more information based on the specifics of your event.

More generally, facilitators should be focused on facilitating a fun and educational experience for all students. The activities are structured to have an emphasis on student engagement. Facilitators should do their best to guide students through their experience and share information where appropriate. If there are additional community members or organizations who will be facilitating or exhibiting their own activity, check in before the event to ensure the activity is hands-on and appropriate for the age level of the students participating in the event.

Why are there no print materials for the field day?

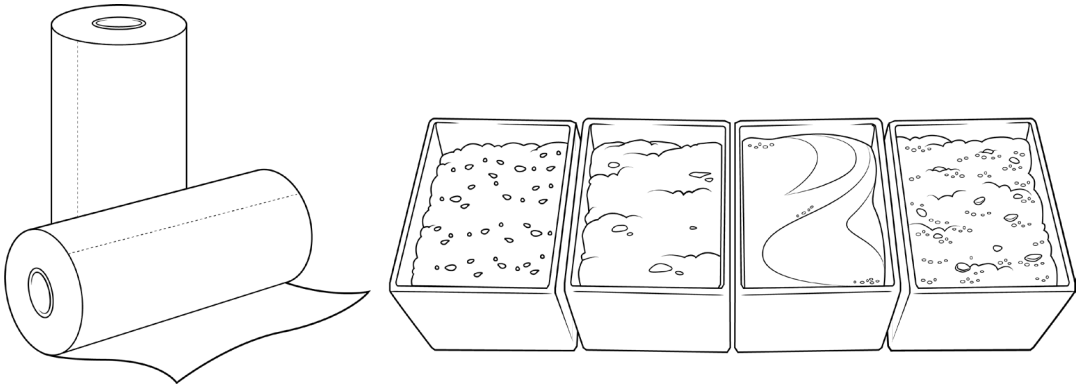
This Soil Health Field Day does not come with a print student field guide. Each of the stations include hands-on content and activities and an outline for facilitators to ask questions to gauge students' knowledge as they participate. Conducting a large event outdoors means that there are already many variables to consider and things to troubleshoot. Eliminating a print student field guide allows you to remove an item that may be costly, as well as to create a more sustainable event.

By not including a print field guide, we are hopeful that the emphasis of your Soil Health Field Day will be on student engagement in the activities and the hands-on components at each station.

WHAT'S SOIL MADE OF?

Materials

- A variety of soil samples, including: local soil(s), potting soil, sand, clay
- Magnifying glasses, enough for students to share in groups of 2-3
- Pie pans
- Soil triangle image
- Hand sanitizer and paper towels



Background Information

Soil is made up of particles. 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. Depending on the types of particles present, soils may be dry and sandy, or wet and sticky. Particles include: **Silt** - rock particles that are 1/20 millimeter or less in diameter, **Sand** - granular (tiny) material from the disintegration or erosion of rocks, coarser than silt, and **Clay** - very fine particles with little organic material, often damp, sticky and hard. Depending on the age of the students at this station, you may want to discuss the soil triangle and how farmers and soil scientists can identify a soil type by understanding what particles it is composed of.

Station Instructions

- Ask students if they have ever taken a close look at soil. If they have, what are some of the things that they have noticed? These can include how it looked, felt or smelled.
- Explain that they are going to work in small groups to observe some soil samples using a magnifying glass. Ask if they have any ideas about what they might see.
- Have students work in small groups. Ensure that soil samples are divided into pie pans. Allow students to observe the soil samples with hand lenses. If possible, allow students to handle soil samples and remind them that soil should not be tasted or moved from one pie pan to another.
- Ask students if they notice any difference between the soil samples.
- If time allows, discuss the soil triangle and discuss different soil types.
- If necessary, have students clean their hands with hand sanitizer and paper towels.

Evaluation

Students should be able to explain that all soils are not the same and that they have different characteristics.

SOIL WATERCOLORS

Materials

- Watercolor or heavy-duty paper
- Watercolor paints
- Different soil types in small cups (soil used in this station should be air dried and in a variety of colors for best effect)
- Cups of water to clean brushes
- White glue
- Paper towels
- Paint brushes
- Pencils
- Note that you may want to use artist acrylic for painting with soil, but it is a pricier option.

Background Information

Soils are an important part of our ecosystems and a valuable natural resource. But, soils can also be a source of beauty! Soils can provide color in bricks and pottery and can also be used in painting. The pigments, or colors, in soil come from the different minerals found in it.

Station Instructions

- Ask students if they think soils come in a variety of colors and ask them to share examples.
- Tell students that soils have pigments that are from the minerals that are found in the soil, and that soils can be used to provide color to bricks, pottery, and even paintings!
- Explain that students will create a painting using soils, and watercolors if they wish.
- Tell students more about where the soil samples were found and demonstrate how to paint with it.
- Students can add a thin layer of glue to their page and add soil to it
- Students can try to gently dampen soil and paint with it like watercolors
- Students can use acrylic paint to paint with the soil
- Give students a sheet of paper and make sure they write their name on it with a pencil.
- All students should have the opportunity to paint with at least one soil sample and embellish with other watercolors if time allows.
- Students will leave their completed artwork at this station to dry and will pick it up at the end of the day.

Evaluation

Students will be able to explain that soils have a variety of pigments. These pigments come from the minerals in the soil and they give the soil its distinctive color. This may vary based on the types of minerals and where the soil was found.

HEALTHY SOILS PICNIC

Materials

Pictures of food items with their connection to the soil printed on the back

- Oranges (oranges grow on trees, which need soil for their roots)
- Raspberry jam (raspberries grow on bushes that need soil for their roots)
- Bread (wheat is grown in the soil)
- Potato chips (potatoes are grown in the soil)
- Tuna fish (tuna is fished from the ocean)
- Watermelon (watermelons are grown in the soil)
- Chocolate bar (cacao beans are grown in the soil)
- Lettuce (lettuce is grown in the soil)
- Mustard (mustard seed is grown in the soil)
- Cheese (dairy cows are fed alfalfa, grass, hay, or other plant material)

Background Information

Most of the foods that we eat are the result of our relationship with soil. All the fruits and vegetables we eat are grown in the soil. Animals that we eat also eat plants from the soil. Soils help to form the foundation of our environment and without healthy soil we likely wouldn't have a very healthy (or interesting!) life.

Station Instructions

- Ask students if they know how humans and soil are connected. If necessary, explain that many of the foods we eat either directly grow in the soil or are connected to the soil in some way.
- Tell students that they are going to put together a picnic, but they can only use foods that don't require soil.
- Give students the food item cards and ask them to put together a picnic that doesn't require soil. If they need additional help, let them know that they can read the back of the card for more information.
- Ask students what they observed. Were they surprised about the items that were included or excluded? What do they think a world without soil would be like?

Evaluation

Students should be able to explain that many of the food items that we eat daily require soil. Humans and soil have a complex relationship that involves many systems.

