LESSON: What’s In Soil

INSTRUCTOR: Stephen Bunker
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DISTRICT: Alpine School District
GRADE LEVEL: 4

CORE CURRICULUM

Science Standard 3: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 3: Observe the basic components of soil and relate the components to plant growth.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills.

Lesson Objective: The students will be able to identify the different components of soil, the names for the particle sizes, and the parts of a soil profile.

Content Connections:
Writing, Mathematics

INTRODUCTION

Background Information

Soil, along with air, water and sunlight, is essential for sustaining life on earth. All living things are dependent upon each of these natural resources. Because it takes anywhere from 100 to 1,000 years to make an inch of soil, soil is considered a nonrenewable natural resource.

Soil is made when rock particles are broken into smaller pieces by the weathering forces of running and freezing water, wind, plants, and chemicals. These soil particles are deposited and form layers. A cross-section of the soil layers is called a soil profile. If there is some type of excavation because of a new home foundation or roadway construction, you could see a soil profile. These layers have names. From the top down they are organic matter, topsoil, subsoil, and bedrock.

In a sense, the soil profile is like a layer cake with each layer made from a different type of cake mix. Just as different cake mixes have different proportions of ingredients, the soil profile has different proportions of the following ingredients: minerals, water, air, and living organisms and their remains. The biotic content of the soil is primarily at the top.
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Soil Profile

Organic Matter

Topsoil
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INVITATION TO LEARN:

Show the video segment "Soil Isn't a Dirty Word" from *Dirt: Secrets in the Soil* DVD.

INSTRUCTIONAL PROCEDURES

PRIOR TO ACTIVITY

1. Either have each student bring a sandwich-size zip baggie from home that is filled with soil, or provide one for each group in class. There must be at least 1 generous cup of soil per student.
2. Have students prepare their science journals by writing the name of the activity and the date. Instruct them that they should record what they see both with words and drawings.

SORTING SOIL PARTICLES

1. Have the students dump out their soil sample onto an 11 x 17" piece of white construction paper.
2. Using a hand lens and a pencil, have students begin sorting the different objects they find in their soil sample. The students should start to notice that there are mineral particles and organic matter. They may notice water (their paper would have wet spots). They won't see air because it is invisible. They may find some bugs.
3. Discuss with the students what kind of particles they are finding in their soil samples. They should be finding that there are 4 types of soil particles.
4. Have the students stop every so often (5 minutes?) so you can make sure they are recording their findings in their science journals.

WATER IN SOIL

1. As the students are investigating their soil samples, watch for a sample that shows moisture. Ask to borrow that student's sample and place it on a piece of white tissue paper on the overhead projector. The damp soil will moisten the tissue paper and make it transparent so the whole class can see that there is also water in the soil.
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AIR IN SOIL

1. Have the students measure one cup of their soil and, using their construction paper as a funnel, pour it into an empty water bottle. Make a mark with a permanent marker at the level the top of their soil (this mark will be used in a later activity). Ask students to label it #1.

2. Have the students measure one cup of water and slowly pour the water into the soil. Instruct them to observe what is happening. They should see air bubbles coming up out of the dirt. Have them only add water until the dirt is completely saturated mud, not liquid. Any water that they don’t pour in they should measure.

3. Have the students stop and record their findings in their journals, especially how much water was left in the measuring cup after saturating the soil.

4. Help the students understand that the water they poured into the soil displaced the air that was in the soil. By measuring the remaining water and subtracting it from 1 cup they can calculate how much air was in the soil. Have the students complete the calculation in their journals.

5. Discuss with the students what they now understand about the different things that make up soil: mineral content, organic content, water and air.

DIRT SHAKE

1. Let the students know that as a class we are going to time how long it takes for the particles to settle. Have the students prepare a simple table chart in their journals with which to track this. They will need columns for particle type (sand, silt, and clay), and time.

2. Using the same bottle with mud, add more water to the bottle so it is ¾ of the way full. Add a teaspoon of alum to the water/mud mixture. Screw on the lid and have the students shake it vigorously until all the soil particles are saturated. This should take about 2 minutes.

3. Have them place their bottles down all at the same time and begin timing. After a minute, tell them to mark their bottles at the level they can see the soil has settled. This mark should be labeled #2, and is for the sand particles. Have them carefully move their bottles to a counter away from their desks.

4. Have the students record the 1-minute column as sand in their journals. This would be a good time to discuss the size of different particles of soil.

5. After 3 or 4 hours have them make another mark, labeled #3. These will be the silt particles. Have the students record the time on the chart in their science journals.

6. The remaining particles will take two or three more days to settle out. These will be the clay particles. Have the students mark their bottles with #4 and record the time...
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in their science journals.
7. The organic matter should float on top of the water.
8. On the third day, have the students measure the marks from the counter upwards, using centimeters rather than inches. Have them record the measurements in their journals. This will facilitate their ability to determine the percentage of each particle type that is in their soil sample.
9. To calculate the percentages, students should use the measurement for mark #4 as the denominator in a fraction. The measurement from the counter to mark #2 would be the numerator for the sand percentage; students should then simplify the fraction and change it to a decimal. The measurement from mark #2 to mark #3 would be the numerator for the silt percentage (over the same denominator). The measurement from mark #3 to mark #4 would be the numerator for the clay percentage. For example, if mark #4 is at 10 cm, and mark #2 is at 3 cm, then 3/10 = about 1/3, or 30% of the soil sample is sand.
10. Have the students record their percentages in their science journals.

