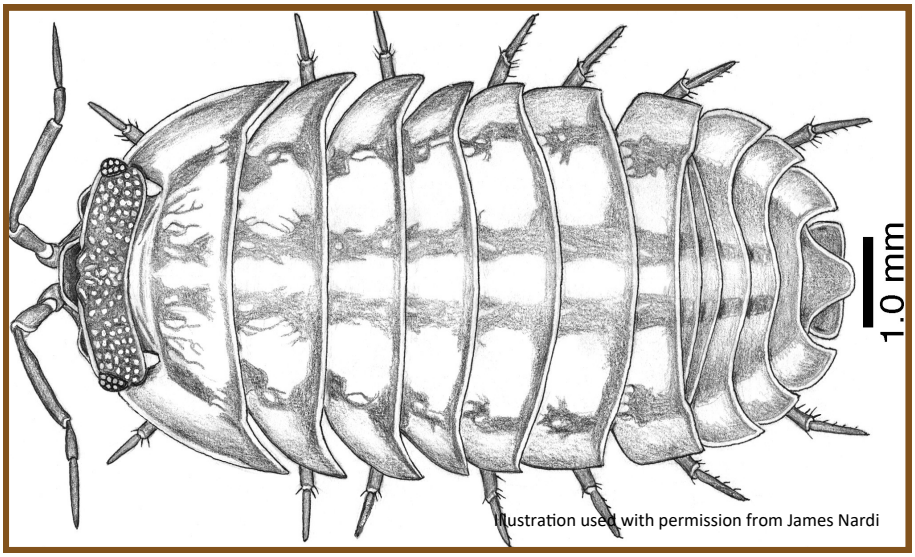
Lessons in a Backpack

United Nations Educational, Scientific and Cultural Organization

LONG POINT BIOSPHERE REGION

Life Under a Log

Death, Decay, and Decomposition



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Description of Lesson

In this lesson, students will discuss the importance of decomposition in the cycling of nutrients in the environment. They will then be introduced to the main decomposers of rotting logs - both macroinvertebrates and fungi. Students will have an opportunity to roll rotting logs and record their observations.

Connect with the Long Point Biosphere

www.longpointbiosphere.com
education@longpointbiosphere.com

LONG POINT BIOSPHERE REGION

At a Glance

Grade Level: 7

Learning Environment:
Outdoor Classroom
Forested Area near School

Prep Time: 15 minutes

Length of Lesson: 2 hours

Key Vocabulary: Decomposition, Macro-invertebrates, Fungi, Hyphae, Mycelium

Staffing: 1 educator/ 5 students

Materials
1/student:
Observation sheets
Clipboards and pencils

1/every 2 students:
Identification sheets
White dishpan
Trowel
Hand lenses
Petri dish
Tweezers
Popsicle stick

Field Guides:
Life in the Soil *by James Nardi*,
Bugs of Ontario *by John Acorn*,
Mushrooms of Ontario Eastern Canada *by George Barron*

Groupings: Whole class, and Small groups of 2 or 3

Teaching/Learning Strategies:
Discussion, Field Trip

Lesson Outline

Time	Activity	Location	Materials
20 min.	Introduction	Indoor or Outdoor Classroom	Macro-invertebrate I.D. Sheet Fungi I.D. Sheet Decomposition Observation Sheet
1 hour and 10 min.	Roll a Log	Forested Area	Clipboards and pencils (1/student) White dishpan (1/every 2 students) Trowel (1/every 2 students) Hand lenses (1/every 2 students) Petri dish (1/every 2 students) Tweezers (1/every 2 students) Popsicle stick (1/every 2 students) Field Guides: Life in the Soil by James Nardi, Bugs of Ontario by John Acorn, Mushrooms of Ontario Eastern Canada by George Barron.
30 min.	Debrief	Indoor or Outdoor Classroom	

Curriculum Expectations Grade 7 Science and Technology

Understanding Life Systems: Interactions in the Environment
Overall Expectations
3. Demonstrate an understanding of interactions between and among biotic and abiotic elements in the environment.

