

The Dirt on Soil

Science Enhanced Lesson – Grade 3



TOPIC

Soil Layers

SCIENTIFIC AND ENGINEERING PRACTICES

- 3.1** The student will demonstrate an understanding of scientific and engineering practices by (a.) developing and using models.
- Use models to demonstrate simple phenomena and natural processes
 - Develop a model (e.g. diagram, or simple physical prototype) to illustrate a proposed object, tool, or process

- 3.1** The student will demonstrate an understanding of scientific and engineering practices by (b.) obtaining, evaluating, and communicating information.
- Communicate scientific information, design ideas, and/or solutions with others

EARTH AND SPACE SYSTEMS

- 3.6** The student will investigate and understand that soil is important in ecosystems. Key ideas include (a.) soil, with its different components, is important to organisms; and (b.) soil provides support and nutrients necessary for plant growth.

EARTH RESOURCES

- 3.8** The student will investigate and understand that natural events and humans influence ecosystems. Key ideas include (a.) soil is a natural resource and should be conserved.

BACKGROUND INFORMATION

Soil provides nutrients and support for plant growth and survival. This is important because plants provide the nutrients and support for human growth and survival. Therefore, it is important to protect soil and understand its make-up.

There are four layers of soil. The definitions below are also included on the soil layer handout available for this lesson.

- **Bedrock Layer** – The lowest layer of soil. This layer is made up of solid rock. Plant roots are not found in this layer.
- **Subsoil Layer** – This layer is found above the parent material layer. It is made up of sand, silt and clay that have not broken down all the way.
- **Topsoil Layer** – This layer is found above the subsoil layer and below the humus layer. It is made mostly of minerals and decomposed organic matter. Plant roots like to live in this layer.
- **Humus Layer** - This is the thin top layer of soil. This layer contains things like decaying leaves, plants and moss. Living material, like worms, like to live in this layer. This layer is very thin and usually dark in color.

Soil also needs nutrients to support healthy plants. Soil gets its nutrients from expected and unexpected places. Some expected places include decomposed animal waste, dead plants, the atmosphere and weathering of rocks. An unexpected place is the local wastewater treatment plant, AlexRenew. AlexRenew distributes a product to farms that is produced from the wastewater treatment process. The product, called biosolids, is rich in nutrients and helps soil retain water.

MATERIALS FOR TEACHER

- 1 copy of the Soil Layer handout (teacher guide version)

MATERIALS FOR STUDENTS

- 1 copy of the Soil Layer handout (teacher guide version)
For students (per group of 3 - 4 students)
- 1 clear plastic cup
- 6 sandwich-size plastic storage bags
- 1 marker, permanent if possible
- Access to outdoors

VOCABULARY

Soil, bedrock, subsoil, topsoil, humus, oxygen, nutrients, biosolids, decomposed, atmosphere

AVAILABLE HANDOUTS

- Soil Layers (teacher version)
- Soil Layers (student version)

STUDENT/TEACHER ACTIONS

TEACHER LESSON INTRODUCTION:

- Ask the students to think of something they need to live or survive. As they name various things, write them on the board.
- If students don't share the following things, offer clues to get them to say these items:
 - Food
 - Air/oxygen
 - Shelter
 - Clothing
- If students don't share the following things, offer clues to get them to say these items:
 - Food – much of our food grows from plants in the ground or comes from animals that rely on plants in the ground to live. Without healthy soil, our food, or food for animals, would not grow.
 - Air/oxygen – oxygen comes from plants that rely on soil to live. Without plants releasing oxygen, we would not have air to breath.
 - Shelter – our homes are built from wood that comes from trees. Trees could not live without soil.
 - Clothing – much of our clothing is made from cotton. Cotton is a plant that relies on soil to grow.
- If students share other basic needs, try to make the connection back to soil.
- Share with students that healthy soil is very important for all living things.

TEACHER ACTIVITY INTRODUCTION:

1. Tell the students they are going to work in groups to build a model that represents the four layers of soil.
2. Share that they are also going to add nutrients to their model. Nutrients are things that help soil stay healthy. People get nutrients from things like food, water and vitamins.
3. Share that everything used to build their model will be collected from nature.
4. Before breaking students up into groups, take time to identify and define the four layers of soil using the “Soil Layer” handout.
5. Distribute the handout and start reviewing the definitions with the “bedrock layer.” Read the description of this layer. Have the students write the name of the layer on their handout and draw a line from the definition to the correct layer on the image. Repeat for all layers, ending with the humus layer.