SOIL HEALTH FIELD DAY STATIONS

ORANGES

Oranges grow on trees, which need soil for their roots

RASPBERRY JAM

Raspberries grow on bushes that need soil for their roots

BREAD

Wheat is grown in the soil

POTATO CHIPS

Potatoes are grown in the soil

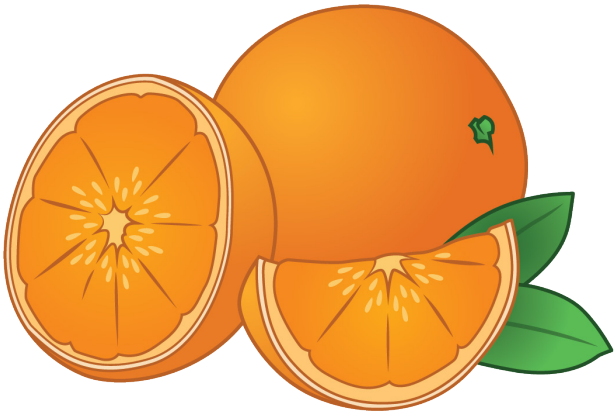
TUNA FISH

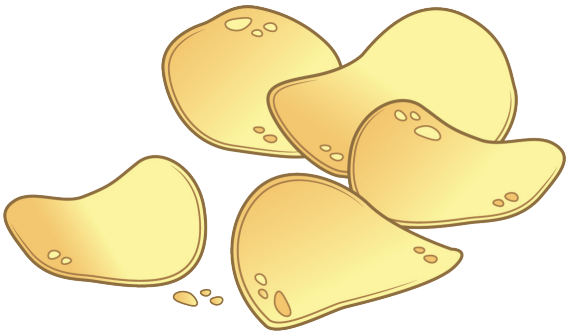
Tuna is fished from the ocean

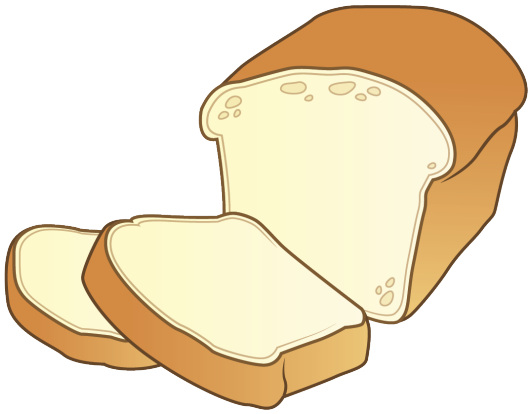
WATERMELON

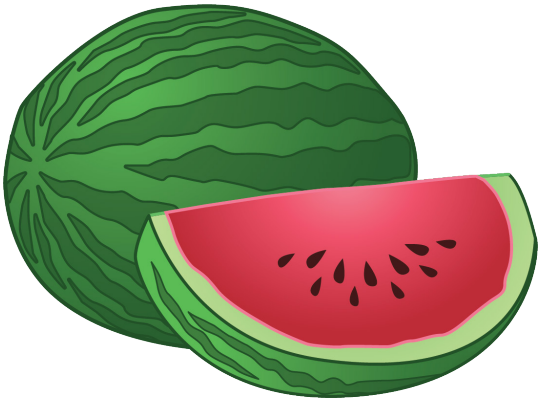
Watermelons are grown in the soil

SOIL HEALTH FIELD DAY STATIONS









SOIL HEALTH FIELD DAY STATIONS

CHOCOLATE BAR

Cacao beans are grown in the soil

LETTUCE

Lettuce is grown in the soil

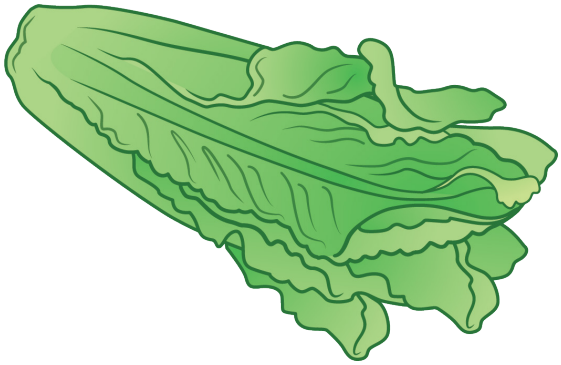
MUSTARD

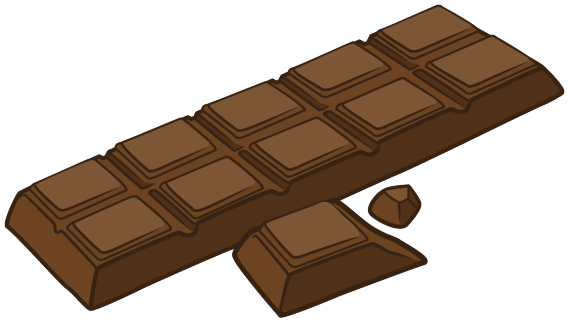
Mustard seed is grown in the soil

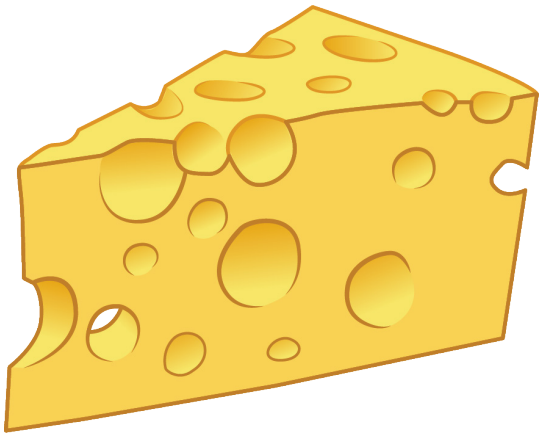
CHEESE

Cheese technically does not rely on soil for production, but if the dairy cows were fed alfalfa, grass or hay, then soil is involved

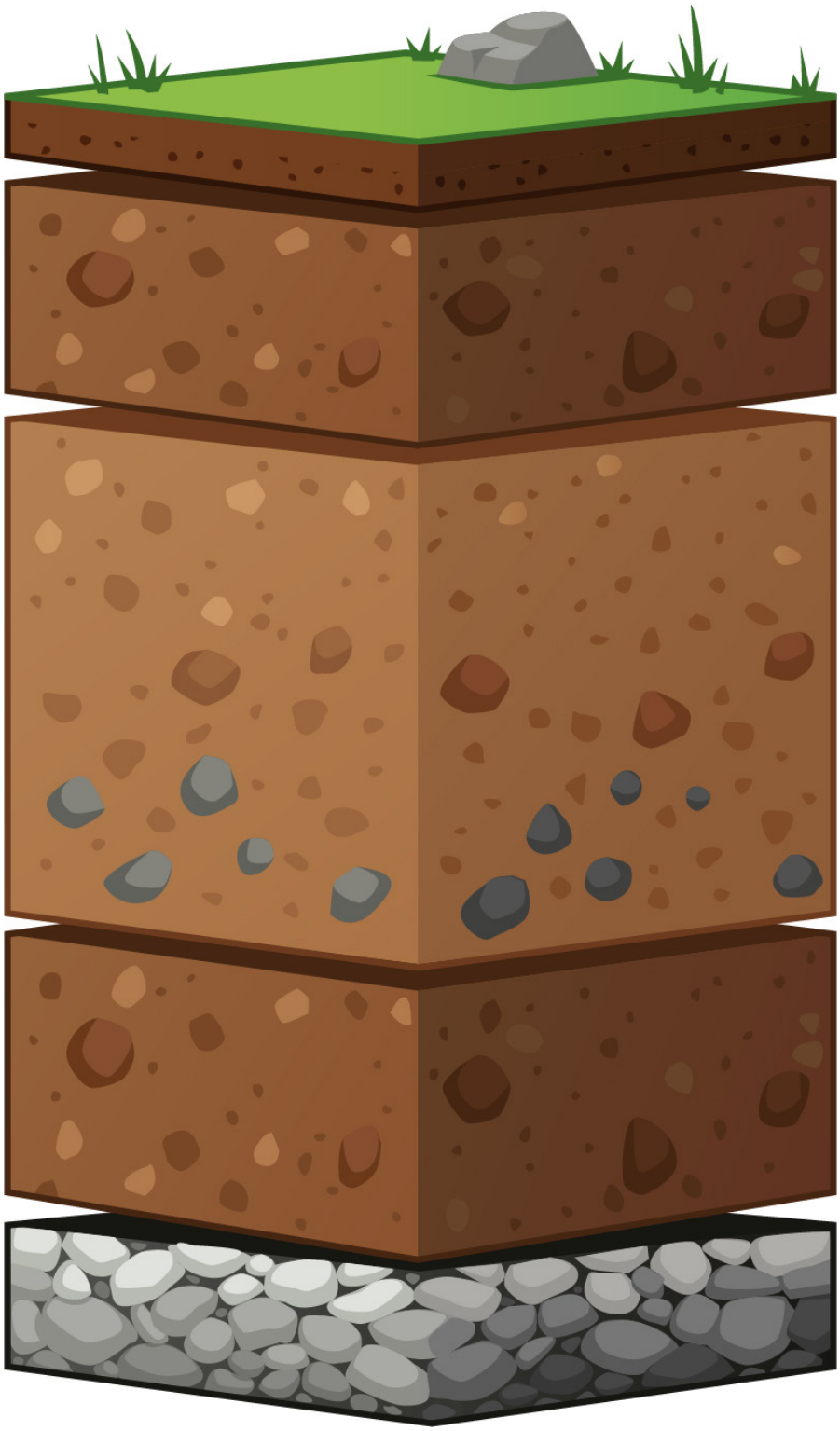
SOIL HEALTH FIELD DAY STATIONS







SOIL HEALTH FIELD DAY STATIONS



ADAPTATION MATCH!

Materials:

- Animal cards, including drawings of: mole, ant, pillbug or rolly polly, earthworm, mouse, gopher
- Animal cards including a close-up feature of each of these animals

Background Information

Soils provide a habitat for many large and small animals, and numerous organisms that are too small for our eyes to see. However, living in the soil isn't always easy! Many animals that live in the soil have unique adaptations that allow them to survive in this particular environment. Students will work to match up the close up of the animal adaptation to the whole animal.

