

Huron County Nature Center Wilderness Arboretum

Observing Soil Sizes

Lesson Plan

Level: 3rd - 6th Grade

Developed by Bob Tallman with funding support, in part, from the Huron County Nature Center

Program Description: Students will examine soil samples from different parts of the nature center to understand how larger diameter particles like sand settle more quickly than silt and clay, and to understand what Particle Size Distribution means. The investigation will also help them to understand how the distribution of different sized particles in the natural environment affect how the landscape appears and how soil can and cannot be used.

MEAP Benchmarks:

SCI. V 1.Elem. 2: Recognize and describe different types of Earth Materials.
SCI.V 1. Middle 3: Soil determines surface changes over time.

Overview

The size of particles is a very important characteristic of soil. Smaller particles, like clay, will not let water pass through as easily as larger particles, like sand. Soil that allows water to drain, and not pond, is best for growing gardens, building buildings, and many more uses. However, soils that retain water create good habitats for fish and waterfowl and are good for recreational uses, but not for roads and buildings.

Time

One class period, and allowing filled bottles to stand overnight once completing all steps.

Key Concepts

- How larger diameter particles settle more quickly than smaller diameter particles
- How different sized particles are distributed to create specific soil textures
- How soil particle size distribution affects the movement of water, heat, and nutrients in soil.
- How soil texture impacts the use of soils

Skills

- Identifying variations of particle sizes Acknowledging the behavior of soil particles in water
- Analyzing the rate of settling of soil particles
- *Understanding that gravity, velocity, particle size, temperature, and liquid are factors that influence settling of soil particles.

Materials and Tools

- Soil - 1 1/2 cups
- Sand - 1/2 cup
- 2 juice bottles with wide mouths and lids
- Paper or plastic cups
- Masking tape
- Pen
- Metal teaspoon
- Water

Alternate Materials

- Centrifuge and tubes
- 3 cm soil
- water

Preparation

Conduct a discussion about sand, silt, and clay, where they are found in the natural environment.

Discuss that knowing how much sand, silt and clay are in a soil help determine how much water and heat will be held in soil and move through soil, and also how well nutrients will be held in soil for plant use.

Background

Existing in the natural environment are mineral materials that make up soil. There are three particle sizes of mineral material known as sand, silt and clay.

The United States Department of Agriculture (USDA) defines particle sizes as:

sand 2.0 mm - 0.05 mm in diameter

silt 0.05 mm - 0.002 mm in diameter

clay less than 0.002 mm in diameter

The amount of each size particle in soil is called particle size distribution. Since it is very hard to determine the approximate amount of each particle size in soil, certain tests are done to determine their amounts. Here is a simplified test that gives students the basic ideas pertaining to the soil particle size distribution test soil scientists use.

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Student Worksheet

Procedure:

Use your masking tape and pen to label one bottle soil and the other bottle soil and sand

Put about one cup of soil from a moist part of the Nature Center in a cup

1. Fill the soil bottle about $\frac{3}{4}$ full of water. Very slowly pour the soil into the water.

What do you notice about the way the soil particles sink in the water? Do the different sizes seem to sink at different speeds?

2. After all the soil is in the water, fill the rest of the bottle with water if the water is not to the top already. Put the lid tightly on the bottle. Shake the bottle back and forth several times. Place the bottle on a flat surface where it will not be disturbed.

3. Take your remaining $\frac{1}{2}$ cup of soil and add $\frac{1}{2}$ cup of sand to the soil. Mix thoroughly with your spoon.

4. Repeat steps 1 and 2 with the soil and sand bottle and the soil and sand mixture. Wash hands after handling soil. Allow both bottles to stand overnight. Observe the bottles the next day. Look at the bottles from the side.

class investigation- Do you notice any layers in the bottles? How would you describe the particles that make up these layers? Are some layers thicker than others? Do you think this is a good way of finding out the amount of different size particles in soil? Why or why not?

Alternate Procedure if a Centrifuge is available.

- 1. Place 2 cm of soil sample in a centrifuge tube.**
- 2. Add 3 cm of water for a total of 5 cm of material in the tube**
- 3. Place thumb over the tube opening and shake**
- 4. Place the tube in the centrifuge and spin.**
- 5. Observe the side profile of the soil which will show the layers of different materials in the soil and answer the questions above.**