Grade 5 Structures & Functions of Living Organisms

Focus on: Soil Ecosystem

This lesson is meant to support the unit on Structures & Functions of Living Organisms. It can be done prior to the unit to develop background knowledge, during the unit to reinforce lessons or as a follow up to the unit to increase the retention of information. How you guide your students will depend on the information you have already taught and the information you want to introduce. Please remember that many gardens run on a yearly cycle and it will be easier to find more components of that ecosystem when it is at its peak season. You can, of course, utilize the garden at different times of the year, but the components of the ecosystem will be most evident during the peak growing season.

Clarifying Objectives:

5.L.2.2 Classify the organisms within an ecosystem according to the function they serve: producers, consumers, or decomposers (biotic factors)

5.L.2.3 Infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem.

Focus Question(s):

What is in a soil ecosystem? How are the organisms dependent on each other?

Key Vocabulary:

Definitions can be found at http://learnersdictionary.com

-Organism
-Ecosystem
-Function
-Producer
-Consumer
-Decomposer
-Biotic Factor
-Infer
-Interconnected Relationship

Materials:

School Garden
Science Notebooks
Garden Gloves to wear while exploring the garden especially if touching plants, digging in soil, etc.
Hand shovel or trowel for digging
Bucket or gallon sized bag to hold the soil
Plates or trays on which to sift through the soil

Activities:

1. Take students to the garden to explore soil ecosystems.
2. Have students work with a partner to collect 1-2 shovels full of soil. Place the soil in a bucket or bag.
3. Have students take small handfuls of soil at a time and place it on a plate or tray to explore it. Remind students that it is easier to find organisms in soil if they spread it out and look through small samples at a time.

Guiding Questions:

- What do you see in the soil?
- Is it organic or inorganic?
- Is it an organism?
- Is it alive?
- Can you identify it?

4. Give students the "Soil Organisms" sheet found at the bottom of this lesson plan. It has an image and information about the different organisms students may find. This information was found on the following websites: *http://www.wunderground.com/blog/gardencoach/giving-soil-the-respect-it-deserves *http://www.agclassroom.org/ny/resources/pdf/activities/soil.pdf 5. If an organism is found, have students use the "Soil Organisms" sheet to help identify their organisms and learn more about it. They should record their findings in their science notebook. 6. As students identify and read about their organisms, guide them to decide whether it is a consumer or decomposer; herbivore or carnivore. 7. After students have explored and identified some of the soil organisms, have students share their findings with the class. 8. As a class, create a food web for the organisms they found. Discuss the dependent and interdependent relationships between the organisms.	• Is it a consumer or decomposer? • Is it an herbivore, carnivore or omnivore? • What is its function in the garden ecosystem? • Are there producers in a soil ecosystem?

BACKGROUND FOR TEACHERS

Information from Ag in the Classroom http://www.agclassroom.org/ny/resources/pdf/activities/soil.pdf