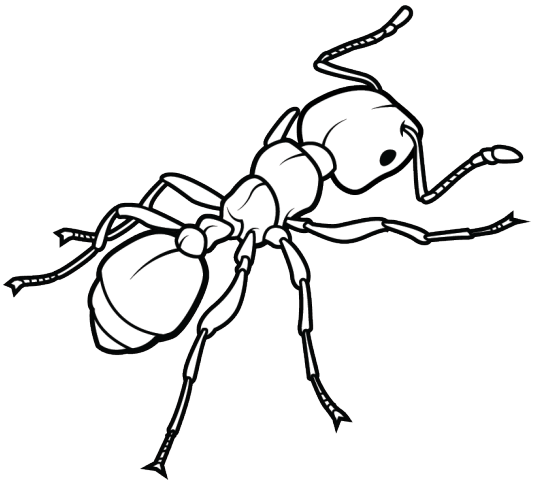
Station Instructions

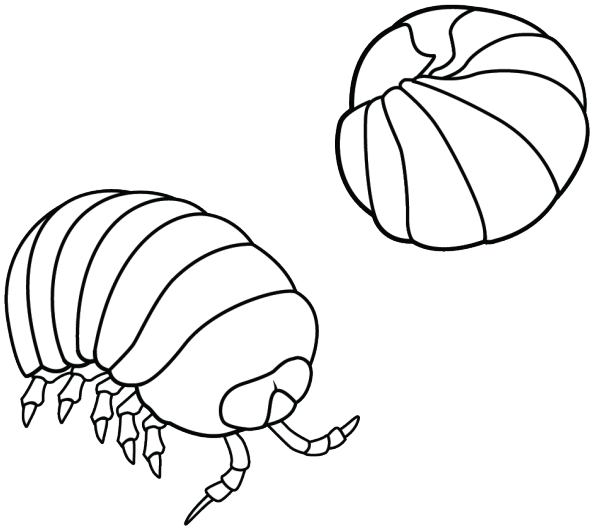
- Ask students if they know what an adaptation is. Explain that adaptations are a physical trait or behavior that helps an organism survive in their environment.
- Ask students what adaptations they think animals would need to live in the soil. What do they think living in the soil would be like? What would they need to survive?
- Begin by giving students images of the close up adaptations. What do they think these adaptations are for? If they need help, there is a description on the back.
- Then, show students the full image of each animal and have them match the close-up image to the full animal. Have students read the back of the full animal card for more information on the adaptation and how it helps each organism survive in the soil.

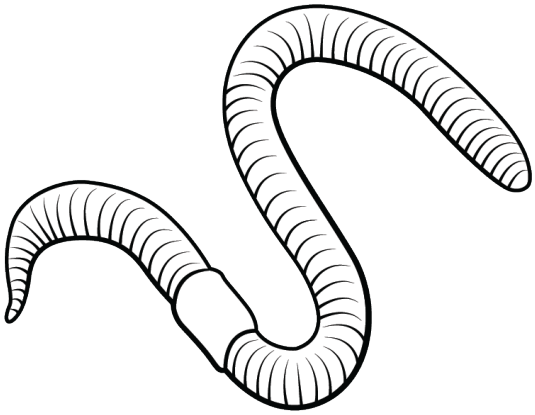
Evaluation

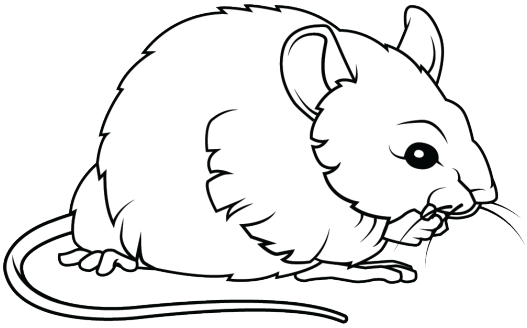
Students should be able to explain that soil is a unique habitat and animals that live there have a variety of adaptations to survive in these conditions.

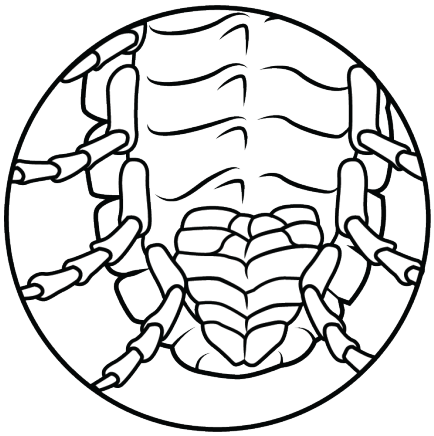
SOIL HEALTH FIELD DAY STATIONS

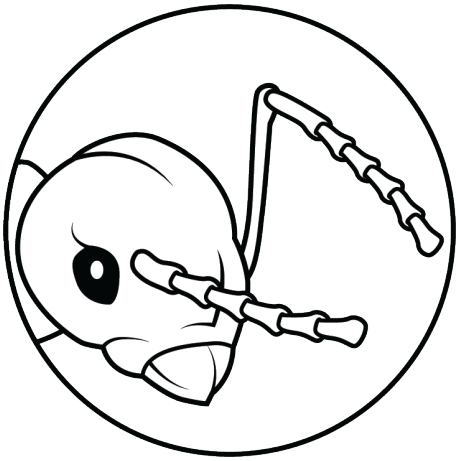


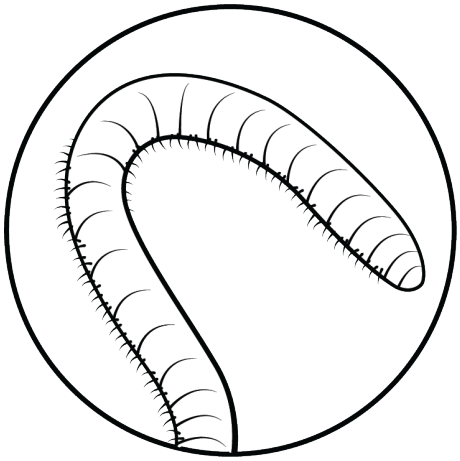








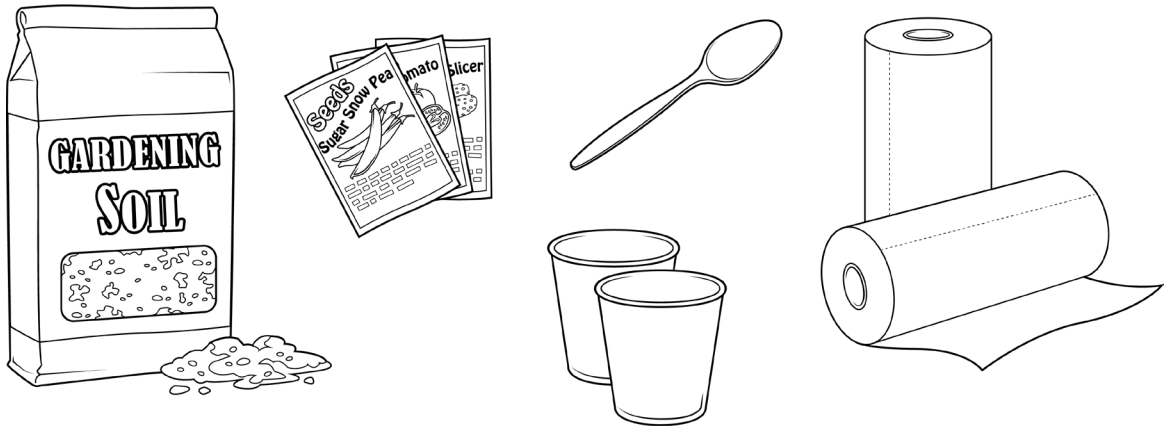




GROW YOUR OWN!

Materials

- Diagram of a plant growing in soil, with roots included
- Small cups
- Potting soil
- Seeds (any variety)
- Spoons
- Hand sanitizer
- Paper towels



Background Information

The plants that we rely on for food (in addition to clean air and water) rely on soils to grow healthy and strong. Without soil, plants wouldn't have a place to grow their roots and absorb nutrients. Without soil, we wouldn't have fruits and vegetables to eat, trees for shade and habitat, or even flowers!

Station Instructions

- Ask students what they know about plants and what they need to grow.
- Remind students that in addition to air, water and sunlight, plants also need soil. Show them the diagram of the plant growing in soil and ask them what they notice.
- Tell students that while we may see tree trunks, leaves and stems, plants have roots that grow underground. Roots absorb water and nutrients from the soil.
- Let students know that even seeds need water and nutrients from the soil! Today, they are going to plant a seed to take home to remind them of the importance of soil.
- Give each student a small cup and a spoon. Allow them to fill their cup with soil.
- Then, give each student a seed to plant. Demonstrate how to gently plant it in the soil.
- Ask students what else their seed will need to grow. If time and space allows, let each student water their seed.
- Remind students of the steps they will need to take to keep their seed healthy as it begins to grow, and further instructions for how to plant it and keep it alive.

Evaluation

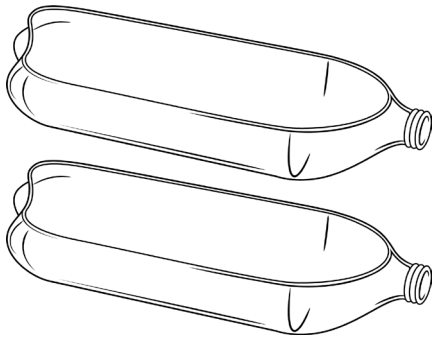
Students should be able to explain that in addition to air, water and sunlight, plants need soil to grow. Plants will absorb water and nutrients from the soil.

