



What's the Scoop On Dirt?

Introduction:

This lesson is presented as a hands-on approach to learning the components of soil. Students will get their hands dirty exploring soil and discovering firsthand why each component of soil is important for keeping the soil and our plants healthy. Students will look closely at a scoop of soil to discover the living, non-living, and once living parts. They will then practice stewardship and discuss the things we can do to keep our soils healthy.

Standards:

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment.

K-ESS3-3. Communicate solutions to reduce the amount of natural resources an individual uses.*

K-LS1-1. Observe and communicate that animals (including humans) and plants need food, water, and air to survive. Animals get food from plants or other animals. Plants make their own food and need light to live and grow.

1-LS1-1. Use evidence to explain that (a) different animals use their body parts and senses in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air, and (b) plants have roots, stems, leaves, flowers, and fruits that are used to take in water, air, and other nutrients, and produce food for the plant.

Learning Outcomes:

1. Students will be able to name the four main components of soil: organic material, air, water, rocks/minerals.
2. Students will be able discuss why soil is important for plants and animals.
3. Students will have an idea on how we can keep soil healthy.

Materials Included in this box:

- Lesson Plan
- Soil Sieves
- Shovels
- Rock Forming Minerals (quartz, feldspar, hornblende, muscovite, biotite, olivine, plagioclase, pyroxene, calcite)
- Books
- Copies of Soil Journals
- Model soil ingredients (rocks, minerals, leaves, bugs)

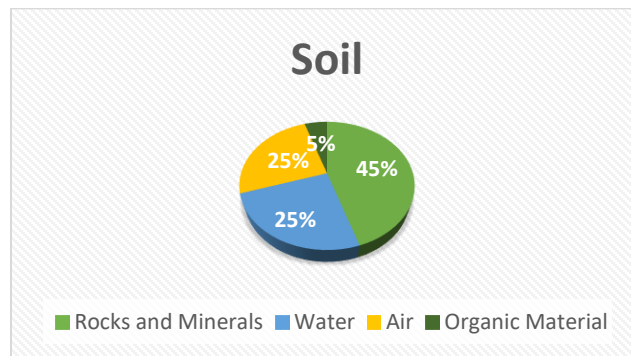


Teacher Background

Believe it or not, soil and dirt are not the same thing! Dirt is what you wash off your hands after working in the soil outside. Technically speaking, dirt is defined as displaced soil. Soil is the outermost layer of the solid Earth and consists of organic material, clay, and rock particles. Soil is essential for all life on Earth. It is a complete self-sustained system that is alive and breathing with animals, insects, fungi. All these things bring essential nutrients to the soil by breaking down (eating and pooping) decaying organic matter (plants and animals). These essential nutrients are what help feed the plants that grow. The size of the particles in the soil will determine a soil's texture and aid in aeration and drainage. The color of soil will help indicate what minerals are present. Dirt is considered dead; it does not contain living organisms or essential nutrients. A garden would not be productive if planted in dirt.

As you can determine now, healthy soil is vital for everything on Earth! Without healthy soil we could not sustain life. Plants need healthy, nutrient dense soil in order to thrive. Without soil we would not have all the plants, trees, vegetables, fruit, etc. that are present on Earth. And of course, without plants we would not have any animals. Soil is quite literally the foundation on which life is built!

Soil 'Ingredients'



A soil's ingredients can vary depending upon where it is located. But all soils are composed of organic materials, air, water, rocks, and minerals. The chart to the left shows an average soil composition. In reality, soil is very dynamic, and its composition will differ depending on many factors, such as precipitation, location, farming practices, etc.

Rocks and Minerals

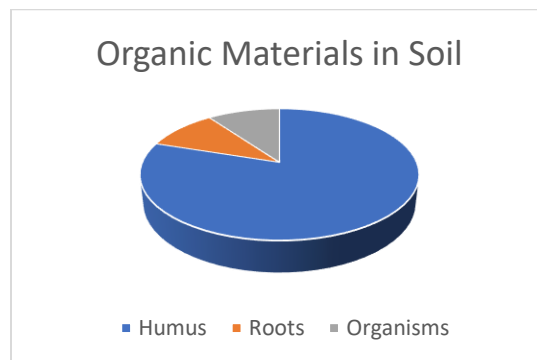
When bedrock or rock outcrops weather and erode they create sediments. These sediments are fragments of the rock that have eroded (the parent rock). Sediments are what make up 45% of soils and will vary greatly depending on the types of rocks present in an area. Areas that have volcanic bedrock are known for having very fertile healthy soils due to the mineral content and volcanic ash and pumice which provides excellent aeration. Soils that form over rocks that are resistant to weathering (quartz rich) are coarser, sandier soils. Soils that form over highly weatherable minerals will be silty in texture.

Finally, soils that form from rocks with clay minerals will have a high clay content. The size and type of the rock and mineral content of a soil will impact the soil's structure, how compacted or aerated the soil becomes, the soil drainage, porosity, and permeability. The soil's ability to hold air and water is vital to keeping micro-organisms alive and thriving.



