

“Soils and Sponges” is great for teaching a unit in Soils, Landscaping, Horticulture, Turf Management, Ecology, Conservation of Natural Resources, Soil and Water Management, Science, etc.

**I. SOIL TEXTURE and SURFACE AREA --SOILS WATER HOLDING CAPACITY (AWC) Available Water Capacity**

- Sand** (Largest Particle Size) Least Amount of Surface Area
- Silt** (“Medium” Particle Size) “Medium” Amount of Surface Area
- Clay** (Smallest Particle Size) Largest Amount of Surface Area



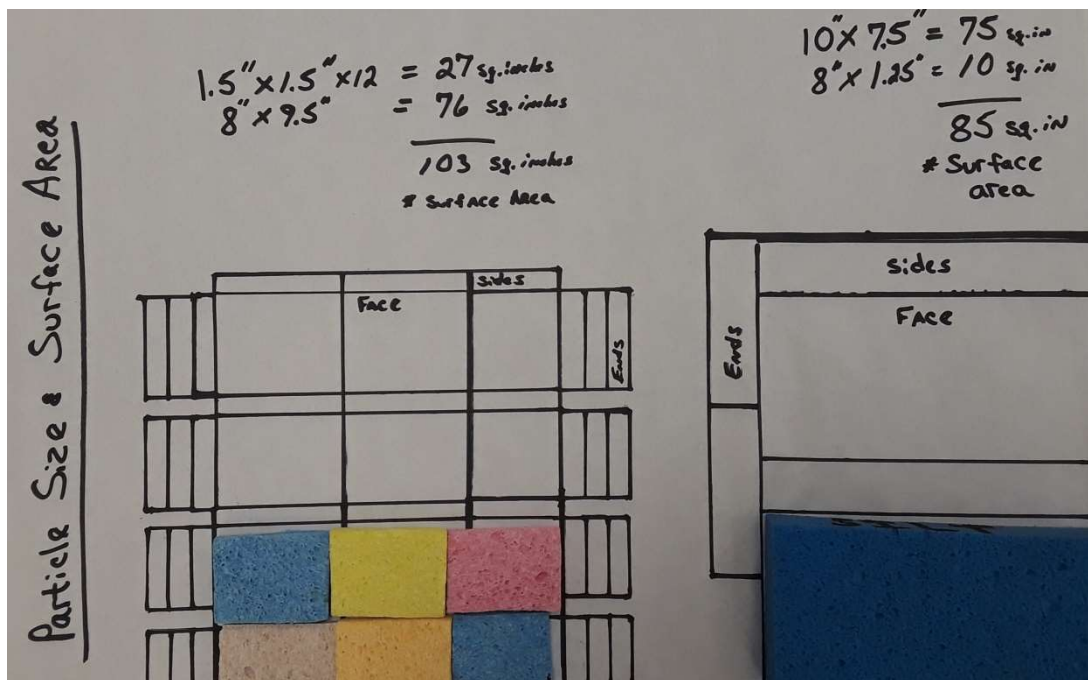
D. Texture Triangle

Source: <http://www.hwr.arizona.edu/globe/globe2/soilpb42.html>

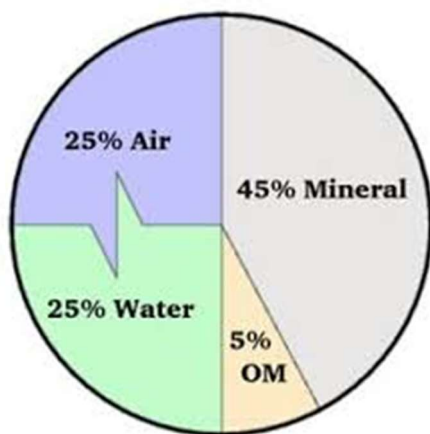
**II. Soil Particle (sponge) Size and Surface Area**

Lay out a sponge on a table and flip to show that just one large sponge flipped (rolled) over the table top only covers so much of the table top surface. Do the same with smaller sponges to make the same size as the larger single sponge and flip each of the smaller sponges on the table top and students can see how much more surface area is covered by flipping over each smaller sponge:

(See Photo Below)



