The Three 'R's in the Forest

LESSON

GRADE LEVEL K-5

CATEGORY Earth, Ecosystems and Ecology

TOPIC Recycling & Decomposers

LENGTH
Part 1: 45 - 60 minutes
Part 2: 45 - 60 minutes

MATERIALS
Part 1: Guided Imagery (copy page)
Part 2: The Fallen Tree Recycler Detective Sheet (copy page)

SETTING
Part 1: Indoors or Outdoors;
Part 2: Outdoors

GROUP SIZE
Any size

SKILLS
Observation, creative thinking, critical thinking

SUBJECT AREAS
Science, Language Arts

KEYWORDS
Bacteria, decomposers, fungus, micro-organisms, organic matter, nutrients, recyclers,

HCTF Education

Overview

Matter cycles. Matter for growth, maintenance and reproduction in all organisms cycles through the ecosystem and Earth processes. All life needs certain matter in order to stay alive. This includes nitrogen, phosphorus, and water; oxygen for many but not all animals; and carbon dioxide for plants, to name a few kinds of matter.

Objectives

To understand, through guided visualization (part 1) and hands-on investigations (part 2), how matter cycles through an ecosystem. To gain an understanding of decomposition, a community of forest recyclers, and the critical role decomposers play in the food web and the cycling of matter. (NOTE: The two parts can be done consecutively or separately).

Making Connections

If matter were to cease cycling, Earth would be very different and life would soon come to a stop. Earth is a closed system when it comes to the amount of matter it has. (Other than comets that hit Earth, contributing ice and cosmic dust/rock). Matter cycles through Earth's systems or spheres continually renewing life.

Background

Life in the forest is a continuous cycle of growth, decline, death, decay and renewal. When trees die their lives are only partly over. A tree accumulates nutrients (matter) from the environment, and uses them for maintenance, growth and reproduction. In death, the nutrients in a tree are recycled back to the environment through a process called decomposition. Once the tree dies and decay starts, caused by fungi, bacteria and/or insects, the dead tree provides food and shelter for wildlife. Eventually, the basic elements of the tree contribute to soil fertility, enriching and stabilizing the soil ecosystem from which new growth germinates and grows.

Downed wood, also known as coarse woody debris, provides important habitat for species and nutrients for the next generation in the forest. Fungi, bacteria and other microorganisms decay leaves, twigs, pieces of bark, and seed coverings and other natural forest debris.

A fungus is an organism that obtains food by feeding on other living or dead organisms. Some fungi secrete powerful enzymes that break down organic structures which it can then absorb as food. Thus fungi act as great recyclers. Fungi live almost everywhere on Earth, and in almost every environment. Mushrooms and toadstools are common examples of fungi – they represent the fruiting body of the fungus.

Other important decomposers are the trillions of bacteria that live on Earth. These tiny one-celled organisms play an important role in recycling and decomposing dead material. From the moment a tree dies, bacteria attack and digest the dead wood, breaking it down into simpler substances. These bacteria are called saprophytes and use the broken-down molecules of a once-living organism as their source of energy and nutrition.

Termites, sowbugs, and carpenter ants are all examples of life that eat or tunnel through wood. Many of these animals also eat other kinds of vegetable matter such as dead leaves. As they chew their way through the wood, they help break down a log. Sowbugs and pill bugs – the small, grey, armoured animals you see scurrying out of sight when you turn a log or rock over – are the relatives of crabs and lobsters. They eat dead and living plant matter. By eating, digesting, and then excreting, these little animals recycle nutrients back into the soil.

Earthworms feed on leaves and other organic matter. They eat organic matter which gets broken down through digestion. Their castings, what they excrete, enrich the soil. Thus, they decompose and mix organic matter in soil. Their burrows also create space for air and water in the soil. In the forest, mites, spiders and nematodes (tiny worms) are also important recyclers. One of the most important things soil bugs do is to break things into smaller chunks for bacteria and fungi to go to work on.

Without these organisms to recycle the energy of life, our world would not be the same. The forest litter eventually decomposes and becomes part of the forest soil, providing nutrients for plants. The humus combines with elements from the physical environment to provide a place for seeds to grow.