Specific Expectations
2.1 follow established safety procedures for investigating ecosystems (e.g., stay with a partner, wash hands after investigating an ecosystem);

2.4 use appropriate science and technology vocabulary, including sustainability, biotic, ecosystem, community, population, and producer, in oral and written communication;

3.2 identify biotic and abiotic elements in an ecosystem, and describe the interactions between them (e.g., between hours of sunlight and the growth of plants in a pond; between a termite colony and a decaying log; between the soil, plants, and animals in a forest;

3.3 describe the roles and interactions of producers, consumers, and decomposers within an ecosystem

3.5 describe how matter is cycled within the environment and explain how it promotes sustainability

Background

The amount of activity under a log is surprising. There is a whole micro-ecosystem - made up of bacteria, fungi, and macro-invertebrates -dedicated to decomposition. Thank goodness that these decomposers are there – without them to clean up our forest would soon be covered in a mile-high pile of fallen trees, leaves, dung, and dead animals. Decomposers are a vital link in the natural cycle of life and death, breaking down the remains or waste products of other organisms. Decomposition is the natural breaking down of organic materials, the main way that nutrients are recycled back into the soil.

In the breakdown of organic material, decomposers create soil that is richer, finer, and better consumable for plants. Although many decomposers are microscopic such as bacteria, those explored in this lesson are visible to the naked eye.

Photo credit: Killbear Provincial Park,

The thread-like hyphae strands of fungi penetrate wood, beginning the process of decomposition.

Fungi

In their role as decomposers, fungi deserve an academy award. Not a plant or an animal, fungi inhabit a kingdom of life that is all their own. They actively forage for food throughout the forest, sending out tiny fungal strands called hyphae that are a thousand times thinner than a strand of human hair. These hyphal strands allow fungi to penetrate the hardest wood and begin the process of decomposition. Fungi possess some of the most powerful digestive enzymes on the planet, able to break down the complex carbohydrates in wood. The majority of fungi that you'll notice on dead and dying trees are shelf or bracket fungi, sticking out from the tree like a shelf. These fungi are wood-rotters par excellence. You will notice white rot - wood that flakes apart and looks like it has been bleached – and brown rot - wood that breaks apart in cubes and is a rich chocolaty brown colour. Different species of fungus are found rotting specific species of trees and some create brown rot, while others white rot.

Macro-invertebrates

Macro-invertebrates are animals without backbones that are visible to the naked eye. Some of those involved in decomposition are earthworms, woodlice, millipedes, snails, slugs, and carrion beetles (See Macro-invertebrate I.D. Sheet). Some are first to arrive on the scene, like the woodlice that eats freshly fallen leaves. Others follow feeding off the fallen tree, or the insects that have gathered, or even dead animals or dung that they find on the forest floor. All are involved in the breakdown of organic material into finer, more nutrient-accessible soil.

Teaching and Learning

Part A: Introduction to Decomposition

Discuss with students:

What happens to all of those trees that fall in the forest?

Why doesn't it just pile up like a mountain of garbage, getting bigger year after year?

How about the droppings of animals?

Or even dead animals, themselves?

Where do all these things go?

Handout "Macro-Invertebrate I.D. Sheet," "Fungi I.D. Sheet" and "Decomposition Observation Sheet." Introduce the main fungi and macro-invertebrates that students are likely to find.

Part B: Roll a Log!

Go over log-rolling procedures. Roll logs away from yourself, ensuring that no one is in the way. Be sure to replace logs after observation to preserve the habitat.

Have students record their findings on the Decomposition Observation Sheet, writing what they have seen, felt, heard, smelled, etc. and any questions they might have about their observations, as well as drawing what they have seen.

Part C: Debrief

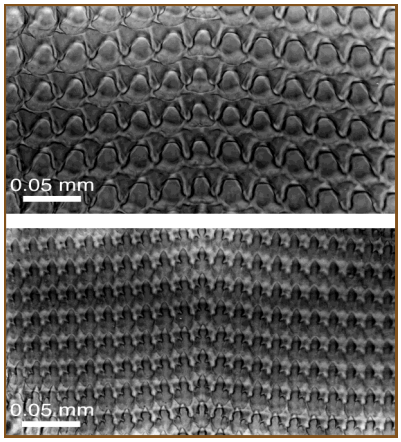
Discuss with Students:

