Identifying Your Soil for Rain Gardens

Activity Overview
Students identify soil type at their proposed rain garden location(s) using a soil texture feel test key.

Objectives
Students will:

- Manipulate and feel soil to classify soils by texture using a key
- Understand the relationship between soil particle size and water movement through soils
- Compare the composition of soil types

Subjects Covered
Science

Grades
K through 12

Activity Time
1 hour

Season
Any

Materials
Soil samples, spray bottles of water, paper toweling, Key to Soil Texture by Feel

State Standards
Science: C.4.2, C.4.3, C.4.4, C.4.5, C.4.7, C.4.8, C.8.1, C.8.2, C.8.4, C.8.5, C.8.7, C.8.9, C.8.10, C.8.11, C.12.1, C.12.2, C.12.3, C.12.5, C.12.6, D.4.1, D.4.2, E.4.1, E.4.2, E.4.3, E.8.3, E.8.4, F.4.4

Background

Determining the soil type for your proposed rain garden is an important factor for calculating its size. Two other factors needed to size a garden are drainage area and percent slope. Together these three factors give you the square footage needed to collect and infiltrate 100% of the rain water that falls in the drainage area. The type of soil influences the size and depth of the garden area. If the soil is sandy, rain gardens can be smaller and deeper because water drains quickly. If the soil has more clay, the garden will need to be larger and shallower because water drains more slowly. It is important to allow water to drain quickly so that mosquitoes will not complete their life cycle from egg to insect. Determining soil type, drainage area and slope will ensure that water will soak into the garden within 6 to 12 hours.

There are several methods to identify the type of soil in your proposed rain garden. It is not necessary to use expensive equipment to analyze your soil type; simply feeling the soil with your hands is adequate. If interested in learning more about your soil, such as its fertility, you can have your soil tested. It is also possible to test water flow through your soil to determine soil type. This soil test is described in Earth Partnership for Schools activity, "Infiltration Test: Exploring the Flow of Water Through Soils."

What is soil type?
Soil is made up of three particle sizes—sand, silt, and clay. Sand is the largest particle (0.05 to 2 mm diameter); silt is intermediate (0.05 to 0.002 mm); and clay is the smallest (less than 0.002 mm). Soils have different textures depending upon the proportions of sand, silt, or clay particles in the soil. A soil texture is graded into 14 texture classes or types such as sand, sandy loam, silty clay loam, loam, sandy clay, or clay. Sandy soil is any mix with over 90% sand; sandy loam is 70% sand, 15% silt, and 15% clay; clay soil is 50% clay, 25% silt, and 25 % sand; heavy clay is any mix with over 60% clay particles.

The texture of the soil influences the moisture holding capacity of soil, the drainage rate, and the soil's ability to hold nutrients. Coarse, sandy soils drain water quickly, are poor storehouses of nutrients, and create droughty conditions for plants. In clay soils water drains slowly; as a result, soil remains wet for long periods and often hinders root development. Plants growing in clay must be able to tolerate long periods of excessive moisture with low oxygen conditions, or endure dry, hard soil. The medium texture of silt-sized particles creates a loamy soil that is well drained and holds nutrients. It is ideal for most plant growth.

Soils can be classified into texture classes or types by the way they feel and respond to handling. Sand feels gritty, and the grains do not stick together when squeezed. Silt feels velvety or flour-like when dry and forms a weak ribbon when wet. Pulverized dry clay feels smooth; aggregates and clods are

very hard and difficult to crush by hand. Wet clay feels sticky or very smooth and satin-like when rubbed and forms a long, flexible ribbon.

Where does organic matter fit into the soil mix?
Organic matter is the biological components of the soil. Organic matter is either decomposed material or material in the process of decomposition; or fresh organic material; or living organisms. Organic material plays vital roles in the soil. It acts like a sponge, being able to absorb six times its weight in water. It holds onto nutrients that would otherwise wash away. Organic matter loosens heavy clay soil by creating spaces for air and water movement. Also, it adds nutrients such as nitrogen, phosphorus, potassium, and carbon.

You will notice over time that your rain garden will drain water more quickly. That is because the plants have a tremendous ability to infiltrate more water than soil alone. The deep-rooted plants encourage infiltration two ways. First, the long roots create channels that direct water down into the ground. Second, they slough one third of their roots each year, adding organic matter to the garden. Additionally, the plant roots have a great capacity to absorb water that will eventually transpire from the leaves and stems.

Activity Description

Collect soil samples from proposed rain garden locations on the school grounds. Collect one and one-half cups of soil per sample for your classroom. Place about two teaspoons of soil in your hand. Spray water from a spray bottle to moisten the soil enough to form a ball. Next, use the soil texture feel test key to determine soil type. The step-by-step directions on the key will guide you through the process of soil identification. As a warm-up exercise, practice determining soil type with samples that are clearly comprised of sand, silt, or clay.

Extensions

- Soil textures vary from one horizon (soil layer) to the next; therefore, try to determine the texture in each of the A, B, and C horizons. Learning the soil texture of each horizon will help you assess the soil's permeability at different levels. In some soils, the water drains quickly in the topsoil but drains poorly in subsoil. See Earth Partnership for Schools activity, "Soil Profile Investigations 3-12," for more information about soil horizons.
- Take soil samples in the schoolyard, and send samples to a soil testing lab for professional testing and analysis.
- Determine soil type using a soil texture triangle to determine percentages of sand, silt, and clay in a soil sample.
- Classify and compare soil texture at different locations on a slope or in eroded areas. Which particles collect at the base of the slope or remain on top? Which particles erode first? Is the pattern similar to particle movement on a slope? Can you predict which soils are more susceptible to erosion?

