

Mount Saint Vincent University Community Garden: An Outdoor Laboratory

Learning Objectives

1. You will learn where soil comes from, what makes healthy soil and
2. You will learn about the different types of micro (small) and macro (large) organisms and how they contribute to healthy soil.

Introduction

Healthy soil is important for growing and maintaining healthy plants. These plants provide organisms, including people, with food. In this lesson we will use our eyes and our hands in the garden. We will learn about decomposers in the soil food web and the importance of healthy soil for growing plants.

Mi'kmaq people have a strong relationship with the land and environment. Through this relationship they have built knowledge of ecosystems that is diverse. Examining nature's cycles, like the nutrient cycle in soils, are important to understanding and preserving soil health.

Ika'taqn (My garden or where I have planted it)

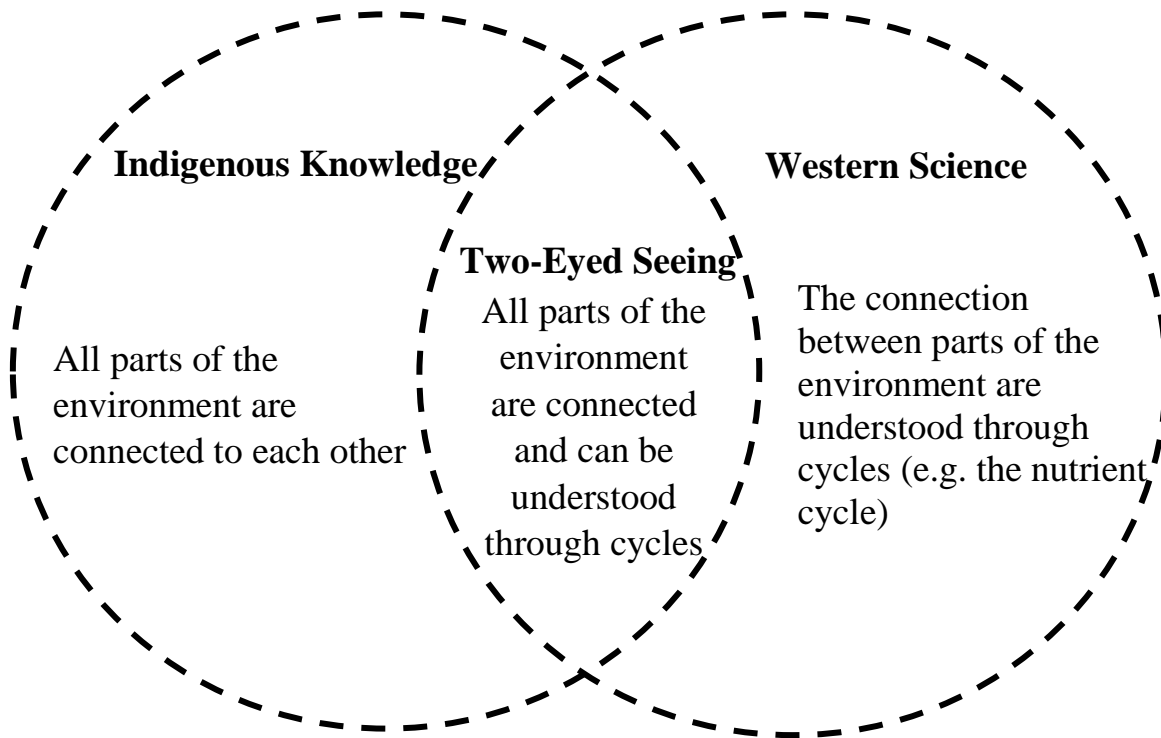


Figure 1: Two-Eyed Seeing Diagram

Table 1: Vocabulary

Soil Food Web	The soil food web is the interconnection of plants and animals in soil. It describes the interaction of the environment, plants, and animals in the soil (1).
Organism	A plant, animal, bacteria or fungus.
Organic	Organisms that are living or items that have a biological source.
Inorganic	Things that are non-living or have a non-biological source.
Symbiotic Relationship	A relationship where two or more organisms benefit from each other.
Feeders	Controls bad organisms by feeding on them.
Mutualism	Interaction between organisms that benefit both.
Healthy soil	Healthy soil is soil that contains sufficient amounts of organic and inorganic matter and have the ideal conditions that symbiotic relationships can exist among beneficial organisms.