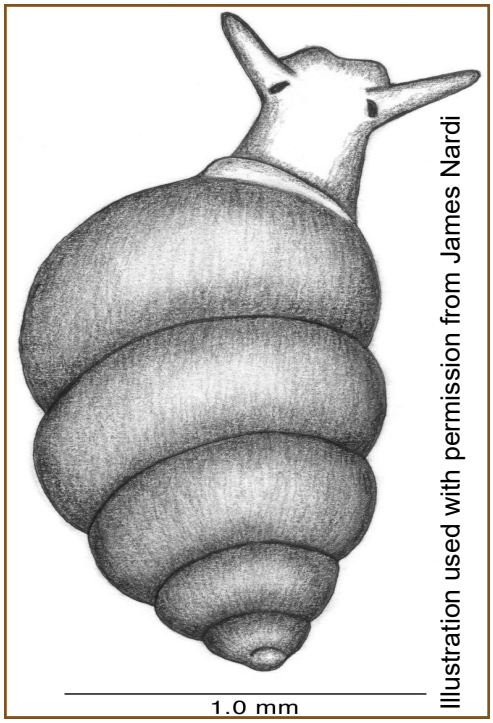
What did you find?

Was there anything that you were surprised about?

How could you tell that decomposition was happening?

Snails and slugs use their rasp-like tongue to cut up leaf materials and cycle the nutrients back into the ecosystem.





Extension Activities

Optional Assessment Activity

Using their Decomposition Observation Sheets for reference, have students write and draw a one-page report on Life Under A Log. Include in the report::

- The kinds of macroinvertebrates and fungi observed;
- How they knew that decomposition was occurring, and;
- The importance of decomposition in the cycling nutrients.

Extending our Learning

I. What is first to go?

Mark off a 1 x 1 foot square of leaf-covered ground and have students note which leaves are first to decompose. Why might this occur?

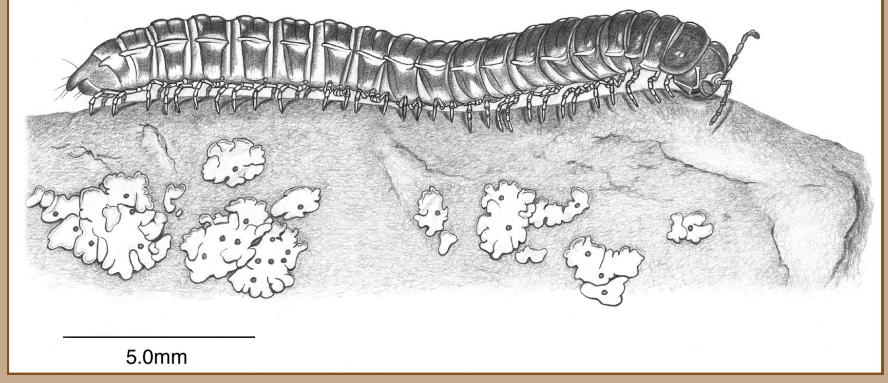


Illustration used with permission from James Nardi

Millipedes feed on decaying plant material. The droppings that they leave behind help to enrich the soil.

II. Vermi-Compost Bin

Create a vermi-compost bin.
Decompose leftovers from lunch with the help of red wiggler worms.

III. Composting Equations (Class Compost Bin)

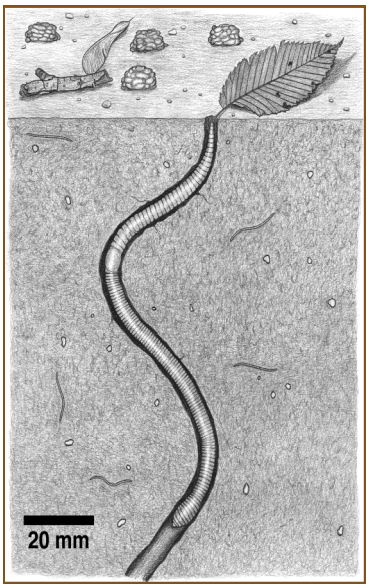
After nutrition breaks, take mass of daily garbage and daily compost – how much is diverted from the garbage by composting?

Measure depth of compost in container before and after adding compost as an indicator of the rate decomposition. Chart results.

Additional Resources

ON Nature - Nature Notes. Ontario's natural history magazine's companion geared to 10-12 year olds https://onnaturemagazine.com/wp-content/uploads/2006-fall-backyard-nature.pdf.

