For Land's Sake - Know Your Soil

Environmental Education Aid from the Hoosier Chapter Soil & Water Conservation Society

Soil, it's a dirty topic, but somebody needs to talk about it. The following discussion guide will be useful in helping people learn more about one of their community's natural resources- soil.

Know your Soil: Objectives:

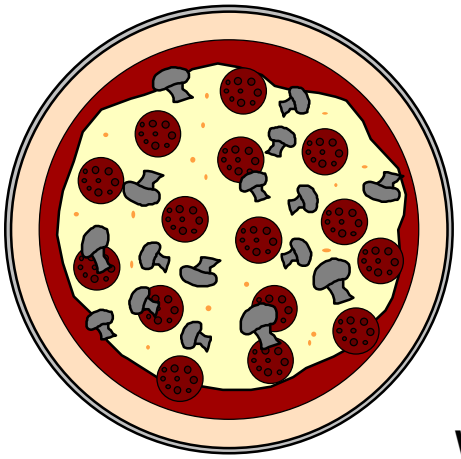
1. Students will develop an awareness of soils.
2. Students will collect soil samples from near their homes.
3. Students will analyze and compare the different soil samples.
4. Students will identify the major components of a soil sample.
5. Students will examine a soil for texture.
6. Students will describe why and how soils differ.

SOIL AND WATER CONSERVATION SOCIETY

Introduction

Activity 1: Soil and Pizza ... What's the Connection?

Supplies needed: Encyclopedia, Internet, other reference materials, & charts 1A-B



Where did our pizza ingredients come from?

Listed below are some of the ingredients of a pizza. You may want to add some of your favorites that are not on the list.

1. Identify each ingredient of the pizza.
2. Identify the source material for each ingredient.
3. Identify a possible geographic location of where the source material is produced.
4. Identify what processing step(s) are needed to make the ingredient.
5. Identify a possible geographic location of the processing facility

Fill in this Chart #1A below. The first item has been done as an example.

Chart #1A- Pizza Ingredients Information				
Ingredient	**Source Material**	**Source Location**	**Processing Facility**	**Facility Location**
Flour	Wheat	Kansas	Cleaning Mill	Indianapolis, Indiana
Salt				
Spices				
Tomato Sauce				
Sausage				
Pepperoni				
(Your Favorites)				

The ingredients for our pizza came from many different locations and were probably processed in many other locations.

What basic natural resources were involved in producing the pizza's ingredients? Put a check following each ingredient in the natural resource chart 1B below that was involved in producing the ingredient.

Chart #1B- Pizza Ingredients and Natural Resources					
Ingredient	**Soil**	**Water**	**Air**	**Plants**	**Animals**

Chart #1B above should show that all our pizza's ingredients involved the soil.

What Is Soil?

We walk, play, travel, and build upon it! We use it to grow our food. You probably call it "dirt", but your life, and that of all other creatures, depends on this relatively thin layer of material that has developed on most of the land surface of the earth. Because most of us take soil for granted, we may have never taken the time to find out what it really is, what is its source, and how it is made. We may not have even noticed that soil in one place may be different from that in another.

Soil is living. Soil contains plant material in the form of roots, and animals such as moles, earthworms, snails, and insects. Soil also contains water, organic material (former living organisms), air, and mineral particles (which have been ground up finely by weather and erosion over long periods of time). Most soil comes from worn down rock material, which formed thousands or millions of years ago. The soil we see today is a result of these many changes.

Soils differ in different locations because they are influence by five different soil formation factors. Those factors are the climate (kind of weather), vegetative cover (plants), parent material (bedrock), topography (sloping condition of the land), and time that the soil has had to form. The mineral portion of the soil consists of sand, silt, and clay particles. They differ in size, sand being the largest, silt being medium in size, and clay being the smallest. Nearly all soils contain these 3 sizes, however the percentage of each varies tremendously in different soils. The amounts of each of these particles determine the TEXTURE of a soil. A soil that has about equal amounts of all three sizes of particles is called a LOAM. Soil scientists think of LOAM soils as being ideal for most agricultural uses.