Mycelium	Root like structure of fungus (such as mushrooms) (2)
Nutrient Cycle	How food and nutrients are food that is cycled through plants, animals, and the environment. (3)
Decomposer	Break down chemical products in soil that allow for new ones to form.
Macroscopic	Can be seen with the naked eye
Microscopic	Too small to be seen with the naked eye, seen with a microscope

Questions and Answers about Soil

What do you think healthy soil is?

There are many things involved in healthy soil. Some of the things important to soil are listed below.

They are listed below:

- Rock
- Mushroom
- Rubber Worm
- Stuffed Fish
- Ant ornament
- Grass
- Leaves and twigs

As we complete this activity you will see how everything listed above is an example of the components that are important to healthy soil. Soil is the result of many processes. It is made up of organic matter (e.g. plants and animals) and inorganic matter (e.g. clay, silt and sand).

What are the inorganic parts of soil?

Most elements and many minerals that are found in food originate from tiny crystals in rocks also called minerals. This is the inorganic part of soil. Plant roots,

water, some bacteria and even some fungus work together to break up the rocks and take the nutrients directly from the tiny crystals. Micro (small) and macro (large) organisms convert the minerals into a form that is more easily absorbed by plants.

What are the organic parts of soil?

Organic parts of the soil come from living things. This includes plants, animals, and microorganisms. Living things die and decompose, putting nutrients back into the soil. These nutrients can be used by plants to grow and help make soil healthy.

Activity 1: Macroscopic Compost Critters

A diversity of decomposers and mutualists are at work in our compost pile at the Mount Saint Vincent University (MSVU) Community Garden. In this activity you will learn about the macroscopic organisms at work in compost. Some examples of macro organisms are worms, insects and other bugs. They all play a major role in composting. The steps outlined below will help you build a better understanding of these organisms.

What we need for our activity:

- Gloves
- Toothpicks
- Compost

What we will do, step by step:

Step 1: Observe the Compost

The counselor will show you the compost

The counselor will try to find as many different organisms as possible

Put on your gloves and use your toothpicks to get a closer look at the different organisms (“critters”)

Step 2: Identify the Organisms

Try to identify the organisms using the compost critter identification chart (Figure 2). Record the name of the “compost critter” in the first column of table 2 on the next page.

Step 3: Identify the Organisms Role in Composting

Using Figure 2, write the role of the organism and describe how it looks in table 2.

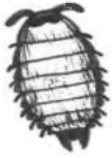
Table 2. Critters, critter characteristics, composting role

Compost Critter/Organism	Description	It's role in Composting

In the table provided above, list the various organisms found in the compost that the counsellor is picking through. Write the name of the critter in the first column, in the second column give a description of the organism, in the third column outline it's role in composting.

Compost Critters

Potato Bug Kopite'j



Sowbugs prefer a moist environment and like to bury themselves under a few centimeters of soil. They eat decaying vegetable matter and can commonly be found around gardens.

Centipede Pukumej

Centipedes can be found in the top few inches of the compost. They are fast moving predators, that don't usually eat plant material. Centipedes prey on the critters in your compost for food.



Snail Jikijij

Like slugs, snails can be a pest in the garden. They can help break down the material in the compost by eating and digesting it. Watch out for snails or slugs before moving compost to the garden, so they don't cause damage to your plants.



Other Decomposers

Some other decomposers you might encounter include
 Earwigs
 Pot worms
 Springtails
 Mites
 Fruit Flies
 Flatworms

Ant sismo'qonej

Ants can be beneficial to compost because they can introduce fungi and other organisms to the pile. Too many ants in a compost pile could mean that its too dry.



Fly Wije's

Flies are insects that prefer most kinds of organic materials. They also carry bacteria that can be introduced to your compost pile. Although flies are not often a problem for compost, you can control them by putting a layer of leaves or grass clipping on the top of the pile.



Beetle Lnuatalte'w

There are a variety of different beetles that can be found in the compost. Some feed on decaying plant material, while others prey on slugs, snails and other small insects. Some species can be helpful in the garden if slugs are a problem.



