Ecology in Classrooms & Outdoors

SUMMER SOIL SCOOP
TEACHER GUIDE

Introduction

In this activity, students will study the texture of soil by doing an experiment using soil samples found nearby, a jar or other clear container, and water. After learning what makes soil special and the makeup of soil, students will use an activity sheet and their materials to carry out the experiment and take note of their results. Finally, students are encouraged to perform the experiment as many times as they'd like, using soil samples collected from different locations throughout the summer and comparing them to one another.

Materials

- Summer Soil Scoop Presentation
- Activity Sheet, printed (or digital with scrap paper to draw on)
- Clean, clear containers with secure lids and labels removed (glass jars or plastic bottles work well)
- Spade or shovel
- Soil samples collected from various locations
- Water
- Pencil
- Colored pencils, crayons, or watercolors

Lesson Length

30-40 minute lesson; allow experiment to sit overnight; synchronous or asynchronous

Standards

NGSS

2-PS1-1. Matter and Its Interactions
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

5-PS1-3. Matter and Its Interactions
Make observations and measurements to identify materials based on their properties.

HS-ESS2-5 Earth's Systems
Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Additional Resources

Soil Science Society of America K-12 lessons:

- https://www.soils4teachers.org/lessons-and-activities

Handouts using the soil texture triangle to extend the learning for middle-high schoolers:

- https://culter.colorado.edu/~kittel/SoilTriangle&Tests_handout.pdf
- https://www.nbcsd.org/cms/lib/PA01001217/Centricity/Domain/116/Soil%20Texture%20Soil%20Activity.pdf

Lesson Procedure

1. PRESENTATION: LEARN ALL ABOUT SOIL

Start with the question: **"What is soil?"**
Spend a few minutes discussing this question with the group, thinking about what soil means to each person individually. Using the presentation as a guide, go through the slides and explain the background information as follows.

Soil is the foundation of life on land. Soil is formed over millions of years through geological processes of **weathering** and **erosion** by wind, water, and ice, volcanic activity, and the breakdown of **organic materials**. Because soil is made up of different rocks and **minerals** and varying sources of organic materials, each soil type is unique depending on where it is found!

Soil can have different amounts of "ingredients", but is generally made up of the same few things:

- Water
- Air
- Minerals (i.e. broken down rocks)
- Organic matter, including living things like fungi and bacteria, and the materials left behind by once-living things, like plant parts and animal bones.

Soil **texture** refers to the size of the grains that make up a type of soil. Generally, soil texture is broken down into three categories: **clay, silt,** and **sand.** Understanding the texture and relative amounts of clay, silt, and sand in a soil sample can tell us more about what kind of plants the soil can support.

For example, soils that are rich with clay hold on to more water, which is good for water-loving plants like cranberries. In contrast, sandy soils that drain water easily support plants like carrots, which have long taproots that require a loose soil to push down through.

CLAY

Clay is the smallest (also called fine) grain size found in soil. Because of this, clay is generally more compact and sticks together, resulting in more water retention. When clay soils dry up, they are more easily blown by the wind because the grains are so light.

SILT

Silt is a medium grain size found in soil. Silty soil provides more of a balance between water retention and drainage. This also results in increased capacity to hold on to nutrients from organic materials for longer.

SAND

Sand is the largest grain size found in soil; so much so that one may notice the individual grains with the naked eye. Because of this, sandy soils drain easily, resulting in a more dry texture.

Understanding soil texture can also tell us what kind of habitat it came from, or even the geology of the area it came from. For instance, the soils of the Willamette Valley in Oregon formed over millions of years as a result of geologic events, from the uplifting of seabeds to explosive volcanic activity to the rich sediment deposits of the Missoula floods! For this reason, Willamette Valley soil is especially suited for growing crops like grapes, apples, and cherries, which do particularly well in the nutrient-rich, silty topsoils brought by the Missoula floods.

A fun way to learn more about the texture of a sample of soil is to study it by conducting a simple experiment using minimal materials.

2. SOIL EXPERIMENT & ACTIVITY SHEET

In this experiment, students will collect a sample of soil or multiple samples of soil from different locations to compare them. The process of mixing the sample with water and letting it settle out will help determine the soil's texture and showcase the relative amounts of sand, silt, and clay in the sample.

Show students the Summer Soil Scoop Activity Sheet, where they will be recording their experiment findings. Point out the activity instructions, materials list, pre- and post-experiment questions, and the space where they will color in their results.

Before students begin, ask students to form a hypothesis based on what they just learned about clay, silt, and sand. **Ask students: what do you predict will happen?**

Lesson Procedure, cont.

Because of the size and weight of the grains, the settled sample will show three layers: sand on the bottom, silt in the middle, and clay on the top. Organic materials that have not yet broken down such as bits of wood, leaves, and pine needles will float on top.

In the last slides of the presentation, check out the ECO team's soil experiment collection for inspiration.

HELPFUL TIPS FOR STUDENTS:

- The soil should take up half the container, and the rest of the container should be filled with water, leaving a bit of air space at the top (about a ½ to ¾ cups of soil, depending on the size of the jar or bottle).
- Use a spade and stick it fairly deep and straight down into the soil to get a good sample. Avoid collecting just the soil or leaf litter from the top of the ground.
- Ensure students have adult supervision when using tools such as spades or shovels.
- When using a recycled jar or plastic bottle, make sure the labels are peeled off completely on all sides to better view the end result.
- If using a narrow-mouthed bottle, use a funnel to pour soil into the container.
- Ensure the lid of the container is snug before shaking soil and water mixture.
- Use a sticky note or a piece of masking tape to label each container with the sample number, the date it was collected, and the location it was collected from.
- If the jar appears murky and it is difficult to see the soil layers, try holding the jar up to a window or lighting it from behind using a flashlight.

BE MINDFUL:

Before students head outdoors to collect soil samples, remind students to be mindful of their impact when doing so. This means they should check with the landowner before digging soil from any private location. If collecting on public land such as a park or other natural area, ensure the sample is small, and collected away from trails or other heavily-used areas. Don't leave holes behind, or dig up living plants.

3. CREATE A COLLECTION

Explain to students the option to conduct the experiment throughout a time frame of your choosing - this may be done within a week of school or summer camp, during an after-school program, or self-directed throughout the summer break.

Have students record their findings using a new Activity Sheet for each sample (this is where it will come in handy to label and date their containers).

4. SHARE

Have students share their findings from their Activity Sheets with one another, comparing the soils they experimented with.

If students share their containers of soil, remind them to be careful not to re-shake the container, keeping the settled layers intact. Invite students to mark on a map (use Google Maps or a physical map printed off the internet) where they collected their samples from.

Have students discuss the process, what they noticed, and their takeaways from the activity. They may have made some surprising discoveries!