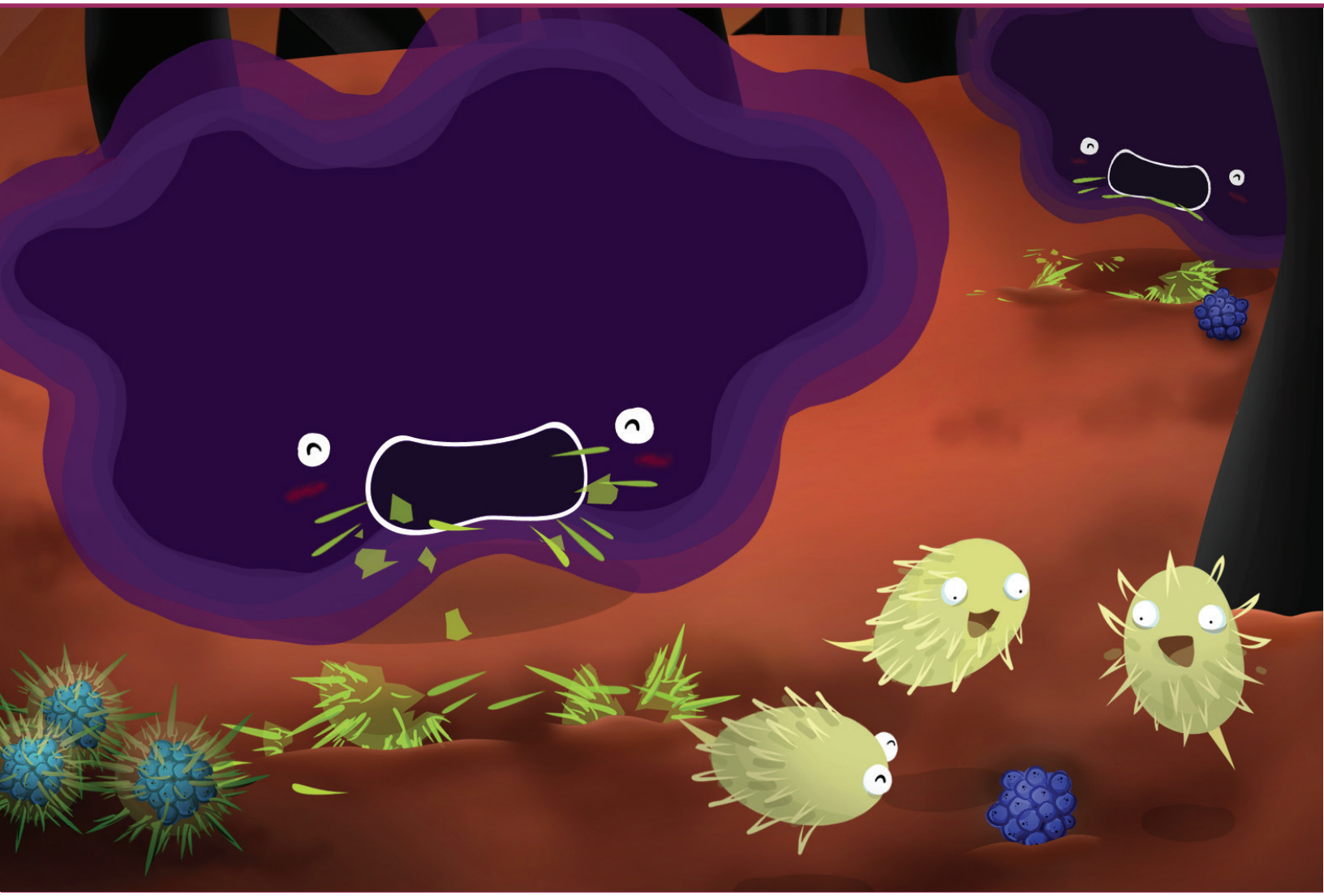
MODULE 3

MAGICAL MICROBES

NGSS TEACHER'S GUIDE

Soil Ecology and Nutrient Cycling



NGSS Alignment

CORE IDEAS

Core Idea LS1: From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function
LS1.C: Organization for Matter and Energy Flow in Organisms

Core Idea LS2: Ecosystems: Interactions, Energy, and Dynamics

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Core Idea PS3: Energy

PS3.B: Conservation of Energy and Energy Transfer
PS3.D: Energy in Chemical Processes and Everyday Life

Core Idea ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem
ETS1.B: Developing Possible Solutions
ETS1.C: Optimizing the Design Solution

CROSS CUTTING CONCEPTS

- ☐ Patterns
- ☐ Cause and effect: Mechanism and explanation
- ☑ Scale, proportion, and quantity
- ☑ Systems and system models
- ☑ Energy and matter: Flows, cycles, and conservation
- ☑ Structure and function
- ☑ Stability and change

PRACTICES

- ☑ Asking questions (for science) and defining problems (for engineering)
- ☑ Developing and using models
- ☑ Planning and carrying out investigations
- ☑ Analyzing and interpreting data
- ☐ Using mathematics, information and computer technology, and computational thinking
- ☑ Constructing explanations (for science) and designing solutions (for engineering)
- ☑ Engaging in argument from evidence
- ☑ Obtaining, evaluating, and communicating information

LESSON 2: BACKGROUND

STUDENT HANDOUT

Soil City – Find out what lives in the soil

Objective: In this activity students explore the different types of organisms that live in the soil.