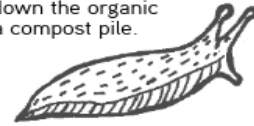
Earthworm Weti

There are over 6000 species of earthworms worldwide! They don't have lungs so they breathe through their skin. Species vary in what they eat, but most eat fallen leaves and decaying plants and leave nutrients for the soil



Slug Sqmoqnej

Slugs are a gardeners enemy because they will eat plants in the garden. A compost pile can deter slugs from the garden because it provides a large food source. They can help break down the organic matter in a compost pile.



Spider Awo'kwejit

Spiders can be helpful for controlling garden pest that might bother your plants. They may be attracted to the compost because of the prey that live around and inside of it.

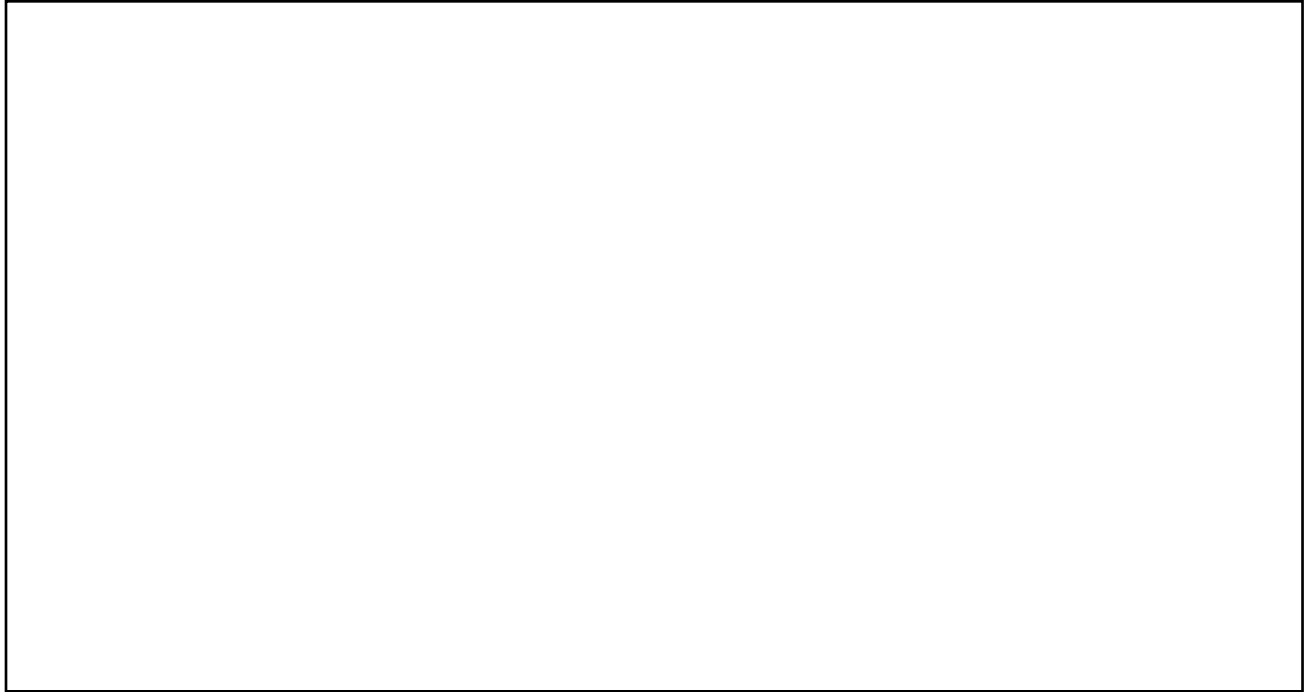


Figure 2: Compost Critters (Organisms) in the garden (photos adapted from: Joel Morrison, Illustrator of “Do the Rot thing: A teachers guide to Compost Activities”)

Step 4: Making Observations in Compost

In the area provided draw a picture of what you see in the compost.

Box 1. Compost Relationships



Do you see anything that looks white and stringy? What do you think it is?

There's a fungus among us.