UNDERSTANDING EROSION

Materials:

These should be prepared in advance:

- Up to four 2-liter bottles. Each bottle should be cut lengthwise, keeping the top intact
- Each bottle should include one of the following: damp soil, damp soil covered in mulch, soil covered in dry leaves, damp sand (be sure to keep the lid for this demonstration bottle)
- Sprinkling-style watering can or spray bottle filled with water
- Plastic cups



Background Information

The top layer of soil includes most of the nutrients needed for plant and animal life to thrive. Farmers and ranchers work to keep soils healthy since healthy soils mean healthy crops and animals. One way we can keep soils healthy is by working to prevent erosion. Erosion is the process of wearing away due to wind, water or other natural agents. When soils erode too quickly, it may impact the growth of plants, cause flooding or impact water quality. There are many practices that we can put in place to keep soils healthy and to prevent erosion.

Station Instructions

- Ask students if they know what erosion is. Explain that erosion is a process of wearing away due to wind, water or other natural agents. Ask students what they think would happen to places like farms or rivers if there was too much erosion.
- Keeping soils healthy and intact is one way that we can prevent erosion. Explain to students that we are going to work to demonstrate this process with the soil samples on hand today.
- Let students observe the water bottles with soil samples and ask them to make predictions about what would happen if the bottles were held at an angle and water was “rained” on them.
- Demonstrate this process with each water bottle. Have one student hold a water bottle at a time at a gentle angle (no more than 40 degrees) with the top pointing downwards. Another student should hold a cup under the top of the bottle.
- Pour water from the sprinkling-style watering can, or spray on water from the spray bottle and watch what happens. How much soil is making its way to the cup?
- Repeat this process with each of the samples and ask students what they observed.
- Samples with ground cover will have less erosion. Explain that by tending to soils, we can keep them healthy which has a positive impact on the environment.

Evaluation

Students will be able to explain the process of erosion and that soils with more ground cover will be less likely to erode.

CAN YOU SURVIVE?

Materials

• 50-60 small items in a variety of colors. If doing this activity outdoors, use biodegradable items like colored pasta or beans. Indoors, you can use pipe cleaners, yarn, or paper. One color should be designated as water, one as food, one as air. There should be approximately the same number of each color of item.

Background Information

Organisms are part of a complex food web and rely on other organisms to survive. Soil is no exception. In this habitat, like habitats on land, organisms need certain resources, like air, food and water, to meet their needs and survive. Water can be found in soil, in addition to air. In healthy soils, there is space for air. We call this soil porosity, or soil pore space. Food may include decomposing material, plant matter, or other organisms. Organisms may also be in competition with each other for resources.

Station Instructions

- Prior to students arriving at this station, objects that represent air, water and food should be evenly distributed in an open space. One example of each should be retained to explain the game.
- Ask students if they know what living organisms need to survive. Highlight the need for food, air, and water.
- Ask students if they think that organisms that live in the soil also need these things. Explain to students that in healthy soils, air, water, and food should be present to support the organisms that live there. They are going to play a game that models what happens when resources are in balance and what happens when they aren't.
- Let students know what the objects you have represent. Tell students that they are going to be organisms in the soil. When you give the cue, they should head out into the open space to collect air, water, and food objects. Let students have 1-2 minutes to collect items then come back together.
- Ask students what they noticed. Was it easy to find these resources? Why or why not?
- Collect the items that the students have gathered. Tell them that they are going to play this game again, but this time food will be more limited and each organism needs to collect at least 5 food items to survive. Spread out the items, removing 10-20 of the objects that represent food and run the simulation again. Let students have 1-2 minutes to collect items then come back together.
- Ask students what they noticed. Did any organisms struggle to survive?
- You can keep running this game tinkering with the number of items and the needs of the organisms until time runs out.
- Ask students if they think this type of scenario plays out in the soil. Why or why not? What can people do to ensure that soil stays healthy? If time allows, talk about how plants need healthy soils to survive and that we rely on plants for food, clean air, and other resources.

Evaluation

Students will be able to explain that organisms in the soil, like organisms on the land and in water, need food, water and air to survive. Organisms may compete for these resources. If a resource is missing some organisms may struggle. In healthy soil, all of these resources should be present in balanced amounts to sustain soil life.

SOIL FOOD WEB

Materials:

- Food Web Cards: sun, soil, tree, insects, birds, small mammals, large mammals, decomposers
- Prior to the activity, punch a hole in each Food Web card and add a piece of yarn to make a necklace
- Ball of yarn

Background Information

Food webs describe the relationships between organisms in a community. While a food chain is hierarchical, a food web illustrates the complexities of the relationships between living things in an ecosystem, including the transfer of energy. For example, a food web may illustrate the relationships between different food chains in an environment. Within a food web there will be producers (plants) that can convert sunlight into energy, consumers (animals that consume plants and other animals), herbivores (animals that eat plants), carnivores (animals that eat other animals), omnivores (animals that eat both plants and animals), and decomposers (animals or fungi that break down organic matter.)

Station Instructions

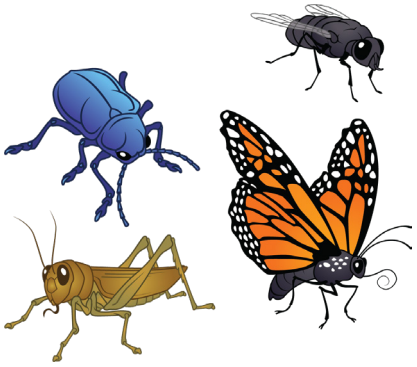
- Ask students if they know what a food chain is. What about a food web? While a food chain may demonstrate the relationships between a few animals, a food web demonstrates the multiple connections between living and nonliving things in the environment.
- Tell students that today they are going to demonstrate a food web. Each of them will get to represent a living or nonliving thing in the environment and students will work together to illustrate their connections to each other.
- Have all the students put on a food web card and stand in a circle.
- Give the end of the ball of yarn to the student wearing the sun food web card. Explain that this represents energy from the sun. Have this student toss the ball of yarn to someone wearing a card that can use that energy from the sun, like the student wearing the plant card. From there, have the student wearing the plant card toss the yarn to someone who can use the energy from the plant. Continue this process until everyone is connected.
- Once everyone is connected, or holding on to a piece of yarn, have the students slowly step back to feel the tension in the web they have just created.
- Ask students what would happen if someone was removed from the web.
- Be sure to remove the soil from the food web and ask students what happened.
- We might not always think of soils as being part of the food web, but soils are a habitat for many plants and animals, and many of these organisms rely on the soil.
- This is why it's important to keep our soils healthy so that the ecosystems we are a part of continue to thrive.

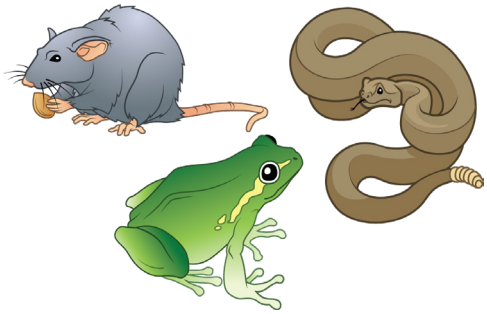
Evaluation

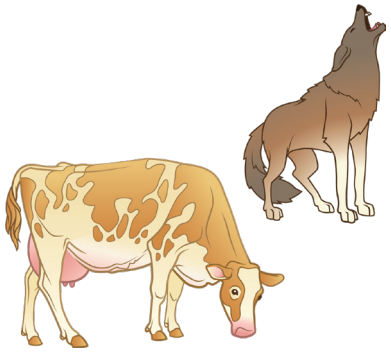
Students are able to explain that soils are a habitat and many organisms may get nutrients from the soil. If solis are degraded or removed from an ecosystem, many animals and plants may not survive.

SOIL HEALTH FIELD DAY STATIONS

SUN	SOIL
TREE	INSECTS
BIRDS	SMALL ANIMALS
LARGE ANIMALS	



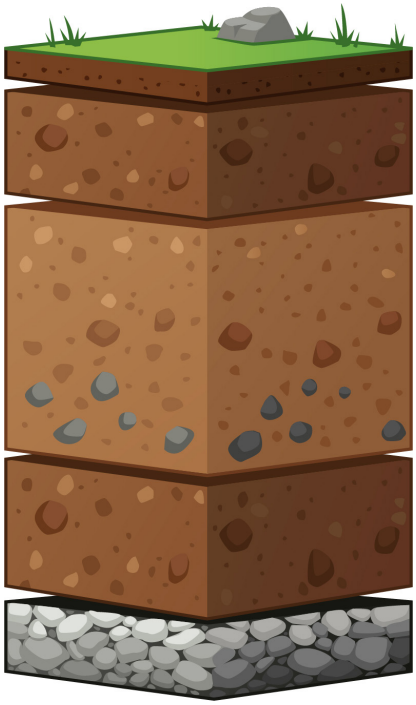




WHAT'S ON THE HORIZON?