Texture greatly influences the ease with which roots, air, and water move through the soil. Sandy textured soils, for example, allow water to move freely through them. Therefore, after a rain, these soils become dry quickly. On the other hand, water moves more slowly through clayey soils. They tend to be "muddy and wet longer after a rain. Rainfall runs off hills and collects in valleys. Usually hills tend to be well drained and valleys tend to be wet. A sandy soil on a hill will tend to be drier than a clayey soil in the same location. A clayey soil in a valley will tend to be wetter than a sandy soil.

To build just one inch of high quality topsoil in most areas takes about 100 years; in places where the climate is dry and cold an inch of topsoil may not develop in 1000 years. This is why it is important that we use the soil wisely. A SOIL SURVEY is an important tool to help us better understand soils. It contains information about soils in a specific community, and has maps that show the location of the various types of soils in the community. In most communities, a copy can be obtained or reviewed by contacting the local Natural Resources Conservation Service (NRCS) office listed in the phonebook under United States Department of Agriculture (USDA). Your local Soil and Water Conservation District and the Cooperative Extension Service also have information that should help you learn more about your local soils. See the References section at the end of this teaching aid for web sites with additional information about soils.

Activity 2: Collecting Soil Samples

Supplies needed: Jars with lids, soil samples, chart 2

The best way to understand soil is to get really close to it and examine it. Have you ever stopped and looked at the soil that is all around you? It's down below your feet and easy to ignore. There are billions of small plants and animals in soil and you might be walking on top of their homes. When you stand in a field of grass, you could be on top of a city of ants. There could even be a family of moles beneath your feet.

Collect soils from many different locations. Possible locations to sample are the top two inches of soil from a flowerpot, a backyard, a schoolyard, an agricultural field, a forest,

near a creek, etc. Note that many soils in yards and playgrounds may contain man made objects such as bricks, wood, etc. because of what man has added in these areas. (*The instructor can collect samples from locations where students might be in danger, such as near a river or a cliff*).

Look at the soil that is all around you. Get a trowel or shovel. Dig up enough of the top two inches of the soil to fill a pint or a quart jar. Look closely at the particles and living creatures that make up the soil. Save your samples for use in the following activities.

Number your samples and answer the questions in Chart #2 (i.e., date, weather, location, etc.). To conclude this activity, examine at least three different samples and record the information requested.

Chart #2- Soil Sample Collection Card

Soil sample number _____ Collected by: _____ Date: _____

Weather the day the sample was collected: _____

Describe the place where you collected your soil sample. What type of vegetation (grass, shrubs, trees, bare soil, etc) was on your soil? _____

Describe your soil. What color is it?_____

What does it smell like?_____

What does it feel like? _____

Do you see any living plants or animals? What do they look like? _____

_____

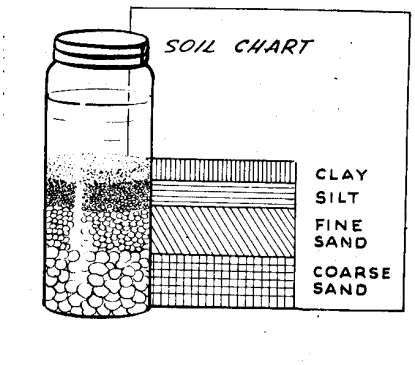
Activity 3: Make a Soil Composition Chart.

Supplies needed: Jars with lids, soil samples, water, paper for chart, and patience

This simple experiment allows you to separate soils into layers of different-sized particles. Put a cup of soil into a quart jar and fill it with water. Replace the lid and shake the soil mixture vigorously and let the soil particles settle. You will have to let the jar sit for several hours to several days to let all particles settle. The coarser materials will be on the bottom and the finer materials on top. Materials will settle out in this order from bottom to top: sand, silt, and clay with organic matter mixed and floating on top. Clay particles are very small and take a long time to settle. Separate several different soils by this method.

Hold a card or heavy piece of paper against the side of the jar and draw a diagram showing the different layers. Refer to the information about soil particle sizes in Chart #3 and label the layers, beginning at the top, clay, silt, and sand, as you feel appropriate. Do this with several soils taken from different types of places in your community and compare the diagrams of the soils in the various jars.