Additional Resources

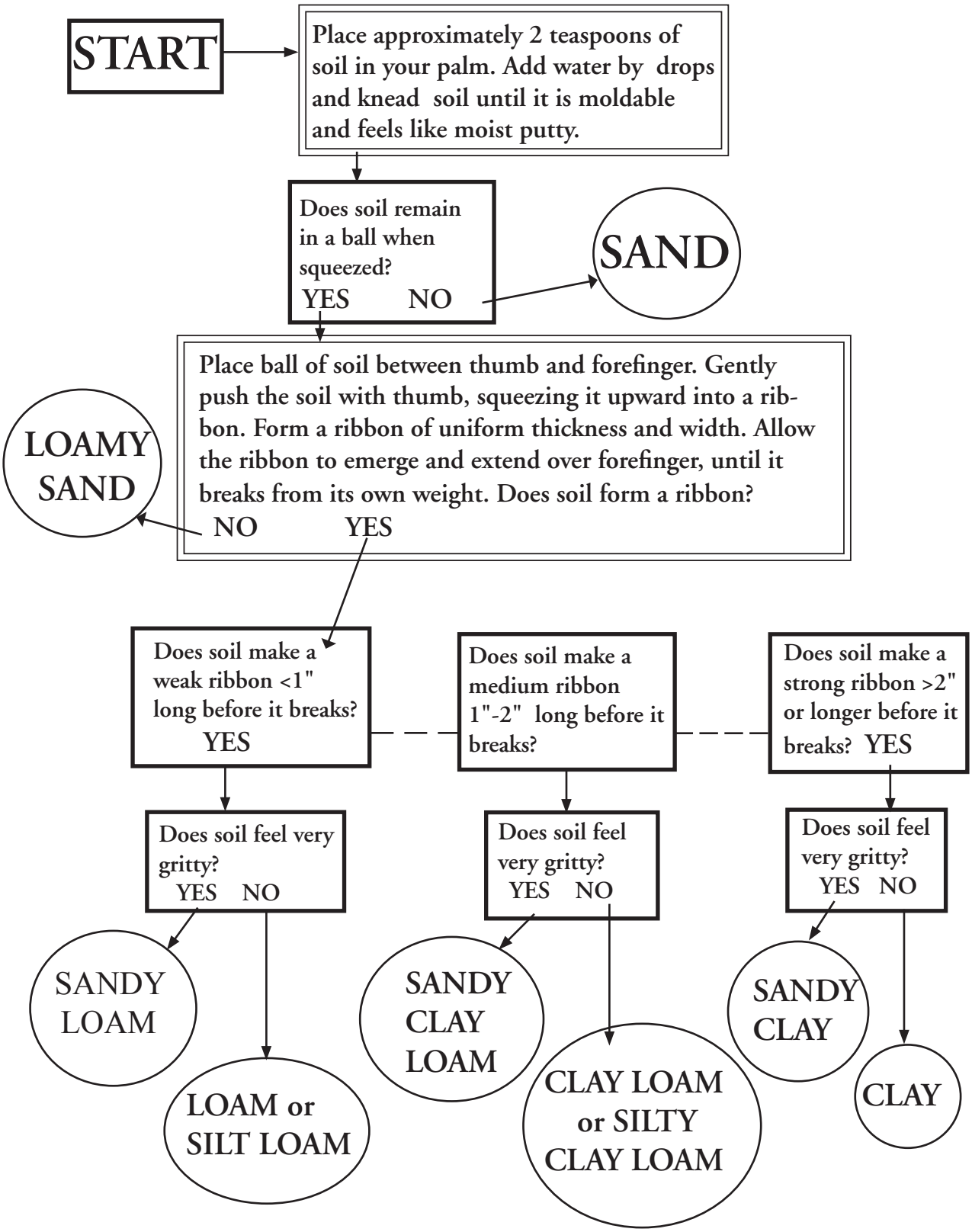
- Hole, F. (1976). *Soils of Wisconsin.* Madison, WI: The University of Wisconsin Press.
- Kesselheim, A.S., Slattery, B.E. (1995). *WOW! The wonders of wetlands.* St Michaels, MD: Environmental Concern Inc.
- Lynn, B. (1988). *Discover wetlands: A curriculum guide.* Olympia, WA: Washington State Department of Ecology Publications Office.
- Mitsch, W. J., Gosselink, J. G. (1993). *Wetlands,* 2nd ed. New York, N.Y.: Van Nostrand Reinhold.
- Project WILD. (1992). *Aquatic Project WILD*. Bethesda, MD: Western Regional Environmental Education Council.

Assessments

- Explain how soil is classified, and describe two to three properties of each soil textural type.
- Explain the relationship between soil particle size, plant growth, and water.
- Determine the soil texture of three soil samples.

Soil Texture Feel Test Key

Begin at the place marked "start" and follow the flow chart by answering the questions, until you identify the soil sample. Please note that soils having a high organic matter content may feel smoother (siltier) than they actually are.



Source: Adapted from WOW!: The Wonders of Wetlands, Environmental Concern Inc.