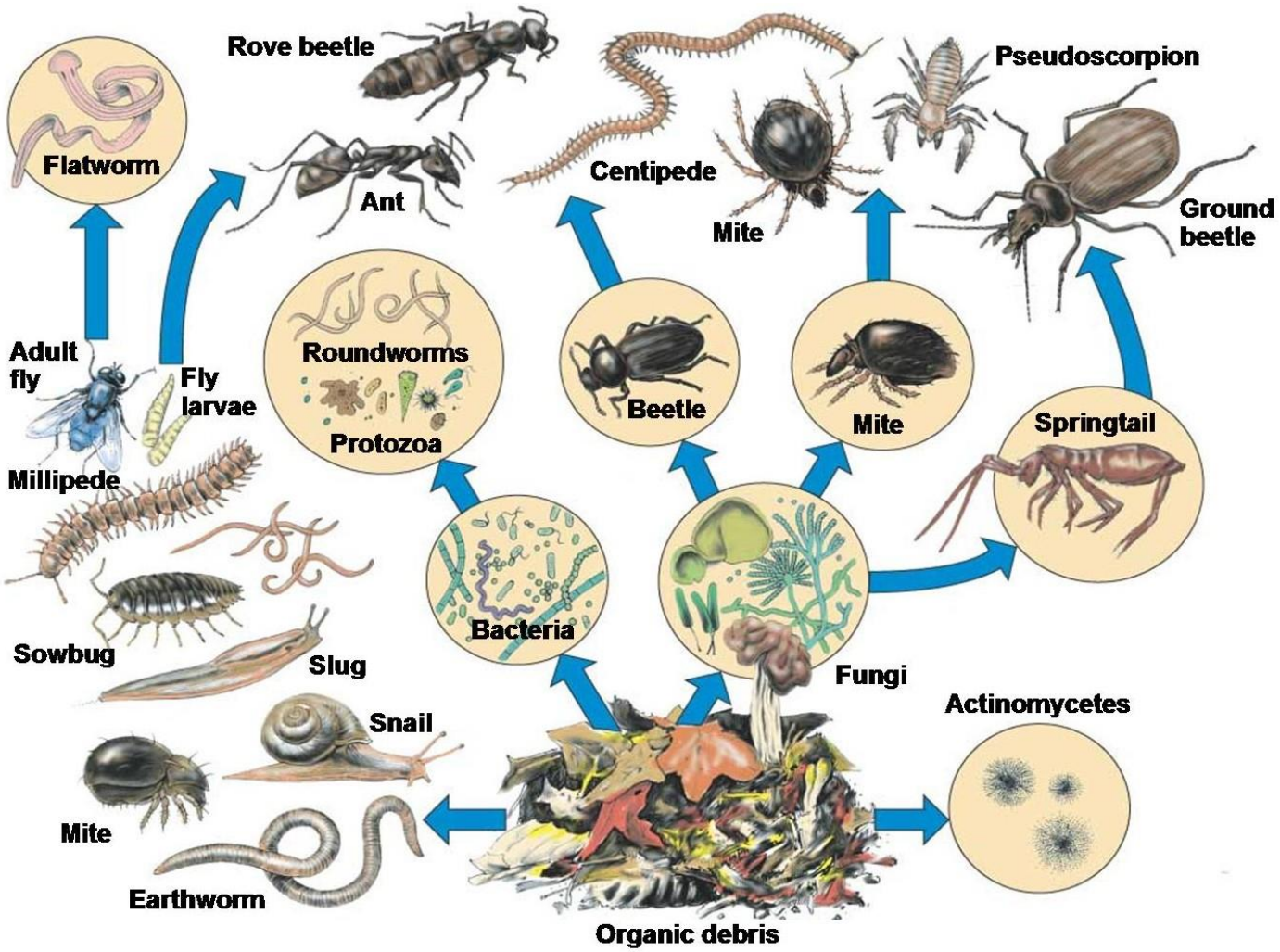
Soil is the result of the erosion of parent material (different types of rocks, like sedimentary, igneous, and metamorphic). Therefore soil is full of various minerals like calcium, iron, nitrogen, phosphorous and potassium. "NPK" (Nitrogen, Phosphorous and Potassium) are characteristic nutrients needed by plants in large amounts (macronutrients) and make up most commercial plant fertilizers. These inorganic substances are necessary to support soil life. Soil organisms make these nutrients available to plants, supporting plant health. Unless we consume those plants (getting our necessary vitamins and minerals from their fruits, stems, or leaves) they break down into the soil as organic matter when they die, re-supplying those nutrients to the soil. They then become humus (compost) after being broken down partially by the soil community. These contributions can be seen in three key functions of soil: supporting plant growth, maintaining water quality, and recycling life. Soil supports life in many ways. It provides an anchor for plants' roots, keeping the plants from falling over. Through respiration, the process that allows plants to "breathe," roots bring in oxygen from the soil and the plant produces carbon dioxide. This is sometimes called ventilation. Pockets of air or water in soil are called pores and harbor many creatures like mites, earthworms, and small insects like ants. Soil pores make water available to these creatures, and plants and other animal life like nematodes and roundworms. Pores have unique environments, such as variations in pH (acidity or alkalinity), humidity, and mineral composition. Because of the variety of environmental conditions found right next to each other, many types of soil life can be found within a small amount of space, and different plants thrive in different soil types.Soil protects water through filtration, using the soil community of plants, animals, fungi, and bacteria to recycle it. Soil can also contaminate water if it is high in toxic minerals and metals due to pollution like pesticide and fertilizer buildup. Soil can also hold water for plant use or to support the soil community, or soil can contribute to the loss of moisture, due to its surface (bare or planted), structure, parent material, and organic matter.