Chart #3- Example Soil Composition Chart and Grain Size Scale



Grain Size Scale (Used by Soil Scientist)

mm	Inch	Sieve Series	Texture Description for below the sieve series (shown on left)
2.0	0.08	No. 10	Very coarse sand
1.0	0.04	No. 18	Coarse sand
0.500		No. 35	Medium sand
0.250		No. 60	Fine sand
0.100		No 140	Very fine sand
0.050		No. 270	Silt
0.002		N/A	Clay

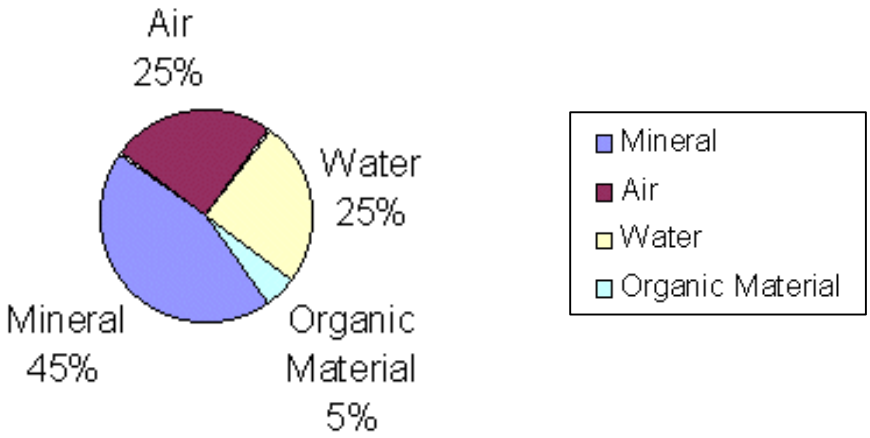
Activity 4: Soils: What Are They?

Supplies needed: Magnifying glasses, microscopes, sieves, soil samples, chart 4A-B

In this activity, you will investigate soils. Use the same soil samples you have brought in for Activity 2. You will use magnifying glasses or microscopes and sieves of different screen size (if available) to examine your soil samples.

Soils are mixtures of four ingredients: mineral, air, water, and organic material. The amount of each ingredient changes from one soil to another. The following pie diagram indicates an ideal mixture of these ingredients.

Chart #4A- Soil Mixture of an Ideal Silt Loam Surface Soil



Look at your soil sample. The mineral particles give the soil texture. Separate some of the larger minerals and look closely at them with a magnifying glass or microscope. Ask your teacher to help you identify them as sand or silt. Note individual particles of clay can not be seen with hand lenses or most microscopes.

Chart #4B- Soil Sample Description Card

Soil sample number: _____ Collected by: _____ Date: _____

Sample location: _____

What is the color? _____ Smell? _____

Texture? _____
*Example- Color: ..Dark black, brown, dark gray_ Texture: Loamy_*

Draw or describe the organic matter in your soil sample: _____

_____

Draw or describe the minerals in your soil sample. _____

_____

Trade your soil sample with several of your classmates. On the back of this activity sheet write the name of the person, the location from where the sample was taken, and the sample number. Then describe how the sample is different from or similar to yours. Examine the color, smell, texture, and organic matter.

Activity 5: Discovering More Ways That Soils Differ?

Supplies needed: Scales, graduated beaker, soil samples, jar, and charts 5 A-D

Soil samples from Activity 2 can be used for this experiment. The relative values obtained will be dependent on the natural conditions that existed when the samples were collected. Work in small groups to analyze- their soil samples and to answer the questions. Complete chart #5A using the following directions. Estimate the volume of pore space in a soil sample. Measure 100 milliliters (ml) of a soil sample into a glass or beaker. Determine the mass (weight) of the sample and beaker and record data. Slowly pour water into the sample until the water level rises to the top of the soil sample. Then re-determine the mass of the mixture. The mass difference in grams is equal to the volume of pore space in milliliters per 100 ml of soil since 1 gram of water = 1 ml of water. Compare the pore space volume of several soil samples. Discuss the importance of pore space with your class.

Chart #5A- Soil Mass Dry and Wet				
Soil Sample number	**Mass-dry (g)**	**Mass wet (g)**	**Difference =wet-dry (g)**	**Estimated pore space (ml)**

Soils differ from one another in many ways. One soil can be acid. *Ask your instructor about how you can use litmus paper to determine soil acidity (pH).* Another can be low in nutrients. These soils have chemical differences. The easiest way to tell one soil from another is to look at physical traits. Two important physical traits are color and texture.

Use the following charts #5B-C, and answer the questions below about your soil sample.

