LESSON PLAN: Soil Hand Texturing

Introduction:

Soil texture is a soil property that can tell us a lot about the fertility and water management needs for a given soil. This lesson introduces students to a very useful technique that is commonly used by soil scientists and other land managers in the field – hand texturing.

Prescribed learning outcomes (PLO) are content standards for the provincial education system; they are the prescribed curriculum. The "Soil Hand Texturing" lesson plan will help students to achieve the following BC PLOs[1]:

Science 8, 9, 10 – Processes of Science (A1-A6)
Earth Science 11 – Surface Processes and the Hydrosphere (F3)
Geology 12 - Surface Processes and the Hydrosphere (F1, F2)
Chemistry 11 – The Nature of Matter (B3-B5)

Learning Objectives:

- Observe the differences between fine and coarse textured soil
- Determine which soil texture (fine vs. coarse) has better drainage and nutrient holding abilities
- Become familiar with the tests used by soil scientists to work through a hand-texturing key (as would be used in the field)

Materials:

- A dry, coarse soil (preferably sieved to the 2.0-0.5 mm diameter range)
- A dry, fine soil (preferably sieved to <0.5 mm diameter)
- Two other dry, sieved soils of known textures (to be used as “Mystery Soils”)
- Water bottles

Activity Description:

Outline the idea that plants need 3 main things to grow: air, water, and nutrients. The soil regulates the belowground accessibility of these components to uptake by plants, and the texture of the soil plays a large role in this. Texture is the size of the mineral particles in the soil, and it is comprised of 3 main class sizes:

1) Sand: 2.0-0.5 mm diameter
2) Silt: 0.5-0.002 mm diameter
3) Clay: <0.002 mm diameter

The diameter information is not terribly important; what is important is that clay is much finer than sand, and a fine textured soil has different properties than a coarse textured soil. (These properties are outlined in more detail on page 2.) This means that knowing the soil

[1] Please consult the appropriate Integrated Resource Package (IRP) to identify the PLOs. A catalogue of the BC Curriculum Documents (including IRPs) can be found here: http://www.bced.gov.bc.ca/irp/all.php?lang=en#

texture can provide soil scientists with valuable information about a particular soil. There are lab methods that exist to work out the exact percentages of each size class, but in the field, soil scientists rely on the **hand-texturing method**. In this lesson, students will practice the hand-texturing method on samples of known texture, and then put their skills to the test in identifying some "mystery samples".

Photos: Dru Yates

Figure 1. The student above has made a ball/cast of the soil (left) and a worm (right) to test for differences in soil texture.

To begin, place the equivalent of about a teaspoon of soil in the palm of your hand. Pick out and discard coarse fragments and large pieces of organic matter. Then, add some water to moisten the soil; having the soil too wet makes it hard to manipulate, so add the water drop by drop, and work the soil with the fingers of your other hand to obtain a moist, workable putty.

Students can then work through the "Key for Soil Texture Determination" (page 5). By working through this key, students can try different hand-texturing tests (as shown in Figure 1) in order to end up at a particular soil texture type. Some tests to help students work through this key are outlined on page 3.

Hand-texturing takes a lot of practice! Once students have had a chance to work through a few known samples, have them move on to two "mystery samples", where they need to use their newly acquired texturing skills figure out the texture of the soil. Have students record their observations in the table on page 6 as they work through the texture key.

Why is Soil Texture Important?

Coarse soils are grainy, and have larger mineral particles than fine soils. You can use the worksheets on pages 6 and 7 to show how coarse soil (page 7) has larger spaces in between particles than the fine soil (page 6). These spaces are called "pores", and the larger pores means that water will be able to flow through the coarse soil much easier. Coarse soils have good drainage, in comparison to fine soils, but they also have poor water retention and require more irrigation during dry months.

Using the particle size worksheets again, you can then show how the fine soil has more surface area than the coarse soil. There are more reactive surfaces in the fine soil, and so more nutrients are attracted to the soil surface, where they are held and kept available for uptake by plants. Organic matter, like compost, has high surface area, and so adding organic matter to a

coarse soil can increase its fertility. Not to mention that organic matter contains its own nutrients!

A great follow-up question to this lesson is to ask: If I tell you that the Fraser River Valley has some of the best agricultural soils in Canada, what can you infer about the texture of this soil? *A: Fine. Largely silty.* Why is it so "good"? *A: Mostly because of the high nutrient retention capacity (higher surface area) lending to good fertility. Also, water retention is good in the dry summer.*

Key to Hand-Texturing

(From "Field Methods for Describing Terrestrial Ecosystems", 1998)

Graininess Test

Rub the soil between your fingers. If sand is present, it will feel "grainy": you will be able to feel the individual grains. Determining whether sand constitutes more or less than 50% of the sample is the first decision in the key.

Moist Cast Test

Compress some moist soil by clenching it in your hand. If the soil holds together (i.e., forms a "cast"), then test the durability of the cast by tossing it from hand to hand. The more durable it is, the more clay is present.

Stickiness Test

Moisten the soil thoroughly and compress it between thumb and forefinger. Determine degree of stickiness by noting how strongly the soil adheres to the thumb and forefinger when pressure is released, and how much it stretches. Stickiness increases with clay content.

Worm Test

Roll some moist soil between the palms of your hands to form the longest, thinnest worm possible. The more clay present, the longer, thinner and more durable the worm will be.

