

Professor Profile looks over the horizon

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Objective of the Lesson:

This exercise is designed to introduce students to:

- ✧ Differences that exist in soil properties with depth.
- ✧ The factors that influence a soil's development (soil forming factors).
- ✧ The impact of soil compositional differences on land use.

Standards Addressed:

Science

K-3	4-5	6-8
Standard 1 <i>Nature and Application of Science and Technology</i> A-1, A-2	Standard 1 <i>Nature and Application of Science and Technology</i> A-1	Standard 1 <i>Nature and Application of Science and Technology</i> A-1
Standard 2 <i>Materials and Their Properties</i> A-1	_____	_____
Standard 5 <i>Earth's Dynamic Properties</i> A-1 B-1	Standard 5 <i>Earth's Dynamic Properties</i> A-2	Standard 5 <i>Earth's Dynamic Properties</i> B-2
Standard 8 <i>Ecology</i> A-1	_____	_____

Materials Needed:

Visual aids

- ✧ Poster of food-related items that will help them understand what a horizons and profiles are (cakes, Oreo's, Neapolitan ice cream, smores, etc.).
- ✧ Poster of the 5 soil forming factors and how they are inter-related
- ✧ Large cards with the soil horizon symbols (O, A, E, B, C, R) on them for the kiddy profile.
- ✧ 3 shovels or hand trowels

Soil Monolith construction materials

- ✧ 1 ¼ " piece of clear plastic tubing for soil profile (I used a fluorescent light protector purchased in the electrical department at Home Depot)
 - ✧ 1 ¼ " wooden disks to insert in the end of the profile tubes (I used a 1 ¼ " deadbolt drill to make the wooden disks and filled the center hole with silicon gel)
 - ✧ Silicon sealant to fill hole in wooden end caps
 - ✧ Elmers white glue to hold wooden caps in place
 - ✧ Various horizon materials (Rocks, sand, leaf litter, top soil etc (O-R))
 - ✧ Horizon labels
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Teaching Tips:

- ✧ Students will work in groups of six, however each student will make their own monolith.
 - ✧ Each group should have a set of cards with the soil profile letters.
 - ✧ When describing the master horizons a pre-constructed soil monolith would be useful. However, a poster showing the soil horizons is also sufficient.
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Procedure:

1. What is a horizon? Relate soil horizons to things they have seen before. Use the visual aids here
 - ✧ The sun sets on the horizon
 - ✧ Cakes have horizons
 - ✧ Hamburgers have horizons (bun, lettuce, tomato, onion, cheese, burger, etc.)
 - ✧ And yes, even soils have horizons.
2. Describe the master horizons.
 - ✧ O - stands for organic. Like the Oreo cooking, the top layer is normally dark and composed of things like sticks, leaves, dead animals and anything else that might fall to the earth and start decomposing.
 - ✧ A - Mixing of mineral from below and organic material from above commonly known as topsoil (what they plant plants in).
 - ✧ E - Exit (Elluviation). Materials leave this horizon and end up in the B horizon. Influenced by rainfall, more of it, more movement and visa versa.
 - ✧ B - Into (Illuviation). Materials leave the horizon above and accumulate in this horizon. This is why the E horizon is normally lighter than the B.

- ✧ C - Take two rocks and rub them together, or add a couple of drops of vinegar or HCL, to show them how the rock may weather and begin to form the overlying soil. Use different types of rocks to show them how soils formed over/from different parent materials will have different properties
 - ✧ R - Parent Material- Sandstone, shale, limestone. This is the bedrock.
3. Not all soil profiles are the same. Introduce the soil forming factors.
- ✧ Time - The factors below take place over periods of time from hundreds to thousands of years. The soil profiles will develop over time making a soil in the early stages quite different than a well-developed soil.
 - ✧ Climate - The climate of the area in which a soil forms affects the weathering of the parent material, the transport of sediment, etc. This is an appropriate time to discuss the different soils the students think may be found in hot environments vs. cold environments, moist vs. dry, etc. The freeze-thaw cycles that may take place can also be discussed.
 - ✧ Organisms - The living organisms that depend on the soil for nutrients and water can affect the makeup of the soil. This includes plants, worms and humans. Also, waste materials and dead plants are eventually decomposed and added to the soil.
 - ✧ Parent material - The type of material that is the source for soils can differ and when weathered produce different sediments that will make up the soil.
 - ✧ Topography - The location of a soil can change the ways in which the climate may affect the soil. Soils on steeper slopes will differ from those on shallower slopes in vegetation, water runoff, etc.
4. Kiddy Profile
- ✧ Have the students each take a letter corresponding to a horizon. Have them line up accordingly O-R.
 - ✧ This exercise is designed to further emphasize the order of the horizons that occur within the soil profile below, and prepare them for monolith construction.
5. Soil Monolith Construction
- ✧ Monolith- One (mono) example of the Lithosphere (the sphere of matter covering the Earth's surface roughly down to bedrock), hence the name Monolith.
 - ✧ Have the kiddies pick up the materials to make the profile. With the knowledge they have just absorbed, they can begin to build their soil profiles. There will be ample construction supplies for them to build and label the profiles.
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Check for understanding:

Possible Questions

1. Describe the structure of soil.
2. How is time a factor in the formation of soils?
3. Describe how a soil formed on a steep slope may differ from a soil formed in an area with very shallow topography.
4. How are the upper most horizon and the lower most horizon most different in soils?

Suggested Answers

1. Soil is made up of horizons or layers that can be differentiated by their grain size, percent organic material and color.
 2. Young soils will look very different from soils that have had hundreds or thousands of years to form. Older soils will be more likely to contain all of the expected horizons. The horizons may also be much more distinct in older soils.
 3. The vegetation in steep sloped areas will differ from shallow areas, which indicates a difference in soil type. Soils at the bottom of a hill will receive more runoff than those at the top. Minerals and nutrients will also accumulate differently in areas of different topographic relief.
 4. The upper most horizon (O horizon) will contain more organic material than the lowest horizon (R horizon). The R horizon is the bedrock material and will contain very little organic material.
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Summary of learned material:

Soils are a very important part of our lives. Certain soils are beneficial for agricultural purposes, while others are used to build roads. Factors such as climate and topography can affect soils and make thousands of different types. Soil types are differentiated by the presence, or absence, of six horizons. These horizons differ in composition, thickness and grain size. Understanding soil types not only requires an understanding of the standard horizons, but also the factors that can change these horizons.

Additional Resources:

General Soil Formation sites:

<http://interactive.usask.ca/ski/agriculture/soils/soilform/index.html>

Soil Profiles:

http://interactive.usask.ca/ski/agriculture/soils/soilform/soilform_prof.html

Soil Forming Factors:

http://interactive.usask.ca/ski/agriculture/soils/soilform/soilform_fact.html

<http://ltpwww.gsfc.nasa.gov/globe/soilform/parmat.htm>

<http://www.soils.umn.edu/infoserv/orgs/mapss/soilformingfactors.html> - Good images.

Soil Zones:

http://interactive.usask.ca/ski/agriculture/soils/soilform/soilform_zone.html