K-12 IYS Activity

Soil Science Society of America

Soils are Everywhere!

Exploring the Soils around Us Every Day

Summary

Soils are all around us all of the time, growing our food, filtering our water, supporting our buildings and roads, and stabilizing our trees. Soils can be very different from one another. Some are very shallow and rocky, while others are deep and soft, or clayey and hard. Each of these soils may be suited to a different purpose or land use based on its characteristics. Soil scientists have actually created maps of all of the soils around us everywhere, describing the unique characteristics of each soil that make it special to a certain area and for particular uses. These maps are available online to the public (http://casoilresource.lawr.ucdavis.edu/gmap/), so you can see the soils that you interact with everyday.

Not only do the maps show the extent of the soils, they also show typical properties of each soil, such as organic matter content, soil texture (percentages of sand, silt, and clay), and pH that may make a particular soil suited to a particular purpose. Simple tests, such as the test of infiltration in this activity can show how different soil properties can affect how soils behave. For example, the texture or organic matter content of the soils can affect how quickly water flows into and through the soil.

Using the SoilWeb survey, students will explore what soils they use in daily life and how they are important in land use. They will also perform tests of water infiltration to see how different soils behave differently.

Celebrating the 2015 International Year of Soils

soils.org/IYS

Learning Objectives/ Outcomes

1. To understand that soils are important in everything we do, in many professions.
2. To explain that soils are very different, and different ones are suited (matched) to different purposes.
3. To compare a variety of soils and explore them through observation and the measurement of soil properties.
4. For older students, the data collected can be used to practice communicating data through graphing.

Materials (per student, group etc.)

- Internet: http://casoilresource.lawr.ucdavis.edu/gmap/
- Plastic bag to collect soil sample
- 2 water bottles per student of the same size. Remove labels and cut the necks off the bottles. Leave half of the bottles tall and poke 5 to 6 holes in the bottom to drain water. Cut the other half of the bottles so they are only about 3 to 4 inches tall (NO HOLES). Each student will get one bottle to put their soil in (tall) and another in which to nest the soil bottle—when water drains through the top bottle, the bottom one will catch it.
- Food coloring
- Stop watch

Ages of Audience

Middle school to adult

Recommended group size?

Unlimited

Where could you offer this?

1. Your university
2. Local school

What type of room do you need?

1. Classroom seating
2. Computer access

Type of Lesson (may be more than one)

1. Indoor
2. Small group exercise/discussion critical thinking

Methods/Procedures

1. Go to SoilWeb at school: http://casoilresource.lawr.ucdavis.edu/gmap/
2. Find the soil where your home or school is located:
   a. Click on “Menu” in upper left corner
   b. Click on “Zoom to Location”
   c. Type in your home address
   d. Click inside the yellow outline that includes your home. The letter inside the yellow outlined space represents the series name of your soil.
   e. To the left, a box appears with the predominant series name and the map symbol of your soil.

   Map Unit Composition gives the percentages of the soil series that make up your map unit. If this is not 100%, focus on the predominant soil series. Click on the predominant series.

   - A new window pops up with 5 categories: Soil Profiles, Soil Taxonomy, Land Classification, Hydraulic and Erosion Ratings, and Soil Suitability Ratings. Focus on the Soil Profiles and Soil Suitability Ratings tabs.
   - In Soil Profiles, you can find various physiochemical properties of the soil. This could be used to graph the organic matter content or pH across the different soils brought in by your class.

   Close Map Unit Composition and click on Map Unit Data for an overview of important properties for your predominant soil series
3. Record information for your soil type. (Depending on age group, include variables you think are relatable, e.g., organic matter → carbon storage → climate change; pH → plant growth → farming and gardening). Look at Soil Suitability Ratings to see what the possible land uses are for your soil.

continued...

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4. Using the diagram to the right, discuss the ways in which the soil is being used in the picture: growing food, waste storage, supporting roads and buildings, filtering water, purifying air, supporting plants.

This activity can be done as a class looking at the soil at the school location or an additional set of activities can be added where students look up the soils at their home.

1. Collect a soil sample from home or school (2–4 cups of soil)
2. In the classroom, remove any sticks, leaves, or stones
3. Fill a water bottle with 4 inches of soil. Tap the bottle gently on the table as soil is added so the soil settles and there aren't large air pockets.
4. Line up all of the soil bottles and label each with a letter.
5. Observe all of the different soils, taking notes for each one. What is its color (which is darkest, lightest, reddest, yellowest)? structure (clumpy, dusty looking)?
6. Nest your soil bottle into the shorter bottles that can collect water running out the bottom
7. Measure out one cup of water and add 5 drops of food coloring (all students should use the same color).
8. Add the water to the top of your soil at the same time as other students and start a timer.
9. Record a few things for your soil:
   - How long did it take for water to infiltrate into the soil (no water left on the surface)?
   - After 1 hour, how much water is in the bottle below the soil bottle?
   - Rank the color of the water in each bottle. The soil with the least color gets a 1, the second least a 2, and all the way to the water with the most color. This will rank the soils in order of their ability to filter the water.

Depending on the level of your students you can have them graph the data they collect compared with any of the soil properties that they find on SoilWeb for their soil.

- Infiltration vs. clay content
- Infiltration vs. soil organic matter content

Soil supports plant life including large root systems such as the tree in the background. Soil provides the food we eat through crops and plants for our meat. It also provides structural support for our buildings and roads. We use soil to contain our waste and sometimes nutrients and pollutants move through the soil into our waterways, harming the biota in these systems.

Discussion Questions

Using the image above as a guide, answer the following questions:

1. What are all of the professions that might interact with soil or where soil would be important? *Potential answers: farmer, construction worker, engineer, potter, forensics detective, archeologist*
2. For each profession, what properties of soil (i.e., clayey vs. sandy, organic matter content, deep vs. shallow, dry vs. wet) would be important to have for a particular activity?

   Farmer: high organic matter soil, fertile, loamy (good mixture of some sand, silt, and clays)

   Construction worker and engineer: A stable soil that can be compacted easily but then remain sturdy (high shear strength), does not erode easily, no shrink-swell properties, which have to do with the clay type.

   Potter: A clayey soil with "low activity" clays that do not shrink and swell with drying and wetting. The best type of clay is kaolinite, which is what bricks are made of.

   Forensics detective: A unique soil! Forensics detectives can sometimes trace the mineral type, soil color, or soil texture (% of sand, silt, and clay) to a particular area.

   Archaeologist: A dry soil that will preserve fossils and other artifacts. Dry soils tend to have slow decomposition and weathering. A sandier soil will also be easier to dig and excavate archaeological sites.

3. How is soil a limiting factor in how land is used?

   In everything we do as humans, we need to consider whether or not the soil in that area can handle it.

   Potentially bad situations:
   - Building roads on soils with high erodibility
   - Building houses on soils that shrink and swell
   - Farming on high salt or low organic matter soils
   - Building septic tanks on soils that flood easily

   Older students can think about socio-political relationships and implications
   - Land ownership/tenure
   - Where in the world are the most fertile soils? How can the distribution of fertile soils affect a community's ability to feed itself?
   - What would the cost of land built on shrink-swell soils be relative to those built on more stable soils? Do you think soils are considered in housing development plans?
   - Soils in flood-prone areas (for example, near the levees in New Orleans) tend to be cheaper. What are the effects of this?