6. After reviewing the layers of soil, discuss nutrients.
 7. Remind the students that humans get nutrients from things like food, water and vitamins. In fact, everything we eat has nutrients.
 8. Share that the nutrients we take in helps keep our bodies healthy and strong.
 9. Share that soil can get its nutrients from many things. Some examples include decomposed animal waste, dead plants, the atmosphere and weathering of rocks. The nutrients in soil are needed to produce strong healthy plants.
 10. Ask students, “Did you know the process to treat dirty water creates a product that is healthy for soil, which means it is healthy for plants?”
 11. One local business that provides nutrients to Virginia farms for their soil is Alex Renew Enterprises, the wastewater treatment plant.
 12. Share that the wastewater treatment process creates something called biosolids. Biosolids is a product that’s safe for the environment and full of the nutrients soil needs. When biosolids are applied to soil, they make it healthy and strong. It also helps soil hold water.
 13. Soil passes along its nutrients and water to plants, so they can be healthy and strong.
7. Share with students that the way people use land can affect the levels of nutrients and pollution in the soil. For example, when a new development like a shopping center is built, plants and their roots are pulled up and pollution like oil from dump trucks can find its way into soil. Pollutants found in soil can also negatively impact water that flows through it.
 8. It is important to protect layers of soil because students heard at the beginning of the lesson that soil is a necessary resource for life. But protecting layers of soil also protects water quality.
 9. Ask the students how the health of the soil is also related to the health of water. After they share some thoughts, connect the fact that rainwater filters through layers of soil before ultimately finding its way to a local creek or reservoir. When pollutants are in the soil, they can also end up in our water and make it difficult to clean and protect.
 10. Ask the students if they think an urban area or rural area would have soil at a higher risk for pollution and why.
 11. Ask the students to share some potential ways to protect the layers of soil, especially in an urban area. Some examples may include planting trees, containing pollution on a construction site, and installing storm water controls to prevent rainwater from flooding land.

TEACHER ACTIVITY INSTRUCTION:

Activity Introduction:

1. Once you have reviewed the layers of soil and nutrients with the students, break the class up into groups of 4-5 people.
2. Give each group 5 sandwich-size plastic storage bags and 1 clear plastic cup.
3. Have the students label the plastic bags. Four bags will be labeled with the name of a soil layer (one name per bag). One bag will be labeled with the word “nutrients.” These bags will hold items to build a model.
4. Tell the students they are going to build a model in the clear plastic cup to represent the four layers of soil, and the nutrients it needs. The model will be built with items found in nature.
5. Escort the student groups to the outdoor environment. Make sure each group brings their 5 labeled bags. The clear plastic cup will remain inside.
6. Once outside, while all students are still together in one large group, have them observe the surrounding area. Ask the students to look for evidence of ways people have affected the soil on or around your school

Activity Guidance:

12. Give students about 10 minutes to collect items in nature to represent each layer of soil and nutrients. The only rule is that none of the collected items can be actual soil.
13. Remind the students they only need a small amount of each item. They can place the item for each layer in the correctly labeled bag.
14. After collecting items, have the students gather in their assigned groups back in the classroom. Using the soil layer handout as a guide, have the students assemble a model in the clear plastic cup that presents only the four layers. They do not need to do anything with their collected item for nutrients.
15. Once assembled, have the students write the name of each layer in the correct spot on the cup.
16. After students complete the models, tell the students they just built a model that represents the body of soil.
17. Remind the students that soil, just like our bodies, need

nutrients to stay healthy. Have the students top the model with their final item that represents nutrients.

18. If time allows, student groups can present their models to the rest of the class. Or, you can let student groups walk around to other stations to view all models.

TEACHER ACTIVITY CONCLUSION:

- Today we talked about the layers of soil and the nutrients it needs.
- Healthy soil helps healthy plants grow. Healthy plants help produce the food, oxygen, shelter and clothing we need to live. Healthy soil also protects our water

ASSESSMENT

QUESTIONS

- What are the four layers of soil?
- How does soil get nutrients?

JOURNAL/WRITING PROMPT

- Think about how soil supports your basic needs for survival. Write a thank you note to soil for supporting your needs. Be sure to explain why you are grateful.

EXTENSIONS AND CONNECTIONS

- Invite a representative from AlexRenew to speak to class about the use of biosolids at local farms.
- Plant seeds in soil and watch them grow over time.
- Have the class explore the area around school to determine factors that may impact the quality of soil on their school campus.

STRATEGIES FOR DIFFERENTIATION

- Have students create a soil model using items found indoors. Some suggestions:
 - Demonstrate the layers of soil with markers.
 - Demonstrate the layers of soil with items found in the classroom (e.g. school supplies).