Materials

- Clear plastic cups or jars
- Paper discs that fit within the cups or jars
- Plastic spoons
- Pie tins containing the following materials: leaves and other organic material, potting soil, a tightly packed soil sample, small rocks or pebbles (aquarium rocks work great), larger rocks that can fit into the cups
- One fully assembled soil horizon example
- Illustration of soil horizons
- Hand sanitizer



Background Information

Soil has multiple layers, or horizons. These include organic material, like decaying leaves, the topsoil, the eluviated horizon, the subsoil, parent material, and bedrock. The following horizons are found underneath our feet:

- Organic Matter - The topmost layer. Included things like decomposing leaves. Not present in every type of soil.
- Topsoil - Includes minerals and organic matter. Where many plants and organisms are found.
- Eluviated - Mostly sand and silt particles. Found mostly in older soils and forest soils.
- Subsoil - Full of minerals that have leached from other horizons. Roots from plants can be found extending into this horizon.
- Parent Material - The deposit at the Earth's surface where the soil developed. Parent material can be from the same location where the soil is found (residuum) or can be transported from a different location (wind-moved aeolian deposits, deposits from glacial till, volcanic deposits, et cetera).
- Bedrock - Mass of rock that forms the parent material of some soils.

WHAT'S ON THE HORIZON?

Station Instructions

- Ask students if they have ever wondered about what the ground beneath their feet looks like. Not just the top layer, but what it might look like if they were able to keep digging.
- Take student responses and explain to them that underneath the ground there are multiple layers that make up the soil.
- Tell students that they are going to work together to assemble a model of what they think it looks like underground using the materials they have. Let students know that they will work together in teams to create their model in plastic cups. They should place a paper disc between layers to keep them separated so other groups can use these materials.
- Give students 5-7 minutes to assemble their model.
- Once their models are assembled, share the soil horizon diagram and the soil horizon model.
- Ask students how their models compare to the diagram. Explain the soil horizon diagram and answer any questions that arise.
- Have students disassemble their models.

Evaluation

Students should be able to explain that there are multiple layers of soil beneath our feet. These horizons are made of different materials, ranging from topsoils to rocks.

Additional Station Ideas

- Draw your favorite food that grows in the soil!
- Soil horizon bracelets - using the soil horizon diagram, assign different colors of beads to different layers. Have students make bracelets that represent these horizons.
- Design your own garden! Draw your dream garden - it could be a planter box or a whole farm! How will you tend to the soil in the garden to make sure that it's healthy?

GENERAL POST-EVALUATION

After your Soil Health Field Day, take a few moments to find out what students discovered. You can record responses and reflect on the responses collected during the Pre-Evaluation.

- What do you know about soil?
- What do you know about organisms that are found in the soil?
- Do you think it's important for soil to be healthy? What do you think this means?
- Do you know where your food comes from?
- What do you think would happen if the Earth's soil disappeared?
- Is there anything that people can do to help soil health?
- Is there anything you'd like to learn about soil?
- Is there anything that people can do to improve soil health?
- Is there anything new that you learned about soil or soil health?
- Are there any specific actions you are going to take?
- Is there anything else you would like to learn about soil health?

K-2 LESSON • FIELD DAY REFLECTIONS

Learn more about Common Core Connections in Appendix C

Time: 1 hour (can be divided into two 30-minute sessions)

Materials:

Student Page
Optional: general art supplies like paper, colored pencils and markers

Background Information

Students will have the opportunity to reflect on their field day experience. If necessary, review the soil health activities students completed to help guide their reflection.

Students Will

Explain and describe the importance of healthy soil using information they gained from participating in the Soil Health Field Day.

Write a short story (a few sentences to a few paragraphs) about soil.

LESSON • 5 E MODEL

Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Soil Health Field Day. Is there anything they learned that surprised them? What was their favorite thing about the experience?

Explore

Tell students that they will write a short story about soil. They should include 2-3 things they learned. They may also include drawings or images. If appropriate, review the basic components of a story or essay.

Students may write their story on the student page provided.

Explain

After students write their stories, have them share with each other or the group. Review the importance of soil to the natural environment and to humans.

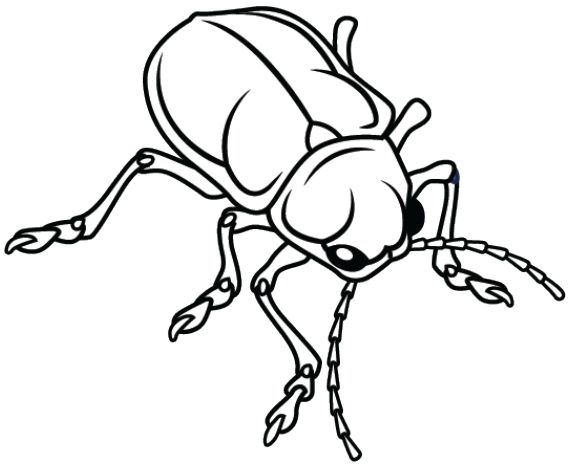
Extend

Provide or find a copy at your local library of the books listed in the at the end of this lesson plan. Read these books aloud to students or let them read independently.

Have students share their stories with other students that participated in the Soil Health Field Day.

Evaluate

Revisit any questions or ideas that were generated during the post-evaluation and discussion.



MY SOIL HEALTH FIELD DAY EXPERIENCE

Here's what I learned at our Soil Health Field Day!

3-5 LESSON : SHARING SOIL CONNECTIONS

Learn more about Common Core Connections in Appendix C

Time: 1 hour (can be divided into two 30-minute sessions)

Materials

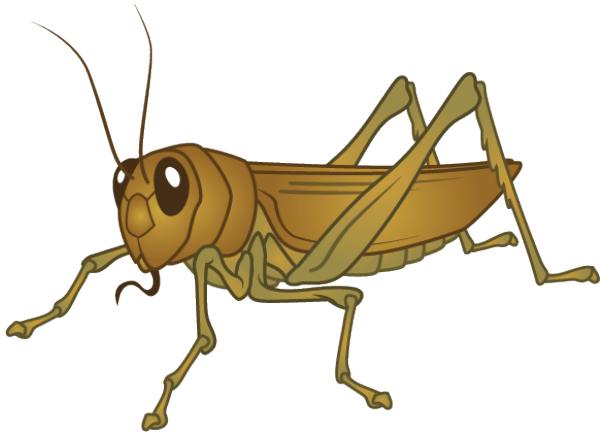
- Student Page
- Optional: access to a computer or general art materials

Background Information

Writing is a great way to share information about the natural world. People like authors and reporters use writing to communicate about the environment. An article or essay is a great way to share the experiences that students had at their Soil Health Field Day with peers and a general audience.

Students Will

- Write a short article or essay (a few sentences to a few paragraphs) about their
- Soil Health Field Day experience
- Be able to communicate about their Soil Health Field Day experience in writing, both verbally and visually.
- Describe the characteristics of soils, specifically mentioning the benefits of healthy soils



MY SOIL HEALTH FIELD DAY EXPERIENCE

Recall what you learned at the Soil Health Field Day to help you write an essay about your experience!

LESSON • 5 E MODEL

Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Soil Health Field Day. Is there anything they learned that surprised them? What new facts are they most interested in sharing with others?

Explore

Tell students that they will write a short essay or article about their Soil Health Field Day experience. They should include factual information they learned during the pre-activity and Soil Health Field Day. Students can write about a particular activity, their experience as a whole or something new they learned. They may also include drawings or images to accompany their article. If appropriate, review the basic components of an essay or news article.

Students should brainstorm their ideas on the student page provided. Articles should be written on notebook paper or a computer. You can also provide art materials for students to include an illustration.

Explain

Allow students to share the articles with their peers. Did their writing have anything in common? For example, did some students find the same fact interesting? Did they learn anything new from their peers?

Extend

If time and resources permit, allow students to work together to craft their own soil health newspaper with information about the field day and research on soil health.

Have students interview each other to create a short news story about their experience during the Soil Health Field Day.

Evaluate

Students should be able to communicate about their Soil Health Field Day experience in writing, both verbally and visually.

Revisit any questions or ideas that were generated during the post-evaluation and discussion.

6-8 LESSON • WRITE A LETTER TO THE EDITOR

Learn more about Common Core Connections in Appendix C

Time: 1 hour (can be divided into two 30-minute sessions)

Materials

- Student Page
- Access to the Internet
- Examples of letters to the editor (can be sourced from the print or online additions of local or national newspapers)

Background Information

Writing a letter to the editor is one way that individuals can express their opinion about an issue or topic to the general public. Published in a newspaper or magazine, a letter to the editor is typically a short letter that includes an opinion and the reasoning behind it.

