Secrets to Healthy Soils

Healthy Food from Healthy Soil

Objectives

Students will be able to infer that the diversity of life in soil contributes to soil fertility.

Materials

- sample of soil from top layer of soil high in organic matter
- funnel and capture container (same ones used in "Perkin Through the Pores"
- small piece of coarse screen, 1-1/2 inch square
- light source with a shade (direct light)
- hand lenses
- wet paper towel
- ziploc bag
- soil nutrient testing kit *(optional)*
- Creatures in the Soil transparency

Time

Activity 1: 50 minutes
Activity 2: 30 minutes

Getting Started

Gather materials, and make the necessary copies. For this activity, you will need a sample of soil for each group of students. The best results will be obtained if soil is collected from late spring to early fall by the students. Samples should be taken from the topsoil in area with higher organic matter will yield better results. Cultivated gardens or fields may not yield as much diversity of life unless compost of other organic material has been added. Great collections can be obtained under logs, under greenhouse benches, or around compost piles. Students should watch for signs of life while collecting the soil and record any observations. Keep the soil samples moist until you conduct the in-class part of this activity. The first day is spent setting up equipment to separate out larger organisms. The second day is spent looking at microorganisms with a magnifying glass. After the activity, return the soil samples and the organisms to their environment. For the second activity, samples may be sent to the USU Soil Testing Lab or soil testing kits can be obtained from Utah Agriculture in the Classroom or purchased from science supply catalogs.

Procedures

Activity 1 - The living soil

1. Divide the class into four or five groups.
2. Each group should designate someone to collect the soil sample or go on a walking trip around your school to make the collection.
3. Watch for signs of life as you collect the soil for this activity. Dump the sample on a piece of white paper. Record your observations and make note of the number of different invertebrates you see.
4. Back in the class, assemble the apparatus as shown on page 62. Make sure the lamp is 1/2 to 3/4 of an inch away from the soil otherwise it will dry out too fast and cause some organisms to die.
5. Place wet paper towel in the bottom of the container under the funnel, and then place the screen inside the funnel and fill loosely with your soil sample. Label jar with your groups name.

6. Turn on the light source and leave it overnight. Most soil dwellers do not like light and they will try to dig deeper to escape the lamp.
7. The next day, turn off the light source and collect the organisms that have been forced into the jar below the funnel. Observe the specimens with your magnifying glass and under a light microscope. Identify as many different types of creatures as you can.
8. When you are finished, return all organisms and the soil to a suitable environment.

Activity 2 - What nutrients are in my soil?

1. Send to the USU Soil Testing Lab (4830 University Blvd., Logan, UT 84322-4830) or test with the samples with a classroom soil testing kit the sample that had the largest number of organisms and the soil that had the least. Which one will have the highest plant nutrient value?
2. If you have a classroom testing kit, conduct the tests as instructed.

Discussion

1. Based on the amount of soil life in your samples can you predict the nutrient value? (yes, but not exactly, the more organic matter the more soil life and the higher the nutrient value of the soil)
2. Why are soil nutrients important? (plants need them to grow)
3. How do you think you can increase the nutrient value of soils? (by adding organic matter)

Background

Plants and animals play a major role in soil development. Plants are the primary source of organic matter. They provide a protective covering which traps water and allows it to enter or infiltrate into the ground. The protective covering also lessens the erosion of the developing soil underneath. But perhaps most important, plants accelerate the process of chemical weathering through the release of carbon dioxide from respiring plant roots. In soil, carbon dioxide (from the plants roots) combines with water to form weak carbonic acid which chemically decomposes mineral matter releasing plant nutrients and other constituents into the soil solution.

