



Soil Sleuths

Grade: 3

Subject Areas:

Life Science, Earth Science, Social Science

Skills: classifying, , describing, identifying, observing, predicting

Duration: 1 hour

Connections: agriculture, geography, geology, plant science, natural resource planning

Vocabulary

natural resources

soil

humus

texture

sand

clay

loam

soil type

dirt

Objective:

Students will be introduced to the importance of soils and will classify various soil types using a hands-on investigation.

Materials

- a poster of a soil profile
- three clean soil samples for introduction
- a cup of water at each table
- eye droppers
- small shovels or hand trowels
- containers for collecting soil samples
- microscopes or magnifying glasses
- tweezers
- jars with lids
- tall jars or cylinders
- gloves (optional)
- student worksheet

Standards

Strands: Excellence in Environmental Education Guidelines

Strand 1 — Questioning and Analysis: B) Designing Investigations:

Learners are able to design simple investigations. **C) Collecting Information:** Learners are to locate and collect information about the environment and environmental topics.

Strand 2.4 — Environment and Society: C) Resources: Learners understand the basic concepts of resource and resource distribution.

California State Educational Standards:

Life Sciences 3b: Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, grasslands, and wetlands.

3d: Students know living things cause changes in the environment in which they live; some of these changes are detrimental to the organism or other organisms, and some are beneficial.

I and E 5e: Students will collect data in an investigation and analyze those data to develop a logical conclusion.

Background

Building Blocks

It takes centuries of weathering and decay to make a rich loamy soil. The most fertile places on Earth are river valleys. These are the places where rivers periodically overflow their banks replenishing the earth by adding valuable nutrients. Fertile valleys like the Central Valley of California or the Nile River Valley of Egypt have been formed by sediments being carried and deposited over centuries. Elsewhere soils have been depleted beyond repair and civilizations have collapsed as a result.

Soil is one of the most important natural resources. **Natural resources** are naturally occurring substances used to meet human needs and wants. Soils bring air, water, and nutrients to the plants they support. Places with rich loamy soils are important for growing food, like the central valley of California. Because of these rich soils, California is able to provide 80% of all fruits and vegetables consumed in the United States.

Simply put, soil is weathered rock combined with a mixture of living material (plants, animals and bacteria) and air space. It takes as much as 500 years to produce 1 cm of topsoil. In steep mountainous areas, soils may never reach 1 cm thick. **Humus** is the term given to the living part of soil. One tablespoon of rich soil has more microorganisms living in it than there are people living on earth (over 6 billion). As the world population continues to grow, there is increased pressure to supply more food.

Intensive farming has put pressure on soils. Through mismanagement, soils can become depleted. Farming techniques that practice crop rotation, apply organic fertilizers, such as compost, and refrain from regular plowing can maintain productive soils. Anyone who has tried their hands at gardening knows something about soils.

Most plants, including those humans depend on for food and materials, need soil. Plant roots tap the soil for needed water and absorb much needed nutrients supplied by the soil. In turn, the roots of plants help aerate the soil. Soils are often classified by texture. **Texture** refers to their “feel”. How much clay, silt and sand a soil

has determines its texture. **Sand** has the largest particle size and feels gritty. **Clay** has the smallest particle size and feels smooth. What plant communities will grow in certain places depends largely on the soil type. The ideal **soil type** for most fruits, nuts and vegetables is a loamy soil. **Loam** is a fairly equal mix of all three textures (clay, silt and sand). In addition to texture, soil type is also classified by soil structure and soil color.

How much water holding capacity a soil has helps define its structure. Much of the King Range National Conservation Area (NCA) is covered by forest. Forests need lots of water and healthy soils. In fact, trees partly fertilize themselves when they shed

Local Connection

Teachers have a wealth of informal environmental education opportunities available to them, many of them free. The hub of activity is primarily through the California Regional Environmental Education Community (CREEC), also known as the CREEC network. The overlying goal of this state funded organization, is to connect teachers with high quality environmental education resources to increase the environmental literacy of all California students. The North Coast CREEC region 1 services Del Norte, Humboldt, Mendocino, Sonoma, and Lake counties.

The CREEC network collaborates with a host of resources including private business, government agencies, and community organizations. This network has its fingers on the pulse of environmental education across the nation. There are many local members including the zoo, the parks, BLM, Fish and Game, 4-H, the Redwood Science Project and several non-profit organizations to name a few. The regional website features a searchable Resource Directory of environmental education programs and resources.

Outreach efforts by members of the Resource Directory include lectures, field trips, environmental fairs, special classroom programs and after school programs. To find out what programs and resources are available at your school, go to: <http://www.creec.org/region1/>. This website provides links to partners, calendars, newsletters, and much more.

their leaves by adding nutrients to the soil. The roots of trees help stabilize the soil and prevent erosion. Many trees have special relationships with microorganisms, like fungi, that live in soil. The nature of soils is always changing. For instance, a fallen log adds organic matter to forest soil as it decays.