Fungi is a type of organism that is different than plants and animals. Mushrooms are an example of a type of fungus. What we see in the compost is called mycelium and this is like the roots of a plant. Mycelium collects and transports nutrients (4) from the soil to the rest of the fungus (mushroom on the surface). A relationship that we don't often think about as beneficial to plants is the one they share with some types of fungi. Although some fungi (like some types of mushroom) can be poisonous for humans, animals or plants, there are types of fungus that are beneficial to plant growth.

Mycorrhizal fungi are types of fungus that have a symbiotic relationship with plants. It is found in the soil interacts with the roots of plants and both the plant and fungus benefit from this (4). The fungi improves the absorption of water and nutrients to the plant and increases how well it can fight off organisms that harm it (4). Fungus is also beneficial to compost. Table 3 lists how the different types of fungi such as, decomposers, mutualists and feeders, are beneficial to compost and plants.

This table describes what decomposers, mutualists and feeders do in the garden.

Table 3: Benefits of Fungus

Decomposers	Mutualists	Feeders
Retain nutrients	Protect plant roots from disease causing organisms	Feed organisms that are beneficial to the plant
Create new organic compounds that are sources of nutrients for other beneficial organisms	Deliver nutrients and water to plants.	Controls fungal growth
Produce compounds that help build soil into aggregates		Control root-feeding or disease-causing pests
Bind soil aggregates		
Convert Nitrogen		
Inhibit disease causing organisms		

Activity 2: Symbiotic Relationships in the Garden: Plants and Organism Relationships

What we need for our activity:

- Pencil

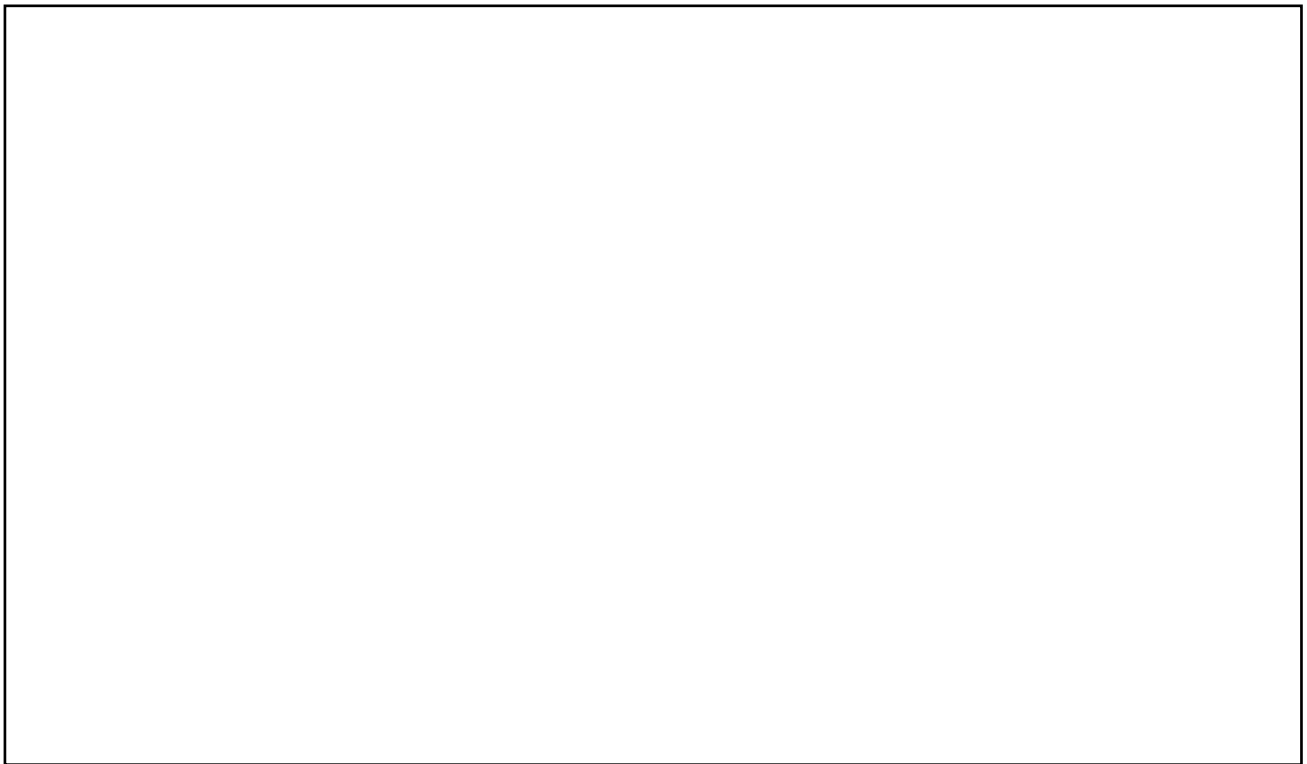
What we will do, step by step:

