Activity 33: Soil Horizons

Maine Geological Survey

Objectives:

The purpose of this laboratory exercise is to examine soil horizons in the classroom and to have students realize the nature of the components in each horizon.

Time:

This activity is designed to last approximately 45 minutes.

Background:

As bedrock weathers to form soil, different layers or horizons are formed. Classifying these layers helps in the identification of soil types. The capital letters O, A, B, C, and R represent the master horizons (see Figure 1). Soil scientists will break down each of the master horizons into sub-horizons, usually designated by a letter and number combination, A1 for example.

The O horizon is composed of organic materials and is usually found in the top 2 inches of soil. The A horizon extends from 2 inches to 10 inches in depth and is a surface mineral zone where the mineral grains have been leached by organic acids and darkened by humus; humus is the final decay product of the organic materials in the O horizon. The B horizon, which extends from 10 inches to 30 inches in depth, is the layer which contains the maximum concentrations of mineral materials such as iron, silicate clay particles, aluminum oxides, and similar materials. The C horizon extends from the

bottom of the B horizon to the R horizon. The C horizon is composed mostly of loose, larger pieces of parent material. The R horizon is the parent material, the solid bedrock.

Each soil is different due to different bedrock and weathering conditions. Some soils may not show all of the above horizons, while other soils may clearly show the development of each layer. The thicknesses of the individual layers may vary greatly.

Materials:

This lab requires a spray bottle filled with water, a spade and possibly a trowel, and heavy duty plastic sandwich bags; Zip-Loc bags are ideal.

Procedure:

This lab activity is designed to be used when the soil is inaccessible to the students due to frozen ground in the winter. The instructor will need to collect the soil horizon samples prior to the ground becoming frozen. One excellent place to gather samples is in a recently excavated road cut or pit where the horizons have already been exposed.

After exposing the various soil horizons in a continuous vertical sample, the instructor will carefully scrape a generous sample into a plastic bag and then seal the bag. It would be preferable to have a number of samples from each layer depending on the size of your class. Label the sandwich bags with either the soil horizon symbols or some code of your own devising. Also be certain to note the location and date that the sample was collected.

If the horizons, or the contacts between the horizons, are hard to identify in the soil you have chosen to sample, spray the exposed horizons with a light mist of water; this will create greater brightness and contrast in the colors and make the layers more discernible.

When this activity is done in the classroom, the bags from one soil are brought out and the students are instructed to put the bags in the proper order. This involves student groups looking at each other's sample bags as well as their own and sharing information. A variation on this is to label the bags with student names and let them arrange themselves, and their samples, in the correct sequence.

After some discussion, during which the instructor makes certain that the students have gotten the soil samples into their correct horizon sequence, the bags may be opened and examined to let the students see the different textures and properties of each horizon. More accelerated classes could test for the presence of iron and aluminum oxides.

Follow-Up:

A variation on this activity is to take a clear, plastic tube and fill it with a sequence of soil horizons of a particular soil. In this fashion a permanent display of a soil profile can be shown in the classroom. Students can be encouraged to bring in materials and make profiles of the soil type(s) on their land. Calendars and posters are often shipped in clear plastic tubes. Four foot long fluorescent light bulb protectors are sold in many hardware stores for about $1.50 each.

NOTE: The process of fixing a soil profile into a prepared wooden tray, which has been a common practice over the years, involves the use of plastic powders and solvents (methyl ethyl ketone, and acetone at a minimum) which are probably proscribed in your school laboratory. While instructions are still available on the mechanics of this process, unless you have experience in this technique, AND have access to a laboratory with all the needed materials and equipment (magnetic stirrers, 1000 ml graduates etc.), it is best the make soil profiles in the plastic tubes.

References:

An excellent resource available free of charge at Soil Conservation Service offices (see Appendix B) is the booklet entitled Conserving Soils. This contains transparencies and duplicating masters for use in the classroom.

Activity developed independently by both David Hersey and Kevin Godsey, in conjunction with the 1991 CREST intern program.

Name_____

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Student Sheet

Purpose:

To learn about and be able to identify soil horizons.

Materials:

Students should work in groups as designated by the instructor. Each group will need the following: a sample bag containing material from one horizon of a local soil profile.

Part I:

The undisturbed, natural development of a soil produces a series of layers called horizons. These horizons are assigned letters such as A, B, C and so on; each horizon with the same letter will have similar overall properties and characteristics, although specific details will vary from soil to soil. All of the horizons put together in the correct sequence are called a soil profile. Each group of students will be given a plastic bag with a sample of soil from ONE horizon of a local soil's profile. Your group must figure out where in the profile your sample fits. Without opening the bag, examine your sample and record any information you can obtain by this visual inspection. Record this information below:

Color: _____

Grain sizes: _____

Texture: _____

Other: _____

Next, examine the soil information that other groups have collected; using this information, figure out where your sample fits into the overall profile. Your teacher will tell you the total number of horizons you are working with. Record below your sample's position in the soil profile; sketch the profile showing your group's sample relative to other samples.

Part II:

Once you have established the correct sequence of samples in your profile, place each group's sample bag, in correct sequence, on the floor or lab table. Examine this profile and describe it.

Part III:

Retrieve your group's sample, open the bag, and examine the contents. Note the smell, texture, color, feel, and consistency of the sample. Record this data.

Texture: _____

Feel: _____

Consistency: _____

Color: _____

Smell: _____

Components: _____

Other: _____

Part IV: Return your sample to its bag at the end of the lab.

Questions:

1. List three factors which would affect the nature of a soil horizon.

2. Explain how each factor listed in question # 1 might affect a soil horizon.

3. Will all soil profiles, even in the same geographic area, always look the same? Explain your answer.

4. What role do you think rainwater plays in determining the nature of EACH of the soil horizons? Explain your answer.