Practical ecology
Laboratory 2

Soil texture, density and porosity

1. Soil texture

- Soil texture is defined as the relative proportion of sand, silt, and clay.
- Soil is made up of different-sized particles. Soil texture refers to the size of the particles that make up the soil and depends on the proportion of sand, silt and clay-sized particles, and organic matter
- Soil that contains equal amount of sand, clay, and silt called loam

Importance of soil texture

- Soil texture is one of the most important properties of soil, and greatly affects land use and management.
- It affects the amount of water and nutrient that a soil can hold and supply to the plant.
- Soil physical properties such as structure, and movement of air and water through the soil are affected by the texture.

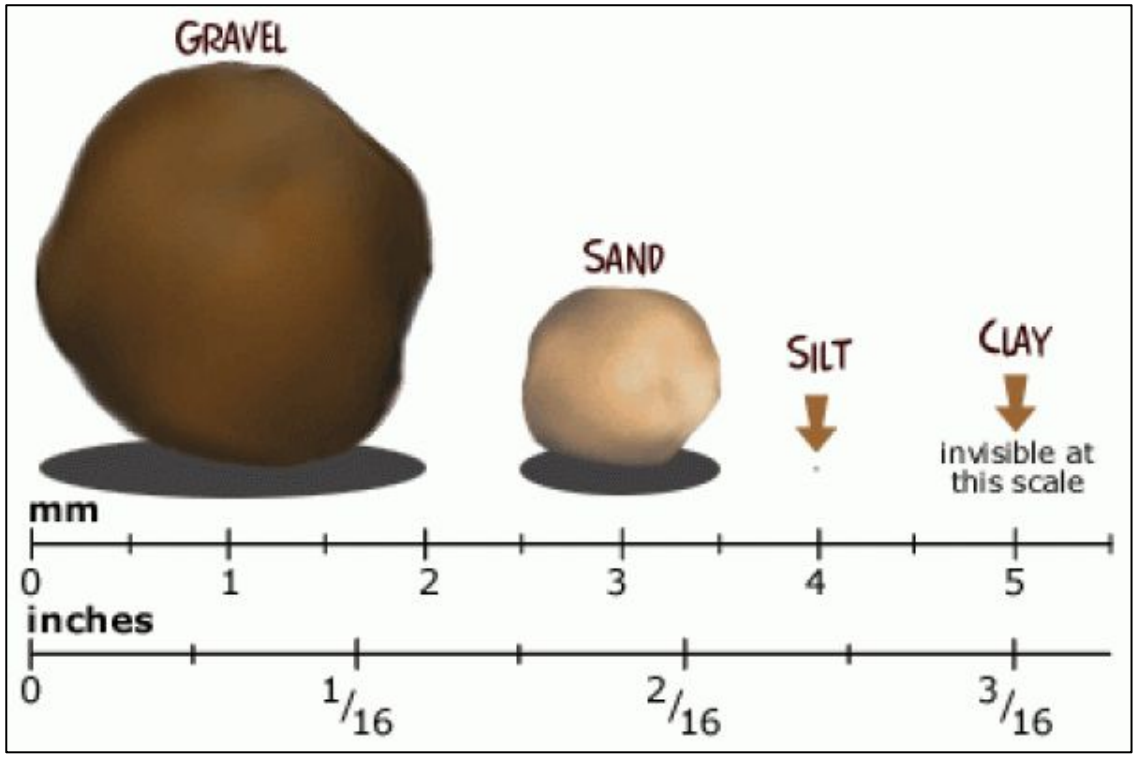
Soil types

1. Gravels: are soil particles that have diameters of more than 2 millimeter.

2. Sand particles soil particles smaller than gravel (<2.0-0.5 mm) in diameters with large pore space. This allows water to drain quickly and air to enter the soil. Sandy soils tend not to get waterlogged in winter but can be subject to drought during summer.

3. Silt particles are too small range of diameter (0.05-0.002mm) for us to see with our eyes. Silt soils have much smaller pore spaces but a lot more of them.

4. Clay particles are smaller than 0.002 mm in diameter. Clay soils are poorly drained and hold on to the water in their pore spaces for much longer.