Soapiness Test

Work a small amount of wet soil between your thumb and fingers. Silt feels slick and not too sticky (i.e., clay) or grainy (i.e., sand); the greater the dominance of a slick feel, the greater the silt content. Silt particles are distinguished as fine "grittiness", unlike sand, which is distinguished as individual grains (i.e., graininess). Clay has no grittiness.

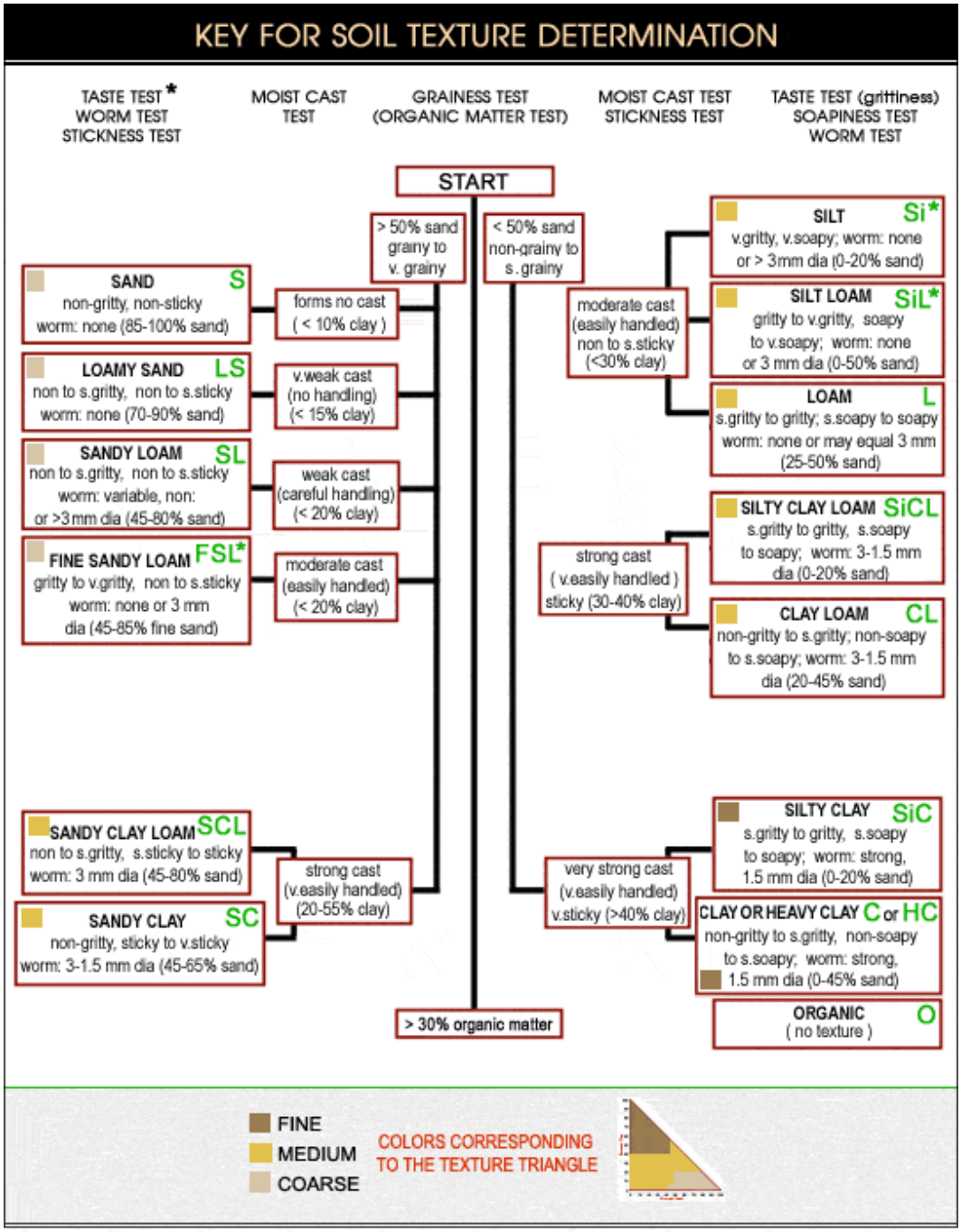
**Note: Well-decomposed organic matter (humus) imparts silt-like properties to the soil. It is generally very dark in color when moist or wet, and stains the hands brown or black. This organic matter is not used as a determinant of soil texture; estimates of the silt content of humus-rich mineral soils should be reduced accordingly. If the soil contains more than a few % of organic matter, hand texturing may become unpractical.

Reference

BC Ministry of Environments, Lands, and Parks and BC Ministry of Forests. 1998. Field methods for describing terrestrial ecosystems. Land management handbook no. 25. Victoria, BC.

DATA COLLECTION SHEET FOR HAND TEXTURING

	Mystery sample A	**Mystery sample B**
Graininess test		
Moist cast test		
Stickiness test		
Worm test		
Soapiness test		
Soil texture		
Justification (why you chose that texture)		



* Silt feels slippery or soapy when wet; fine sand feels stiffer, like grinding compound or fine sandpaper.

Key to Abbreviations

s = slightly
v = very
dia = diameter

Measurement Conversions

3.0 mm = 1/8"
1.5 mm = 1/16"

Fine Fraction		**(particle diameter)**
SAND ----------	(S)	2 - .05 mm
SILT ----------	(Si)	.05 - .002 mm
CLAY ----------	(C)	<.002 mm