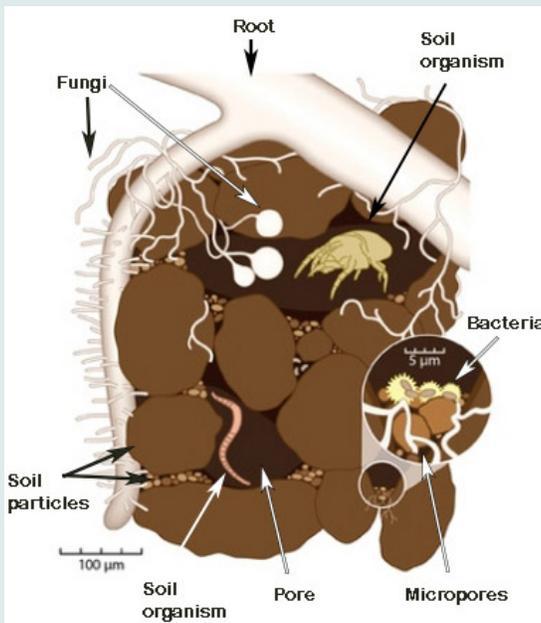


# Card: Soil Structure and Soil - Water Relations

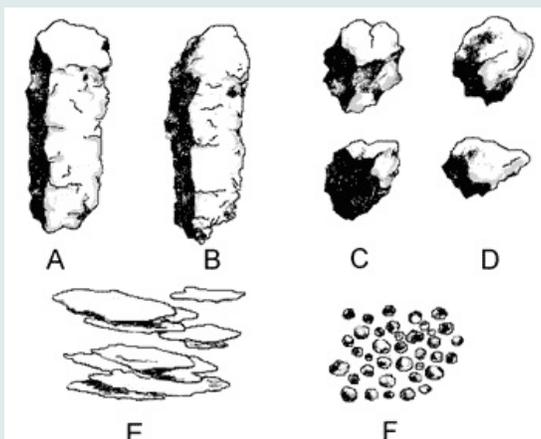
## LEARN ABOUT SOIL

### How Does Water Move Through Soils with Different Structures?



#### PARTICLES AND PORES IN THE SOIL

**Soil structure** is the arrangement of the individual soil particles in relation to each other forming small groups of particles call aggregates. Some **aggregates** may bind to each other into **peds** which make larger masses. The spaces among aggregates are called **pores** and can be filled with air, water, roots, or animals. A healthy soil will have similar number of small (< 0.06 mm) and large (> than 0.06 mm) pores. Large pores are good as aeration systems that allow the water to flow, while small pores hold water against gravity making the water available to plants.



The peds have different shapes with rounded or sharp edges and have shapes of prisms (A), columns (B), blocks (C and D), plates (E) or grains (F). Soil texture will determine the pore space within an aggregate, while the arrangement of aggregates with respect to each other determines the pore space between aggregates. The structure of the pores is going to determine how easily air, water, and roots move through the soil. The most desire soil structure is the granular that is arranged in small aggregates with rounded edges with small and large pores.

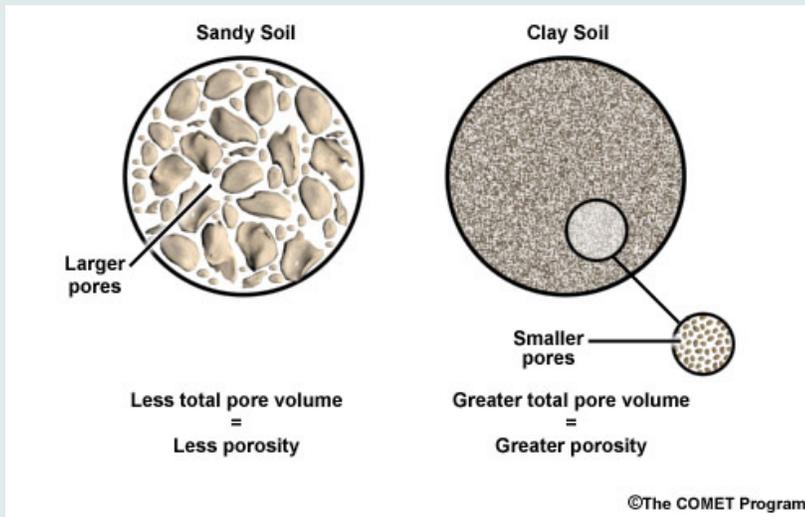


When water falls to Earth, plants intercept some water that evaporates. Leaves and leaf litter cushion the impact of water droplets on the soil. Some water flows over the surface as runoff and some infiltrate into the soil. Depending on soil's properties water can be taken by plant roots, remain stored in pores, or move downward to become part of underground water stores.