Soil is rarely devoid of life. Soil which supports plant life is teeming with many soil organisms, the majority of which are too small to see. Some examples of soil organisms are fungi, bacteria, nematodes, diatoms (algae), earthworms, ants, centipedes, millipedes, beetles, snails, and slugs. All these soil creatures and more make up the soil community. Most fungi and bacteria are supported by relationships with plant roots, so they stay close to plants. Any creatures that live on fungi and bacteria also stay close to the roots. Other larger herbivores, like beetles, ants, centipedes, and termites, feed closer to the surface where more plant debris is located. By virtue of where the food is located, most soil creatures live within a few inches of soil closest to their food sources.This community of organisms is deeply involved in the soil food web. It's basically a recycling program, where plant and animal residues are broken down by a chain of soil consumers (nematodes, bacteria, fungi, mites, earthworms, etc), who are then consumed by birds and other mammals, cycling carbon and essential nutrients. (See diagram that follows background information.) Soil protects soil organisms from harsh sun, wind and, rain, while still providing air, water, and nutrients essential to life. When soil organisms break down plant and animal debris they change the structure of the soil. Creatures like earthworms break down larger vegetative clumps into smaller clumps of organic matter, making the soil structure finer. In a good plant debris-based soil (wooded soils), the actions of earthworm, as well as the amount of organic matter, greatly increases the soil's ability to hold nutrients and water, as well as structure (pores).

Soil lacking in oxygen, water, and organic matter would be very bare and devoid of biodiversity. The area would consist only of a few, very specific kinds of soil organisms and specific plants that could tolerate these challenging environmental conditions.

Soil Organisms

http://www.wunderground.com/blog/gardencoach/giving-soil-the-respect-it-deserves



Examples of Soil community Creatures

Information from Ag in the Classroom http://www.agclassroom.org/ny/resources/pdf/activities/soil.pdf

Ants: Ants are known for their highly organized underground colonies and nests. Colonies can occupy a wide area of land. Some ants consume other soil creatures like centipedes, spiders, and mites, others prefer a vegetarian diet, and others live on animal and plant debris. The building of underground tunnels and nests can improve the soil's capacity to hold air and water, and cause changes in soil pH.

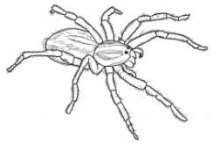
Termites: Termites are less involved in soil processes than ants, but there has been more research done on them. They can be found in many locations, but are most common in grasslands and tropical forests (both humid and arid). Their main contribution to the health of soil is through churning - bringing lower soil layers to the surface while taking surface layers deeper. The surface layers contain plant residues, which the termites use for food. This mixing of soil layers affects how the soil is formed and the overall health of the soil community.

Nematodes (Round Worms): The nematode is a unique soil creature, highly diverse in its feeding habits and
size. These non-segmented worms are found in almost all soil types, but most are too small to see without some sort of magnification. They usually feed on fungi and bacteria, but some are plant parasites that attack plant roots. Still others are cannibalistic. As nematodes digest a bacterial population, a lot of nitrogen is released, increasing the amount of that valuable nutrient available to plants. However, those nematodes that feed on plants create puncture wounds that can quickly lead to infection by fungal and bacterial cultures. Nematodes move mainly by swimming, so they are most often found in wet, sandy soils.

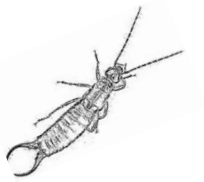
Slugs and snails: Slugs and snails do not directly contribute to the health of the soil, but are still members of the soil community. Both feed on plant roots and tender new leaves and stems, although most snails don't do significant damage. During cold New York State winters, these creatures hibernate in the sheltered soil layers, but in warmer areas they are active all year long.

Centipedes and Millipedes: These soil organisms also feed on plant roots. They are most common in moist soils that are high in organic matter, like forest soils. They spend the winter in the subsoil (below the surface), but the majority of their time is spent near plant roots and near the surface in plant debris.