Macro-invertebrate I.D. Sheet



Earthworms: Composting Powerhouses

Type of Invertebrate: Animals without backbones or jointed legs

Description:

Only come out of their burrows at night because they are very sensitive to the ultraviolet rays of the sun.

Role in Decomposition: Earthworms plough through the soil, aerating it and eating debris. Their manure, called “castings,” is mixed with minerals and is always more usable—finer, richer, and less acidic—than the soil and litter they initially swallowed.

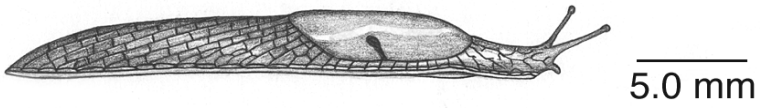
Snails and Slugs: Scraping the Forest Floor

Type of invertebrate: molluscs

Description:

- Snails and slugs are molluscs—just like clams. They are the only molluscs to leave their sea homes, doing so long before the dinosaurs appeared.
- Have slimy, protective mucous layers that help them to conserve water necessary for their survival.
- Instead of a tongue, snails and slugs have a “radula,” a structure covered with many hard, sharp teeth. The teeth of the radula scrapes away at decaying leaves.

Role in Decomposition: The variety of enzymes found in the digestive tracts of slugs and snails are greater than any other organism in the soil, making it possible for them to break down tough fibres of leaves and wood.



Woodlice: Leaf-eating Crustaceans

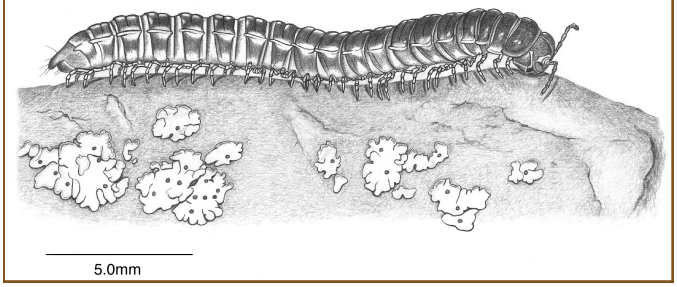
Type of Invertebrate: crustacean

Description:

- Woodlice are crustaceans - just like crayfish are! They evolved out of the water, yet have managed to take water with them wherever they go. They recycle their urine, conducting it through the channels that run around their bodies and underneath their body segments. The oxygen in the water is absorbed by gills that are found on the rear end of woodlice.
- Easily recognizable by their many legs and many-segmented shell of a body
- Slow moving, heavily armoured

Role in Decomposition: Woodlice convert freshly fallen leaves to humus—usable dark organic material that can be used by plants. They seem to prefer the flavour of freshly fallen leaves to the ones that have been there all winter.

Millipedes:
Multi-legged Soil Creators

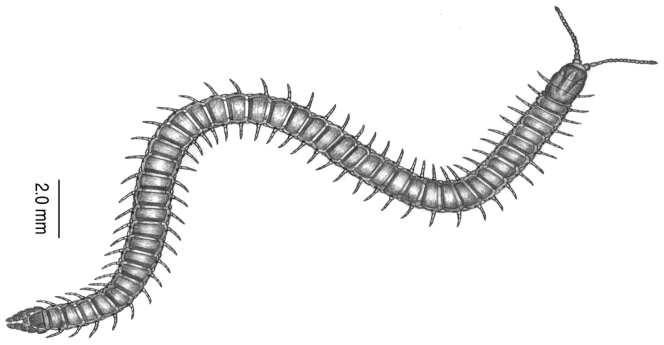


Type of Invertebrate: myriapoda (myriad = very numerous; poda = legs)

Description:

- Immature millipedes continue to add more pairs of legs and body rings as they moult.
- Take a year or more to mature and can live for several years.
- As a prey species, millipedes protect themselves with repellent or toxic substances that they release from pairs of glands on the sides of their body segments.

Role in Decomposition: Millipedes feed on plant debris, fungi and algae; their droppings create humus and help form the soil.