# Card: Soil Structure and Soil - Water Relations

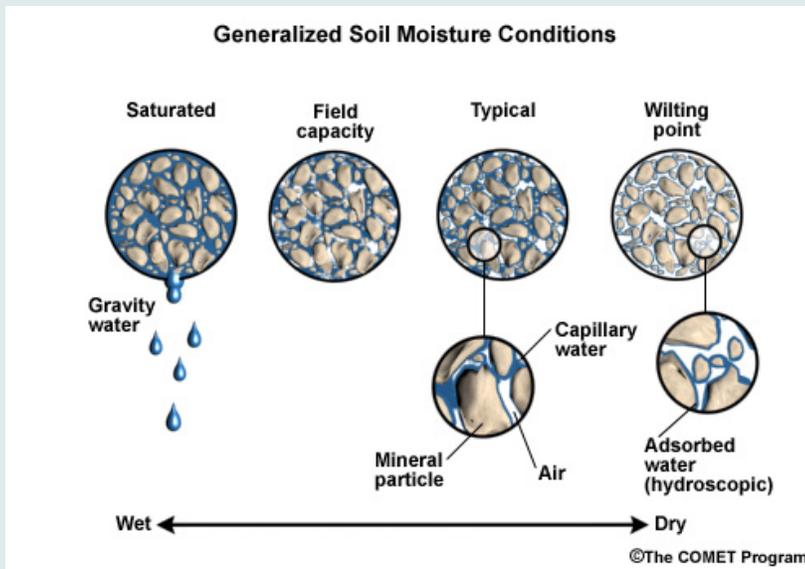
## LEARN ABOUT SOIL

### How Does Water Move Through Soils with Different Structures?



#### HOW DO SOIL PROPERTIES INFLUENCE WATER FLOW THROUGH IT?

For plants to grow, the soil needs to have properties that allow the water to move slowly so plants can use it. Depending on **soil structure** and **texture**, water infiltrates faster into granular soil with numerous pores than in massive compacted soil. The compacted soil forms crusts sealing the soil and causing runoff of water over the surface. A coarse soil with large particles and large pores is a soil through which the water moves easily within hours (sandy soil). On the other hand, water moves very slowly (2-3 days) through soil with fine textures with small pores (clayey soil) holding the water so tightly that plants cannot get to it.



**Soil moisture** also affects water movement through the soil. In dry soil, the water infiltrates faster than when the soil is wet because there is not that much room for water to move through the soil. When there is excess water due

to heavy rains and floods, the soils become **saturated** since all the pores are filled with water and no air is left to provide oxygen that is essential for the survival of most organisms.

With time, the water in large pores moves downward and the soil dries out, the water that remains in the soil is retained more tightly and is more difficult to use it. As less water is available, plants wilt and may die. At this stage the water content of the soil is called the **permanent wilting point**. If the soil continues losing water through evaporation, the remaining molecules of water are tightly held and at this point the content of moisture in the soil is termed the **hygroscopic coefficient**.

# Card: Soil Structure and Soil - Water Relations

## LEARN ABOUT SOIL

### How Does Water Move Through Soils with Different Structures?

#### WATER MOVEMENT THROUGH DIFFERENT SOIL TEXTURES

##### Materials

- Cards: Soil Structure, Soil Texture, and Soil-Water Relations
- Coffee filters (2)
- Measuring cylinder (300 ml)
- Plastic bottle (2 liters). Cut in 2 making sure that the top (funnel) when upside down fits and holds into the bottom part of the bottle.
- Soil sample (1/2 cup). Ask each group to bring a soil sample from their backyard or go with the students to collect soil samples at the school. Make sure that the samples represent soils with contrasting soil structures and textures (sandy soils, loam, clay, etc.). Dry the soil samples overnight before using.
- Timer
- Water (1 cup)
- Watering can, small with shower head. The head of the watering can should be smaller than the opening of the cut bottle.
- Worksheet



##### Follow these steps to measure the amount of water that passes through different soils with different textures:

- Remove from the soil sample rocks, twigs, and any other large objects
- Place the top of the bottle (funnel) upside down inside the bottom part of the bottle
- Place a coffee filter into the funnel
- Add the soil sample (1 cup) and cover the sample with another filter. Make sure the soil is evenly distributed in the filter. This will avoid "hollow" areas on the sides that will allow water to run freely instead of passing through the soil affecting the measurements.
- Assign a student as time keeper who will record the time from the moment the water is poured into the funnel until water drops run 5 seconds apart.
- Measure one cup of water and place it in the watering can.
- Pour the water evenly on top of the filter avoiding pouring water at the edges and on a particular spot.
- Also avoid moving the bottle or pulling the filter during the filtration of the water. Water may go very fast or very slow through the soil. Record in your worksheet the time it took the water to pass through the soil (section 2).
- To measure the amount of water collected in the bottle, lift the funnel without pulling the filters to avoid extra water to be collected.
- Use the measuring cylinder to calculate the amount of water collected. Record this amount in the worksheet (section 2).
- Complete section 2 with the results from the other groups.
- Compare the results among groups by responding to the questions in section 3 of the worksheet.
- Use also the Soil Structure and Soil Texture Cards to help you respond the questions in the worksheet.