Soil Characterization:

Following this protocol, you and your students will:

1. expose the top 1 meter of soil
2. describe the exposed soil profile
3. take samples of each soil horizon
4. prepare soil samples for lab analyses
5. analyze the soil samples in the lab
6. review the data to understand your soil better

Sample *at least* two sites

Field measurements are done once at each site

Three replicate samples from each horizon are taken and reported one time for each site.

Soil Pit Technique:

First, obtain permission to dig a pit. Obey any and all safety precautions requested, and ask about power and water lines.

1. Starting from top, observe profile to determine properties and differences between horizons.
2. Place golf tee or marker at the top and bottom of each horizon to clearly identify it.
3. Look for: different colors, shapes, roots, the size and amount of stones, small dark nodules (called concretions), worms, or other small animals and insects, worm channels, and anything else that is noticeable.
4. First, obtain permission to take samples from the road cut, excavation, or other soil profile exposed by others. Obey any and all safety precautions requested. Ask about power and water lines.

Auger Technique:

1. Identify an area where you can dig four holes where the soil profiles should be similar.
2. Spread a plastic bag, tarp, board, or other surface on the ground next to where you will dig your first hole.

3. Assemble a profile of the top 1 meter of the soil by removing successive samples with the auger and laying them end-to-end as follows:
4. Identify each horizon and measure its thickness using the depth of the auger hole.

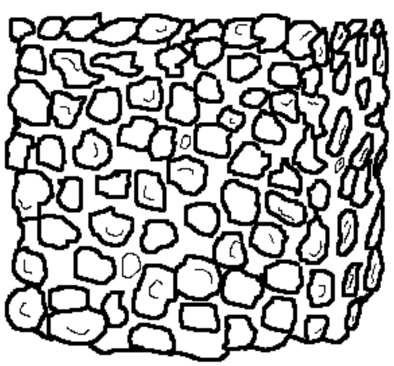
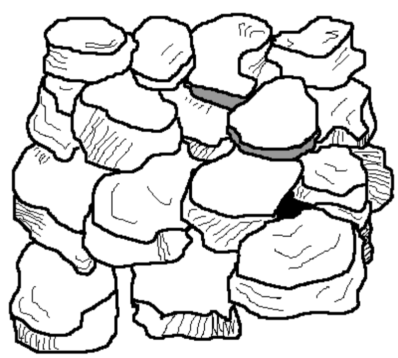
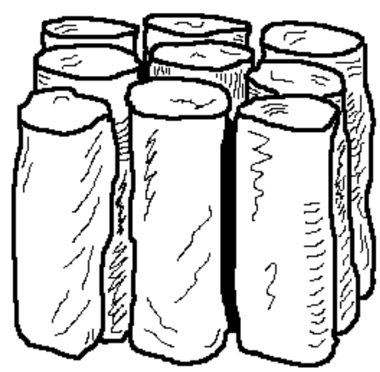
Surface Sample Technique:

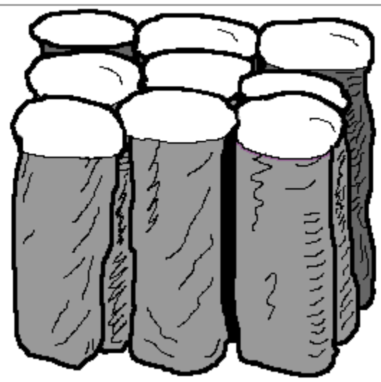
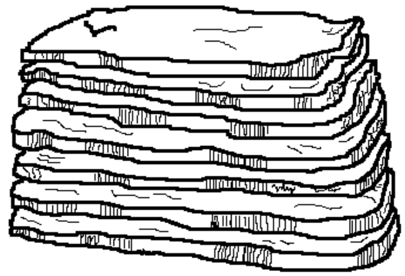
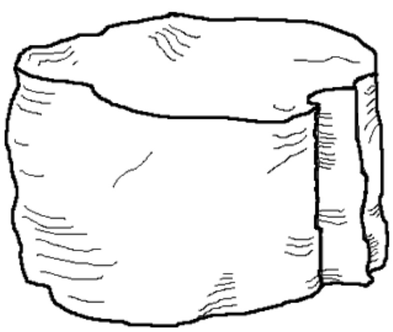
In situations where it is not possible to expose the top meter of soil, another option is to use the top 10 cm of soil as a horizon sample for soil characterization.

