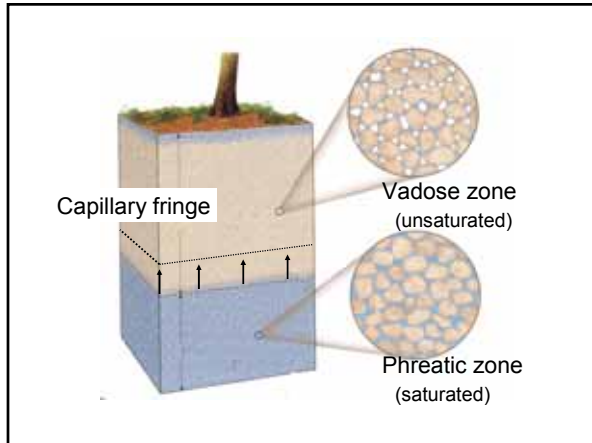
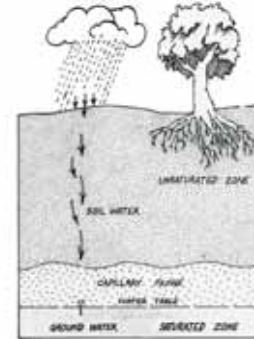


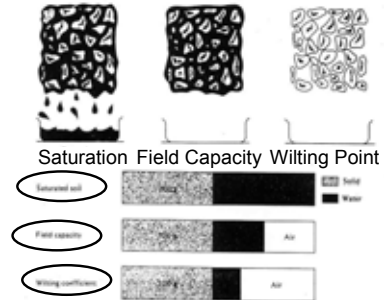
SUMMARY Water Balance

- On a continental scale (North America) there is water surplus ~ 26 cm
- There are regional differences in water balance (**water surplus** vs **deficit**)
- These are reflected in differences of **surface vs groundwater** use

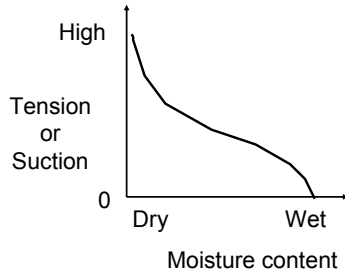
Water below Surface



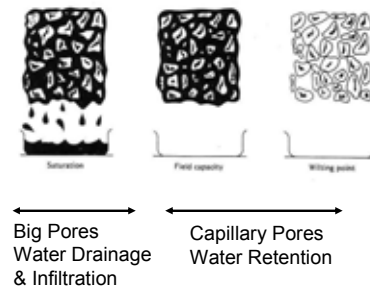
Soil Moisture Status

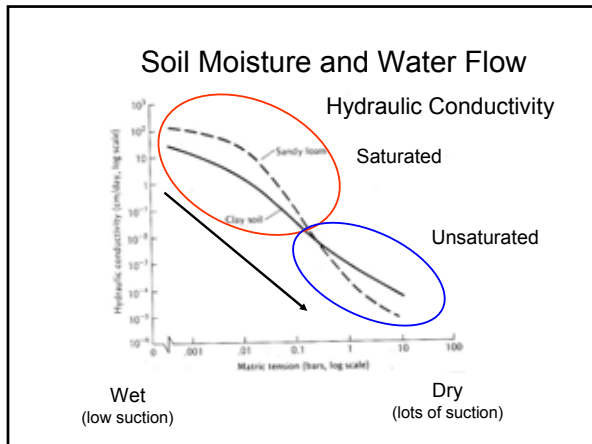


Soil Moisture and Tension



Pores & Soil Water

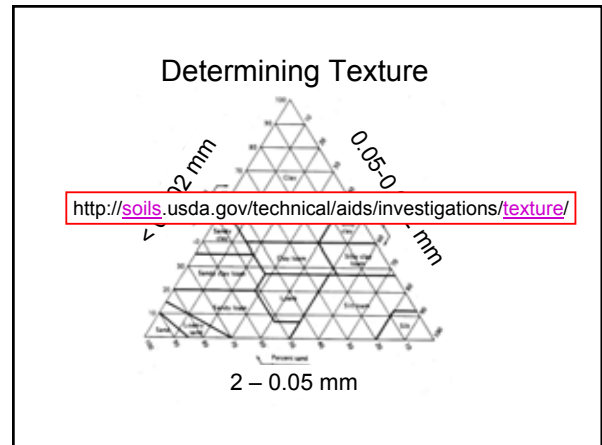
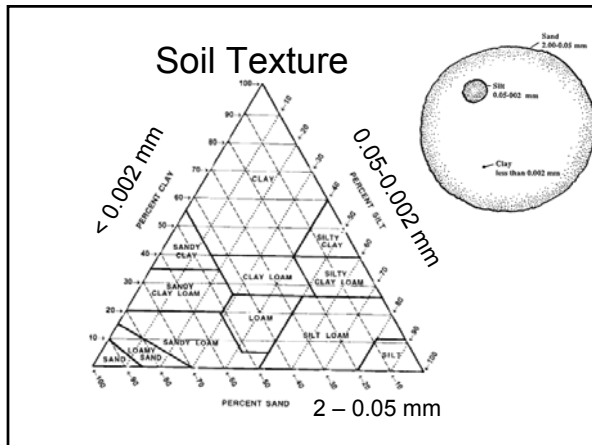




What is responsible pore volume and pore size distribution?