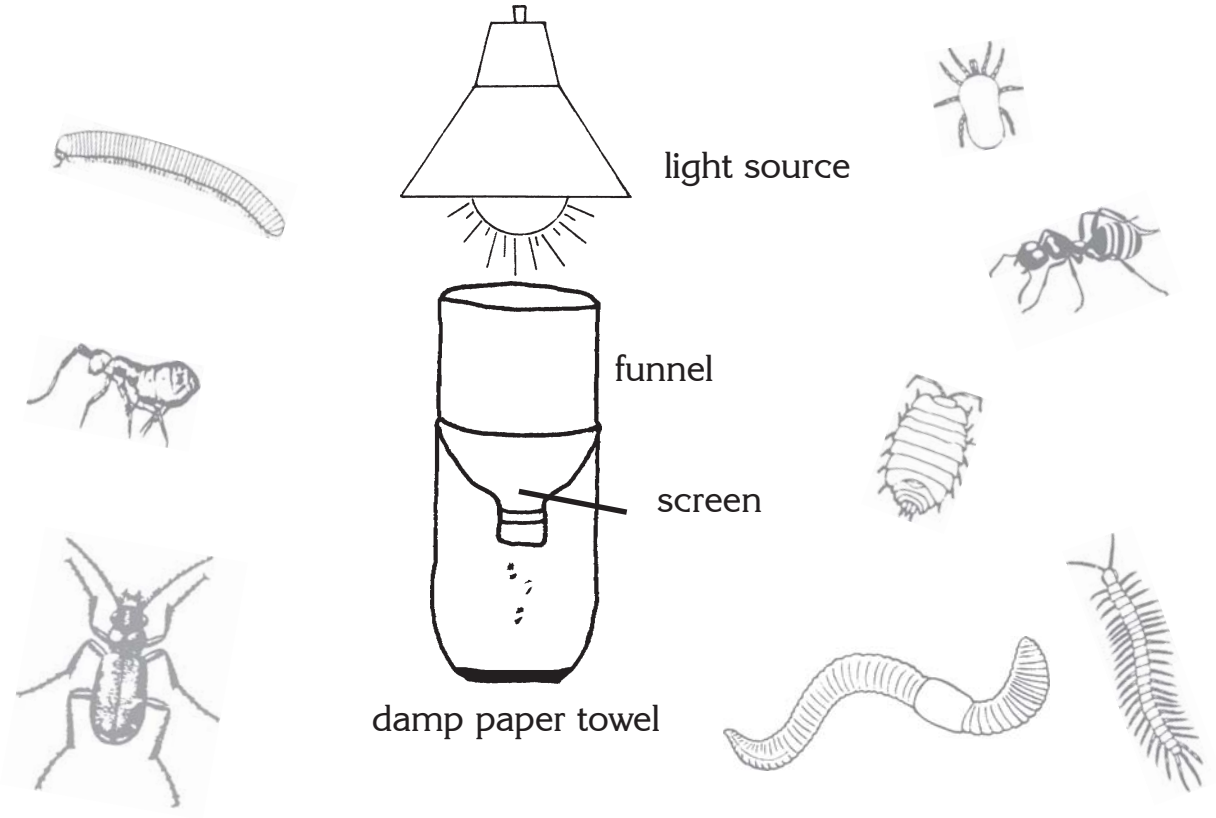
A multitude of animals, insects, and microorganisms also contribute to the process of soil formation. The burrowing, eating, and mixing activities of invertebrates such as insects and earthworms, and small mammals allow organic matter on the surface to become incorporated into the soil. However, of the billions of organisms in a handful of earth, 99.99 percent are microscopic decomposers that play the important role of recycling nutrients within the soil ecosystem. As nematodes, protozoa, bacteria and countless other microorganisms (you'll need a microscope to see these) attack organic matter in search of their own food, they release nutrients into the soil and water for uptake by plants. Fungi, which

feed primarily on wood and leaf tissues, are important since a considerable amount of plant material cannot decay without their initial action.

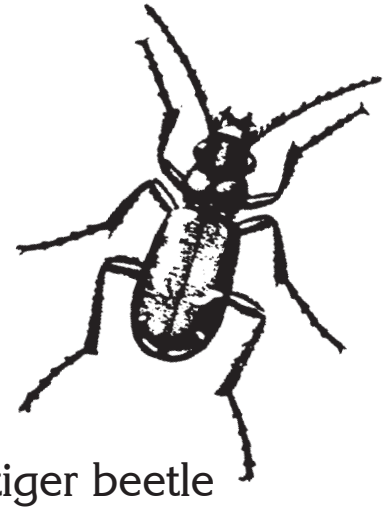
An interesting contribution to soil formation is provided by the "work" of lichen (pronounced like-en). On bare rock, lichen are usually the first plants to be established. They are able to cling to rock with tiny hairlike roots. In order to get the nutrients they need, lichen secrete chemicals into the surface of bare rock. This weathers the rock and creates a thin layer of broken mineral matter or parent material, thus beginning the process of soil formation. As lichen die, more organic matter accumulates. Debris brought by wind and water gets caught in the lichen. Eventually there is enough soil formed for mosses to grow and later ferns, grasses and other herbaceous plants. Therefore, lichen play a crucial role in the development of soil on bare rock. Lichen are very interesting to look at close up with a hand lens.

Vocabulary

bacteria: single cell organisms
fungi: mostly multicellular organisms, and consisting of filaments (tiny root like structures)
nematodes: tiny roundworms that live in the soil, can be devastating to crops.
protozoa: single cell organisms that are usually motile.



Creatures in the Soil

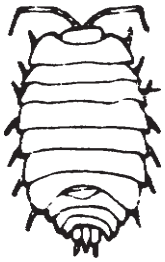


tiger beetle

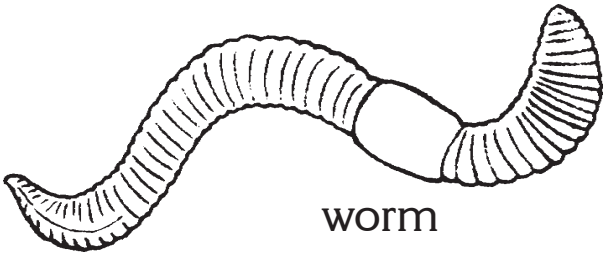
millipede

mite

nematode



pillbug or sowbug



worm

centipede

springtail

ant