Western Upper Peninsula Center
for Science, Mathematics and Environmental Education

A partnership of

Copper Country & Gogebic-Ontonagon Intermediate School Districts and Michigan Technological University
Serving schools and communities in Houghton, Baraga, Gogebic, Ontonagon and Keweenaw Counties

Thirsty Soil Science

Duration: 1.5 hours **Grade: 4-6**

Sources: Wow! The Wonders of Wetlands (pg. 231-238) St Michaels, MD: Environmental Concern Inc. and The Watercourse

Objectives

At the end of this lesson, students will be able to:
1) Explain why the study of soils is useful to humans.
2) Conduct an investigation to determine texture of a soil sample using the "feel method."
3) Conduct an investigation to compare the soils found at 2 or more different sites.

Materials:

- Soil Augers
- Trowels
- Clipboards/pencils
- Soil Profile data sheet
- Soil Profile Horizon sheet
- Soils Data chart
- Soils Quadrat Sampling Study
- Key to Soil Texture by Feel sheet
- Meter sticks
- Magnifying glasses

Introduction:

What is soil?
Soil is the solid material on Earth's surface that results from the interaction of weather and biological activities with the underlying geologic formation. There are nearly 21,000 soil types found in the United States.
Ask students the difference between soil and dirt? Dirt can be dust on the floor and mud on shoes, while soil is the medium in which plants grow and animals live.

What Is soil made of?
1. 45% Minerals (Rocks break down to soil due to water and air erosion)
2. 5 % Organic matter = decomposed plants & animals
3. 25% Water (from precipitation: rainfall and snowfall)
4. 25% Air (fills the spaces between particles, until forced out by water.

How does soil form?
1. Weather/climate
2. Underlying geology
3. Biological organisms
4. Topography
5. Time - soils in U.P. are ~10,000 years old; soil forms at rate of 1 cm per 250-2,500 yrs

How Are Soils Described?
A) Soil Profile – Soils are arranged in layers called horizons
1. Organic Horizon – plant and animals range from undecomposed to fully decomposed. Peat soils are 100% organic material found in bogs and fens.
2. A Horizon – *topsoil* – Topsoil is the most important layer of soil because it can be modified by cultivation, erosion, fertilizer, and it is where the activity of soil organisms takes place.
3. B Horizon - Subsoil
4. C Horizon - unconsolidated parent material
5. Hard Bedrock

B) Naming of Soils – each soil type is named after the town where it was first described. Michigan State Soil is "Kalkaska Sand."

C) Physical Properties of Soils – color, texture, drainage (infiltration rate), structure, depth

D) Soil Texture (or particle size) – all soils made up of clay, silt, sand; ~ equal parts of each is called loam. Soil texture influences: permeability, porosity, erodability.
Soil Texture can be determined by:
"Feel Method"– using small amount of soil and water, try to ribbon out soil between your thumb and forefinger. This is the method that we are going to use today.

What lives in soil?
In a single spoonful of fertile soil there may be seven billion bacteria, a million fungi and one hundred thousand algae. These tiny microorganisms and bigger animals help build, enrich and restructure the soil. Burrowing worms and mammals, such as moles, badgers and prairie dogs, help keep the soil loose so that water can penetrate and circulate in the soil. Loose soil makes it easier for plant roots to take hold and grow. The rich organic humus (dead organic matter) enriches the soil for living organisms.

Earthworms are especially important and necessary to the good health of the soil. Earthworms eat soil and digest the organic matter from the soil to get nutrients. They are

considered *nutrient recyclers or decomposers.* They then spread their nutrient rich excrement throughout the topsoil, creating new soil in which new plants can grow. They live in tunnels called burrows in the soil which loosens the soil, allowing plant roots to grow down through the soil. These burrows also help bring oxygen down into the soil and permitting rainwater to flow through soil and carry nutrients to plant roots.

Why Is It Important to Know the Type of Soil?
Soil Type determines suitability for different land uses, such as:

- What kind of crops will grow there (fertility) –farming, gardening, orchards
- Grasslands & pasture for grazing
- Type and productivity of different forest types – conifer, hardwood
- Roads & building sites (sand is best)
- Whether it will erode—blow or wash away
- Wildlife habitat – grassland, forest, desert
- Septic system /percolation? Landfill siting? (clay has very limited drainage; gravel and sand may drain too quickly)

Activity: Compare Soils at Different Locations

Materials Needed: soil augers, meter sticks, trowels, clipboards and data sheets.

1. Organize students into groups of 3 or 4 students. Each student should have their own data sheet.
2. **Soil Profile:** Explain the soil profile hand-out. Review the soil profile description presented in the introduction. Tell students they will be making their own soil profile on their data sheets. Students will compare two different sites and record the soil profile.
3. **Ask: why is it important to take a soil profile?** Soil profiles indicate the best use for that type of soil…some soils can support the massive weight of buildings, shopping centers and airports, and highways. Some are best for crops or ranging land, some for wildlife habitat and forest.
4. Complete the Soils Data Chart for each of the 2-3 soil profiles (about 10-15 min. per site)
5. Compare the soil characteristics at each site.

Assessment:
Ask students:
What is soil?
What is soil made of?
How do animals affect soil, in particular earthworms