

Worming Your Way Through the Soil

Levels



Grades K-4

Overview:

Soil is composed of tiny rocks, and plant and animal debris. In this lesson, students explore soil by sorting it into living and non-living particles and starting a composting box.

Objectives:

The student will:

- sort soil into living and non-living categories; and
- observe a composting box.

GLEs Addressed:

Science

- [3-4] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [3] SC3.1 The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by identifying and sorting examples of living and non-living things in the local environment.
- [4] SE2.1 The student demonstrates an understanding that solving problems involves different ways of thinking, perspectives, and curiosity by identifying the function of a variety of tools (e.g., spear, hammer, hand lens, kayak, computer).

Materials:

- Ebeling, E. (ed.) (2003) *Basic composting: All the skills and tools you need to get started*. Mechanicsburg, PA: Stackpole Books.
- Soil mixed with small rocks, leaves, twigs, living or dead insects, seeds, flowers, and other items (such as bits of paper, plastic, etc.)
- Coffee canister, or similar sized container or bag (one per pair of students)
- Magnifiers or hand lenses (one per student)
- Spoons (one per student)
- Newspaper or plastic sheeting to cover work surface
- Plastic bin, opaque, 5- to 10-gallon
- Newspaper
- 1 pound redworms
- Drill with ¼- to ½-inch drill bit
- Paper shredder, optional
- 1 pound food scraps, cut into small pieces
- STUDENT WORKSHEET: "Soil Sorter"

Whole Picture:

Soil is composed of very small rock particles formed from weathering and erosion, air, water, and organic material (dead animals and plants).

Permafrost is frozen ground. When permafrost thaws, the dead plant and animal matter within the soil begins to decompose, releasing methane and carbon dioxide gases. Methane is a greenhouse gas that contributes to global warming. Large quantities of methane are currently "locked" within the permafrost. As the permafrost thaws, methane gas is produced and released, contributing to atmospheric

warming, which further warms the permafrost, causing a feedback loop. Scientists study thawed permafrost, called thermokarst, to determine how it will affect local ecosystems and global climate.

Decomposition occurs in three stages at varying temperatures. During the first stage, at 55° to 70°F, microbes called psychrophiles appear and begin to digest the food. The second stage, from 70° to 90°F, involves mesophiles. These bacteria perform most of the work in the process of decomposition. The final stage, at 104°F and above, brings the thermophiles. After the thermophiles are done eating, the temperature will decrease and the mesophiles will return, beginning the cycle again.

Small insects and other invertebrates (earthworms, millipedes, sow bugs, grubs, mites, snails, spiders, etc.) feed on the bacteria and fungi throughout the soil and help with decomposition. As they burrow through the soil, they help to mix the organic materials and create natural tunnels that provide air circulation. The presence of these organisms indicates that decomposition is occurring.

Activity Preparation:

1. Cover student work surfaces with newspaper, plastic sheeting, or other material to keep work areas clean.
2. Fill coffee cans, or similar sized containers or bags, with soil so there is one container per pair of students.
3. Use the instructions on pages 77-81 of *Basic Composting* to create a worm composting bin.

Activity Procedure

Sorting Soil

1. Show students a sample of soil. Ask the class what soil is made of. List responses on the board. If necessary, explain soil is made of a variety of things. Soil is full of tiny rocks, and also dead plants and animals that give the soil nutrients that plants need to grow.
2. Explain students will explore soils and classify the items they find in the soil into two categories: living and non-living. Explain non-living things are rocks, both large and small. Living things are plants and animals. (NOTE: Dead plants and animals fall into the living category.)
3. Divide students into pairs and distribute a sample of soil, magnifiers or hand lenses, and spoons to each pair. Ask students to look at the soil but not to touch it yet. Ask students to share what they see with their partner. Ask students to empty a small portion of soil with the spoon onto their desks (covered during Activity Preparation) and describe what they see. This discussion can occur as a class or in pairs.
4. Ask pairs to use their magnifiers to sort the soil. Make sure students work together with their partner. Distribute the STUDENT WORKSHEET: "Soil Sorter," and ask students to draw what the soil looks like before it is sorted and what it looks like after it is sorted. Ask students to label their drawing.
5. Ask pairs to share their findings with the whole class. Discuss the trash items found in the soil. Discuss how these items are the same and different from the other non-living items (rocks) in the soil. Make sure students understand that trash items are foreign to the soil, they can be harmful to plants and take a very long time to break down and become part of the soil.
6. Make sure students wash their hands.

Making Soil

7. Explain students will help start a composting box and then observe it over several weeks. Show students the bucket of worms. Explain worms produce something called castings. Castings, which look like dark soil, are rich in nutrients (food) that are good for plants. To produce castings, the worms need food scraps and bedding.

8. Explain soil is produced in a similar way. Worms, and other insects called decomposers, eat dead plant and animal material and turn it into nutrient-rich soil that combines with small rocks and other non-living material to form topsoil (the top few inches of soil).

Teacher's Note: Soil is made of many components. Worm composting produces castings, which are high in nutrients. Traditional composting, without the human addition of worms, is a more accurate, but less sanitary, way to model soil production.

9. Point out the features of the worm composting box (box, air holes, paper). Show students how they should be gentle when handling the worms. Reach down into the bedding and lift up a section. Place a handful of worms in the area. The worms may move into the bedding to avoid direct light. Repeat in different sections of the bin until all the worms have been distributed.
10. Carefully bury the food scraps down in the bedding and cover with fresh paper. Ask students to make observations and discuss. Ask students to predict how long until they will be able to see castings. Record student predictions.

Critical Thinking Question: Think-Pair-Share Method. Ask students to pair up and talk about the following question: How does temperature affect the soil? Once students have explored the question with their partner, ask them to share their ideas with the class. As a class, discuss with Level II students how the temperature of soil affects global climate change. Then ask each student to write their thoughts on how global warming is affecting their local area.

11. Each week, add another pound of food scraps covered with fresh paper. Alternate locations of food placement in the bin. Check the moisture content of the bedding each time food scraps are added. If it is too dry, add water with a watering can or spray bottle. Involve students as much as possible in the collection of food scraps and maintenance of the bin. Conduct regular (weekly) observations of the bin. Discuss how the worms' environment compares/contrasts to the environment outdoors.
12. Approximately every three months, castings can be removed and bedding replaced. Use pages 85 of *Basic Composting* as a guide to harvesting the castings.

Extension Idea: In spring, dig up a soil sample and examine it as a class. A sample near water, if possible, will have a wider variety of things to be examined. What types of decomposers can be seen? What living and non-living particles can be seen?

Composted soil can be used as fertilizer in student gardens.

Answers:

1. Answers will vary but should show a drawing of soil with several items, such as flowers, rocks, or trash, labeled.
2. A. Answers will vary but should show a drawing of **living** items from the soil, such as flowers, insects, or twigs. Items should be labeled.
B. Answers will vary but should show a drawing of **non-living** items from the soil, such as rocks and trash. Items should be labeled.

Name: _____

Levels

Soil Sorter

Student Worksheet



Directions:

Draw the soil before and after it was sorted. Label your drawings.

1. BEFORE

2. AFTER

A. LIVING

B. NON-LIVING