Estimating Soil Texture

Sandy, Loamy, or Clayey?

Fact sheet outline:

- Sand, silt, and clay, page 1
- Soil texture triangle, page 2
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- Estimating soil texture by measurement, page 5

Note: For additional information on managing soils refer to CMG fact sheet #S-13, Managing Soil Tilth.

Sand, Silt, and Clay

Texture refers to the size of the particles that make up the soil. The terms sand, silt, and clay refer to relative sizes of the soil particles. Sand, being the larger size of particles, feels gritty. Clay, being the smaller size of particles, feels sticky. It takes 12,000 clay particles lined up to measure one inch. Silt, being moderate in size, has a smooth or floury texture.
The Size of Sand, Silt and Clay

<table>
<thead>
<tr>
<th>Name</th>
<th>particle diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very coarse sand</td>
<td>2.0 to 1.0 millimeters</td>
</tr>
<tr>
<td>Coarse sand</td>
<td>1.0 to 0.5 millimeters</td>
</tr>
<tr>
<td>Medium sand</td>
<td>0.5 to .25 millimeters</td>
</tr>
<tr>
<td>Fine sand</td>
<td>0.25 to 0.10 millimeters</td>
</tr>
<tr>
<td>Very fine sand</td>
<td>0.10 to 0.05 millimeters</td>
</tr>
<tr>
<td>Silt</td>
<td>0.05 to 0.002 millimeters</td>
</tr>
<tr>
<td>Clay</td>
<td>below 0.002 millimeters</td>
</tr>
</tbody>
</table>

Soil Texture Triangle
The soil texture triangle gives names associated with various combinations of sand, silt and clay. A coarse-textured or sandy soil is one comprised primarily of sand-sized particles. A fine-textured or clayey soil is one dominated by tiny clay particles. Due to the strong physical properties of clay, a soil with only 20% clay particles behaves as sticky, gummy clayey soil. The term loam refers to a soil with a combination of sand, silt, and clay sized particles. For example, a soil with 30% clay, 50% sand, and 20% silt is called a sandy clay loam.

Identifying texture by feel

**Feel test** – Rub some moist soil between fingers

- Sand feels gritty
- Silt feels smooth
- Clays feel sticky

**Ball squeeze test** – Squeeze a moistened ball of soil in the hand

- Coarse textures (sand or sandy loam) soils break with slight pressure
- Sandy loams and silt loams stay together but change shape easily
- Fine textured (clayey or clayey loam) soils resist breaking

**Ribbon test** – Squeeze a moistened ball of soil out between thumb and fingers

- Sandy or sandy soils won’t ribbon
- Loam, silt, silty clay loam or clay loam soil ribbons less than 1 inch
- Sandy clay loam, silty clay loam or clay loam ribbons 1 to 2 inches
- Sandy clay, silty clay, or clay soil ribbons more than 2 inches

Note: A soil with as little as 20% clay may behave as a heavy clayey soil. A soil needs 45% to over 60% sand to behave as a sandy soil.
Managing Semi-Arid Watersheds: Beaver Creek: Field Day 1: Determining Soil Texture by Feel

Soil Texture

Step 1 (Get and moisten sample)
Use the triangle to determine the soil texture of your horizon.
Place some soil from a horizon (about the size of a small egg) in your hand, and, using the spray mist bottle, moisten the soil. Let the water soak in and then work the soil between your fingers until it is the same moisture throughout. 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, go to Step 5.

Step 2 (Test for Clay)
A. If the soil:
- Is really 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 3.
Otherwise, go to B.
B. 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 3.
Otherwise, go to C.
C. If the soil is:
- Soft
- Smooth
- Easy to squeeze,
- At most slightly sticky,
- Forms a short ribbon (less than 2 cm)
Call it a loam and go to Step 3.
Otherwise, go to D.
D. If the soil forms a ball but no ribbon, go to Step 4.
E. Add the word sandy to the initial classification.
Soil texture is (check one): ❑ sandy clay,
❑ sandy clay loam, ❑ sandy loam
Soil Texture is complete.

Step 3 (Refine initial soil texture classification from Step 2 for relative amounts of sand and silt)
Wet a small pinch of the soil in your palm and rub it with a forefinger.
If the soil:
- Feels very gritty, go to E
- Feels very smooth, with no gritty feeling, go to F
- Feels only a little gritty, go to G

Step 4 (Test for loamy sand or silt)
If the soil:
- Forms a ball
- Forms no ribbon
- And is
H. Very gritty
Soil texture is: ❑ loamy sand
Soil Texture is complete.
Or
I. Very soft and smooth with no gritty feeling,
Soil texture is: ❑ silt
Soil Texture is complete.

Step 5 (Test for sand)
If the soil:
- Forms no ball and falls apart in your hand,
- Soil texture is: ❑ sand
Soil Texture is complete.

Free Carbonates
Working from the bottom of a profile up to the top, squirt vinegar in a straight line onto the soil. If free carbonates are present, they will “effervescence” or bubble when the vinegar reacts with them.

Record one of the following based on your observation:

None: you observe no reaction (the soil has no free carbonates).

Slight: you observe a slight amount of bubbling (the soil is coated with some carbonates).

Strong: you observe a strong reaction (many bubbles) (the soil has many carbonate coatings present).

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GLOBE Soil Characterization Field Protocols

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 consistency. Commonly found in sandy soils.
- **Massive**: Soil has no visible structure, is hard to break apart and appears in very large clods.

Soil Color
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. Stand with the sun over your shoulder so that sunlight shines on the color chart and the soil sample you are examining. Break the ped.
3. Compare the color of the moist inside surface with the soil color chart.

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).

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.

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

- **Loose**
- **Friable**
- **Firm**
- **Extremely Firm**
Identifying soil texture by measurement

1. Spread soil on a newspaper to dry. Remove all rocks, trash, roots, etc. Crush lumps and clods.
2. Finely pulverize the soil.
3. Fill a tall, slender jar (like a quart jar) ¼ full of soil.
4. Add water until the jar is ¾ full.
5. Add a teaspoon of powdered, non-foaming dishwasher detergent.
6. Put on a tight fitting lid and shake hard for 10 to 15 minutes. This shaking breaks apart the soil aggregates and separates the soil into individual mineral particles.
7. Set the jar where it will not be disturbed for 2-3 days.

8. Soil particles will settle out according to size. **After 1 minute**, mark on the jar the depth of the sand.

9. **After 2 hours**, mark on the jar the depth of the silt

10. **When the water clears** mark on the jar the clay level. This typically takes 1 to 3 days, but with some soils it may take weeks.

11. Measure the thickness of the sand, silt, and clay layers.
   a. Thickness of sand deposit __
   b. Thickness of silt deposit __
   c. Thickness of clay deposit __
   d. Thickness of total deposit __

12. Calculate the percentage of sand, silt, and clay.

   \[
   \frac{\text{clay thickness}}{\text{total thickness}} = \text{___ percent clay}
   \]

   \[
   \frac{\text{silt thickness}}{\text{total thickness}} = \text{___ percent silt}
   \]

   \[
   \frac{\text{sand thickness}}{\text{total thickness}} = \text{___ percent sand}
   \]

13. Turn to the soil texture triangle and look up the soil texture class.