sauvie island center

POST-TRIP LESSON: DIRT DECONSTRUCTED

Overview: Students discover the soil composition outside the school with a simple scientific test, and discuss actions they can take to improve soil health.

Sauvie Island Center Field Trip Connections: Soil and Compost

Objectives:

Students will be able to:

- Identify the four ingredients of soil (water, air, minerals, and organic matter), and describe how each is important for healthy plants
- Describe the composition of their soil sample
- Explain actions they could take to improve the health of their soil.

NGSS Essential Questions

- *How do organisms interact with the living and nonliving environments to obtain matter and energy?*
- *How do humans change the planet?*

Grade: *3-5*

Time: Two 30-minute lessons, at least one day apart

Location: Schoolyard and classroom

Materials:

- Mason jars or other wide-mouth clear containers with lids, quart size or larger- enough for every 2-3 students to share
- Trowels
- Water
- Science notebooks or other paper
- Pencils
- WAMO Soil Composition Pie Chart (Appendix A)
- Magnifying glasses

Lesson Outline:

Day 1:

Part 1. After the field trip, review the ingredients of soil (WAMO) using the soil pie chart. In order for healthy plants to grow, soil must have the right amounts of:

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Lesson Outline *cont:*

▪ **Water** - for plants to suck up through their roots
▪ **Air** - so plants have space to grow into the soil
▪ **Minerals** (the ingredients of rocks) - to give structure to the soil. Minerals are organized into three particle sizes, and the healthiest soil has an even mixture of each:

▹ *Sand*: gritty particles of rock big enough for us to see with our naked eye. Water moves very quickly through sand, so soil with lots of sand in it dries out very fast.

▹ *Silt*: smaller particles of rock, tough to see with the naked eye. Silt lets water drain slowly, so many farmers think soil with plenty of silt is the perfect soil.

▹ *Clay*: teeny tiny particles of rock too small to see, which often stick together into big globs of clay. This is the same clay we use in art class. Clay retains too much water in the soil, so the soil becomes water-logged, and is tough to work with.

▪ **Organic matter** (anything living or dead in the soil) - decomposers like worms and bacteria break down dead matter into compost. Plants need the nutrients in compost to grow. Tell students that in this activity, they will discover what the soil around the school is made of.

Part 2. Go outside and find a place to dig. Ideally, find a place that is relatively dry (under a tree or next to the building) and not very packed down. Working in small groups of two or three, have students scrape away the top loose layer of the soil, including dead leaves and other "duff." Then, have then dig in the soil and fill their jars ½ to ⅔ full of soil.

Part 3. Back inside the classrooms, have students label their jars with their names, and then make observations of their soil. In their notebooks, have them answer the following questions to address each soil ingredient:

- **Water**: How wet is the soil? Does the soil feel moist and cool? Sticky and muddy? Dry and dusty?
- **Air**: How much air does the soil have in it? Does it feel light and fluffy, or hard and packed? Can you squeeze it smaller in your hand?
- **Minerals**: Do you think this soil has more sand, silt, or clay in it? When you rub it between your fingers, does it feel gritty (sand), dusty (silt) or sticky (clay)?
- **Organic Matter**: Look closely at the soil with magnifying glasses. Can you see evidence of decomposers or other animals? Dead bits of plants like leaves, roots, or twigs?

Part 4. Have each student complete the soil jar test
▪ Pour water into the jar until the soil is covered with 1-2 inches of water, but not completely full of water
▪ Screw the lid on TIGHTLY
▪ Shake the jar vigorously for several minutes, until all the clumps are broken up
▪ Set the jars in an out-of-the-way location where they will not be disturbed. Do not touch them for at least 24 hours to allow the particles to settle. The heaviest particles (sand) will settle first, then the silt, and then finally after many hours, the tiny clay particles.

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Lesson Outline *cont:*

Day 2:

Part 1. Have each group CAREFULLY AND GENTLY retrieve their jars, without sloshing or shaking, and bring them to their tables. By now, the particles should be visible in clear layers, with the gritty sand on the bottom, silt in the middle, and clay on top. The organic matter, including any dead plant parts, should be on top of the clay and/or floating on top of the water

▪ Have students observe their jars with magnifying glasses, draw their jars in notebooks, and label the layers
▪ Compare the size of each layer. Does it have a relatively even mix of sand, silt, and clay? Would this be good soil to plant in?

- Example: my soil has a lot more sand in it than silt and clay. It will be very loose, and will not hold on to water well, so it could be difficult to grow plants in.

▪ How much organic matter does your soil have? Is there are least 10% as much organic matter as minerals?
▪ How healthy is this soil overall? How do these findings compare with your observations and hypotheses from day one? Is this what you expected to find?

Part 2. Have students imagine they were going to turn this soil into a garden. Discuss what you could do to improve the quality of this soil to grow the healthiest plants:

Water: Make sure to water the garden just the right amount, so that the soil is not to wet & not too dry.
Air: If the soil is packed down, it can be tilled and/or shoveled to be "fluffed up so there will be more space for plant roots and decomposers to move around.
Minerals: It is possible, although difficult and expensive to adjust the mineral content of soil, by mixing in sand or clay. However, many gardeners will just choose to buy new topsoil instead.
Organic Matter: If soil has too little organic matter, gardners can add homemade or store bought compost to increase this.

Extension Opportunities:

▹ Practice fractions: Using a ruler, measure the height of each layer of minerals, and convert to fractions to calculate the mineral composition of the soil.

- Example: I have 3 inches of soil in my jar. I measure 1½" of sand, 1" of silt, and ½" of clay. My soil composition is ½ sand, ⅓ silt, and ⅙ clay.

▹ Take soil samples from several different locations, compare and contrast.

▹ Take soil samples from the school garden. Determine the health of the soil, and then make suggestions to improve the garden health.

▹ Research and conduct other types of soil tests, like pH and temperature.

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Next Generation Science Standard Connections:

Disciplinary Core Ideas:

▪ **Life Science 2.A: Interdependent Relationships in Ecosystems** *How do organisms interact with the living and nonliving environments to obtain matter and energy?*

- ▹ Plants depend on water and light to grow. (2-LS2-1)
- ▹ The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

▪ **Earth Space Science 3.C: Human Impacts on Earth Systems** *How do humans change the planet?*

- ▹ Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (secondary to K-ESS2-2)
- ▹ Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

Science and Engineering Practices:

▪ **Planning and Carrying Out Investigations**

- ▹ Planning and carrying out investigations in grades K-2 involves making observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.
- ▹ Planning and carrying out investigations in grades 3-5 progresses to include making observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

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Appendix A: WAMO Soil Composition Pie Chart