



Rotting Away

Grade 2 Standards

GPS.S2L1.b,d, S2E3;
NGSS.5.S.LS2.A, B

Time

(2) 45 minute periods

Supplies

(per student)

- Book: Log Hotel by Anne Schreiber
- Garden Journals
- Compost critters from a compost pile or under a rotting log
- Magnifying glasses
- Clear tub for planting a small hugelkultur garden.

Garden Connection

Students will make observations in the garden or the schoolyard. Any of the following would be suitable for observations:

- Rotting log
- Compost pile
- Worm bin

Overview

Students compare and contrast rotting logs and compost piles to recognize that all living organisms follow a pattern of rotting and contributing organic matter to soils when they die, and this organic matter is decomposed through the interaction of a special community of organisms that live in the soil.

Guiding Questions

- How can I take advantage of natural cycles in the garden?
- Why doesn't the forest floor fill up with dead trees?
- What happens to plants and animals when they die?

Engaging Students

Read aloud to the class: Log Hotel by Anne Schreiber. Students will then go out in the schoolyard and find a rotten log to explore with magnifiers or field microscopes. They will make drawings of the organisms, mycelia and bits of decomposed matter that may be found, and try to identify each.

Exploration

After exploring a rotting log, students will investigate the garden compost pile or vermiculture (worm) bin in the same manner, with magnifiers and field microscopes. They will again draw pictures of the organisms, mycelia and bits of decomposed matter that may be found, and try to identify each.

Explanation

Students will be able to articulate that after living organisms die, decomposers (mushrooms, bacteria, other microorganisms) use them for food. In a compost pile or a rotting log, decomposers turn organic matter such as rotten logs or vegetables into soil nutrients by dissolving or eating, digesting, and excreting them. Although plants make their own food, they also need nutrients such as those in the soil, to be healthy. Students will make the connection that since people eat plants - or people eat animals that eat plants - the nutrients from decomposed matter in the soil eventually help nourish humans.

Environmental Stewardship

Students build a hugelkultur bed: <http://www.richsoil.com/hugelkultur/>
This kind of gardening mimics a forest floor and doesn't need to be watered or fertilized. Hugelkulture offers a great way to grow vegetables while conserving water usage. See attached hugelkultur cross sections and details.

Evaluation

Students will demonstrate understanding of soil life cycles and decomposition by drawing pictures of decomposers found in the compost pile and the rotting log, and labeling processes.

Standards

Georgia Performance Standards in Science

- S2L1. Students will investigate the life cycles of different living organisms.
- b. Relate seasonal changes to observations of how a tree changes throughout a school year.
- d. Identify fungi (mushroom) as living organisms.
- S2E3. Students will observe and record changes in surroundings and infer the causes of the changes.
- a. Recognize effects that occur in a specific area caused by weather, plants, animals, and/or people.

Next Generation Science Standard

Core Idea LS2: Ecosystems, Interactions, Energy and Dynamics

5.LS2.A: Interdependent Relationships in Ecosystems

The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

5.LS2.B: 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. (5-LS2-1)

Background Information

Composting information and soil organism field guides:

Cornell Guide to Composting in Schools: <http://compost.css.cornell.edu/schools.html>

Soil Food Web poster: <http://jessicagarden.net/wp-content/uploads/2011/02/soil-ffod-web.jpg>

Compost Critters field guide: p. 15-17: <http://highfieldscomposting.org/news-resources/resource-library/do-the-rot-thing-a-teachers-guide-to-compost-activities>

Recommended Books:

Life in a Rotten Log by Malcolm Penny

Who Eats What? By Patricia Lauber

A Log's Life by Wendy Pfeffer

PROCEDURES FOR LESSON ACTIVITIES

Day 1 Engagement

- Take students on a walk outside in the schoolyard and around school gardens. Equip students with magnifiers or field microscopes as well as their garden or science journals, and pencils for sketching decomposers. On the walk they will be looking for rotting logs and evidence of living organisms on and under the logs. Stress the importance of being careful not to damage or disturb the rotting log's cycle (and to return organisms that are sketched). If no natural areas are available, find a rotting log in advance and bring it to school, along with some of the dirt and organisms underneath it.
- Read the class the book; Log Hotel by Anne Schreiber. Pose the question “What is a Life Cycle?”
- Prompt students to describe the life cycle of the tree that became a rotting log.
- See if students can then explain the role of each organism in decomposition. Help students see that the same pattern of organisms is repeatedly found under rotting logs. This pattern shows the close relationship that these organisms (pill bugs, earthworms, millipedes, and fungi) have to one another and to the log. Each member of the decomposition community plays a key role in the division of labor that turns wood fiber into soil.

