Gateway Greening
The Power of Growing Food

Soil Recipe

Connected Next Generation Science Standard

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

2-ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

Featured Science and Engineering Practice

Asking Questions and Defining Problems

Featured Cross-Cutting Concept

- Stability and Change

This lesson works better if students are familiar with the term **decomposer**.

Overview

Healthy soil is essential to a garden, but it can take up to 500 years for an inch of topsoil to form. In this lesson, students will investigate what ingredients are broken down over time to create soil and the factors that are responsible for decomposition.

Students will

- Observe and recognize the components that make up soil.
- Demonstrate that soil is created over a long period of time.
- Compare soil from different locations.

Teacher Preparation

- Walk through the garden and identify soil sample collection sites around the garden where students can dig. Sample sites should include a variety of soil profiles (raised garden bed, grassy lawn, compost pile, etc.)
- Optional: Mark soil sample sites.

Guiding Questions - How is soil made?

Explore

- On the way to the garden, say to students, *What have you noticed about soil when we have dug in the garden before?*
- Once in the garden, explain to students that today they will be scientists collecting soil samples to investigate in order to answer the question: *How is soil made?*
- The class should know that decomposers are important to soil but *what else is in the soil? Imagine you had to create soil from scratch, what ingredients would you need? Today we are going to make an ingredient list for soil.*
- Put students in pairs and pass out a cup, hand trowel, and garden journal or Soil Recipe worksheet to each pair.
- Give students a few minutes to find a spot in the garden space to dig or direct students to predetermined soil sites. Soil sites should ideally have a variety of soil like a garden bed, a spot near a compost pile, a grassy lawn, or a native plant garden.

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Materials

- Teacher - small whiteboard or chalkboard
- Garden journal or clipboards and Soil Recipe Worksheet
- Pencil
- Magnifying glasses
- Scrap paper, paper plates, or cardboard for sorting soil pieces
- Cups for collecting soil sample
- Rocks or sand
- Organic matter that students can tear
- Water for making soil
- Hand trowel
- *Optional*- soil site signs, tweezers

Setting

- School garden or green space
- Can be taught at any time of the year as long as the ground is not frozen.

Either use the term "rotten plants and animals" or introduce students to the term **organic matter**. Students can build off their prior knowledge of **matter** (anything that has mass and takes up space), understanding that **organic** refers to natural compounds.

- Have pairs collect a soil sample in their cup. Remind students to only put soil in the cup, not garden plants.
- Then have pairs find a space to sit with the soil and make careful observations of the ingredients that make up soil. Pass out scrap paper, paper plates, or cardboard to each group. Provide a hand lens and tweezers if available.
- Remind students about tool safety and respecting wildlife found in the soil as they investigate.
- Students will spread their soil sample out on the paper and use a hand lens and tweezers to make careful, close observations of the ingredients found in soil.
- Students will write down what ingredients they think make up the soil and any soil observations

Digging Deeper

- Circulate among groups during the observation phase, encouraging deeper investigations. Students will easily identify sand or rock particles but may not as easily identify decomposed organic matter. Ask questions that probe students for deeper thinking and understanding. *Do any of the ingredients look like smaller pieces of things they have with seen in the garden space or nature?*
- Bring students back together, with their soil samples and ingredient list. *What ingredients did they find? Does all the soil look the same?* Guide students to recognize that there are 4 categories of soil ingredients: **organic matter** (decaying plant and animal material and decomposers), **rocks** (weathered into small sizes), **water**, and **air**. You may need to help students to recognize that water and air are in the soil with questions such as, *Is the soil moist? What ingredient makes the soil wet? (Water.) Was the soil a solid block or were there spaces in the soil? What ingredient might be in the spaces? (Air.)*
- Allow students a few minutes to edit their ingredient list and add to their soil observations.

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Making Connections

- Now that students know the soil ingredients, see if they can make soil! Students will get another cup and provide rocks/sand, water, and plants to see if they can make soil. Give pairs a few minutes to break the ingredients into smaller pieces and mix together the "soil recipe" in their cups.
- Have pairs compare their soil samples. *How are their soil samples similar and different? How is the soil they dug up and the "soil" they made different?*
- What does the class think is missing from the "soil" they made?
- Explain that to make soil, the ingredients need **decomposers** and time. It takes a long time to break rocks into small-sized pieces and turn dead plants into soil.
- (To see how long it takes for something to decompose see the Soil Your Undies experiment.)
- Have students put their soil samples and soil ingredients back or save soil for the Soil Shake experiment.
- Revisit the guiding question, H*ow is soil made? What did they observe today that helped them figure out how soil is made?*

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