Writing a letter to the editor is a great way to get students to think critically about a topic and to hone persuasive writing techniques. In this lesson, students can use the information that they gained during their Soil Health Field Day experience in addition to independent research.

Students Will

- Write a letter to the editor about soil health. If possible, students will submit their letters to a local newspaper or magazine.
- Be able to communicate about their Soil Health Field Day experience in writing and verbally.
- Conduct independent research on soil health.
- Describe the characteristics of healthy soils.

LESSON • 5 E MODEL

Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Soil Health Field Day. Is there anything in particular that they think the general public should know about soil health? Write down any ideas that arise.

Explore

Ask students if they know of a way that they can communicate their ideas about soil health with the people that live in their community. Explain that one way that people can share their ideas with community members is by writing a letter to the editor for publication in their local newspaper or a local magazine.

Have students review examples of letters to the editor. What are a few things that they have in common? What elements should they include in a letter to the editor about soil health?

Explain

Allow students time to draft and write a letter to the editor using the student page or a computer. Students should conduct additional online research to support their opinions and arguments.

Have students peer edit each other's letters and allow them to share their letters with each other.

If you are planning on having students submit their letters to the editor, they should research local newspapers and magazines to find the appropriate contact information and submission instructions.

Extend

If appropriate, have students send in their letters to the editor. If any of them get published, share the print and online versions with your class or group.

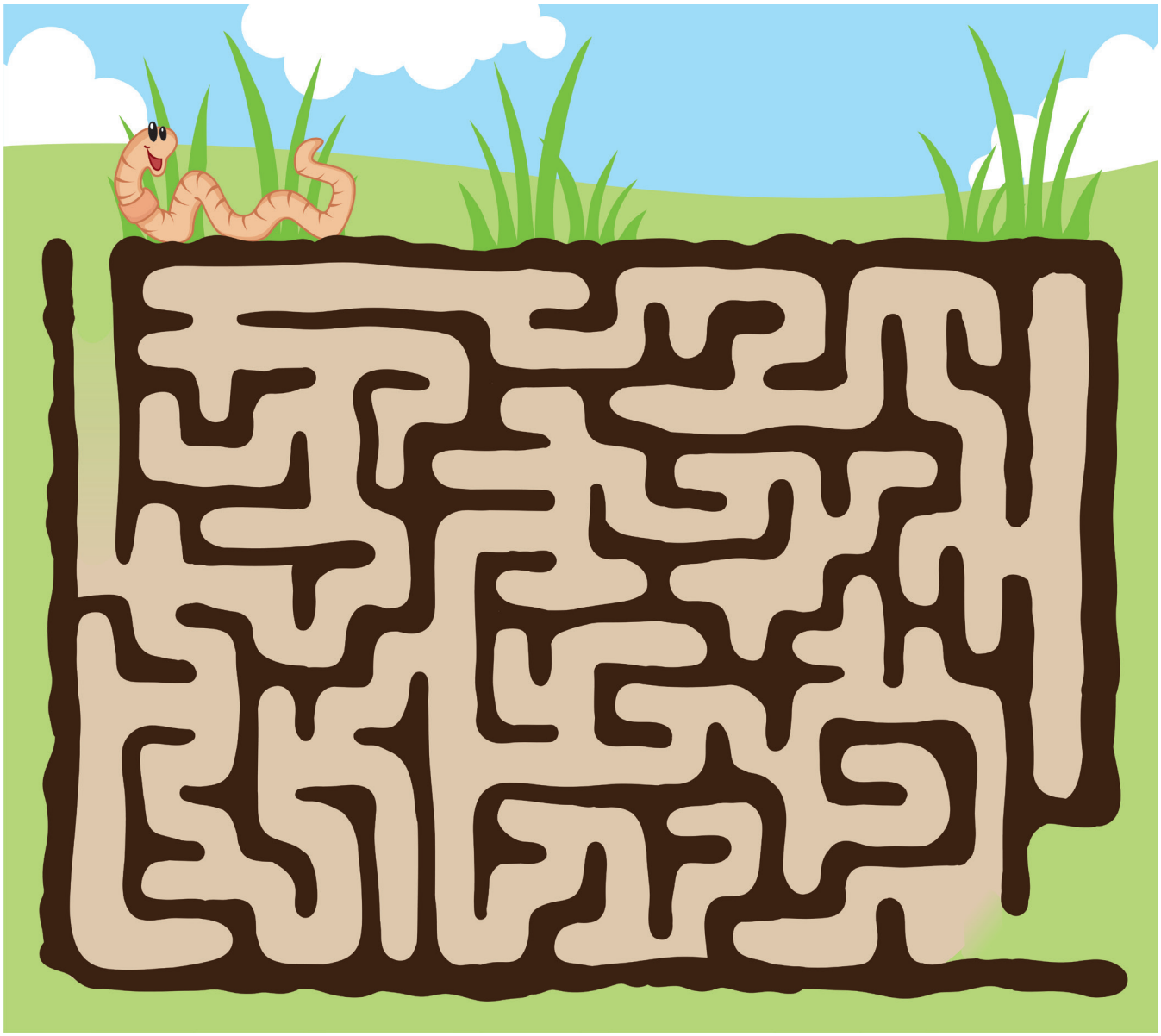
If any journalists in your area cover environmental issues or local news, invite them to come to your classroom or location to share their experience writing and reporting on these issues.

Evaluate

- Students will write a letter to the editor about soil health.
- Students should be able to communicate about their Soil Health Field Day experience, the characteristics of soil health, both in writing and verbally.
- Students should be able to conduct independent research on soil health.
- Revisit any questions or ideas that were generated during the post-evaluation and discussion.
- Revisit any questions or ideas that were generated during the post-evaluation and discussion.

LETTER TO THE EDITOR

Start your draft or write your letter to the editor expressing how you feel about healthy soils.

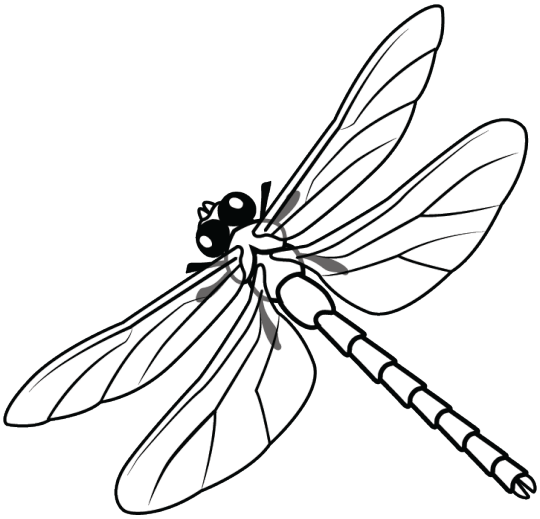


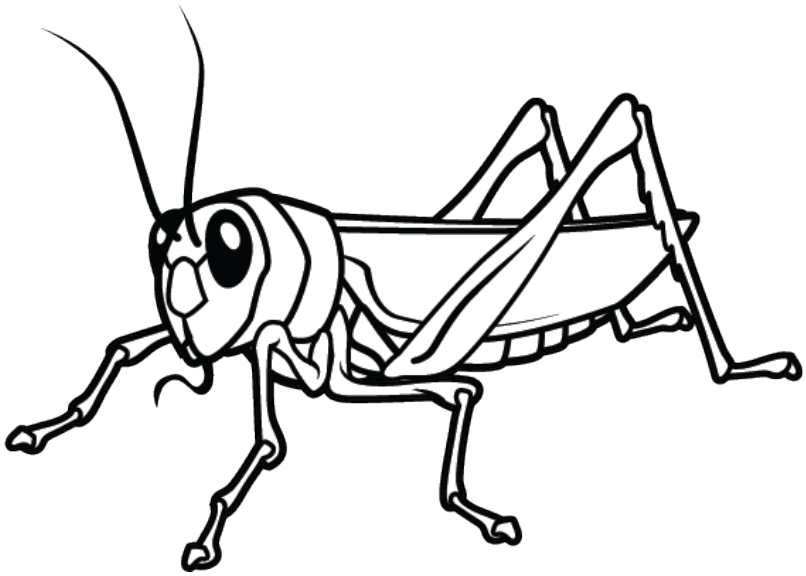
WORD SEARCH

T	O	S	S	O	W	T	L	H	T	T	I	W	R	V
A	S	K	O	D	J	A	E	W	R	O	C	N	P	C
T	T	B	N	I	B	A	P	E	I	P	C	N	I	R
I	I	V	N	S	L	A	C	E	D	S	N	S	Z	O
B	U	R	B	T	K	M	T	V	E	O	N	M	Z	P
A	R	T	H	G	I	L	N	U	S	I	L	G	S	S
H	F	Y	C	E	I	D	R	M	R	L	F	N	F	U
B	K	V	E	G	E	T	A	B	L	E	S	O	N	Q
F	O	O	D	N	H	T	F	W	V	B	P	C	E	C
X	B	L	P	M	G	Z	K	A	H	V	D	U	F	W
L	C	N	D	X	R	N	U	T	R	I	E	N	T	S
C	O	W	A	T	O	O	E	E	A	L	F	S	F	X
Y	U	S	S	S	W	T	A	R	D	S	Q	C	Z	D
S	N	O	Z	I	R	O	H	M	R	A	F	K	P	J
U	C	I	K	H	V	U	T	A	R	V	Y	Y	I	W