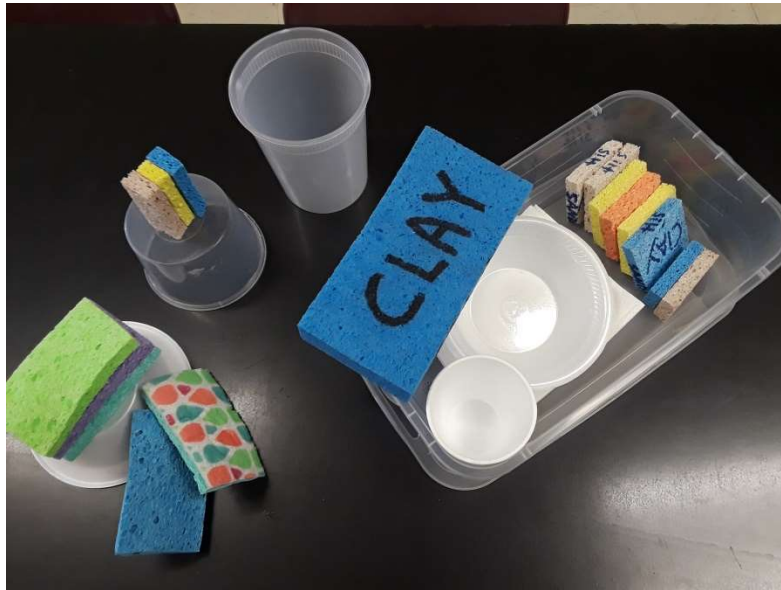
III. Ideal Soil: (Student Question) Which Soil Texture will get you the closest to this? Why?



Source: <http://courses.soil.ncsu.edu/resources/physics/composition/compo3b.png>

<http://courses.soil.ncsu.edu/index.php?expand=0>

#### IV. DEMONSTRATE SOIL WATER PRINCIPLES WITH THE SPONGES FROM VIDEO:



1. FIELD CAPACITY – (Sponge laid flat in your hand and slowly pour water on sponge till it cannot hold any more)
2. GRAVITATIONAL WATER – (Once the sponge is at “Field Capacity” any water added will drip out of sponge)
3. CAPILLARY WATER (Plant available water- water you can “squeeze” out of the sponge)
4. HYGROSCOPIC WATER (Water held so tight by the soil particle – not plant available = wilting point of plant) Squeeze all the water out of the sponge - the sponge will still be a little damp.
5. PERMEABILITY OF A SOIL - (Sponges with different pore sizes will absorb water up sponge at different rates when you put sponge strips side-by-side and place them in a lid of water)
6. CAPILLARY WATER- (higher to lower concentration & water hydraulic movement
  - a. Adhesion Principle (Attraction of unlike particles: sponge and water)
  - b. Cohesion Principle (Attraction of like particles: water to water molecules)

#### V. WATER MOVEMENT IN SOIL HORIZONS

1. Gravitational Water Movement  
Place three sponges on top of one another as it would be in nature with three different soil profile horizons with a lid below them. Pour water slowly on the first sponge and watch the entire sponge fill up before it moves to the next sponge (horizon). This is due to Gravitational Water.

2. Capillary Water Movement

Place three different sponges on top of one another as above. This time place them in a lid that gives you room to add water to the bottom. Watch the water go up each sponge (horizon) and you can discuss water table levels to the students and more water holding capacity due to texture.

3. Discussion Point: When watering house plants – top down or bottom up? Ever see the mineral salts accumulate on top of a soil from “bottoms up”?

VI. **EFFECTS OF FRAGIPANS:** (Reduces Water Holding Capacity by  $\frac{1}{2}$  for that Horizon)

Place the three sponges like V.1. and V.2. above; but this time, place a sponge of the same size that has a “scrub or coarse side” such as a cleaning sponge in the middle horizon. Add water like above and you can see that the fragipan “scrub surface” acts like a fragipan and halts the water movement to the next horizon until Gravity takes over.

Horizon. You can do this for top down and also from bottom up, thus reducing water table level or like what a drainage tile would do for a field.

VII. **STUDENT ACTIVITIES:**

Demonstrate all the Terms and Principles above

With Different Sponge Pore Sizes - Could Measure Water Held by each (pore space)

Discuss Watering Methods of Potted Plants

Calculate Water Holding Capacities of each Soil Horizon based upon texture and depth of horizons to depths of 36 inches

VIII. HAND OUTS

SHOW WORK: Figure the Water Holding Capacity for the Soil Ped Below. NAME \_\_\_\_\_

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**SOIL TEXTURE**

**AWC Rate in Inches of Water**

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Sand, Loamy sand =	.06
Sandy loam =	.12
Loam, Silt loam =	.22
Silty clay loam, Clay loam =	.17
Silty clay, Sandy clay =	.12
Sandy clay loam =	.15
Clay =	.09 (Clay is low because it holds the water so tight)

**CALCULATED AWC CLASS:**

High: More than 6 inches

Medium: 4-5.9 inches

Low: 3-3.9 inches

Very Low: Less than 3 inches.