Soil Composition: What is Soil?

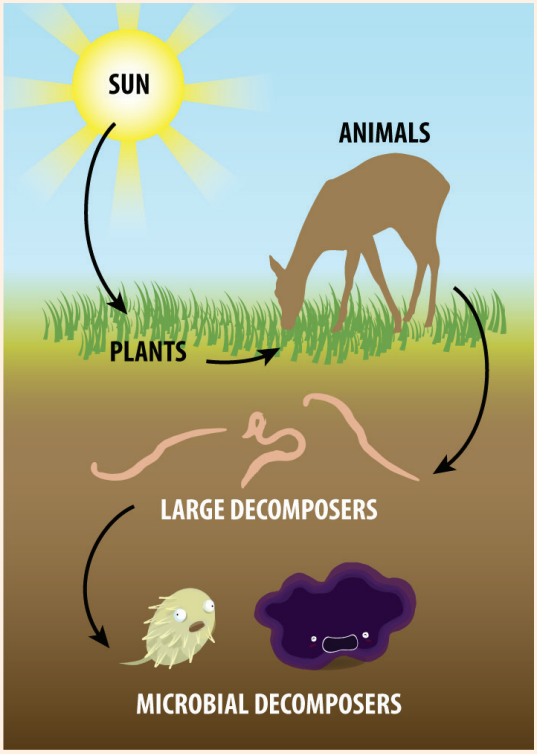
Introduction:

Ever wonder what lives in the soil? Most of us don't really know what lives in the soil. In this activity you will examine soil samples to determine what organisms live in it. Maybe you have dug in your garden and found an earthworm or a pill bug? Did it make you wonder what else lives in the soil? Soils contain a ***huge*** number of different organisms of all different types and sizes. The number of different types of organisms that live in a particular area is referred to as **biodiversity**. It is important to find out how many different types of organisms live in your soil, or what the biodiversity of the soil is. The degree of biodiversity is an indicator of how healthy the soil is!

If your soil has a high biodiversity (many different types of organisms), there tends to be better soil formation, better cycling of nutrients and greater energy production in the food web. Greater biodiversity can also help control flooding and prevent soil from eroding. Believe it or not having a diverse group of organisms in the soil can also help clean the soil and water by breaking down pollutants!

Some of the organisms that live in soil are big enough for you to see (they are **macroscopic**) but many are too small for you to see without a microscope (these are **microscopic**). This activity focuses on the macroscopic soil organisms. You will explore micro organisms in the next investigation.

Figure 5. The Soil Food Web



LESSON 2: STUDENT ACTIVITIES

Activity 2A: Let's Sort it out!

Find out what lives in the soil using a manual method.

Objective: In this activity students collect, count and identify the number of different types of macroscopic organisms living in the soil. Students will collect the organisms manually.

Time

1 class period

Materials

- Soil sample
- Magnifying glass
- Tweezers

Procedure

1. Obtain a sample of soil
2. Pour the sample out onto the table or into a sorting tray.
3. Using a magnifying glass and tweezers try to locate and separate the organisms in the soil.
4. Record your observations in the table below (create additional columns to record more organisms).
5. Use the identification key link: http://www.insectidentification.org/insect-key.asp to identify the organisms you found.

Table 1: Soil Organisms

	Organism 1	Organism 2	Organism 3	Organism 4	Organism 5	Organism 6
Soil sample type						
Sketch a picture						
Color						
Number of legs						
What is it? (use ID chart link)						

Reflection

1. **How many different types of organisms did you find in your soil sample?**

2. **Which organism was the most abundant?**

3. **Which organism was the least abundant?**

4. **Do you think that the soil sample used has a high biodiversity or a low biodiversity? Use your data to support your answer.**

Activity 2B: Let's Sort it out!

Find out what lives in the soil using a Berlese Funnel

(Adapted from: http://www.doctordirt.org/teachingresources/berlese. Credit: Thomas Loynachan, PhD, Soil Biologist, Iowa State University.)

Objective: In this activity students collect, count and identify the number of different types of macroscopic organisms living in the soil. Students will collect the organisms with the use of a Berlese funnel that they make themselves.

Introduction: Here's another way you can find out how many different types of macroscopic organisms are living in your soil: you can make a Berlese Funnel! A Berlese funnel is a device that is used to extract insects from soil samples. It uses a heat source (in this case a light bulb) to dry the sample, which forces the insects through a screen and into a temporary container (with air holes) or terrarium.

Time

1 class period

Materials

- a one-gallon plastic milk container (empty)
- an empty jelly jar (or a one-pint Mason jar) with a tight lid
- a stick – about 25 cm long
- 1/4" mesh hardware cloth or aluminum window screen (15 X 15 cm)
- a pair of scissors
- masking tape or duct tape
- a gooseneck lamp (optional)

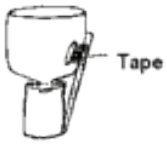
Procedure

1. Cut the bottom out of the milk jug (Fig. 1) and turn it upside down over the Mason jar to make a funnel.

Figure 1

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.

Figure 2



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. Collect several handfuls of humus or leaf litter and put them on top of the wire mesh.
5. Carefully set the funnel on top of the jar and tape the stick to the jar so it won't tip over.
6. 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.

Figure 3 – Completely Set Up

8. In the table below record your observations of the organisms that are collected.
9. Use the online identification link: http://www.insectidentification.org/insect-key.asp to identify the organisms you found.

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