How to determine soil texture

- Essentially, soil texture is determined by the amount of sand, silt or clay found in the sound
- The consistency of soil as determined by soil particle size

1. Take about 2 tablespoons of soil in one hand and add water, drop by drop, while working the soil until it reaches a sticky consistency.
2. Squeeze the wetted soil between thumb and forefinger to form a flat ribbon.
3. Determine the texture based on the length of the ribbon that can be formed without breaking.

Step Three

- Form a ribbon of soil between your forefinger and thumb
- Ribbon length:
  - < 2.5 cm = loam
  - 2.5 to 5 cm = clay loam
  - > 5 cm = clay

- Longer ribbon = greater clay content

2. Soil density

The soil density is expressed in well-accepted concepts as bulk density and particle density

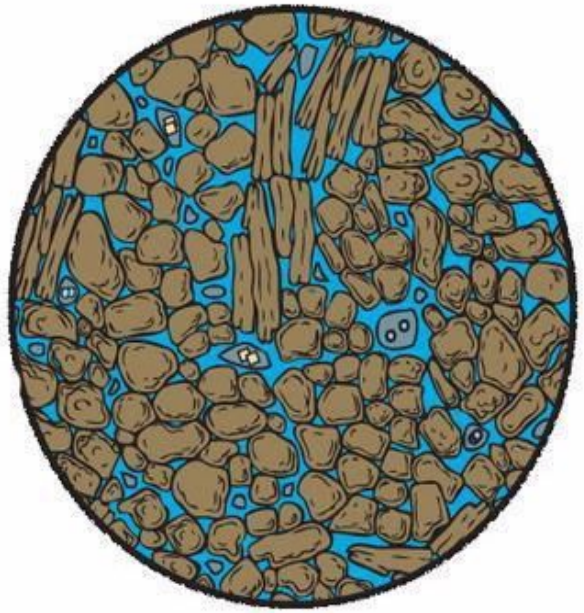
- Particle density the weight per unit volume of the solid portion of soil is called Particle density

Generally, particle soil of normal soil is 2.65 g per cubic centimeter, particle density is higher if large amount of heavy mineral present in the soil while with the increase in organic matter of the soil the particle density is decrease.

Bulk density

- Bulk density The oven-dry weight of a unit volume of soil inclusive of pore space is called bulk density
- The bulk density of soil always smaller than its particle density

Lower bulk density
Lower weight
More pore space



Higher bulk density
Higher weight
Less pore space

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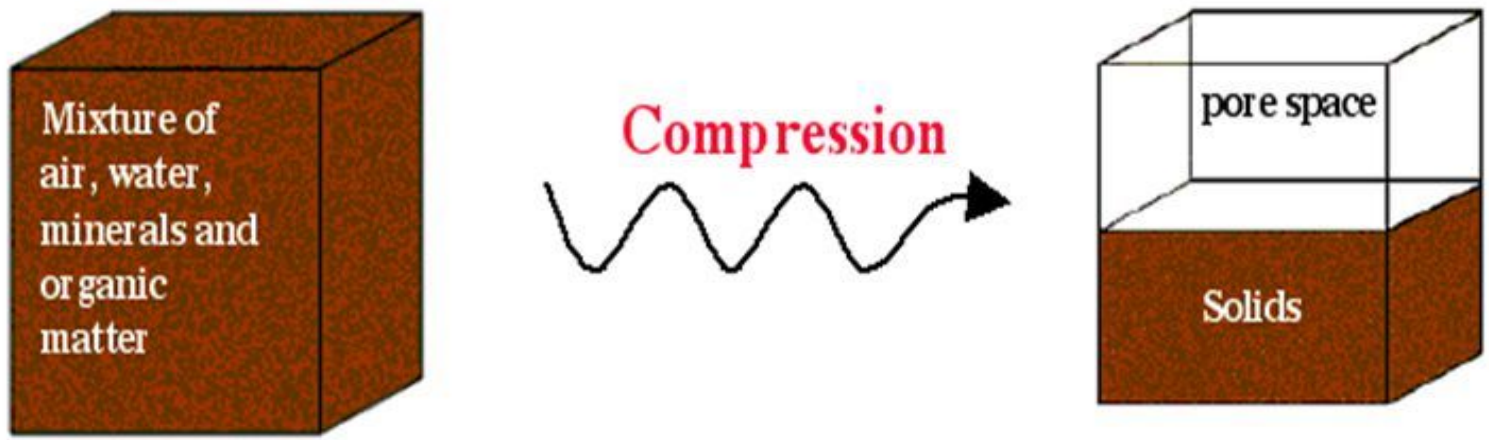
Bulk Density of Soil (Db)