CROPS
DIRT
FARM
FOOD
FRUITS
GROW
HABITAT
HEALTHY
HORIZONS
NUTRIENTS
SOIL
SUNLIGHT
TOPSOIL
VEGETABLES
WATER

COLORING PAGES





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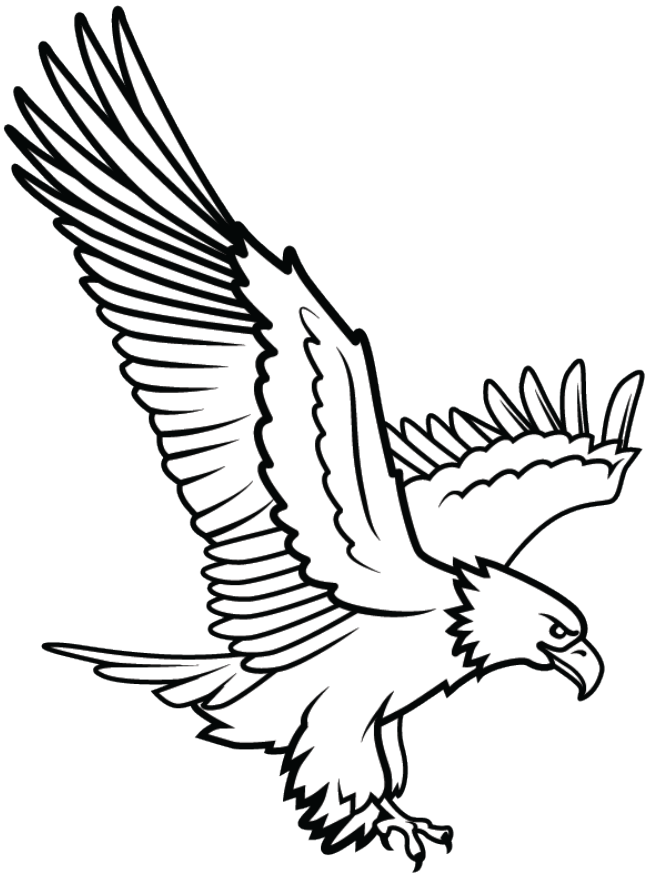

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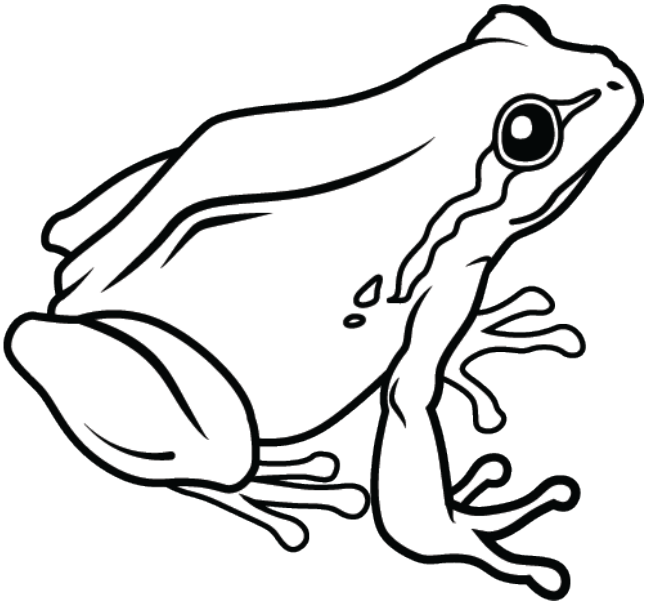

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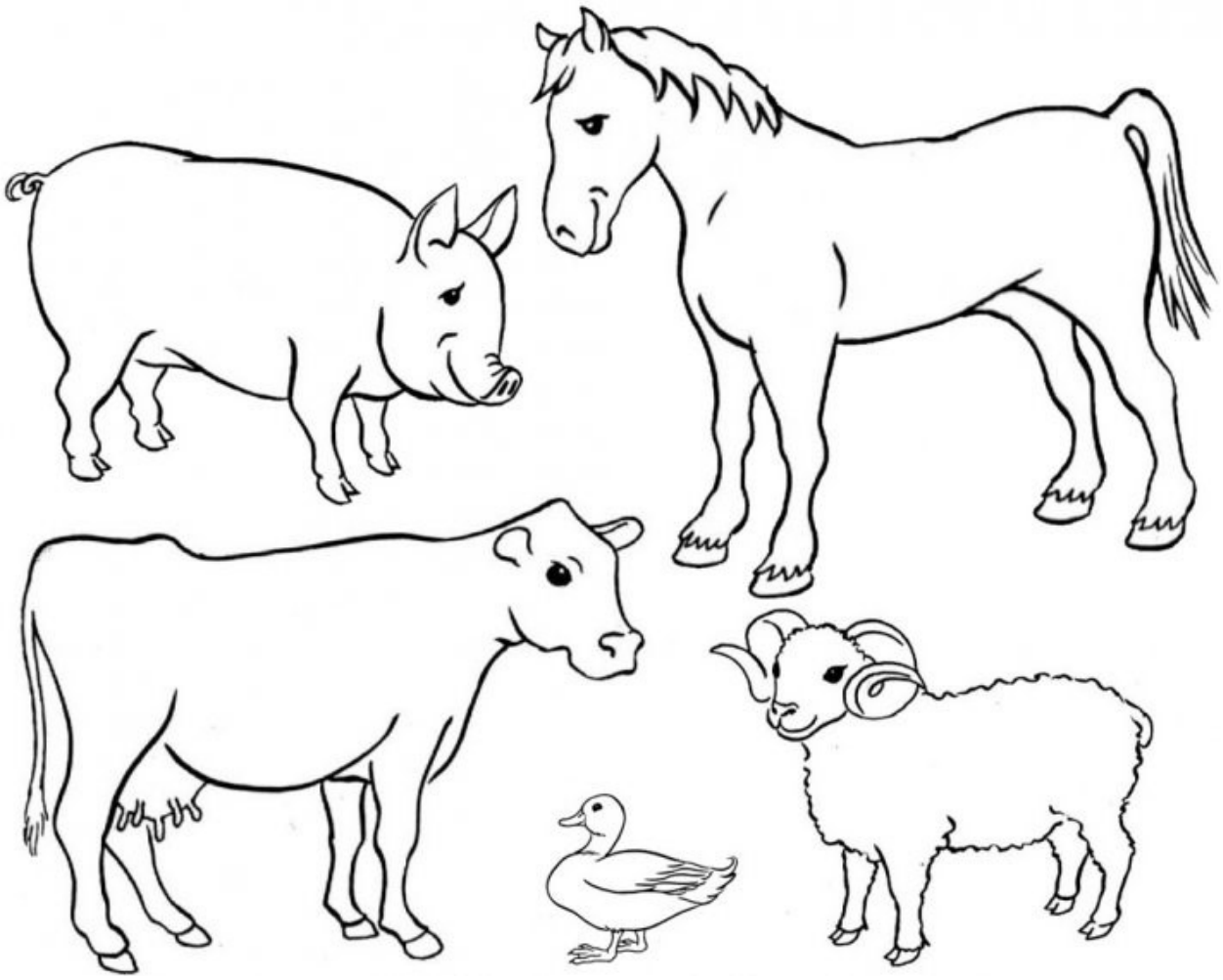

FIELD DAY EXTENSION ACTIVITES

There are multiple ways to extend the learning from your Soil Health Field Day. Consider the following activities:

Participating in a citizen or community science project

A citizen or community science project allows students to contribute data to real scientific research. You can learn more about projects appropriate for students by visiting: https://pbskids.org/scigirls/citizen-science

Field trips

Extend the learning of your Soil Health Field Day by going on a field trip! Ideas include visiting a local farm or community garden to learn how they keep their soil healthy to support the plants they grow.

Growing a school or organizational garden

If you have the space at your school or site, consider planting a garden. Consider planting vegetables or native plants. Students should use concepts they learned in this guide to ensure that they are creating healthy soil for the garden to thrive.

APPENDIX A

We're here to help ensure that the planning of your Soil Health Field Day is as easy as possible! On the following pages you'll find templates for outreach letters that you can send to parents and guardians to notify them of the upcoming event and ask for volunteer assistance, and a letter to potential partners to run stations at the event.