Step 1: Making Observations in the Garden

Follow the Camp Counsellor to the Garden Plot

In the area provided below, draw a picture the plants and critters in the garden.
Take note of what the critter is doing.

Box 2. Garden Plot



When you have finished look at Figure 3 on the following page. The camp counsellor will go over the image with you so that you may better understand the relationships.

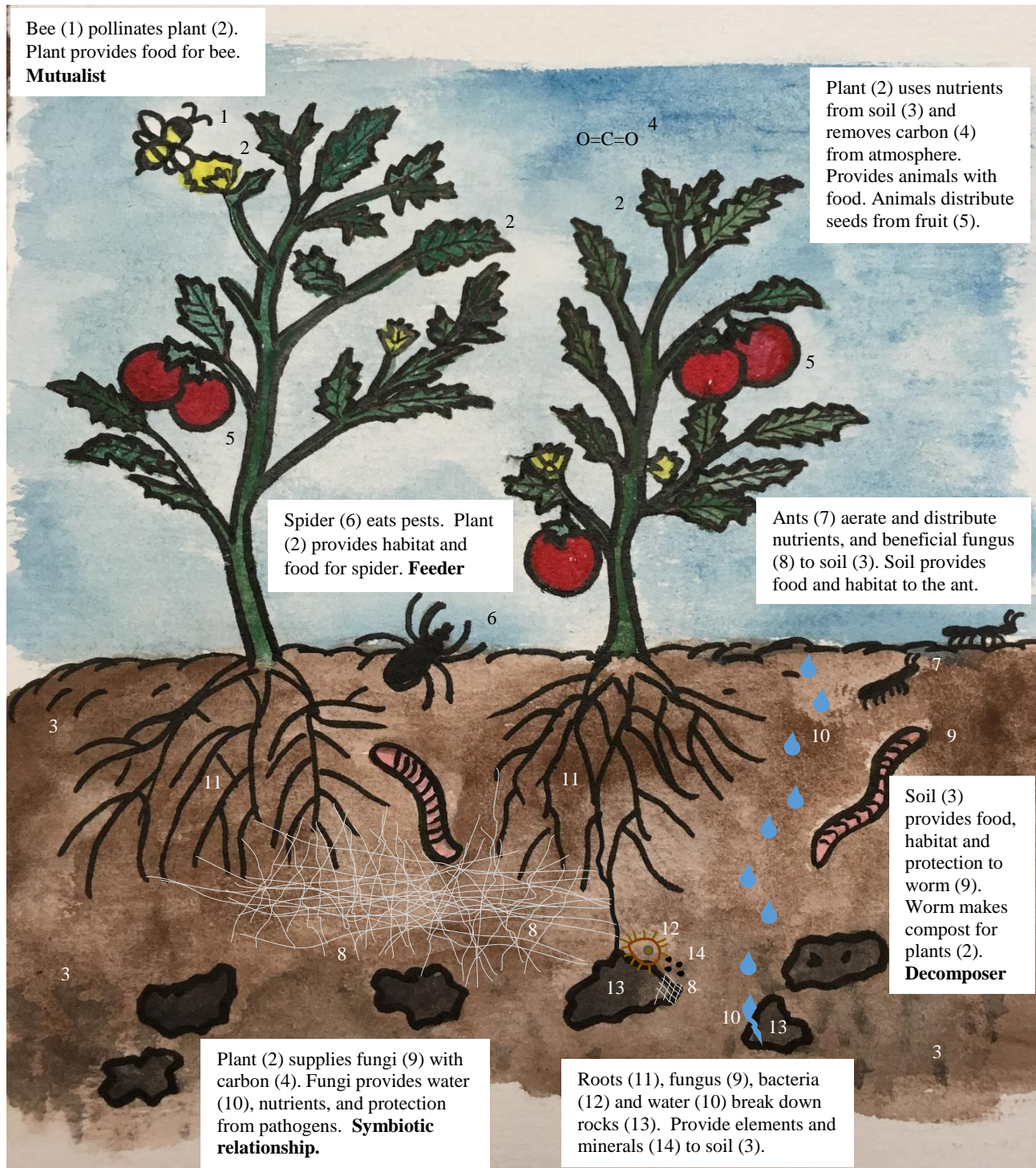


Figure 3. The Nutrient Cycle. The interaction of plants, fungi, critters, microorganisms, water and rocks in the soil and how they contribute to the nutrient cycle. Words in bold type (mutualist, decomposer, feeder and symbiotic relationship) contain examples for that word in that text box. (4)

Step 4: Apply your knowledge

Using what you learned in this activity about compost critters and fungus, how do you think the organisms we found help each other? Refer to figure 2 (Compost Critters) and the information about fungus to answer the following the questions.

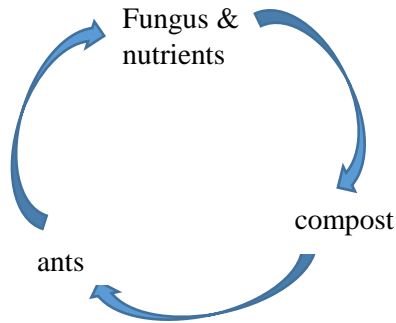


Figure 4: The interaction of ants, fungus, and compost

1. How does the figure above explain how fungi and ants are important to compost?

Use the next two images to explain why some organisms are beneficial to a garden. Beside each arrow write what is happening and if it is good or bad. Then answer the question below it. You can find what you need in Activity 1 about compost critters, how do you think one organism helps another in the garden.

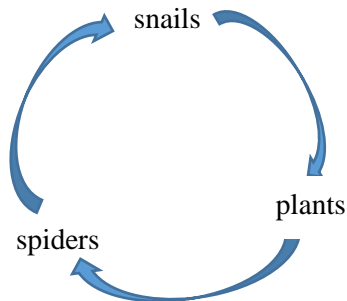


Figure 5a: The interaction of snails, plants, and spiders

2. Based on this image do you think pesticides sprays that kill spiders and snails are a good or bad idea? Why?

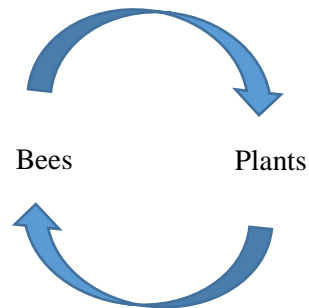