Soil is an important filter. It helps absorb pollutants and it helps to regulate how fast water moves through the landscape. The rate in which water can percolate down through the earth is dependent upon a soil's porosity. Porosity refers to how large the air spaces are within the soil structure. The roots of plants need to have space around them to trap air and moisture. The greater the porosity the farther apart the sediments sit. Soils with high porosity move water quickly.

Really Resourceful

Often people refer to soil as dirt. **Dirt** is soil that has been depleted of its life giving properties. Dirt is what you get under your fingernails or on the bottom of your boots. Soil is alive. This important resource is often overlooked and underappreciated. Here is a list of the vital functions soil provides from the Soil Science Society of America:

1. Soils serve as media for growth of all kinds of plants.
2. Soils modify the atmosphere by emitting and absorbing gases (carbon dioxide, methane, water vapor, and the like) and dust.
3. Soils provide habitat for animals that live in the soil (such as groundhogs and mice) and to organisms (such as bacteria and fungi) that account for most of the living things on Earth.

4. Soils absorb, hold, release, alter, and purify most of the water in terrestrial systems.

5. Soils process recycled nutrients, including carbon, so that living things can use them over and over again.

6. Soils serve as engineering media for construction of foundations, roadbeds, dams and buildings, and preserve or destroy artifacts of human endeavors.

7. Soils act as a living filter to clean water before it moves into an aquifer. 1. Soils serve as media for growth of all kinds of plants.

Activity: Investigating Soil

Preparation

Scout out the school and the surrounding area for appropriate places for taking soil samples. You will want at least three different sites. Check with the administration or custodial staff about your selected places. Possible places are under trees, the edge of a lawn, a field, a garden area, and an abandoned area. Mark these places by placing a flag or another marker that can be easily spotted. Student work areas will need tools for viewing and classifying soils.

Procedure

1. Show the students a poster showing a complete soil profile. Ask them questions about the picture and the importance of soils. Next, have three soil samples in three different bowls. Ask one or two students to come up and look at the samples closely. When they come up, have them observe and describe the differences between the three soils.

- *Who has a garden at home?*
- *What sort of things have you observed living in soil? (Hold up a picture of a soil profile)*
- *What does this picture show us?*
- *What kinds of changes do you notice between the different layers shown here?*
- *Where might you find worms?*
- *Where might you find roots?*
- *What is found below soil? (bedrock) (pick a few volunteers and show them soil samples)*
- *What is different between these three soil samples?*
- *What is similar about them? (continue with questioning)*
- *Are their clues in soil letting us know where they may have come from?*
- *How might a soil from a desert differ from a soil from a forest?*
- *How does soil help people?*
- *Do you think plants that people need like food crops will grow in any type of soil?*
- *How do you suppose people test for soil type? (they add water, they squeeze it between their fingers, they dig out a sample, look at color, etc.)*

Materials

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- gloves (optional)
- student worksheet

2. Write down some of the vocabulary terms as you talk about soil. An option is to have the students take notes. Explain to the students that you are going to investigate soil. Each team will study and classify a different soil sample (see handout). Using one of the three soil samples brought in, show what kinds of test the students will do to their soil, once they get a sample. Set some clear rules for collecting soil samples. Those who want to dig should take turns.

Activity continued...

3. Break the students up into 4 to 6 teams depending on the class size. Model how to properly collect a sample and how much they should collect once outside. It is important to dig down at least 4 inches below ground level to get a representative sample free of leaves and such. Direct them to the selected locations and have the students bring back a small sample (about 2 cups). Students can select locations as well under adult supervision. Back in the classroom, have stations set up for each group to investigate their soil sample.

4. At the individual stations encourage students to observe their soil closely and fill out their student worksheet. Pass the worksheet out (see attached) Students are bound to be attracted to anything moving in their soil sample, so give them ample opportunity for simple observations. Each group table should have a cup of water, eye droppers, and magnifying glasses. Each person should record what they observe. They should answer the questions on their soil investigation sheet.

5. If time allows, have the students attempt to identify some of the living things in the soil. Using their tweezers have them carefully remove and classify what they see. On a piece of white paper they can label their categories (e.g. leaves, twigs, roots, microorganisms, etc). For anything large like worms, spiders and insect larvae have

special containers ready so that these are not harmed. As students finish touching the soil, make sure they wash their hands. Emphasize the importance of hand washing. At the end, if time allows, have the students share what they have learned about soil particularly the sample that they investigated. Finish by singing a song about soil (optional).