DATE

Dear Parents and Guardians,

On [DATE], our [CLASS/ORGANIZATION/GROUP] will participate in a Soil Health Field Day from [TIME to TIME] at [LOCATION]. We wanted to share this exciting information with you and extend an invitation to come and learn with us!

Over the past few [DAYS/WEEKS/UNIT], our [CLASS/ORGANIZATION/GROUP] has spent time learning about the importance of soil health. ADD SENTENCE ON WHAT THEY HAVE LEARNED. During our Soil Health Field Day, we will build on this knowledge by engaging in hands-on learning and activity stations. We are also looking forward to having [COMMUNITY GROUP OR PARTNER] join us for the day to share their knowledge with our students.

We hope that you will be able to attend as a visitor or volunteer! We have learned so much, and we are looking forward to continuing learning about soils with you and your students.

Sincerely,

[INSTRUCTOR NAME]

Sample Email to Community Group

One of the challenges during setting up a Soil Health Field Day can be limited time for outreach to community members. This sample email text should make it easier for your organization to contact individuals and organizations in your community for assistance in putting together your Soil Health Field Day program.

DATE

Dear Community Group,

On [DATE], our [CLASS/ORGANIZATION/GROUP] will hold a Soil Health Field Day from [TIME to TIME] at [LOCATION]. We would like to invite you to participate in this event to share your knowledge with our students during this event.

Over the past few [DAYS/WEEKS/UNIT], our [CLASS/ORGANIZATION/GROUP] has spent time learning about the importance of soil health utilizing curriculum from the National Association of Conservation Districts [link to curriculum].

During our Soil Health Field Day, we will build on this knowledge by engaging in hands-on learning and activity stations. We would be glad to have [COMMUNITY GROUP OR PARTNER] join us for the day to share knowledge with our students. We will have [NUMBER] of stations and would like for [COMMUNITY GROUP OR PARTNER] to [HOST A TABLE HIGHLIGHTING THEIR ORGANIZATION OR FACILITATE AN ACTIVITY WHICH WE WILL PROVIDE]. All activities will last from 10-15 minutes and will allow your organization to impact [TOTAL NUMBER OF STUDENTS].

We hope that your organization will be able to help make our Soil Health Field Day a success. Please contact me by [DATE] to let me know if you can attend.

Sincerely,

[INSTRUCTOR NAME]

APPENDIX B

VIRTUAL & HYBRID LEARNING ACTIVITIES

Over the past two years, many of us have incorporated virtual teaching and learning into our programs and at school. While these activities lend themselves to collaborative and hands-on learning, there are many opportunities to adapt them to virtual lessons or programs. Here are a few tips and tricks to ensure that learners can engage with this content in a virtual format:

- You may already be comfortable with video conferencing platforms like Zoom or WebEx, but once you have a program in mind, it's a great idea to review the features that can support your program or lesson. Think about how you can make the most of interactivity using reactions, the chat feature and breakout rooms.
- Bring in additional virtual tools and resources. This is a great opportunity to showcase any video content that features your organization, and a way that you can pre-record interviews of guest speakers. Investigate tools like Jamboard, Padlet, and Mentimeter (just to name a few) to bring additional ways for your audience to engage with your program or lesson.
- Understand any barriers to accessing technology. If you are presenting to a school group or organization, be sure to schedule a time to test your technology out before the presentation to make sure everything runs smoothly. It's also a good idea to have a co-presenter available in case you run into any technical issues so the program can run in the scheduled time allotted.
- Teamwork makes the dream work. As mentioned above, having a co-presenter can help make things run smoothly! Not only can a co-presenter help out if the main presenter is having technical issues, but they can also assist with tasks like moderating the chat and helping participants deal with issues they may have so the main presenter can stay on track.
- Be as hands-on as possible! If you are integrating activities, make sure that your audience knows the materials they will need ahead of time to allow them to prepare. If you have the resources available, you can also send them to your audience ahead of time so they have all the materials at hand.
- Decide if you want to record. Let your participants know well in advance if you are recording and if the presentation will be posted online. Note that some people may not want to have their cameras on if you are recording. Recording your session also gives you an opportunity to evaluate your program.
- Be sure to follow up with your participants. This provides an opportunity to receive feedback on the quality of the program and relevance of the content, in addition to feedback on the technical aspects of your presentation.

CONNECTIONS TO STANDARDS

In this appendix, you'll find more information on some of the connections to Next Generation Science Standards and Common Core Standards. This list is not exhaustive. Depending on how lessons and field day activities are presented, content in these standards may be briefly mentioned or deeply explored. Extension activities also provide an opportunity to explore these standards in more depth. For more information, visit:

Next Generation Science Standards: https://www.nextgenscience.org/
Common Core: http://www.corestandards.org/

K-2 Pre-Lesson & Field Day Activities

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]
K-ESS3-1: Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live. [Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]
K-ESS3-3: Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment. [Clarification statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]
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-LS2-1: Plan and conduct an investigation to determine if plants need sunlight and water to grow. [Assessment boundary: Assessment is limited to one variable at a time]
2-ESS2-1: Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land [Clarification statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

3-5 Pre-Lesson & Field Day Activities

3-LS4-2: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. [Clarification statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]
3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]
4-LS1-1 - Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. [Clarification statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment boundary: Assessment is limited to macroscopic structures within plant and animal systems]

APPENDIX C

CONNECTIONS TO STANDARDS

3-5 Pre-Lesson & Field Day Activities Cont.
4-ESS2-1: Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation. [Clarification statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment boundary: Assessment is limited to a single form of weathering or erosion.]
5-PS3-1: Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun. [Clarification statement: Examples of models could include diagrams and flow charts]
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 Pre-Lesson & Field Day Activities
MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]
MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]
MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services. [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

K-2 Post-Lesson
CCSS.ELA-LITERACY.W.K.8, 1.8: With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
CCSS.ELA-LITERACY.W.2.8: Recall information from experiences or gather information from provided sources to answer a question.

3-5 Post-Lesson
CCSS.ELA-LITERACY.W.3.3, 4.3, 5.3: Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

6-8 Post-Lesson
CCSS.ELA-LITERACY.W.6.1, 7.1, 8.1: Write arguments to support claims with clear reasons and relevant evidence.
CCSS.ELA-LITERACY.W.6.6, 7.6, 8.6: Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of three pages in a single sitting.

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 under 0.002 mm in diameter with little organic material. Clays are often damp, sticky and hard
Ecosystem- The assemblage of living organisms and nonliving environmental components in a particular area that are connected by their interactions and interdependence. 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, some algae, protozoa and some fungi.
Mimic - imitating the mannerisms, movements or coloration of another organism
Natural Resource -something found in nature that can be used by humans that is considered valuable in its natural form. Examples include light, air, water, soil, minerals, and fossil fuels.
Organic Material - materials from living sources found in natural environments
Organism - A living thing 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, greater than 0.05 mm in diameter
Silt - rock particles that are between 0.05 millimeter and 0.002 mm 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. For soils, specific texture classifications have been developed based on the percentage content of sand, silt, and clay particles in a soil. See the soil texture triangle.
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 E

LITERATURE CONNECTIONS

Looking for books to highlight connections to soil? Here are a few great options for you and your students! You can find more titles related to conservation at the National Association of Conservation Districts (NACD): http://www.nacdnet.org/general-resources/stewardship-program/

TITLE	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 and up	978-1602535077	Pamela Hall
Celebrating Soil	5 and up	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 and up	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 and up	978-1474706087	Martha E H Rustad
Rocks and Soil	8 - 11	978-1499431537	Peter Riley
Worms Eat My Garbage	8 and up	978-1612129471	Mary Appelhof
Under the Microscope : Earth's Tiniest Inhabitants	8 and up	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

ADDITIONAL RESOURCES

The following resources provide additional information and ideas for expanding these lessons in the classroom, additional background information, best practices for teaching in informal settings, and more. For additional information on your local Conservation District, visit: https://www.nacdnet.org/general-resources/conservation-district-directory/

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

California Academy of Sciences, The Living Soil Beneath Our Feet: https://www.youtube.com/watch?v=MlREaT9hFCw

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

KidsGardening: https://kidsgardening.org/

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

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

National Association of Conservation Districts: https://www.nacdnet.org/

North American Association for Environmental Education: https://naaee.org/eepro/resources/k-12-environmental-education-guidelines

SciShow Kids, Soil Is Alive!: https://www.youtube.com/watch?v=Q-J2FErZHuA

SciShow Kids, Why Different Soils Feel Different: https://www.youtube.com/watch?v=qJ9fJU1X9mA

Soil Health Institute: https://soilhealthinstitute.org/resources/soil-health-educational-resources/

Soil Science Society of America (for kids): https://www.soils4kids.org/

Soil Science Society of America (for teachers): https://www.soils4teachers.org/

Soil Science Society of America (general information): https://www.soils.org/

Soil Stories: 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.usda.gov/sites/default/files/documents/KYFCompass.pdf

National Association of
Conservation Districts