Soil Detectives: The Case of the Lost Friends

Author(s): Kristin Staats (teaching and preparation assistance by Jodie Han)

Objective of the Lesson: Aside from traditional science or agricultural careers, there are new fields that require knowledge of the earth and its properties. In order to solve some crimes/mysteries, forensic scientists have been required to look at the soil for clues about when or where an even took place. This career field may be a new frontier for those with knowledge of natural resources, especially the soils. In this mini-course, we will show how soils can be used to solve a mystery by looking at the physical and chemical properties of various samples.

This lesson is designed to:

- ✧ Show how soil varies across the landscape.
- ✧ Explain how soil can be used to solve mysteries.
- ✧ Introduce techniques that would be used to distinguish soils from different places.

Standards Addressed:

Science

K-3	4-5	6-8
Standard 1 *Nature and Application of Science and Technology* A-1, A-2, A-3	**Standard 1** *Nature and Application of Science and Technology* A-1, A-2, A-3 C-1	**Standard 1** *Nature and Application of Science and Technology* A-1, A-2, A-3 C-2
Standard 5 *Earth's Dynamic Systems* A-1	**Standard 5** *Earth's Dynamic Systems* A-1, A-2	_____
Standard 8 *Ecology* A-1, A-3	**Standard 8** *Ecology* A-1 B-3	_____

Materials Needed:

Posters:

- Soil comparisons of different land uses and regions (beach vs. farm, forest vs. grass cover, creek/stream)
- Different soil properties that could be used to determine where a soil originated (color, pH, types of particles)
- Determining soil color
- Determining soil texture

Investigation:

- Soil Samples (beach sand, clayey sample, A Horizon-type or dark in color, etc)
- Items to find soil on and determine where it came from (a shoe, a shovel, backpack, a toy)
- Small containers (plastic cups or tin foil weigh boats that can be used to collect their sample from the items listed above)
- Plastic spoons
- Water bottles
- Litmus paper, plastic tubes (to determine pH)
- Mock Munsell color sheets (make with poster board and paint/crayons)
- Handout with a checklist to fill in what they find about their sample and where they think the mystery occurred

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Teaching Tips:

- Students will work on groups of 3.
- The storyline for this lesson is as follows:
    - You've just come home from school on Friday, looking forward to spending the weekend with your friends. The only problem is you don't see any of them around. You look around your yard and see some random items sitting around, realizing that they belong to your friends. Can you find any clues on these items that will help you find your friends so that you can have fun for the weekend?

Procedure:

1. Explain that you have to use clues in order to solve a mystery.
    - Have you seen any mystery shows on T.V. or read any mystery books?
    - What types of clues do detectives use to solve mysteries (clothes, fingerprints, tire marks, hair)?
2. Talk about how soil can be used as one type of clue.
    - What things about the soil could be used to help figure out a mystery (color, how it feels, types of particles)?—Use Poster #2. Streams have pebbles, beaches have sand, forests have leaves and dark surface, some soils feel clayey, etc – Use Poster #1. You could find soil particles in someone's car or on their bike and be able to figure out where they have been.

3. Depending on where our class is located at the camp and how much time we have, take a brief walk around the camp to see different soils (down by the water, in the woods, by the driveway).
4. Next, give everyone (or work in groups) and item with some type of soil particles in/on it (e.g., sand in book bag, pebbles stuck in someone's shoe, clayey soil on a toy, dark soil and some leaves on a shovel or on a rake) and record what item they have on their handout.
5. Have students scrape off soil particles with a spoon and put their sample in a small container.
6. Instruct students to describe how the soil feels (gritty, slimy, smooth, gravel-like) and write it down on their handout.
7. Give everyone a mock-Munsell sheet and let him or her determine the color. Record color on handout.
8. Mix a small amount of soil with water in a test tube and shake. Stick in litmus paper and determine soil pH. Record pH on handout.
9. Let students make a guess as to where the item came from (with the soil particles came from) and explain how they came up with the solution.

Check for understanding:

Possible Questions

1. What characteristics of soil can be used to identify its origin?
2. What factors affect color of a soil?

Suggested Answers

1. Color, texture, pH
2. Parent material, organic matter

Summary of learned material:

Certain physical characteristics of soils can aid in distinguishing between different soil types. Distinguishing soil types has become important in the field of forensics. This activity requires students to use what they have learned regarding soil color, texture and environmental conditions, such as pH, to determine the probable locations of their lost friends based on soil sample distinctiveness. To accurately solve the mystery and find their lost friends, students must correctly determine and utilize soil characteristics determined from pH measurements, Munsell charts and texture analysis.

Additional Resources:

General Geoforensics:

http://www.geoforensics.com/geoforensics/art-1101a.html

http://www.bbc.co.uk/radio4/science/thematerialworld_20020926.shtml

http://ltpwww.gsfc.nasa.gov/globe/forengeo/secret.htm

Additional Activities:

http://www.successlink.org/great2/g1489p.html