$$Bulk\ Density = \frac{mass}{total\ volume} = \frac{g}{cm^3} = \frac{M}{L^3}$$

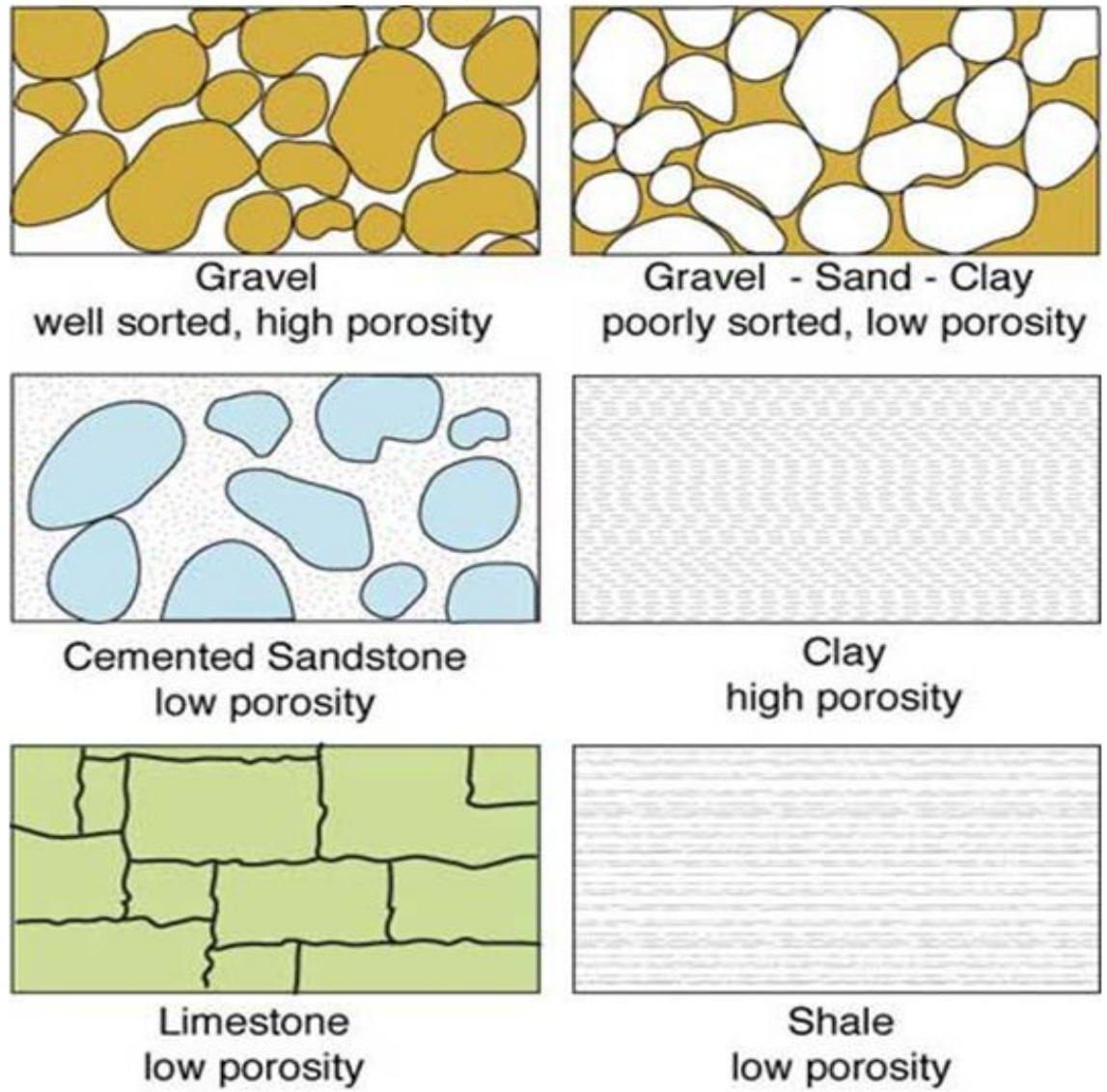
- Mass of a volume of dry soil.
- The volume includes spaces (but not water).
- Db is less than particle density
- Db ranges from 1.0 - 1.6 Mg/m^3
- Common to assume 1.3 Mg/m^3