Chart #5B- General Soil Color and Characteristics		
Soil by Surface Color	**Organic Content**	**Fertility**
Dark Soils: Dark gray, black, brown	High	High
Moderately Dark Soils: Brown to yellow-brown	Medium	Medium
Light Colored Soils: Pale brown to yellow or red	Low	Low

Chart #5C- General Soil Texture and Characteristics				
Soil Texture	**Feel When Wet**	**Looseness of Soil**	**Water Holding Capacity**	**Aeration**
Clayey	Usually smooth, may be slick & very Sticky	Tight, may be clumpy if moist	Medium (water is held so tightly that less is available for plants)	Low
Loamy	Usually between the two in feel, may be more flour like	Somewhat loose, crumbly	High	Medium
Sandy	Usually gritty not very sticky	Generally loose	Low	High

Chart #5D- Soil Sample Description Card with More Details

Soil sample number: _____ Collected by: _____ Date: _____

Describe the organic matter in your soil sample._____

Why are pore spaces so important in soils? _____

_____

Why is it important for soil to have good drainage?_____

_____

Describe the perfect physical traits of soil for a garden or an agricultural field.

_____

_____

Describe the perfect traits of soil for a large building or major highway.

_____

_____

Activity 6: Telling Others!

Supplies needed: Pen and paper

Write the words that first come to your mind when you hear the word "soil" (*The teacher will write the words on the board*). With your newfound understanding about soils write a poem, give a talk, write a report, or make a drawing to help others better understand soil.

References:

Soil Information web sites-

NRCS Information Tidbits for Teachers and Students
http://www.nrcs.usda.gov/feature/education/ or http://soils.usda.gov/teachers.html
Lesson Plans and other resources: http://soils.usda.gov/education/resources/k_12/
S.K. Worm Answers Your Questions About Soils and Stuff
http://www.nrcs.usda.gov/feature/education/squirm/skworm.html
NRCS Soils web site. "Helping People Understand Soils": http://soils.usda.gov/
NRCS Indiana soils information: http://www.in.nrcs.usda.gov/soils.html
or: http://www.in.nrcs.usda.gov/mlra11/index.html
Links to other organizations concerning soils: http://soils.usda.gov/education/organizations/
Additional soils resources: http://www.in.nrcs.usda.gov/mlra11/soilresources.html
Purdue University Agronomy (The study of crops & soils) K-12 Web Site:
http://www.agry.purdue.edu/k12_index.asp
NSTA & NRCS “Dig In-Hands-on Soil Investigations” booklet information:

http://www.nsta.org/pubs/nstapress/pb159X/default2.asp or
http://soils.usda.gov/education/resources/k_12/dig_in/

NRCS & SWCS "Soil Biology Primer":
http://soils.usda.gov/sqi/soil_quality/soil_biology/soil_biology_primer.html,
call 1-800-THE-SOIL for copy of booklet or go to: http://www.swcs.org/f_publications.htm and look under books.

Purdue University Demonstrations in Soil Science:
http://www.agry.purdue.edu/courses/agry255/brochure/brochure.PDF

State of the Land: Soils: http://www.nrcs.usda.gov/technical/land/soils.html
Natural Resource Data and Analysis http://www.nrcs.usda.gov/technical/nri_data.html
Maps, Imagery and Data Resources http://www.nrcs.usda.gov/technical/maps.html
State Soils: http://soils.usda.gov/gallery/state_soils/
Soil Science Glossary: http://www.soils.org/sssagloss/
National Soil Survey Handbook http://soils.usda.gov/technical/handbook/
Soil Survey Manual: http://soils.usda.gov/technical/manual/
Other Technical Soil Resources: http://soils.usda.gov/technical/
World Soil Resources: http://www.nrcs.usda.gov/technical/worldsoils/

Contact the Soil & Water Conservation Society-

Hoosier Chapter- SWCS at: www.hoosierchapterswcs.org or International SWCS at:www.swcs.org

The Hoosier Chapter of Soil and Water Conservation Society (SWCS), Public Information and Education (P&IE) Committee developed this environmental education aid. Send suggestions and comments on this education aid to: Ron Lauster, Hoosier Chapter SWCS, 15211 Valley View Dr., Carmel, IN 46032 or email comments to: rc.lauster@att.net