FIELDWORK: HORIZONS UNDER GROUND: DIGGING THROUGH WETLAND SOIL

This lesson is based on "Do You Dig Wetland Soil?," from WOW!: The Wonders of Wetlands curriculum.

The Basics:

Grade Level
5 - 8

Subject areas
Science

Duration
80 minutes

Number of Docents Needed: 2

Summary

Students collect soil samples and compare the physical characteristics of each. The students learn how to determine different soil types based on soil texture, structure, and color.

Objectives

Students will:

- use keys to recognize different types of soil.
- describe physical differences between wetland soil and coastal terrace prairie soil.
- infer as to why wetland soil and coastal terrace prairie soil might have different characteristics.

California Content Standards Addressed

Grade Six - Science content 5.e: "Students know the number and type of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as soil composition.
Grade Six - Science content 6.b: "Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable."
Grade Six - Science standard 7.c: "Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom."

Outline

There are five parts to this lesson:
1) Physical characteristics practice (25 minutes)
2) Group discussion and walk to reserve (15 minutes)
3) Soil sampling near the water (15 minutes)
4) Group discussion and walk to the classroom (20 minutes)
5) Closing circle (5 minutes)

Materials

1. Physical Characteristics Practice

1 zip-lock bag each of sand, silt, and clay
various bags or jars of different soils with their locations of origin marked on the side
1 empty soil sampling tube
1 soil sampling tube already filled with soil
1 soil sampling tube for each group of 3-4 students
*(you may have to water several spots on the ESHA a few days prior to the field trip if the soil is very dry and hard)

for each student:

1. pencil and clipboard
2. Soil Color Chart (in teacher's kit)
3. Soils Data Chart, 2 pages (Appendix A)
4. 1 hand lens

Vocabulary

physical, characteristic, engineer, hydrologist, texture, structure, horizon

Background Material

Physical Characteristics of Soil Composition

Soil composition

Soil is classified according to its different properties. There are three primary sets of properties in soil: physical, biological, and chemical. There is a huge variation depending on the different combinations of types and quantities of minerals and plant materials from which they are formed. Individual units of soil are analyzed in terms of these properties to determine its classification.

Physical characteristics

Physical properties of soil are determined from the quantity and types of undissolved minerals, produced by the weathered parent material and weathered surface rocks. The physical characteristics of soil used in analysis are **color**, **texture**, and **structure**.

Color can tell a great deal about soil. Generally darker soils are more fertile, because decomposed organic material, or humus, is dark. Red or reddish brown soils, such as those found in the Southwestern U. S., indicate that the weathered rocks forming that soil contain large amount of iron oxide, and that the soil was formed in an arid environment. Soils that are somewhat yellowish can indicate generally low fertility or poorly drained land. Finally, gray soil can mean it is either low in iron or oxygen, or contains higher levels of an alkaline salt like calcium carbonate.

The **texture** of soil is created by the proportions of each of three different soil particles in the sample. These three types of particles are sand, silt, or clay. The size of the particle determines its type. Sand particles are the largest, between 2 to 0.05mm in diameter. They can be seen with naked eye and feels rough or gritty. Silt particles are between 0.05 to 0.002 mm. They can hardly be seen without a microscope and feel smooth, like flour. Clay particles are smaller than 0.0002mm, are invisible to the naked eye, and feel slick and gummy when wet. Soil is put into a textural group depending on the proportions of these three particles.

The texture of a soil has a huge impact on its potential productivity. Sandy soils cannot store much water or organic materials. Clay soils hold on to too much water and do not allow enough aeration for best plant growth.

Structure is the shape of a soil based on its physical and chemical properties. It is important because the structure of the soil determines the amount of water infiltration, water movement through the soil, heat transfer, and aeration. A ped is an individual unit of soil structure.

Soil structure can be directly affected by human action, such as through the addition of compost or other organic materials, or by the addition of minerals such as gypsum to help break up heavy plates of clay soils.

Relative Dating

It is possible to tell younger soil from older soil when looking at the layers, or horizons, of the soil. In general, unless the area has been disturbed, older soil is found at the bottom layers and the top layers will be comprised of newer soil. This occurs because as sediment is washed into a new area by wind or water, it settles on top of sediment that is already settled in that spot.