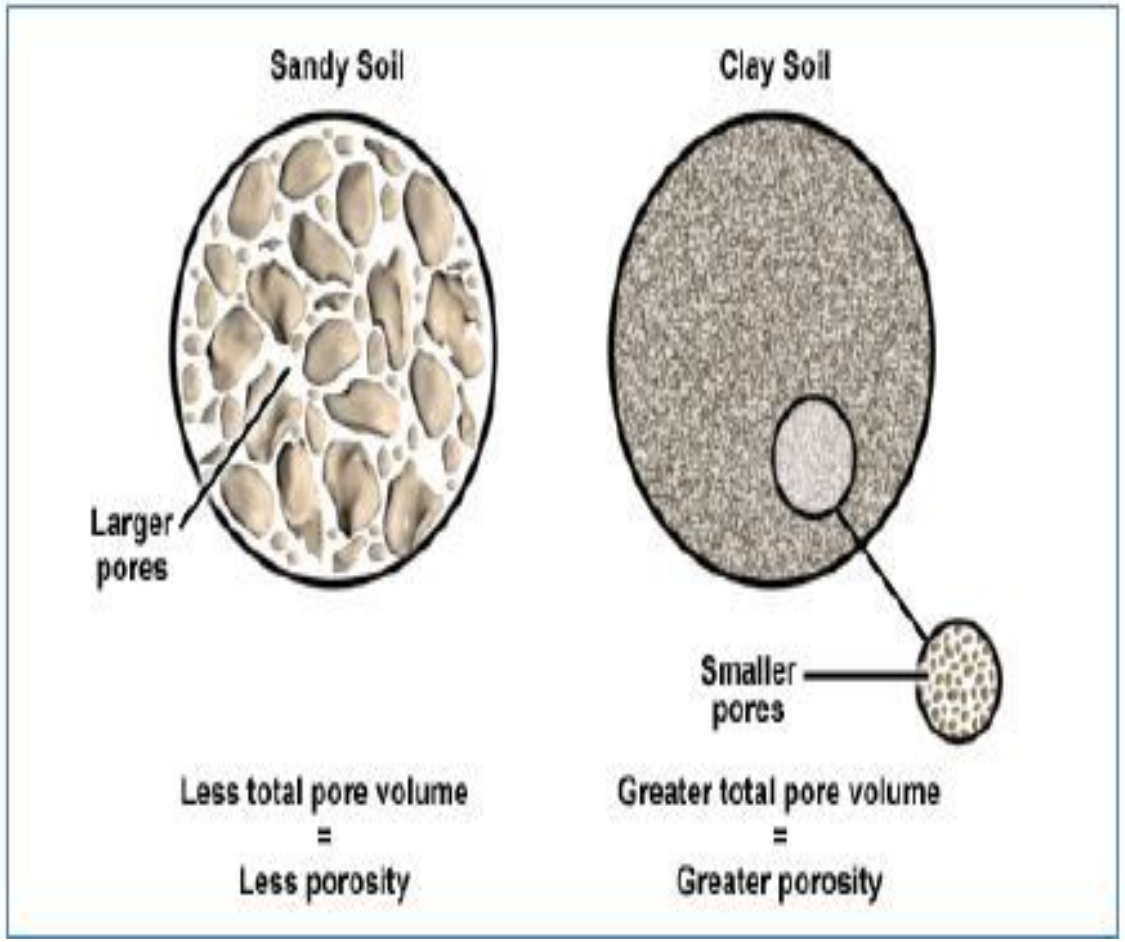


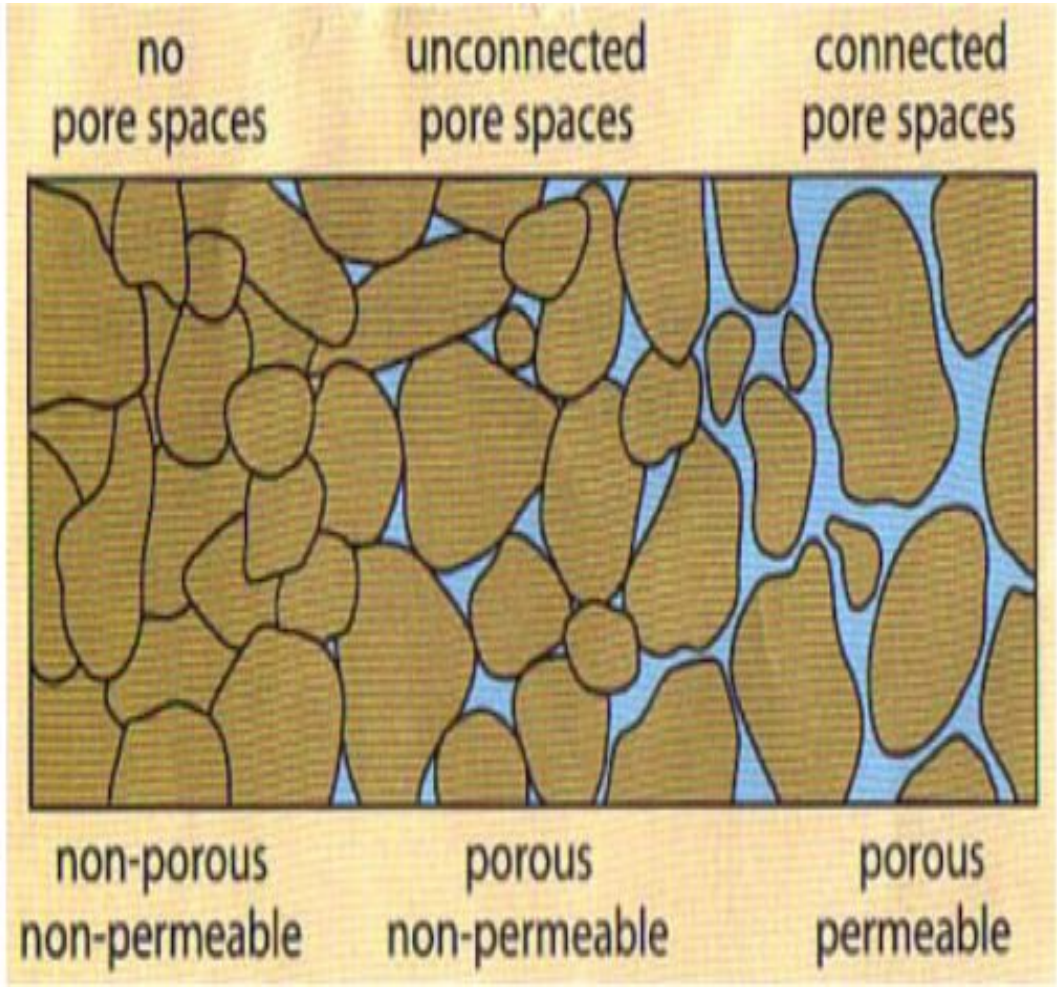
3. Soil porosity

- Soil porosity refers to the pores within the soil. It depends upon the texture, structure, compactness, and organic content of the soil.
- Porosity influences the movement of air and water.
- Healthy soils have many pores between and within the aggregates.
- Poor quality soils have few visible pores, cracks, or holes. The way in which soil is managed can affect its porosity.
- Soil porosity=1-(BD/PD)*100=

Different ground has different porosity.




Sandy Soil
Clay Soil
Larger pores
Smaller pores
Less total pore volume
=
Less porosity
Greater total pore volume
=
Greater porosity


no pore spaces
unconnected pore spaces
connected pore spaces
non-porous non-permeable
porous non-permeable
porous permeable

How to determine porosity

1. Fill one measuring cup to 200 ml with sand, the second cup with 200 ml of clay, and the third with 200 ml with small pebbles.
2. Fill a graduated cylinder to 100 ml with water.
3. Slowly and carefully pour the water into the first cup until the water just reaches the top of the sand.
4. Pour slowly so no water spills out of the measuring cup. Record exactly how much water was used.
5. Use the formula below to calculate the percent porosity for the sand:

Porosity = (Amount of water added to sample ÷ Total sample volume) x 100