1. Use a garden trowel or shovel to carefully remove the top 10 cm of soil from a small area and set it on the ground.
2. Treat this sample as a horizon and proceed to characterize its properties.

To determine Soil Structure:

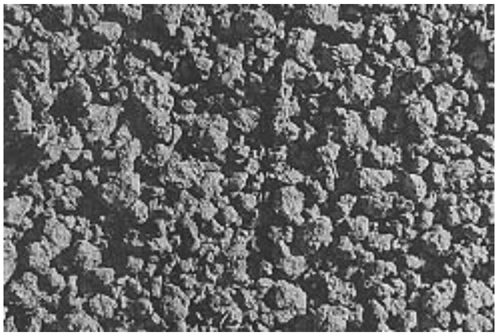
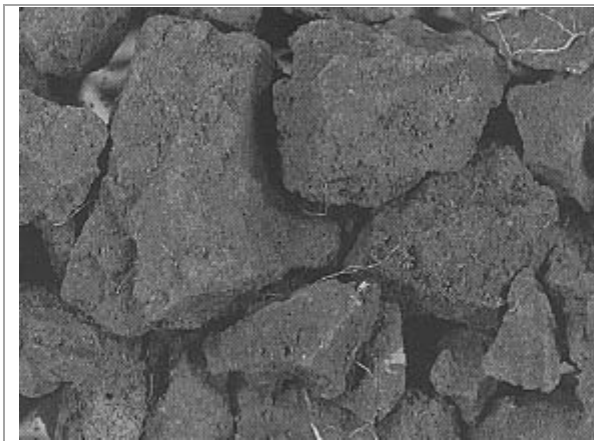
Soil structure is the shape that the soil takes based on its physical and chemical properties. Each individual unit of soil structure is called a **ped**. Take a sample of undisturbed soil in your hand (either from the pit or from the shovel or auger). Look closely at the soil in your hand and examine its structure. Possible choices of soil structure are:

		
Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.	**Blocky**: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.	**Prismatic**: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.

		
Columnar: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.	**Platy**: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.	**Single Grained**: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.
		
Massive: Soil has no visible structure, is hard to break apart and appears in very large clods.		

Below are some images of the different soil structures.

With Structure:

Granular		**Blocky**	
Prismatic		**Columnar**	
Platy			

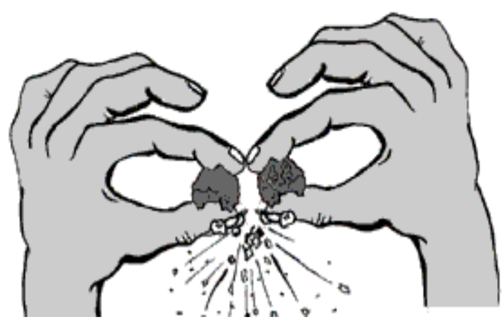
Structureless:

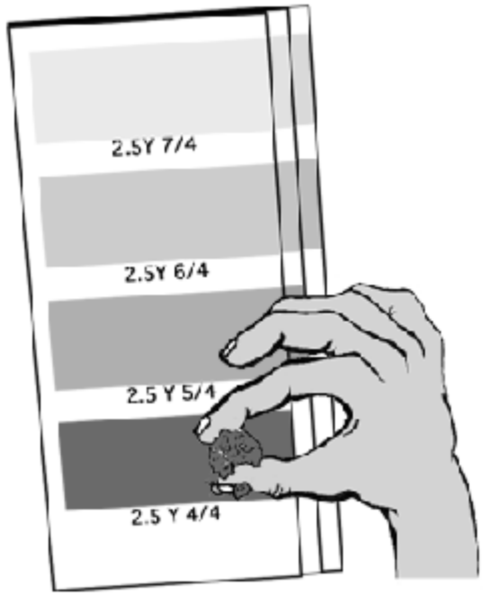
Single grained		**Massive**	

To Determine Soil Color: Use a Globe Color Chart which uses the Munsell System of Color Notation.