When rocks undergo weathering and erosion, the individual minerals that are within a rock are released and make up the sediments that are formed. While there are over 4,000 different types of minerals, just 9 minerals make up the majority of all rocks on Earth. These minerals are referred to as rock forming minerals. These are the minerals you are likely to find in your backyard soil.

Organic Material



The organic material in soil is arguable the most important ingredient. Without organic material, plants would not have the necessary minerals they need to survive. Organic material includes both living and non-living organisms. **Humus**, which makes up about 80% of the organic material, is all the organic material that is decaying. It is mostly made from decomposition of plants (and animals) - leaves, roots, etc. Decomposition takes place through the living organisms that are present within the soil.

Fungus, bacteria, and insects work to eat and decompose this material. They then poop out healthy mineral rich soil! (Most children get a kick out of this fact!) Without these living organisms we would not have healthy soils with which to grow our fruits and vegetables! The final part of organic material within soil is the roots of living plants. The roots of a plant are what help them absorb the water and nutrients from the soil.



Air and Water

The most dynamic ingredients to soil are the liquid and gas components. Air and water also provide vital ingredients to not just the living plants but the micro-organisms in the dirt as well. Too much water and they will drown. (Ever wonder why the worms come up during heavy rains?). Too little water and they will also not survive. (I think we have all seen the effects of too little water on our gardens at some point). Air is also important, most bacteria that live in the soil rely on an aerobic environment. Soil that is too compact or hydrated will have little oxygen.

World's Soil Health

Aside from sustaining life on Earth, soil is also important for many other reasons as well. Soil acts to regulate water. It controls where rain and run-off go (whether it runs over the surface or down through the soil). It also acts to filter pollutants. Bacteria and minerals in the soil act to degrade, neutralize, or immobilize certain materials. Soil gives physical stability and structure to the ground. It provides a substance for plants to form roots but also provides structure for anthropogenic (man-made) structures as well.

Unfortunately, in the last 50 years, up to one third of the world's productive (farming) soils have seen a significant decrease in the organic material and nutrients present. It is believed this is largely due to non-sustainable farming practices. Some of these practices include mono-crops (non-cycling crops), a lack of cover crops, and the use of industrial pesticides and fertilizers. It has been documented now that the health of our food has also been affected by this. Fruits and vegetables growing today in these depleted soils contain less vitamins and minerals than they did 50 years ago. It is a growing problem that needs to be address. But it can be fixed with soil-centric and regenerative farming practices.



Lesson instructions

Part 1

1. Begin by reviewing what living and non-living means with students.
2. Ask the students what do all living things need to live? (Food, water, shelter, space)
3. Ask the students how plants get their food and water. They might say rain, hose (humans), sunlight).
4. Discuss with the student that plants do get their water from rain (or us) and use the sunlight to make their own food. However, plants cannot do those things without soil. For example, they need soil for their roots to grow and hold them steady. Otherwise, they could not stand up.
5. Discuss how the soil holds onto the water for the plants to drink.
6. Discuss how soil holds important nutrients for the plants. While plants primarily make their own food, they also need these nutrients from the soil.
7. Next read one of the books provided.
8. Discuss that without healthy soil, plants could not grow and without plants we would not have fruits, vegetables, trees, or the animals that eat plants and animals that eat those animals!
9. Hand out the soil journal to students and have them cut and staple the pages together.
10. Have the students fill out their name and the first page by drawing a picture and writing a sentence about why soil is important.

Part 2

1. Break the students into groups of 2 or 3 and give each group a soil sieve, shovels, magnifying glasses, and two aluminum pie pans.
2. Go outside and pick a location that has good soil (not mulch beds or playground gravel).
3. Have one student take a shovel of soil and dump it on top of the sieve, while another student holds the sieve over the pan. Gently shake the sieve until the smaller pieces fall through the holes.
4. Have the student holding the sieve dump the contents left on top of the sieve into the second pie pan.
5. Have the students first look through the larger sized particles (the stuff left behind on the sieve) and describe what they see in their soil journal.
6. Next have students use magnifying glasses to look through the smaller sizes particles to observe what they see, using their journal to document. Allow 10-20 minutes for them to explore and look through the soil. They can search multiple locations if space and time allow.
7. After students have looked through the soil outside, they can come back into the classroom to discuss their findings.
8. Have each group take turns describing the things they saw in their soil.
9. Next, list soil's main 'ingredients' using the ingredients box of items. You can spend as much or as little time as you would like to discuss each ingredient in detail. Have the students fill out their final page in their soil journal as you discuss.
10. You can go through each ingredient and discuss which ones are living and which ones are non-living.



11. You should discuss how each ingredient is important to keeping soil healthy, which keeps all our plants and animals healthy.
12. You can ask students ways in which we can protect our soils. Some ideas to discuss might be not using pesticides/fertilizers, growing native plants (great for local wildlife too!), using safe soaps when washing our cars, etc.