Extensions

- Introduce different areas of the planet using different soil types.
- Sing songs about soils. Some songs are available at: Singing Songs of Science.
- Use soil to introduce the lives of plants.
- Using different soils, grow the same type of seed. and have students observe any changes.
- Weigh and measure different soils.
- Explore soils further online at Just for Kids: Soil Biological communities — available at <http://www.blm.gov/nstc/soil/Kids/index.html>

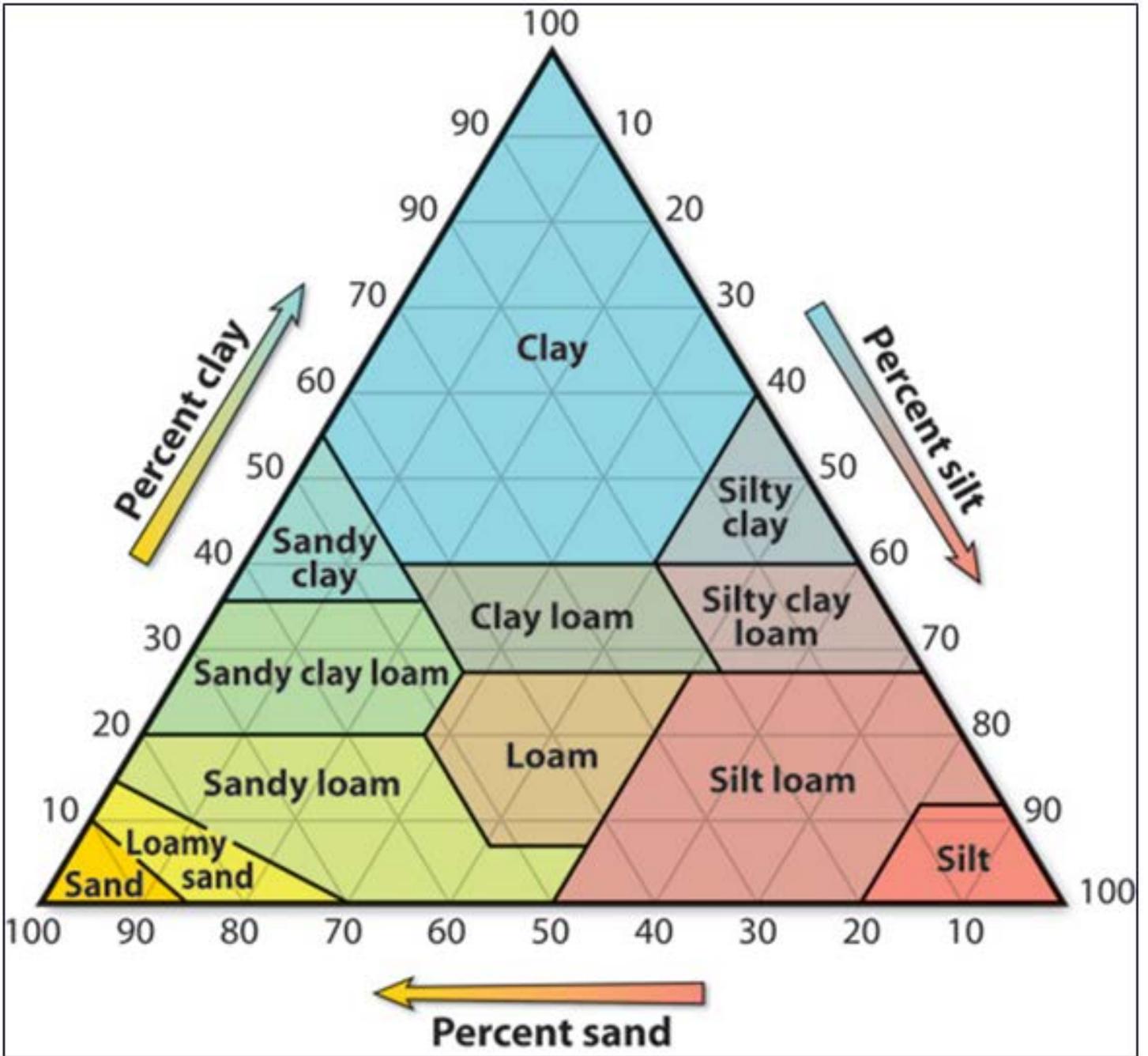
References

- CREEC network, Northcoast, <http://www.creec.org/region1/>, 2011
- Soil Science Basics, <http://soil.gsfc.nasa.gov/>, 2011
- Soils, Secondary Introduction: <http://www.soil-net.com/>, 2011
- Soils Overview: <https://www.soils.org/files/about-soils/soils-overview.pdf>, 2011
- Lesson modify from: "Soil Stories", Project Learning Tree Environmental Education Activity Guide Pre K-8 1993.

FOSS Connection

Grade 3

Earth Science: Earth Materials





**O (humus or organic
A (topsoil)**

E (eluviated horizon)

B (subsoil)

C (parent material)

R (bedrock)

Group: _____

Date: _____



Describe where the soil is from:

- a. Where was your soil site? Use words or draw a picture
- b. What was growing on the site?
- c. Was the location level or on a slope?
- d. What other things did you notice about your site?

Describe the soil:

- a. What color was it?
- b. How does it smell?
- c. What do the largest soil particles look like? The smallest?
Get the soil sample slightly wet by adding drops of water.
- d. How does it feel? Roll some in your fingers.
- e. Does your soil stick together easily?
- f. How does your sample compare to the other soil samples?

Describe what is in the soil:

- a. What are the components of your soil sample?
- b. Describe what living components you observed.
- c. On the back of this sheet, draw a picture of one of the living components observed.