

Soil Characterization Protocol

Field Guide

Task

Identify, measure and record the horizons in a soil profile at a study site. Measure and record the physical and chemical properties that characterize each horizon. Photograph the soil profile. Collect soil samples from each horizon.

What You Need

- Spray mist bottle full of water
- Golf tees, nails or other marking device that can be pushed into a soil horizon
- Trowel, shovel, or other digging device
- Soil color book
- Marking pen
- Camera
- Pencil or pen
- Acid bottle filled with distilled vinegar
- Soil Horizon Definitions page* from [Site Definition Sheet](#)
- Paper towels
- Meter stick or tape measure
- Rolling pin, hammer, or other utensil for crushing peds and separating particles

In the Field

Identifying and Measuring Horizons

1. Make sure the sun shines on the profile if possible.
2. Use a trowel to scrape a few centimeters of soil off of the profile to expose a fresh soil face.
3. Determine whether the soil profile is moist, wet, or dry. If the soil profile is dry, moisten it with the spray mist bottle.
4. Start at the top of the profile and observe the characteristics of the soil moving towards the bottom of the profile.
5. Look carefully at the soil profile for distinguishing characteristics such as color, texture, shapes, roots, rocks, small dark nodules (called *concretions*), worms, small animals, insects, and worm channels. These observations will help to define the horizons.
6. Working in a straight vertical line, place a marker (such as a golf tee or nail) at the top and bottom of each horizon to clearly identify it. Be sure there is a consensus from all of the students regarding the depths of the soil horizons.
7. Measure the top and bottom depth of each horizon beginning at the top (surface) of the profile. Start with the meter stick or tape measure at 0 cm at the top of the profile. Note the depths at which each horizon starts and ends.
8. Record the top and bottom depth of each horizon on the *Soil Horizon Definitions page*.



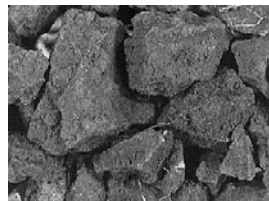
Measuring Structure

1. Use a trowel or other digging device to remove a sample of soil from the horizon being studied.
2. Hold the sample gently in your hand and look closely at the soil to examine its structure.
3. Come to a consensus with other students in the group on the type of soil structure of the horizon. Possible choices of soil structure are:

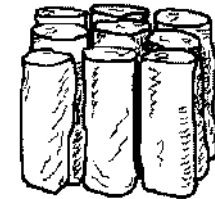
Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.



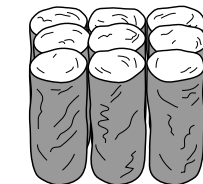
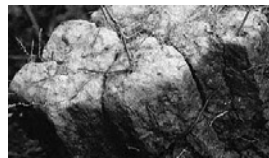
Blocky: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.



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 white, rounded 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.



In certain cases, soil samples may have no structure. These would be classified as either:

Single Grained: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.



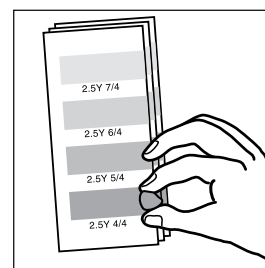
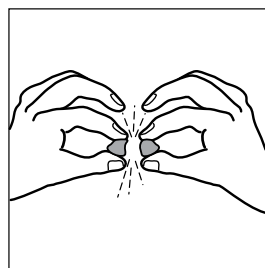
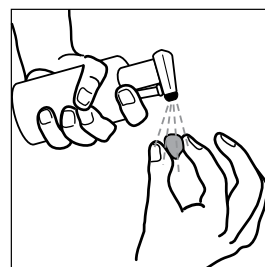
Massive: Soil has no visible structure, is hard to break apart and appears in very large clods.



4. Record the structure type on the *Soil Horizon Definitions* page from *Site Definition Sheet*

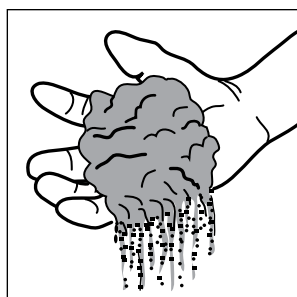
Measuring Main Color and Second Color

1. Take a ped from the horizon being studied and note whether it is moist, dry, or wet. If it is dry, moisten it slightly with water from your water bottle.
2. Break the ped and hold it next to the color chart.
3. Stand with the sun over your shoulder so that sunlight shines on the color chart and the soil sample you are examining.
4. Find the color on the color chart that most closely matches the color of the inside surface of the ped. Be sure that all students agree on the choice of color.
5. Record on the *Soil Horizon Definitions page* the symbol of the color on the chart that most closely matches the soil color that covers the largest area of the ped (dominant or main color). Sometimes, a soil sample may have more than one color. Record a maximum of two colors if necessary, and indicate (1) the dominant (main) color, and (2) the sub-dominant (second) color.