Day 2 Exploration

- If there is a compost pile and/or vermiculture bin, allow students to examine them.
- Students may explore decomposition stations in groups, if several such resources are available. In the absence of a compost or vermiculture bin, let students research and build a small worm bin by filling a dark-colored plastic tub with moistened, shredded newspaper, a few handfuls of organic soil from the garden, some vegetable matter leftover from lunch, and a half pint container of red wiggler worms (available in bait shops and bait departments of discount department stores). Have students use magnifiers or field microscopes to explore, and then record, draw, label, identify, describe and / or write about what they find in their journals.
- Allow students to see the soil food web poster and the soil critter identification guide (linked in the Background Information section) after they have had time for initial exploration and journal entries.
- Bring the class together so students can share and explain what they found. Students should highlight any evidence they can present that shows 1) decomposition is taking place and 2) what is causing it.
- Conclude lesson by having students add diagrams of soil life cycles and processes to their garden journal.

Environmental Stewardship

- Build a hugelkultur garden outside with the class OR
- Provide a clear plastic tub for each group of 4 – 6 students and challenge them to build a see-through hugelkultur garden (either in cross section or an entire mound). Place rotting logs and other items in various phases of decomposition in the plastic tub. Add soil and plants on top of the decomposing matter. Keep the tub in a sunny spot in the classroom to monitor over time.
- Build a control in-ground garden bed or fill a clear tub with soil and plants to serve as a control for the indoor hugelkultur tubs. Discuss the concept of a “fair test” with students and solicit ideas for how the experimental (hugelkulture) and control (traditional all-soil garden) will be treated exactly the same. Be sure students address both gardens receiving equal amounts of water and sun.
- Measure plant growth in the hugelkultur and record findings in science journals.
- Plant an in-ground hugelkultur garden if space allows. Dig a trench, pile rotting logs in it, and mound dirt over the logs. Plant up the sides and over the top of the hugelkultur berm.

Evaluation

Students will demonstrate competency by identifying and explaining the role of decomposers they find in a compost bin, worm bin or under a rotting log, and by labeling and drawing these organisms in their journal

Explanation and Debriefing

Share the following debriefing information with students and ask them to articulate what evidence they found of this process in their investigations of decomposition in rotting logs and compost piles.

Living organisms don't just disappear after death, they become recycled by decomposers and feed the next cycle of life. Gardeners make use of natural cycles to support their garden. A compost pile is similar to decomposition on a forest floor.

Resource on Rotting Logs

http://www.bsu.edu/eft/treetops/p/teachers/classroom_rottingLog.html

Dead logs on the forest floor may look untidy, but one-fifth of all woodland creatures reside in them. All kinds of plants and animals make their homes in different parts of the log. Some of these animals help to further the decomposition process of the log. The log actually becomes a mini-habitat, perfect for studying the relationships among decomposers, the soil community, and green plants.

A rotting log is a prime example of how a once-living organism replenishes the soil with nutrients and is recycled back into nature. In nature, death does not mean uselessness. Death and decomposition play important roles in the cycles of nature. As plants and animals die and decay, they are broken down to become a basis for new life. Through this process, the soil is renewed over and over again.

The elements that help break down dead materials are called decomposers. Examples of these include bacteria, fungus, lichens, moss, weather, insects, worms, and other scavengers.

Resource on Soil Composition

http://utah.agclassroom.org/files/uploads/estore/unit_dirt.pdf

Soil is one of our most useful natural resources. From the soil we get food, clothes and materials for the houses we live in. From gardens and truck farms we get vegetables. Fruit grown on trees and vines come from orchards, groves, and vineyards. Trees also give us valuable lumber and the wood can also be used to make paper, paints and numerous other products. Planted field crops of wheat and corn are used for making flour to make our bread, crackers, pasta, and so many other foods. Nuts and berries come from our farms and forests.

Our animal food also comes from the soil. Cows eat grass, hay, silage, and grain to produce milk, meat, and leather products. Herbivorous animals eat plants; plants grow in the soil. In addition to the products listed above, animals supply us with by-products that are used in paints, camera film, pet food, rubber, crayons, lotions, soaps, leather, medicines, and more.

The fuel that warms our houses comes indirectly from the soil. Coal is made from plants that grew ages ago. Oil and gas also originate from organic materials, possibly including the remains of animals. Some of these things grew in the soil at one time or lived on things that grew in the soil.

