Section 2: Rangeland Soils—Under the Surface

1. Introduction to Rangeland Soils and Soil Particle Size Demonstration; 15-20 minutes
2. Skills Challenge: Soil Texturing; 25-30 minutes

Learning Objectives:

- Understand the relationship between soil, water, and plants
- Learn how to hand texture soils

Idaho General Education Performance Standards

- LS2-MS-6, LS2-5-4, LS2-5-3, ESS3-MS-3

1. Introduction to Rangeland Soils

Fun Fact: the time needed to form soil depends on climate (precipitation and temperature). In mild climates, it take 200 to 400 years to form 1 cm of soil. In wet, tropical areas it takes around 200 years to form 1 cm of soil… that's why we worry about erosion, or soil loss on rangeland.

Time: 25-30 minutes
Supplies:

- 3, large clear vases or clear tubes
- Tennis balls, marbles, and BBs (to represent sand, silt, and clay)
- "Soil Particle Size" worksheet for each student

Soil is a complex mix of weathered rock, air, water, and organic matter (which includes organisms like bacteria, and the decaying remains of once-living things like plants and animals). Understanding soil characteristics like texture, helps us better understand how much water and nutrients are available for plants, and determine how human impacts (e.g., recreation, grazing) may influence what plants and animals are on the range. Understanding soils also helps us predict how much water may run-off when it snows or rains, and how much water we can store in the soil for later use (we'll discuss this more in the Water section).

Soil Particle Size Demonstration

Background:
Soil texture and structure strongly influences the vegetation types that occur on rangeland. Soil texture is related to weathering (i.e., natural process that breaks apart or changes rocks) and parent material (rocks). In other words, soil texture depends on how much of the rock has broken down over time by wind, water, freezing/thawing, glaciers, and plants and animals. Wind and water move soils around the landscape. A little erosion is natural, however, it can become excessive if vegetation is removed. For example, following a wildfire soil erosion often increases because no plants are there to keep the topsoil stable when the wind blows or it rains.

The **texture** of a soil depends upon the proportion of sand, silt, and clay that are in the soil. The texture and soil structure (how the soil particles are arranged), influence the amount of pore spaces (or air) found within the soil. Pores are important conveyors of water, nutrients, and air, as well as provide space for roots to grow.

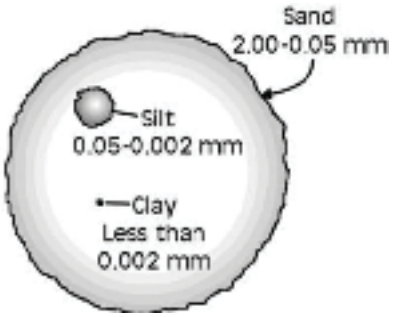
In some locations, the soil will form a barrier (often called a hardpan) that may stop water **infiltration** and root penetration. These restrictive layers may be natural, or may be induced by land

management/human practices. For example, a soil may become compacted due to high foot traffic on a hiking trail. When it is compacted, pore space is lost reducing water, nutrients, and air needed for plants to grow.

Soil Particle Size Demonstration:
To emphasize the different sizes of soil particles, fill one clear tube or glass vase with tennis balls, another with marbles, and the last one with BBs (you do not need to fill the tube/vase completely). Show the students the "Relative Soil Particle Sizes" diagram and vases to facilitate the following discussion.

Do:

- Have students determine what soil particle is represented by the BBs, marble, and tennis ball (*answer: BBs = clay, marble = silt, tennis balls = sand*).
- Have students compare the size of the objects, as well as the pore space between the objects and fill out the "Soil Particle Size Worksheet." Remind students that pore space is very important (pores hold water, nutrients, and air, as well as provide space for roots to grow).



Reflect:

- Discuss each component of the table with the students (each section has a question to start the discussion). Ask students how this may affect plant growth? Ask how humans may influence soil properties (i.e., how might humans impact soil compaction, positively and/or negatively?)?

	Particle Sizes		
	SAND	SILT	CLAY
Size of Particles (Small, Medium, or Large)	Large—tennis ball	Medium—marble	Small—BBs
Describe the pore space for each particle size (also called porosity). Are they large or small, or somewhere in the middle?	Large—large pore spaces allow water to easily run through it and beyond the reach of roots.	Medium	Small—pore spaces are smaller and hold more water, however, small particle sizes also form strong bonds making water and nutrients unavailable for root uptake.
Water-Infiltration Capacity: how well will water enter the soil? Poor, Medium, or Good	Good	Medium	Poor (see note under erodibility)
Water Percolation: how well will water flow through the soil? Poor, Medium, or Good	Good	Medium	Poor (see note under erodibility)
Water-Holding Capacity: how much water will the soil hold before it is moved too low by gravity and plant roots can't reach it? Poor, Medium, or Good	Poor—sandy soils are more drought-prone	Medium	Good—as particle size decreases, surface area increases. Clay has about 10,000 times as much surface area as sand.
Aeration: how much air is in the soil? Poor, Medium, or Good	Good	Medium	Poor
Erodibility: how likely is wind and water going to be able to move the soil? Low, Medium, or High	Low	High	Low—clay particles combine to create large masses (or aggregates). Aggregates also decrease the ability of water to infiltrate the soil and drain.
Compactability: if you were to make a ball of the soil, how likely would it stay in the ball shape without falling apart? Low, Medium, or High	Low	Medium	High