Figure 5b: The interaction of plants and bees

3. What would happen if there were no bees? What are some things we can do to attract bees to a garden?

Knowledge Check

Using all the resources provided in this activity; figures, tables and worksheets, answer the following questions on the lines provided.

1. Where do macro organisms fit into the Nutrient Cycle and why are they important?

2. How do rocks fit into the Nutrient Cycle?

6. Some rocks contain toxic elements, when exposed at the surface these elements come in contact with the atmosphere or water. What activities expose rocks?

If time permits, we will plant snow peas that you can take home later.

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All unreferenced stories, Mi'kmaq words, or Indigenous knowledge was provided by the Elders/Knowledge Keepers listed above.

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2. Adele Corkum, Artist, University of Prince Edward Island.
3. Gavin Kernaghan, Professor, Department of Biology, Mount Saint Vincent University.

This activity was inspired by "Do the Rot thing: A Teachers Guide to Compost Activities", published 2007.

References

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2. Igiehon, N O & Babalola, O O. Biofertilizers and Sustainable Agriculture: Exploring Arbuscular Mycorrhizal Fungi. Appl Microbiol Biotechnol. 2017; 101: 4871.
3. Nutrient Cycles: Recycling in Ecosystems, The Carbon and Nitrogen Cycles. (2017). In ScienceAid. [Cited June, 2019], Available from <https://scienceaid.net/biology/ecology/nutrient.html>
4. Weeks, P. Controlling Ants in Your Compost, The Daily Gardener. [Cited June 2019] (May 2019) Available from <https://www.thedailygardener.com/control-ants-in-compost-bin>