Procedure

1) Physical characteristics practice (25 minutes)

- Show soil sampling tube to the students. Ask if anyone knows what it is for.
- Show students a soil sampling tube that is already filled with soil. Demonstrate how you push the sampling tube into the soil and pull it out to see what is underneath the top layer of soil, or topsoil. Ask if anyone knows who might want to know what is under the top layer of soil, or why. (prompt students to answer: farmers, to understand what kind of soil a plants' roots will grow into, structural engineers, to know what kind of soil a house or other building will be built on, hydrologists, to know how water can travel, or percolate, through the soil.
- Pass the tube filled with soil around the circle and ask students to say one thing they notice about the soil (prompt students to notice layers of soil, changes in color, changes in amount of moisture, presence of any rocks, plant material, worms or other invertebrates)
- Discuss with the group how to compare soils based on their physical characteristics like soil particle size, soil structure, soil color, and what each of these traits tells about the soil. Pass around bags of sand, silt, and clay when discussing soil particle size. Pass around bags with different soil from several locations when discussing how physical characteristics may change from place to place.
- Divide into groups of 3-4 students and give each group a soil sampling tube and a hand lens. Tell students they have 5 minutes to get a soil sample from the ESHA and bring it back to the outdoor classroom. Tell groups to bring their sample to an outdoor table. Be sure to point out areas appropriate for soil sampling.
- When groups return with samples, pass out science notebooks, clipboards, pencils, a Soil Color Chart, and a copy of Soils Data Chart (Appendix A) to each student. Tell students that the Soil Color Chart is similar to the color charts scientists use when they examine soil

- Ask students to record soil characteristics and observations in the Soils Data Chart. Hand lenses are used to observe particles of soil. Allow 10 minutes for this activity. Docents and interns should be available to help groups of students, following the prompts of page 1 of the Soil Data Chart.

2) Group discussion and walk to reserve (15 minutes)

- After 10 minutes of observation, gather the group in a circle. Ask students the following questions:

1. What soil characteristics did you observe? color? texture?
2. How did soil at the bottom of the hole differ from soil near the surface? in color? in texture?
3. Where is the oldest soil located? Which is the newest? Why? Does the soil at the top and bottom of the tube look different?
4. Ask students if they can tell where the water and soils in their sample area come from. What watershed drains to this spot?

- Collect soil from sampling tubes to return to the ESHA.
- Instruct students to gather their clipboards, data sheets, pencils, and sampling tubes to walk to the reserve to sample another soil.

3) Soil sampling near the water (20 minutes)

- Repeat procedure from the Physical Characteristics Practice section. Students can fill out their Soils Data Chart in the field. Docents and interns should help students.

4) Group discussion and walk back to the classroom (20 minutes)

- After 10 minutes of observation, gather the group in a circle. Ask students the following questions:

1. What soil characteristics did you observe? color? texture? Any differences from between Reserve soil and ESHA soil?
2. How did soil at the bottom of the hole differ from soil near the surface? in color? in texture? Were there differences from ESHA soil?
3. Where is the oldest soil located? Which is the newest? Why? Does either the old or new soil from the reserve look similar to either the old or new soil on the ESHA?
4. Ask students if they can tell where the water and soils in their sample area come from. What watershed drains to this spot? How is that different from the ESHA location?

- Collect soil from sampling tubes to return to the reserve.
- Instruct students to gather their clipboards, data sheets, pencils, and sampling tubes to walk back to the classroom.

5) Closing circle (5 minutes)

Pass a rock around the circle and ask each student to say one interesting thing they discovered today.

Extensions

Hands-on restoration gardening project
Wetland Plant and Clay Tile Art

Bibliography/Resources used:

- WOW!: The Wonders of Wetlands. 2003: Environmental Concern Inc and The Project WET International Foundation.

Appendices

WERC Soils Data Chart (page 1 of 2)

How can you describe your soil? Record these words or phrases that apply to each of your soil samples in the chart on the next page.

Texture/moisture: Rub the soil between your fingers. Choose words that describe how it feels.

- *dry, moist, wet, very wet*, or *drippy*
- *falls apart, sticks together, sticky* (sticks to fingers)
- *feels like clay* (easily molded into shapes)
- *slippery, oozes* (extrudes between fingers when you squeeze it)

Soil particles: Draw the size and shape of the particles. What is the sample made of?

- *sand* (feels gritty)
- *minerals* (tiny bits of rock)
- *clay* (easily molded)
- *silt* (like flour or powder, slippery when wet)
- *pebbles*
- *organic matter* (bits of leaves, twigs, bark, etc.)

Color: Use your color chart.

Other features or creatures:
What does the soil smell like? List or describe any rocks, dead plants, or other nonliving materials in the soil. List or describe any living things such as worms, roots, or insects. Do you see any roots with "rusty" red or orange soil around them?

WERC Soils Data Chart (page 2 of 2)

Record the words or phrases that apply to each soil sample in the charts below.

ESHA Soil Sample

Depth from Soil Surface	Texture/Moisture	Soil Particles	Color	Other Features or Creatures
Top of Soil Core/Sample				
Middle of Soil Core/Sample				
Bottom of Soil Core/Sample				

Reserve Soil Sample

Depth from Soil Surface	Texture/Moisture	Soil Particles	Color	Other Features or Creatures
Top of Soil Core/Sample				
Middle of Soil Core/Sample				
Bottom of Soil Core/Sample				

Write down one conclusion about why the soils might be different at the ESHA site compared to the Reserve site.

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