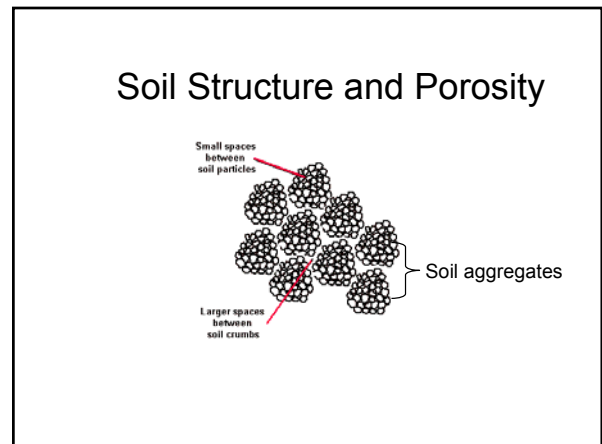
- Texture
 - Particle Size Distribution

A diagram showing three stages of soil particles. On the left, there are a few large, dark brown, rounded particles. An arrow points to the middle stage, which shows a larger number of smaller, dark brown, rounded particles. A second arrow points to the right stage, which shows a very large number of very small, dark brown, rounded particles.



What is responsible pore volume and pore size distribution?

- Texture
 - Particle Size Distribution
- Structure
 - Arrangement of Particles in Aggregates



What Influences Aggregates?

- Factors that promote structure formation
 - Organic Matter (glue)
- Factors that reduce & aggregate formation
 - Loss of Organic Matter
 - Compaction (especially when wet)

Trampling and compaction

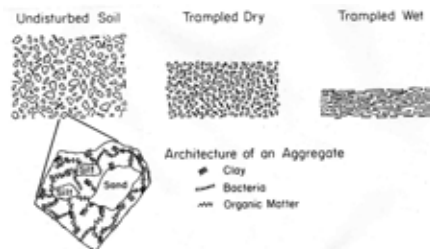
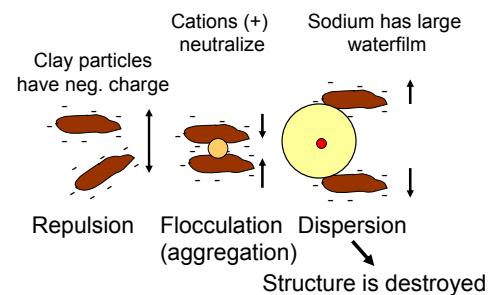


Figure 4.2. Conceptual architecture of a soil aggregate and the changes in soil aggregate structure caused by trampling under wet and dry conditions.

What Influences Aggregates?

- Factors that promote structure formation
 - Organic Matter (glue)
- Factors that reduce & aggregate formation
 - Loss of Organic Matter
 - Compaction (especially when wet)
 - Sodic soil conditions



SUMMARY

Soil Water (Vadose)

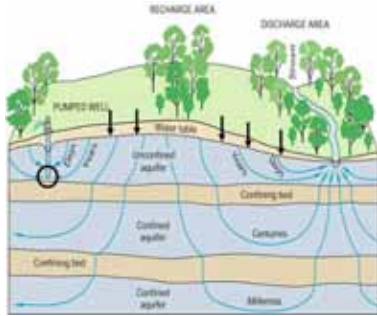
- Soil texture and structure influence amount and size of pores
- In wet soils water resides in capillary (small) and non-capillary (big) pores
- As soil dries water resides in smaller and smaller pores and is held with increasing tension (suction)

SUMMARY

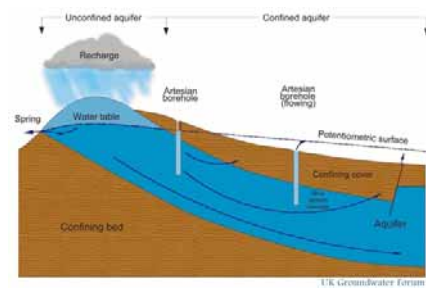
Soil Water (Vadose)

- Water moves faster in wet than in dry soils
- In wet soils water moves faster in coarse- (sandy) than in fine-textured (clay) soils; the opposite in dry soils
- Anything that destroys soil aggregates, alters soil water function

Groundwater – Phreatic Water



Confined & Unconfined Aquifers

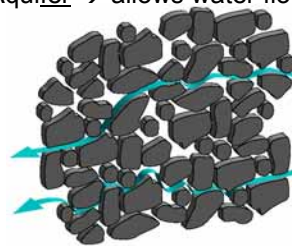


Artesian Well

Water is under pressure



Aquifer → allows water flow



Aquiclude → does NOT allow water flow

Rate of Water Flow Darcy's Law



Darcy's Law: $Q = A K \Delta h / \Delta x$

K: Hydraulic conductivity (m/s)
 $\Delta h / \Delta x$: Gradient of total potential / head
 A: Cross sectional area

Soil water and
Groundwater
 contribute to
 Stream flow



SUMMARY

Ground Water (Phreatic)

- Water in phreatic (saturated) zone resides in unconfined or confined aquifers
- Water flow rate determined by pressure difference and hydraulic conductivity of matrix
- Ground water contributes to stream baseflow