

TTCD Lesson Plan (3): Life in the Soil

Unit: Soil Science	Grade(s): All	Class Size: 1-20	Lesson Duration: 45 minutes	Location(s): Classroom, school yard
Topic(s):	Soil science, geology, living organisms			
Student Prerequisites:	Students have completed the lesson “What is Soil?” or understand that soil is made up of water, air, minerals, and organic material.			
Essential Questions:	Is soil alive? What would happen if there were no living things in the soil?			
Student Objectives:	Students will understand that soil contains billions of living organisms that turn dead material into nutrients. Students will collect and explore soil samples from different locations near the school.			
Standards:	Supports NGS Standards: <i>Note – to meet any one of these standards, students would need to construct an argument or develop a model based on their soil observations. Work with the teacher to see which, if any, of these standards are important to their classroom and include wrap-up questions or teacher-led extensions to address them.</i> 2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats. 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. 4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. 5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. Relevant NGSS Crosscutting Concepts: Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. Structure and Function: The way an object is shaped or structured determines many of its properties and functions. Supports Cultural Standards: E-2: Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to: understand the ecology and geography of the bioregion they inhabit.			

Local Context:	Students perform this experiment using soil from their school.
Vocabulary:	soil, organic material, nutrients, decompose/r
Dena'ina language words:	
Materials:	• 3-5 soil sampling locations near the school • 3-5 trowels (1 per location/group) • 3-5 pots, bottles or quart-size tupperwares (1 per location/group) • 5 gallon bucket or plant tray for each group to store materials while collecting samples • Newspaper or brown paper roll to lay across desks • Magnifying glasses for each student • Optional: “soil filter” demonstration bottles (Cut a 2L bottle a few inches from the top. Remove the cap and turn the top part of the bottle upside down and place it in the bottom part of the bottle, creating a funnel shape). • TTCD Journal or Binder and pencils
Instructor Prep:	• Ask the school admin for permission to dig soil samples in several locations around the school. • Label collection containers for each soil sample site A, B, C, D, and E. There should be a set of containers in a different color for each group, so you will need 3-5 different colors. In this example, I used water bottles with tops removed and labeled them for three groups (red, green, and blue) and three sampling sites (A, B and C)  • Designate 3-5 soil sample sites around the school yard. At least one site should be gravelly, and another full of organic matter. Use a cone or stake to mark your sites as A through E. • Set up your stations with newspaper, A, B, C, D, and E labels (use cones or sticky notes), and set up your classroom timer • Remember: If you will only have 3 groups and 3 sampling sites, only use A, B, and C!
Introduction:	Review: What needs to be in the soil in order for plants to grow? (water, air, minerals, organic material). Remember that organic means that it comes from living things. Ask the class: Can you think of any living things you might find in soil? <i>Students might mention worms, insects, and other animals.</i> These are all correct, but there are also lots of living things in soil that we can't even see! <i>Add fungi, bacteria, and microorganisms to the list.</i> In fact, there are up to 50 billion living things inside one

	handful of soil! These living things work together to recycle dead material (like leaves, sticks, etc.) into nutrients! This is called decomposition, and the organisms that do this job are called decomposers.
Directions:	1. Set up soil exploration stations for each group by grouping desks together and covering them with paper. 2. Briefly explain the following directions to the class and review tool safety (one student at a time, trowel pointed down at all times, no rough-housing with tools, etc.) 3. Divide students into 3-5 groups (there should be the same number of groups as there are table stations and soil sites), and hand out one color set of collection containers and a trowel to each group. If available, have each group keep all of their materials and sample containers in a bucket or plant tray. Explain that each member of the group should have a job at each site, and that students should take turns with each job (digging, holding the sample container, holding the materials bucket or tray, choosing the exact place to dig, etc.). 4. Go as a group to each sample location that you have marked with a cone or stake. Have each group fill their pot with soil from the designated area. <i>You might have them all watch you fill a pot first to demonstrate how you get soil from multiple layers underground.</i> 5. Take a moment at each site to notice any plants or other signs of life that are present. What might this tell us about the soil here? 6. Return to the classroom, and have students place their "A" samples on the "A" table, "B" on "B" table, etc. Assign each group to a table to start at, and allow them to dump out their group's sample jar (ex. Red group at table "C" will dump out their container that has the red "C," but will not dump out the bottle with blue "C"). 7. Set a timer for 5 minutes. At their first table, students will work together to make distinct piles of the different materials in the soil: rocks, roots, sticks, etc. Provide a jar to each group to carefully place living things, like insects and worms. 8. Once the timer goes off, rotate groups to the next table, and have them dump out their group's container and continue sorting. Continue until every group has had a chance to sort their samples at every site. ***It is okay if some groups sort materials differently than other groups! Try to figure out what characteristics the previous group used to sort, and add your group's materials to their piles. 9. Once groups have finished sorting at their last table, start making a master list on the board of everything the class found. Each group should designate one person to come up to add to the list on the board. Did anybody notice fungi?

	<i>Bacteria? These are usually hard to see without a microscope, but how could we check if they are there? We could look for signs of decomposition!</i> 10. Have students draw or list things they find in their TTCD journal or binder.
Wrap Up:	Have students return to their seats. Refer to the master list, and make sure there is nothing else that students found that they want to add now! Wrap up questions: - Count the different types of organisms you see in each soil sample. Which one has the highest diversity of visible organisms? - Choose two soil samples that are very different. Ask students to discuss with a partner: What do you think would happen if you moved this worm/insect/etc. from this habitat to that habitat. Why do you think that?
Lesson Adaptations:	Encourage students to use magnifying glasses to look closer at things they find in their soil. With younger students, count the number of living things that you all found. Count out loud as you point to each item on the “master list”, and have the class count along with you. For younger students: Complete this lesson in two class periods: the first to collect samples, and the second to analyze samples. For advanced students: Set up a microscope station for each group to use as they analyze their soil. Be sure to demonstrate safe and appropriate use of equipment.
Extensions:	- Reserve a pot of each group’s soil and let it sit in the classroom for 2 weeks, explaining that some of the living things in soil are seeds, roots, or stems from plants that could sprout. Allow students to make predictions about what might sprout in the soil based on what they observed at their sample station. <i>Students can water these if they choose, but some plants will probably sprout anyway.</i> - Create scientific sketches of organisms in student journals. Use a petri dish to make an outline for each sketch, and a ruler to determine scale. Label sketches with important information, such as texture, quantity, color, and size. Label any structures on the organism and write down thoughts on what the function of these structures are. - Facilitate a brief discussion where students describe the role decomposers have in soil formation. Have students draw a picture/diagram to illustrate how matter moves among plants, animals, decomposers, and soil. - Try the squeeze test with your soil: does it seem crumbly or does it hold together? Would this soil hold water, or let it run through? <i>You could even give each group a “soil filter” demonstration bottle and a cup of water.</i>

Reflections:	How did it go? What did students understand most/least? What could change about instruction or lesson plan?
Resources Used:	<i>Wings, Worms, and Wonder</i> by Kelly Johnson https://www.soils4kids.org/files/s4k/perkin.pdf