1. Take a ped of soil from each horizon and note on the data sheet whether it is moist, dry or wet. If it is dry, moisten it slightly with water from your water bottle.

2. Break the ped

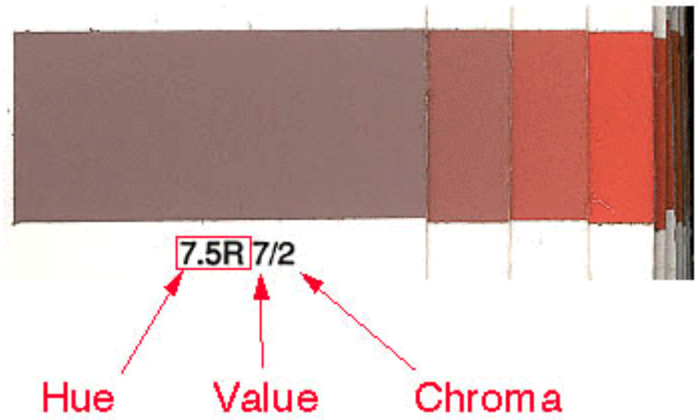




3. Stand with the sun over your shoulder so that sunlight shines on the color chart and the soil sample you are examining.

Note: Sometimes, a soil sample may have more than one color. Record a maximum of two colors if necessary, and indicate (1) the Main (dominant color) and (2) the Other (sub-dominant color).

Munsell Notation: The Munsell code below each color in the GLOBE color chart is a universal notation that describes the soils' color.



To determine Soil Consistence:

Take a ped from the top soil horizon. If the soil is very dry, moisten the face of the profile using a water bottle with a squirt top and then remove a ped to determine consistence.

(Repeat this procedure for each horizon in your profile.)

Holding it between your thumb and forefinger, gently squeeze the ped until it pops or falls apart. Record one of the following categories of soil consistence on the data sheet.

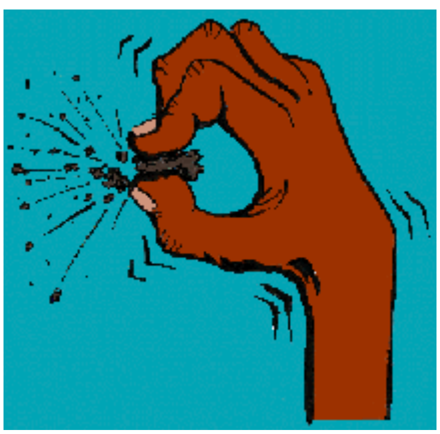
Loose

You have trouble picking out a single ped and the structure falls apart before you handle it.*

* Soils with "single grained" structure always have loose consistence.

Friable

The ped breaks with a small amount of pressure.



Firm

The ped breaks when you apply a good amount of pressure and dents your fingers before it breaks.

Extremely Firm

The ped can't be crushed with your fingers (you need a hammer!).

Relative Size Comparison of Soil Particles

Barrel

Plate

Coin

Clay
(feels sticky)

(< 0.002 mm, USDA) (<

Silt
(feels floury)

(0.05 - 0.002 mm, USDA)

Sand
(feels gritty)

(2.00 - 0.05 mm, USDA)

To determine Soil Texture, consult resource number 5, “Guide to Texture by Feel”.

Presence of Roots and Rocks:

Presence of Roots

Observe and record if there are **none**, **few**, or **many** roots in the horizon.

Presence of Rocks

Observe and record if there are **none**, **few**, or **many** rocks* in the horizon.

* A rock is defined as being larger than 2 mm in size.

Globe Soil Characterization protocols
NASA’s Goddard Space Flight Center