Fish from the sea, rivers and lakes live on plants (some on other fish). And these plants require dissolved minerals that are washed into the sea, rivers, and lakes from the soil.

There are a few exceptions to linking things back to the soil. Here are a few examples: a volcano, the ocean (even though plants are part of the water cycle), and the sky (although plants give off oxygen for the air in the atmosphere).

Evaluation

An assessment rubric is included, to evaluate the student's ability to demonstrate and articulate understanding of decomposition.



The Rotten Truth About Forest Decomposition

Rotten Standing Tree

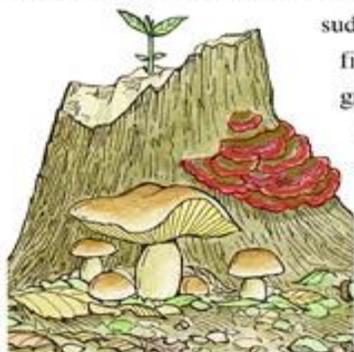
Sometimes a fungus will attack just the inside or heartwood of a dead tree. This will make the tree rot from the inside out. That can be good for forest animals as it provides tree cavities for birds and small mammals to raise young. Once a tree falls to the forest floor it can become a protective home to snakes, salamanders, insects, worms, centipedes, rodents and shrews.



Rotten Logs and Stumps

Rotting trees and vegetation on the forest floor hold water like a sponge and will keep the forest from drying out in a long dry spell of no rain (drought), that might kill plants and trees and lead to forest fires. In the same way, they also keep too much rain from causing damage to the forest from run off, erosion (washing away the topsoil), and flooding.

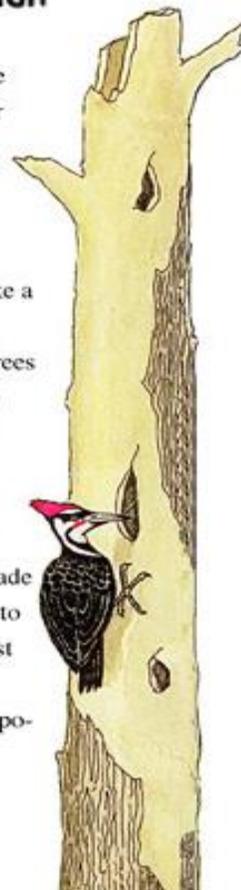
As standing trees rot, they also become an important place for lichens and mosses to grow. When they finally fall, they can open up a sunny spot in the forest. This allows sun to finally reach the forest floor that has been in shade for many years. Seeds that lied dormant in the shade suddenly sprout and grow. Seedlings compete and grow quickly to fill the gap and take their place in the forest canopy – the fastest growing trees winning out. This is part of forest succession an how a forest ages and changes over time. In this way decomposition plays a role in the life cycle of the whole forest.



The Red Belt Fungus

One of the most impressive looking tree fungi is called red belt fungus. This fungus is called a conk, a hoof-shaped fungus with a brown top with a red band near the edge.

Underneath it is white. Red belt fungus causes logs to break down by “cubical rot.” If you have walked much in the forest you have probably seen this. It is when, as the tree rots, the inside becomes broken up into cube-shaped pieces. Sometimes you can spot the delicate white mycelium in some of the cracks. Many fungi can cause cubical rot, their tiny mycelium breaking down the rotting wood into cubes. Look for it on your next hike.



