



Science Unit: *The Earth Around Us: Air, Water & Soil*

Lesson 12: *Soil Analysis*

School Year: 2011/2012

Developed for: Sexsmith Elementary School, Vancouver School District

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Grade level: Presented to grades K-3; appropriate for grades K – 7 with age appropriate modifications

Duration of lesson: 1 hour and 20 minutes

Notes: This lesson is easily connected to three other Scientist in Residence lesson plans: Lesson 1, Making a Soil Separator, in the Soils, Plants and First Nations science unit, Scientist in Residence Program. <http://scientistinresidence.ca/science-lesson-plans/soils-plants-and-first-nations/>

Lesson 7, Soil Composition, in the Plants science unit, Scientist in Residence Program. <http://scientistinresidence.ca/science-lesson-plans/plants/>

Lesson 13, Under our Feet, in the Temperate Forest science unit, Scientist in Residence Program. <http://scientistinresidence.ca/science-lesson-plans/temperate-forest/>

Objectives

1. Learn that soils from different locations look very different and are made up of very different components.
2. Gain experience in sieve analysis, a technique for analyzing particle sizes in a mixture.
3. Discover that soils have organic and inorganic soil components.

Background Information

Students are very familiar with soil, or “dirt”, but often do not know what soil is made up of. Soil has an inorganic component made up of different sized rocks (from large to small: boulders, gravel, sand, silt and clay), and an organic component made up of dead plant and animal matter (ref 1, 2). (There are also living animals and plants that have made soil their home.)

This lesson followed a walk in the woods to find animals living in the soil, such as worms, wood bugs, slugs and other decomposers.

Vocabulary

Soil: the top layer of the earth’s surface consisting of rock and mineral particles mixed with organic matter

Inorganic: non-living material (rocks, sand)

Organic: material from living things (whether dead or alive)



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Materials

- forest soil, dried in a low oven. I collected soil to about 20cm deep. About one large yogurt tub full for each group.
- tarps, or other ground sheet, to prevent soil debris from spreading in the classroom
- trays to catch the soil going through each mesh. Each group had two trays.
- beach soil, dried in a low oven. I collected soil to about 20cm deep. About one large yogurt tub full for each group.
- worksheets
- sheets of white paper on which to easily observe soil components
- construction site soil, dried in a low oven. I collected from the surface of a pile of fill. About one large yogurt tub full for each group.
- home-made or purchased sieves of different sizes. We made wooden frames and tacked three different mesh sizes tacked to them (3/4" mesh, 1/4" mesh and window screen mesh with about 1mm openings). Each group had all three mesh sizes.

In the Classroom

Introductory Discussion

Students are reminded of a walk in the woods, where they discovered wood bugs, worms, slugs and other animals that consume rotting plant matter and turn it into soil. Any follow-up questions to this activity are addressed before explaining to students how we will closely analyze the forest soil, and then two other soil types. (Our younger age class only analyzed the forest soil).

Brief description of science experiment/activities:

- Separate the components of three kinds of soil (forest, beach and construction fill) using meshes of different sizes
- Identify the components separated by each sieve size, for each soil type, classify each as organic or inorganic, and discuss where each comes from.
- Draw one inorganic and one organic soil component of interest, and add a scale to the drawings.

Processes of science that the students will focus on: mechanical manipulation, close observation, recording results, classifying and charting data, calculating the scale of an image.

Science Activity/Experiment

(1) Activity Title: Sieving soil

Purpose of Activity: To separate the components of forest soil, beach soil and construction site fill, and compare their differences and similarities.

Methods and Instructions:

Set-up prior to experiment: Lay the tarp out on the classroom floor, and lay out a set of sieves and soil samples for each group.

Students work in groups, ideally 4 students or less, each group with a set of sieves, and three soil samples (forest, beach and fill).



1. Choose a soil sample to start with. (Our class started with the forest soil, to follow on from our previous lesson on wood bugs and other decomposers that help create the forest soil).



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2. Dump the soil onto the large mesh sieve laid over a tray. Shake the sieve and tray simultaneously until soil stops falling through the sieve (see photo). Transfer the large soil components trapped by the sieve onto a sheet of white paper. Dump the contents of the tray onto the next smallest sieve size, repeat the shaking, transfer the trapped components to a new white sheet of paper. Repeat for the smallest sieve size. Transfer the soil remaining in the tray after the third and final sieve to its own sheet of paper.
3. Clean the sieves then repeat the soil component separation for the next soil type. Clean the sieves and repeat for the final soil type. (In our lesson, there was only time for the kindergarten/grade 1 class to look at the forest soil).
4. For each of the soil types, lay out the four sheets of paper to show the change in appearance of the forest soil components from large to small. Discuss, or do activity 2 before discussion.