The dynamic balance of forests is achieved through a constant cycle of disturbance and renewal, life and death, rebirth and recycling. The recycling or nutrient cycling process that creates soil is just one of the elements needed for a forest ecosystem to sustain itself.

Forest Recycling Definitions

Decomposers: these are organisms, both macro and micro that are part of the process that breaks down organic matter into its basic elements including nutrients needed for plant growth. Decomposition is a natural process. What occurs in nature also occurs in controlled environments like compost bins.

Nutrient: any element or compound that an organism must take in from its environment because it cannot produce it, or because it cannot produce it fast enough to meet all of its needs. Examples include: nitrogen, potassium, phosphorus, calcium, copper, zinc.

Nutrient Cycling: the circulation of elements such as nitrogen and phosphorus, between nonliving and living portions of the environment.

Macro-organisms: organisms that are visible to the eye: includes people, bears, earthworms, beetles, sow bugs, centipedes, etc

Microorganisms: organisms that cannot be seen without magnification: includes mold, bacteria, actinomycetes, and some parts of some fungi.

Actinomycetes: play an important role in the decomposition of organic matter. They are soil microbes that look like fungi but are in fact filamentous non-motile bacteria. (Any creature that is capable of moving spontaneously as a whole is said to be motile.) Actinomycetes degrade or decompose the cellulose of plants.

The Activity

Part 1 Guided Imagery

Materials

- Text for Guided Imagery for the three 'R's Activity

Procedure

Tips for effective guided imagery:

- if at desks, have students clear their desks
- do a few stretching and calming exercises
- students should find a comfortable position to be in
- students need to practice active listening
- eyes closed will help to imagine
- speaker's voice should be calm, slow and level, with paced reading
- pause occasionally to let students to create rich images
- when the narration is finished, allow students time to re-imagine all the images in their mind's eye, before opening their own eyes

Warm Up

If inside, darken the classroom where possible. Have students be aware of how they are sitting and give them time to get comfortable with their eyes closed and their head on their desk. If outside, have the students find their own space, and take a comfortable position where they can be relaxed but aware, and can hear the voice of the guide.

Guided Imagery Activity

Read from Guided Imagery for the Three 'R's in the Forest. When narration is finished and students have been given time to re-imagine images in their mind's eye (2-3 minutes), ask the students to open their eyes. Initiate discussion of the imagery in terms of instructional lesson.

Part 2 The Fallen Tree

Materials

- The Fallen Tree Recycler Detective Sheet
- Pencil

Procedure

Take a walk through the woods, using the powers of observation of a naturalist and the questioning curiousity of a detective and scientist to discover recyclers. Look for a fallen branch, trunk or a stump, and in the duff, to make observations.

Consider:

- What could have caused the tree to die and the branches or trunk to fall?
- Has the fallen tree (part) been here a while?
- What is under, on top, or inside the fallen tree (part)?
- What recyclers are found in the fallen tree (part)?
- What is the connection between the fallen tree (part) and the organisms found?

Be mindful not to disturb the site or habitat. Leave the area as it was found. Tally observations on the Detective tally, take pictures, videos, or draw sketches. Total the tallies.

Consider:

- What recyclers were most common?
- Where were the different recyclers found?
- Were the observed recyclers macro or micro-organisms?
- What happens to a tree after it dies?

Wrap Up

Parts 1 and 2

Discuss the word "decomposition". Brainstorm with the students what happens to the trees in the forest once they die.

Discuss reasons for tree mortality – natural, insect attacks, fungal attacks, disease, fire (agents of change)

Assessment

- What is an example of how matter recycles on Earth?
- What is the process of decomposition? What is its fundamental role?
- Describe a recycling community in nature.
- What is the role of the soil in the decomposition process of a tree.
- What is a microhabitat?
- How is our human recycling behaviour similar to nature's? How is it different?
- What do the 3 'R's represent and why is Recycling the last R?

Extensions

- Visit a forest to search for trees in various stages of decomposition.
- Investigate wildlife trees.
- Consider the epidemic of the pine bark beetle infestation in BC forests and the implications on the recycling of matter in the forest.

Resources

Smarty Plants: Uncovering the Secret World of Plant Behaviour
www.cbc.ca/natureofthings/features/did-you-know