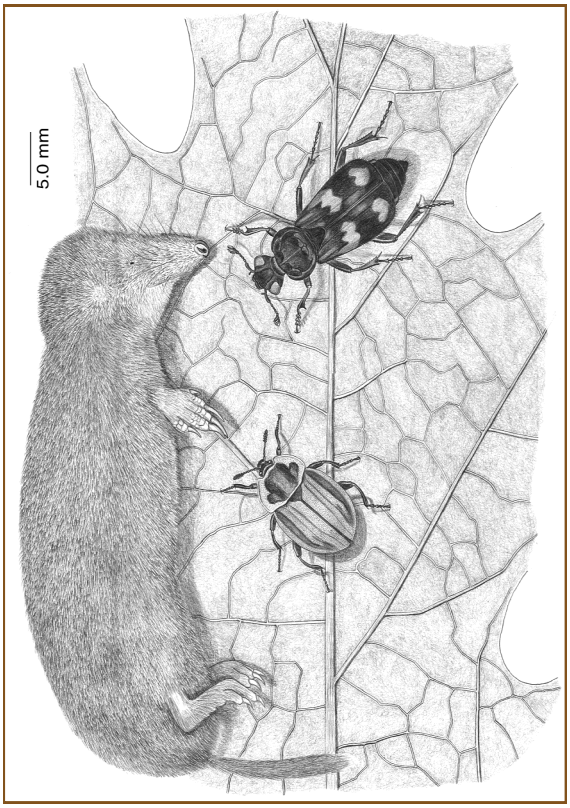
Carrion Beetles:
Vultures of the Insect World

Type of Invertebrate: Insect

Description:

- One type of carrion beetle, the sexton beetle, is black with bright splashes of orange and red.
- Have clubbed antennae are finely tuned to the potent odours of dead animals.

Role in Decomposition: Carrion beetles see to it that the corpses of animals are returned to the soil. Within hours, a dead body is reduced to a round, unrecognizable ball and buried several inches underground. The female lays 20 eggs in what becomes an underground nest.



All illustrations used with the gracious permission from James B. Nardi, Professor of Entomology at the University of Illinois.

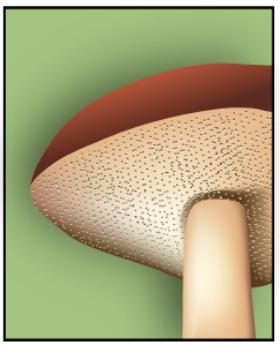
Fungi I.D. Sheet

Mushroom Caps

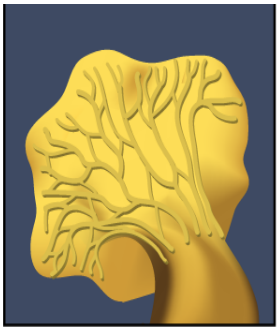
- Bell-shaped
- Rounded
- Centre Bump
- Triangular
- Funnel-shaped
- Flat top
- Shaped like half an egg
- Deep depression in middle
- Depressed Centre

Mushroom Characteristics

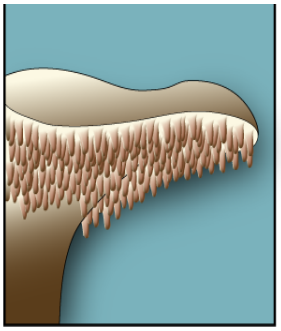
Gills:
wide and thin sheet-like plates radiating from stem



Pores:
many small tubes ending in a spongy surface



Ridges:
short, blunt elevated lines on stem and under cap



Teeth:
many small finger-like projections

White Rot

Description:

- Wood with white rot looks like it has been bleached
- As a result, the wood changes texture, becoming moist, soft, spongy, or stringy.

Role in Decomposition:

_____
_____
_____

Brown Rot

Description:

- Brown-rot fungi are most commonly found on conifer trees.
- Many brown-rot fungi are bracket fungi
- Wood that is brown with cracks that look brick-like
- Types of fungi that produce brown rot aren't as numerous as the ones that produce white rot

Role in Decomposition:

_____

Decomposition Observation Sheet

Observations (What do I see/hear/smell/ feel?):

Questions that I have about my observations:

Drawings of my Observations:

The Long Point Biosphere Region would like to thank the following for making this project possible

Ontario Trillium Foundation
Fondation Trillium de l'Ontario

An agency of the Government of Ontario
Un organisme du gouvernement de l'Ontario

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GEORGIAN BAY BIOSPHERE
MNIDOO GAMII
Spirit of the Water