(2) Activity Title: Identifying and classifying soil components

Purpose of Activity: To identify the components of three kinds of soil, compare their component similarities and differences, and classify the components as organic or inorganic.

Methods and Instructions:

Set-up prior to experiment: The separated soil components, obtained in the previous activity, are used. Students observe the separated soil components in their same groups as the previous activity.

1. Students look closely at the components of each soil type: the large components (trapped by the largest mesh), medium components (trapped by the medium mesh), small components (trapped by the small mesh) and tiny components (fell through all meshes).
2. Working in their group, students record on their worksheets what components they find for each soil. In our lesson time, the kindergarten/grade 1 class just observed and recorded the forest soil. (See first and second worksheets following this lesson plan for worksheets for older and younger grades respectively).
3. Group by group, students report to the class what they find in their soil sample from one of the locations with one of the mesh sizes. For each component, decide as a class whether it is organic (from a living thing) or inorganic (from rock), then add it to a class table.

This is what our class found:

Soil type	Organic components	Inorganic components
Forest soil	roots pieces of dead leaf twigs insect (live)	small stones
Beach soil	roots shells of various kinds including mollusk and crab pieces of seaweed or plant	sand, all different colours (white, red, brown, black) small pebbles, rocks
Construction site fill	a piece of leaf/root	large rocks small rocks clay and/or silt

4. Discuss the relative amounts of organic and inorganic material in the different soil types. For our soil types, forest soil is almost all organic; beach soil is a mix of organic and inorganic although by volume the inorganic component is larger. Fill was almost all inorganic. Other classes that get soil from other locations will give different results.



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5. Discuss how each soil type was formed and how this determines its' composition:

The forest soil is mostly made from the decomposition of dead plants by the decomposers (such as snails, worms, wood bugs, and microorganisms). If relevant, refer back to a forest walk and the decomposers observed.

The beach soil is mostly composed of the sand. This is made by the weathering of rocks, and is then carried by ocean currents before being deposited on the beach. The few plants that grow in the sand generate a thin soil as they die and decompose.

The construction site fill is from the layers of soil below the organic layers (ref 3), so it comes from the weathering of rocks to make particles of different sizes.

- (3) Activity Title: Drawing soil components

Purpose of Activity: To accurately draw a sample, and label the drawing including a scale.

Methods and Instructions:

Set-up prior to experiment: The separated soil components, obtained in the previous activities, are used. Students work alone.

1. From any of the soil types and mesh size groupings, students choose one soil component that is organic and one that is inorganic.
2. Students draw their chosen components on the worksheet (the third (last) worksheet following this lesson). Help the students add a scale to their drawing (how much larger or smaller than the real object, or draw how long 1cm is on their drawing). If appropriate, students can tape the real object on their worksheet.

References

1. <<http://www.landfood.ubc.ca/soil200/>> Soilweb, developed in collaboration with The Faculty of Land and Food Systems at UBC. Accessed May 28 2012.
2. <<http://en.wikipedia.org/wiki/Soil>> Wikipedia entry for soil. Accessed May 28 2012.
3. <http://en.wikipedia.org/wiki/Fill_dirt> Wikipedia entry for fill. Accessed May 28 2012.

Extension of Lesson Plan

Complete a study of animal adaptations and how they are able to live in these different soil types. For example the wood bug and worm have evolved to survive in moist, organic rich environments and play a large role in producing forest soil; the sand hopper lives in beach sand, and makes burrows there. (Not much observable life lives in fill.)

Soil components of three soil types

Names _____

1. Forest soil

Mesh	Soil components
caught by large mesh	
caught by medium mesh	
caught by small mesh	
falls through all meshes	

2. Beach soil

Mesh	Soil components
caught by large mesh	
caught by medium mesh	
caught by small mesh	
falls through all meshes	

3. Fill from the school grounds

Mesh	Soil components
caught by large mesh	
caught by medium mesh	
caught by small mesh	
falls through all meshes	

Name _____

What is in forest soil?

Large

Medium

Small

Tiny

Name _____

Inorganic soil components (rocks, sand, clay particles)

Scale drawing, label with the soil type it is from

Organic soil components life size drawing (dead plant or animal matter)

Scale drawing, label with the soil type it is from