SOIL PROFILES
1. Prior to the activity, either purchase cold cereals or request students to bring them in.
2. The students will be creating their own edible models of a soil profile.
3. Pour the cereals into separate bowls and provide scoops for students to use to remove cereal without touching the cereals. Also have the students wash their hands.
4. Demonstrate how to put cereal into a quart-size bag, zipping it closed and then crushing the cereal.
5. When they have finished making soil profile, provide a spoon and pour milk—to simulate water—over their cereal soil profile.
6. If you would like, have students recreate their soil profile percentages with their cereal.

LESSON MATERIALS
• Zip bag of soil (at least 1 generous cup) – 1 per student
• Sandwich-size zip bags
• Science journals
• 11 x 17” white construction paper
• Hand lens
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- Pencil
- White tissue paper
- Overhead projector
- 1-cup measure
- Empty 1-liter water bottle with a lid
- Liquid 1-cup measure
- Funnel
- Permanent markers, thin-tipped
- Water
- Alum
- Teaspoon measuring spoon
- Timer
- Ruler (centimeter divisions)
- Quart-sized zip bags
- Plastic scoops
- Cold cereal, several kinds
- Large bowls
- Plastic spoons
- Milk
- Dirt: Secrets in the Soil DVD

ASSESSMENT SUGGESTIONS

- Create journal entry prompts for each activity.
- Have students create a drawing (similar to the profile in the introduction) that shows the profile of their soil sample, giving the measurements and percentages of particles.
- Have students create a flip-book of facts about soil that they have learned, or things they observed from looking at samples.

POSSIBLE EXTENSIONS/ADAPTATIONS/INTEGRATION

- Students can learn about what percentages of sand, silt, and clay provide the best environment for growing food crops. Students can try to recreate these percentages and experiment with growing radishes or another quick-sprouting crop in each of their manufactured soils.
- Students can learn about the Great Depression and the agricultural and soil
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- difficulties that led to the widespread famine in America and other countries.

**RESOURCES: BOOKS, MEDIA, ARTICLES, WEB SITES, AND ORGANIZATIONS**

**BOOKS**

- *How to Dig a Hole to the Other Side of the World*, by Faith McNulty, ISBN 978-0874992335


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Dirt: Secrets in the Soil, by Utah Agriculture in the Classroom,
https://extension.usu.edu/aitc/cart/details.cfm?ProdID=69&category=0


MEDIA

Dirt: Secrets in the Soil, by Utah Agriculture in the Classroom,
https://extension.usu.edu/aitc/cart/details.cfm?ProdID=230&category=0


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**ARTICLES**

**WEB SITES**

Retrieved from the World Wide Web on January 12, 2010, from  
http://school.discoveryeducation.com/schooladventures/soil/down_dirty.html  
The Dirt on Soil

Retrieved from the World Wide Web on January 12, 2010:  
http://www.butlerswcd.org/Education/Kids.html#dirt  
Butler Soil and Water Conservation District

Retrieved from the World Wide Web on January 12, 2010:  
http://www.biodiversity911.org/soil/soil_main.html  
Soil

Retrieved from the World Wide Web on January 18, 2010:  
http://forces.si.edu/soils/  
Dig it: The Secrets of Soil

**ORGANIZATIONS**

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FAMILY CONNECTIONS

- Students can choose to make a soil layer cake and write a description of what is in each layer.
- Families can visit the websites.
- Students can visit a gardening center or extension service to learn what we can do to make the soil better for growing plants in.

LESSON AND ACTIVITY [TIME SCHEDULE]

- Each lesson is 55 minutes.
- Each activity is 30 minutes.
- Total lesson and activity time is 90 minutes.

ACTIVITY CONNECTED TO LESSON

ACTIVITY MATERIALS

Sorting Soil Particles
- Zip bag of soil (at least 1 generous cup) – 1 per student
- Sandwich-size zip bags
- Science journals
- “11 x 17” white construction paper
- Hand lens
- Pencil

Water in Soil
- soil sample
- white tissue paper
- overhead projector
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<th>Air in Soil</th>
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<td>1-cup measure</td>
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<td>Soil</td>
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<td>Science Journals</td>
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<td>Empty 1-liter water bottle with a lid</td>
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<td>Liquid 1-cup measure</td>
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<td>Funnel</td>
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<td>Permanent markers, thin-tipped</td>
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<td>Water</td>
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<tr>
<th>Dirt Shakes</th>
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<tr>
<td>Soil sample in bottle</td>
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<th>Soil Profiles</th>
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Erosion Control Practices

Farmers use several methods to conserve soil. Match the number of practices below in the correct box in the picture.

1. **Contour Planting**: plant crops around the curve of a hill rather than up and down the hill.
2. **Terraces**: wide ridges that go around a hill to prevent water from rushing down the hill too fast.
3. **Forest and Grass Areas**: keep steep hillsides in trees or grass rather than clear for cropland.
4. **Grassed Waterways**: plant grass and don’t plow low areas in a field where water usually runs.
5. **Windbreak**: rows of trees planted to slow down the wind and prevent soils from blowing.
Soils on the Move

Identify which area is:

___ wind erosion  ___ gully erosion  ___ rill erosion

___ streambank erosion  ___ sheet erosion
Splash Zone Graph

Raindrop splash
Splash Zone Target

Zone 1

Zone 2

Zone 3

Zone 4