Spiders: While we usually think of spiders as living in webs, there are quite a number of spiders that live and hunt on the ground. These are broadly called ground spiders, all of which reside in one taxonomic family (Gnaphosidae). Found in all sorts of climates, they are commonly located in leaf and bark litter on the soil surface, although some construct very specialized dens in the upper layers of the soil. They are usually very neutral in color to blend in with their surroundings. These dens serve as traps to catch other soil creatures, the spider's main food source. None of the spiders in the ground spider family have been discovered to be seriously harmful to humans, even though there are more than 200 species.



Earwigs: A common soil pest, the earwig devours the flowers and foliage of many garden and greenhouse plants. Like many other soil creatures, earwigs spend the winter in the subsoil. They do not directly contribute to the health of the soil except for adding their organic residues.



Beetles: The dung beetle is the most influential soil contributor in the beetle family. The female beetle creates dung balls to house her eggs; the nutrients from these are not added to the soil right away but are conserved for later. This prevents nutrification, or overloading water with more nutrients than the ecosystem needs.

Toads and Frogs: Contrary to popular belief, toads and frogs are not really different, taxonomically speaking. Toad and frogs are all members of the order Anura. They use the litter layer (leaves, sticks and other organic residues) and sometimes the subsoil to live, digging burrows for nests. Their main purpose in the soil food web is recycling organic matter.

Earthworms: Worms may be the most important contributors to soil health, as well as deeply involved in the recycling of organic matter for nutrients. Earthworms break down organic debris and expel waste material called casts or castings, which are high in nutrients and beneficial bacteria. Plants use these nutrients to maintain health and growth, while the bacteria help to stabilize and improve the structure of the soil. These casts can be seen with the naked eye and appear as small globular clumps, generally located on the soil surface in plant litter where the worms reside. Because worms are so important to the soil community and the soil itself, there is a whole separate unit devoted to them.

Mites: Mites live in the top layer of the soil, leaf litter, or other debris (stuff laying on top of the soil). They can also be found on mosses, lichens, and other low plants. These mites live in huge numbers. Hundreds of thousands of mites can live in one square meter of soil. To see one well, you would need a microscope. eat fungi, algae, and dead plant matter. They also eat dead springtails (tiny insects that live in the soil) and live nematodes (tiny worms). These mites are extremely important. They break down old material, such as dead leaves, and put the nutrients back into the soil. This allows living plants to pull the nutrients back into their roots so they can grow and feed animals. Without mites to "recycle" old material on the ground, plants and animals could not survive.

Sow Bug: Also known as a Rolly Polly, Pillbug or Isopod. These creatures are omnivores or scavengers feeding on dead or decaying plants or animals. Some may eat live plants. They are unique because they breathe with gills, so they are restricted to areas with high humidity, under rocks or logs, in leaf litter or in crevices. Some species are nocturnal. In their immediate vicinity, isopods do minimal soil improvement, but they are a food source for other animals.

Flat Worm: These worms live in moist terrestrial habitats. Terrestrial flatworms can be mistaken for slugs. Terrestrial flatworms are free-living soil animals, 0.5-10 cm in length, with flattened and unsegmented bodies. The size of a flatworm is not constant, as these animals can stretch out or contract considerably, changing shape as they move. Terrestrial flatworms are predators that attack a range of small animals including slugs, snails, earthworms, and other soil invertebrates. Flatworms hunt actively in the soil, moving along crevices and burrows, as they follow the scented trail of their prey. The mouth of a flatworm is not on its anterior (head) end, but half-way down the length of the body, in the centre of the ventral surface. Multiple mouths can be present. The worm feeds by attaching itself to its prey with mucus, secreting digestive juices, and digesting the prey externally. Small prey animals can be swallowed whole. When food is not available, flatworms appear to be able to survive for over a year without feeding. Many terrestrial flatworms feed on earthworms, attacking and successfully feeding on earthworms up to 55 times larger than themselves (Zaborski, 2002).

Grubs: "C"-shaped larvae, up to 1 inch long, with cream-colored bodies and brown head capsules. The have three pairs of legs, one on each of the first three segments behind the head. They live in the top la of soil and eat roots of grasses, vegetable and ornamental plants. They are considered to be a garden p

Wireworms: Wireworms are the larvae of click beetles. They are garden pests that inhabit the soil. They injure plants by eating the newly planted stems, and by boring into stems, roots and tubers.