Soil Stories

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The following are three scenarios and information that I have used and found successful to teach about soil, using the rain simulator equipment to demonstrate the action of rain on various soil samples. The measurable results using the simulator give some evidence to determine soil condition within the parameters of a sampling.
Throughout the lesson, there are several "piggyback" concepts/ideas that you could use, such as: decomposition, importance of the balance between plants and animals, soil is from rocks breaking apart, roots often follow worm tunnels, plants that grow in dense soil usually have short stumpy roots and root foods (ie. potatoes and carrots) need loose soil to grow well, etc.
The last teaching scenario has a huge cross-curricular component, and depends on higher level thinking and application.

The basic lesson outline:

1. Connect to previous knowledge, motivate interest (there are often even worms in the soil! And who knows what is decomposing!)
2. Begin new information – see scenarios 1 and 2 - use your favorite methods (lecture, discovery, internet, etc)
3. Connect soil lesson to the rain simulator: describe and assemble (I have students 4th grade and up assemble as I describe the apparatus)
4. Do first observation – BEFORE making it rain! When all 4 groups have recorded some observations, then...
5. Give each group their 16oz. Water in their measuring cups, instruct them to use only the water given in the cups, pour the water completely and evenly into the upper tray all at once- no splashing!
6. Observe until the water is pretty much through dripping
7. Measure the water per the recording sheet.
8. Do second observation notes, what is your soil made of, how do you know?, etc
   What color is the water in each container?
9. Do a quick share by each soil sample group
10. Do summary and wrap up

If you have questions, suggestions or comments that would be helpful, please contact me at ruth.pearson@att.net and note "Soil Stories" in the subject line.

1. Lower Elementary

Soil Health

What do we need in order to be healthy? (food [nutrients], air, water, etc) (compare to) What do plants need to be healthy? (same etc)

Plants get much of what they need from the soil and just like we need good quality food, nutrients, air and water, the soil needs to provide some of that for the plants. (Yes, they also get air and water from the atmosphere and also make food through photosynthesis, but additional nutrients for growth come from the soil, through the roots)

Healthy plants help keep the soil loose so air and water filter through and so animals in the soil can move around and live.

Soil is made up of:

- 3 kinds of minerals: Clay (teeny, tiny grains of broken up rock)
  Silt (tiny grains)
  Sand (small grains)
- Nutrients that come from decomposing plants and animals, scat
- Air
- Water

You can use 3 clear containers, each with different sized stone, to show that the larger pieces of rock (sand) leaves more space for air and water, as opposed to the other two smaller sized rocks. This is sometimes a difficult concept for the students to understand that the rocks represent the mineral sizes.

- Here's one way to explain density: ie. Have 11 students, representing clay, sit inside a 5'x5' shape(made of yarn??), seat 8-9 students , representing silt, inside another 5'x5' shape, and 4-5 students, representing sand, inside a third 5'x5' shape. The size of the shape depends on the age/size of the students, but you want the largest group to be very crowded to show that the smallest mineral size fits more in numbers, but consequently there is not much wiggle room(room for air and water, roots, and animals to move around), the middle sized(silt) group has a little more space, and of course the sand has lots of space.

Point to make with this demonstration:

ask- would it be best for all the soil to be all sand? Think about beaches and the kind and number of large trees grow on the beach.(no, because roots cannot hold on to such loose soil and water goes right through it before it can be absorbed by the roots) you can demonstrate this by having two students hold hands and pretend to be roots in the sand group- they can easily move around the space and even out!

- So soil is made up of a mixture of teeny and tiny and small pieces of mineral matter (rock), along with decomposed material and air and water.
- The healthiest soil has about 45% mineral mixture, 5%nutrients, 25% air and 25% water
- We can also look at the color of the soil, feel the soil and smell the soil to get predictors of its content, and therefore, its health.

2. Upper Elementary

Soil Health is defined as the continued capacity of soil to function as a vital, living ecosystem* that sustains plants, animals and humans.

(*a biological community of interacting organisms and their physical environment)

Importance of soil health:

- a firm foundation
- regulating water
- cycling nutrients
- filtering, buffering and degrading pollutants

Factors that affect soil health:

Environmental

- parent material
- topography
- time
- climate
- organisms

Human Activities

- soil disturbances/tillage
- cropping
- fertilization
- manure application
- animal/wheel traffic

Soil Texture

The proportion of different mineral particle sizes in a soil determines it's texture. The mineral component of soil is the remnants of weathered rocks and is classified into 3 categories by particle size:

1. Clay (<0.002mm), the smallest particle size, feels sticky, holds nutrients, does not drain/dry well, slow to warm, difficult to work, root growth is poor due to small spaces
2. Silt (0.002-.05mm) is referred to as rock flour, feels silky or floury, can be transported lon distances in air or water.
3. Sand (.2-2mm) feels gritty, warms and dries in early spring, does not hold water or nutrients

Soil Components of a soil in prime health:

1. Mineral matter (inorganic, from various degrees of weathered rock) and makes up approximately 45% of the soil
2. Organic matter makes up approximately 5% of the soil.
3. Water makes up approximately 25% of the soil.
4. Air makes up approximately 25% of the soil.

Each of the components vary in quantity and quality to make up the variety of soils. For example, if the mineral involved is more clay than the other mineral sizes, the soil reacts differently to plant, human and animal interaction

Soil density

Low bulk density: loose, porous soil with plenty of room for air, water, biology and roots; is sustained by reduced tillage and wheel traffic, along with the addition of organic matter from crop residue, cover crops and manure.

Higher bulk density: limited movement of air and water through soil and restricted root growth; is often the result of tillage, wheel and human traffic

3. Soil Stories

Uses of soil/Importance of soil
Where does it come from?
Components of soil
- minerals – silt, clay, sand
- organic materials
- air
- water

Soil varieties

The above list is covered in the previous pages and should be taught as the first part of the lesson, possibly do the information gathering and scientific process on one day, then connect the information, observations and data collection to the following "story outline".
Each of the soil samples in front of you has a story:
- a setting (location from which the sample was taken)
- characters (components)
- problem (Is it healthy? What is it good for?)
- plot (what is happening with the soil?)
- solution (can it be improved for its location? How?)

Students are invited to identify the story details, (ie. The setting is the bank of a creek in rural southwest Michigan etc.) From here it is up to you to model the process, decide to do group stories per soil sample, or individual stories, but keep it short and sweet, not to belabor the point! Or offer it for extra credit for those who want to take it on after your class model! Illustrations encouraged!