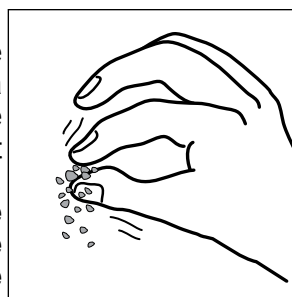


Measuring Soil Consistence

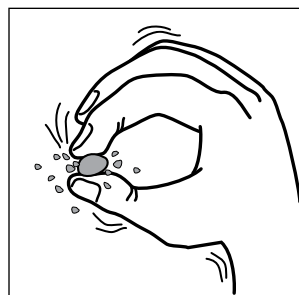
1. Take a ped from the soil horizon being studied. If the soil is very dry, moisten the face of the profile by squirting water on it, and then remove a ped for determining consistence.
2. Holding the ped between your thumb and forefinger, gently squeeze it until it pops or falls apart.
3. Record one of the following categories of soil ped consistence on the *Soil Horizon Definitions page*.



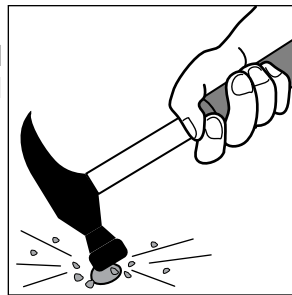
Loose: You have trouble picking out a single ped and the structure falls apart before you handle it. **Note:** Soils with **single grained structure** **always have loose consistence.**



Firm: The ped breaks when you apply a larger amount of pressure and the ped dents your fingers before it breaks.



Friable: The ped breaks with a small amount of pressure.



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

Measuring Soil Texture (for help with this category, refer to the Textural Triangle under "Frequently Asked Questions")

Step 1

- Place some soil from a horizon (about the size of a small egg) in your hand and use the spray mist bottle to moisten the soil. Let the water soak into the soil and then work it between your fingers until it is thoroughly moist. Once the soil is moist, try to form a ball.
- If the soil forms a ball, go on to **Step 2**. If the soil does not form a ball, call it a **sand**. Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

Step 2

- Place the ball of soil between your thumb and index finger and gently push and squeeze it into a ribbon. If you can make a ribbon that is longer than 2.5 cm, go to **Step 3**. If the ribbon breaks apart before it reaches 2.5 cm, call it a **loamy sand**. Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

Step 3

- If the soil:
 - Is very sticky
 - Hard to squeeze
 - Stains your hands
 - Has a shine when rubbed
 - Forms a long ribbon (5+ cm) without breaking,

Call it a clay and go to Step 4.

Otherwise, if the soil:

- Is somewhat sticky
- Is somewhat hard to squeeze
- Forms a medium ribbon (between 2-5 cm)

Call it a clay loam and go to Step 4.

Otherwise, if the soil is:

- Smooth
- Easy to squeeze,
- At most slightly sticky,
- Forms a short ribbon (less than 2 cm)

Call it a loam and go to Step 4.

Step 4

- Wet a small pinch of the soil in your palm and rub it with a forefinger. If the soil:
 - Feels very gritty every time you squeeze the soil, go to **A**.
 - Feels very smooth, with no gritty feeling, go to **B**.
 - Feels only a little gritty, go to **C**.

A. Add the word **sandy** to the initial classification.

- Soil texture is either:
 - sandy clay,
 - sandy clay loam, or
 - sandy loam

- Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

B. Add the word **silt or silty** to the initial classification.

- Soil texture is either:

- silty clay,
- silty clay loam, or
- silt loam

- Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

C. Leave the original classification.

- Soil texture is either:
 - clay, clay loam, or loam
- Soil texture is complete. Record the texture onto the *Soil Horizon Definitions page*.

Measuring Roots

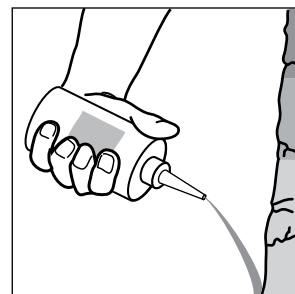
1. Observe if there are **none**, **few**, or **many** roots in each horizon.
2. Record your observation on the *Soil Horizon Definitions page*.

Measuring Rocks

1. Observe and record if there are **none**, **few**, or **many** rocks or rock fragments in the horizon. A rock or rock fragment is defined as being larger than 2 mm in size.
2. Record your observation on the *Soil Horizon Definitions page*.

Measuring Free Carbonates

1. Set aside a portion of the exposed soil to use for the free carbonates test. Make sure not to touch it with your bare hands.
2. Open the acid bottle and squirt vinegar on the soil particles, starting from the bottom of the profile and moving up. Be sure to use caution and point the bottle directly at the soil, not toward other students, especially toward eyes. If vinegar gets into your eyes, rinse with water for 15 minutes.
3. Look carefully for the presence of effervescence. The more carbonates that are present, the more bubbles (effervescence) you will observe.
4. For each horizon, record on the *Soil Horizon Definitions page* one of the following as the result of the Free Carbonate Test:
 - **None:** if you observe no reaction, the soil has no free carbonates present.
 - **Slight:** if you observe a very slight bubbling action; this indicates the presence of some carbonates.
 - **Strong:** if there is a strong reaction (many, and/or large bubbles) this indicates that many carbonates are present.



Photographing the Soil Profile

1. Place a tape measure or meter stick starting from the top of the soil profile next to where the horizons have been marked.
2. With the sun at your back, photograph the soil profile so that the horizons and depths can be seen clearly.
3. Take another photograph of the landscape around the soil profile.
4. These photos can be included in student research projects or used for comparison when exploring other exposed soil profiles.