Soil Bulk Density Protocol

Purpose

To determine the bulk density of the soil

Frequency

Three samples for each horizon

Materials and Tools

For Recording Data During All Measurements:

- Bulk Density Data Work Sheet
- Small, flat can with lid or plastic wrap
- Nail (first time can is used only)
- Short section of 2"x4" (NOT the same as the soil temperature block!)

For Drying and Sieving Samples:

- Newspapers or plastic plates
- #10 sieve (2 mm mesh openings)
- Liter-size bags, jars, or containers for storing soil samples
- Balance
- Rubber gloves

For Bulk Density

- Drying oven or microwave
- 100 ml graduated cylinder to determine volume of rocks
- Balance

How to Measure Bulk Density and Prepare Samples for Other Lab Analyses

Bulk Density (Before going to the Field)

- ❑ 1. Obtain a small sample can. Rinse the can well in HOT water. Dry completely.
- ❑ 2. Mass the clean, dry can. Record on data sheet (Sample 1, B).
- ❑ 3. Fill the can as full as possible with water. If your can has a hole in it, cover the hole with a finger.
- ❑ 4. While you are still at the sink, drain the water into a graduated cylinder. You might have to do this twice, so stop when you get to exactly 100ml, empty the cylinder and repeat. Add the volumes to get the final volume of the container. Record on Data Sheet . (Sample 1, A)

Bulk Density (In the Field)

- ❑ 1. Take your sample one of the following three ways, depending on which type of soil sample you are taking:

  Soil Pit:

  Place the can against the first horizon you wish to sample. (Be sure there is a hole in the bottom of the can… if not, use the hammer and nail to create one.)
  Place the short 2x4 at the bottom of the can. Hammer the can into the soil until it is completely full. Dig the can out with a trowel, and scrape the top so that the soil is even with the top of the can. Cover the can. Label the can with your group number, hour, and

sample number. Do this three times for each horizon.

Near Surface:

Scrape any grass and debris from the soil surface. Place the can on the cleared soil surface. Place the short 2x4 on top of the can and hammer the can into the soil until it is completely full. Dig the can out with a trowel, and scrape the top so that the soil is even with the top of the can. Cover the can. Label the can with your group number, hour, and sample number.

Bulk Density (Back in the laboratory or classroom)

- 1. Weigh the sample as soon as you get back to the classroom. (Record on data sheet C)
- 2. Dry the samples in their containers following the directions given for drying samples in the *Gravimetric Soil Moisture Protocol.*
- 3. Weigh each dry bulk density sample in its container . (Record this on data sheet D)
- 4. Rocks don't hold water or store nutrients, so they don't contribute to the bulk density of soil. To determine the density of any rocks that are in a sample use the following procedure (if there are no rocks in your sample, stop at 4.4):

    4.1 Place a large piece of paper (such as newspaper) on a table and put the #10 (2 mm openings) sieve on top of it. Pour one sample into the sieve.

    4.2 Put on rubber gloves to avoid contaminating your sample with acids from your skin.

    4.3 Carefully push the dried soil material through the mesh onto the paper. Do not force the soil through the sieve as this may bend the mesh openings. Rocks will not pass through the mesh and will stay on top of the sieve. **If no sieve is available, carefully remove the rocks by hand.**

    4.4 Save the sieved soil from each sample for the other lab analyses.

    4.5 Weigh the rocks, and record this weight on the Bulk Density Data Work Sheet. (F)

    4.6 Place 30 mL of water in a 100 mL graduated cylinder, and without spilling, add the rocks to the water. Read the level of the water after all the rocks have been added and record this value and the original volume of water on the Bulk Density Data Work Sheet. (G and H)

    As you add the rocks, if the volume of the water comes close to 100 mL, record the increase in volume, empty the cylinder and repeat the procedure for the remaining rocks. In this case, you must calculate and record the sum of the water volumes with the rocks and the sum of the water volumes without the rocks.

5. Subtract (D-B) to find the dry soil weight. Record at E

6. Determine the Bulk Density of your soil sample. [(E-F) / (A-I)] Record this value at J.

7. Repeat for the remaining two samples from each horizon. ***DO NOT*** throw away your sample; you will need it for several more protocols.