

LESSON: Microbes and Composting**GRADE: 5****OBJECTIVES:****Ecosystems: Interactions, Energy, and Dynamics-**

- **5-LS2-1** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- **5-LS2-B-1** Cycles of Matter and Energy Transfer in Ecosystems- Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

Science as Inquiry-**S.3-5.SI.1 Identify and generate questions that can be answered through scientific investigations.**

- Students ask questions that they can answer with scientific knowledge combined with their own observations.

S.3-5.SI.3 Plan and conduct scientific investigations.

- Students should engage in systematic observation, making accurate measurements, and identifying and controlling variables.
- Students understand the concept of a fair test.

MATERIALS & RESOURCES:

- A variety of compost/soil examples (resources: leaf litter, soil from different locations, home compost piles, etc. Be sure to include a sample of a commercial compost found at most hardware or home & garden stores)
- Gallon, plastic milk containers
- Empty pint jar with tight lid
- Stick about 10” long
- 1/4” mesh hardware cloth or aluminum window screen
- Scissors
- Masking or duct tape
- Rubbing alcohol
- Lamp
- Access to internet site: [The Ground Crew-
http://www.cals.ncsu.edu/course/ent591k/soil.html](http://www.cals.ncsu.edu/course/ent591k/soil.html) & USDA Soil Biology-
http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html

PRESENTATION:

Tell students this is an opportunity to learn about compost and soil through the study of organisms. It's likely kids already know the organisms break down the organic matter into soil. With this lesson they will become familiar with the numbers and identify the many organisms that do the work! Offer the students some attention grabbing facts about soil organisms. (Some facts are listed at the end of this lesson) By creating a Berlese funnel, students will separate the organisms from the soil, then count and identify the organisms for each sample of compost. Students will make predictions and then find if the data supports these predictions.

Bigger Picture Concepts: Are organisms important to soil? How important is soil to human life? These organisms are part of a bigger cycle. What are the things humans can do to be better protectors of the soil? The USDA Soil Biology webpage has answers to these and more questions.

DIRECTIONS:

These directions are found at the Ground Crew page, Procedure for building and using a Berlese Funnel

<http://www.cals.ncsu.edu/course/ent591k/berlese.html>

1. Cut the bottom out of the milk jug (Fig. 1) and turn it upside down over the Mason jar to make a funnel.
2. Tape the stick to the handle of the milk jug (Fig. 2) so it is just long enough to reach the outside bottom of the Mason jar.
3. Bend down the corners of the hardware cloth so it fits snugly inside the wide end of the funnel. If using window screen, cut and pinch numerous slits so larger animals can crawl through.
4. Place a few handfuls of compost sample in screen.
5. Pour alcohol into the Mason jar to a depth of 1-2 cm.

Figure 1

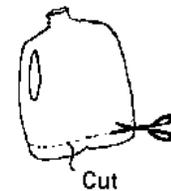


Figure 2

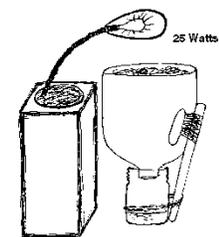
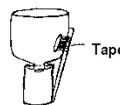


Figure 3 – Completely Set Up

6. Carefully set the funnel on top of the jar and tape the stick to the jar so it won't tip over.
Leave the funnel in a warm, quiet place where it won't be disturbed.
7. Set a lamp over the funnel to speed drying (see Fig. 3). Keep the light bulb at least 10 cm away from the funnel.
8. As the sample dries out, the animals will move down and fall into the alcohol. After 4 or 5 days (maybe longer if the sample was quite wet), you can CAREFULLY remove the jar and screw on its lid. The alcohol will preserve the sample indefinitely.
9. Using an identification key such as found at website: Ground Crew website <http://www.cals.ncsu.edu/course/ent591k/ident.html> or a Soil Organism Identification book, identify the living organisms found in the jar.
10. Create a chart that contains the total number of organisms per sample, the number of different organisms, and the names of the organisms for each compost sample. As the students observe this process, have them discuss and/or journal about their original predictions, what they learned, and the "Bigger Picture Concepts" (see below: Surprising Facts about Soil).
11. For the standard -5-LS2-1, develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. Based on what's been learned from the activity thus far, and reading the USDA Soil Biology webpage, have student's create a model in some form (picture on paper, 3D diorama, painting, etc...) showing the movement of matter. Plants become food for animals, plant and food waste becomes food for worms/decomposers, decomposer waste becomes food for plants.

TIME:

1 week

Surprising Facts about Soil:

- More than half of the trash a family throws away every year, about **1,200 pounds**, is organic matter that could be composted into fertile soil.
<http://earth911.com/recycling/garden/dirt/facts-about-dirt/>
- In one gram of soil, **5,000 to 7,000 different species** of bacteria can be found. <http://earth911.com/recycling/garden/dirt/facts-about-dirt/>
- The American Midwest has the largest area of prime farmland soils in the world. Other large areas are in South America and Eastern Europe and Russia.
<http://www.highlandsswcd.org/everything/News%20from%20the%20Watershed/2009%20articles/Some%20interesting%20facts%20about%20soil.pdf>
- It takes 100 to 600 years to form an inch of topsoil.
<http://www.rienvirothon.org/soil-fun-facts.htm>