www.exploringnature.org



www.makingtrackschallenge.com

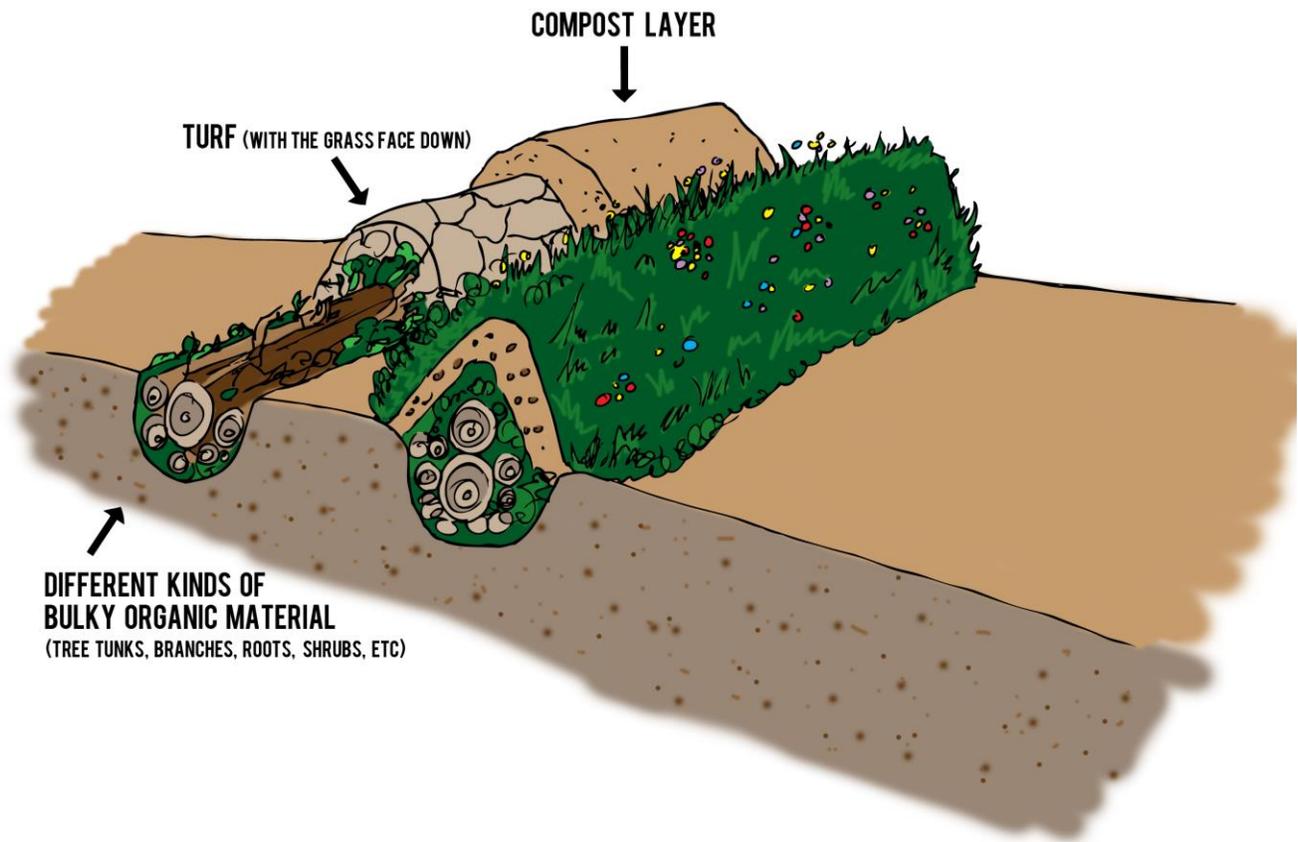
Video of forest decomposition: <http://www.exploringnature.org/db/detail.php?dbID=41&detID=2123>

Instructional materials: <http://www.exploringnature.org/db/detail.php?dbID=104&detID=2307>

Amsel, Sheri. “Science Concepts from the Forest Movies.” The Rotten Truth About Forest Decomposition. Exploring Nature Educational Resource. © 2005 - 2014. August 15, 2014.
<<http://exploringnature.org/db/detail.php?dbID=41&detID=2123>>

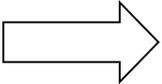
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Hugelkultur color graphic courtesy



Assessment for Rotting Away

Student Name(s): _____ Date: _____

<p style="text-align: center;">Level of Mastery</p>  <p style="text-align: center;">Benchmark or Performance Measure</p> 	 <p style="text-align: center;">EMERGING 0 points</p>	 <p style="text-align: center;">COMPETENT 4 points</p>	 <p style="text-align: center;">PROFICIENT 80%+ proficiency 5 points</p>	<p style="text-align: center;">TOTAL POINTS</p>
<p>What organisms are responsible for breaking down a rotting log?</p>	<p>Student can identify 2 or fewer organisms that break down a rotting log.</p>	<p>Student can identify 3-4 organisms that break down a rotting log.</p>	<p>Student can identify 5 organisms responsible for breaking down a rotten log, including termites, fungus, lichen, pill bugs, beetles, small mammals, worms (in addition to wind and rain)</p>	
<p>What organisms are responsible for breaking down a compost pile?</p>	<p>Student cannot identify or give an example of microorganisms.</p>	<p>Student can identify but not give an example of microorganisms as decomposers.</p>	<p>Student can identify and give an example of microorganisms as compost decomposers. I.e., fungi, bacteria</p>	
<p>What is the role of decomposers in an ecosystem?</p>	<p>Student cannot identify the role of decomposers.</p>	<p>Student can identify the decomposer as the final stage in the food chain.</p>	<p>Student can identify and explain the role of the decomposers in the food chain.</p>	