

Key Topics & NGSS Alignment	Learning Objectives	Learning Materials (LO Alignment)	Optional/Supplemental Materials
<b>KT 1: Nature and Functions of Soil</b> <i>HS-ESS1-5, HS-ESS1-6, HS-LS2-7</i>	LO 1.1: Define soil according to its Technical Definition. LO 1.2: Describe the environmental importance of soils in terms of the basic resources they provide to plants and humans, their impact on the hydrologic cycle, etc. LO 1.3: Describe the origin and distribution of a soil. LO 1.4: Use the soil-forming processes to explain why we find different soil properties in different locations. LO 1.5: Differentiate between master horizons (O, A, E, B, C, R) theoretically and in the field.	Elementary Soils Concepts (LO 1.1-1.2) Why is Soil Important? (LO 1.2) A Brief Guide to Parent Material and Landforms (LO 1.3-1.4) From the Surface Down (LO 1.3-1.5) Soils of New Mexico (LO 1.3) A Brief Supplement on Characterizing Soil Profiles (LO 1.5)	<a href="#">Orographic Effect Video</a> <a href="#">Weather Basics</a> <a href="#">Rock Cycle Video</a>
<b>KT 2: Properties of Soil</b> <i>HS-PS1-5</i>	LO 2.1: Define particle size classes. LO 2.2: Describe the unique properties of each particle size class within the fine earth fraction, and how each affects the behavior of soil. LO 2.3: Define soil texture. LO 2.4: Explain how soil texture affects hydrology, plant nutrition, erosion, etc. LO 2.5: Given volumetric percentages of particle size classes, use the textural triangle to determine texture. LO 2.6: Differentiate soil structure from soil texture. LO 2.7: Describe how structure relates to bulk density, porosity, infiltration, compaction, and gas exchange. LO 2.8: Calculate porosity and bulk density given the dimensions and mass of a soil sample. LO 2.9: Articulate what a soil's color tells us about the components of the soil such as organic matter, iron oxide, and calcium carbonate. LO 2.10: Identify which colors might indicate a hydric soil. LO 2.11: Explain what soil organic matter is, where it comes from, how it is identified, and why it is important.	Elementary Soils Concepts (LO 2.1-2.8, 2.11) <a href="#">Water Movement in Soil</a> (LO 2.1-2.4, 2.6) Field Book for Describing and Sampling Soils (LO 2.3, 2.6) A Brief Supplement on Characterizing Soil Profiles (LO 2.9) NRCS Soil Education The Color of Soil (LO 2.9) Soil Color Lesson, Soil Science Society of America (LO 2.9) Field Indicators of Hydric Soils in the United States Version 8.2 (LO 2.10) <a href="#">Hydric Soils</a> (LO 2.10)	
<b>KT 3: Soil Biology and Nutrient Cycling</b> <i>HS-LS1-2, HS-LS2-7, HS-ESS2-6, HS-PS1-5, HS-LS2-3, HS-LS2-5</i>	LO 3.1: Diagram the soil food web. LO 3.2: Explain the connections between the soil food web, plants, and soil organic matter. LO 3.3: Describe the most important functions of each general category of soil organisms (such as bacteria, fungi, protozoa, nematodes, arthropods, earthworms). LO 3.4: Describe biological nitrogen fixation, mycorrhizal symbiosis, and the importance of these phenomena to plant health. LO 3.5: Create detailed diagrams and descriptions of the carbon, nitrogen, and phosphorus cycles.	Soil Food Web Game (LO 3.1) Soil Biology and Land Management (LO 3.1-3.3) Soil Biology Primer (LO 3.2-3.3) Mycorrhizae Biology LibreText (LO 3.4) The Nitrogen Cycle WikiPage (LO 3.4) Nutrient Cycles Envirothon Resources (LO 3.5) Soil and the Carbon Cycle Lab 5 (LO 3.5)	<a href="#">Hydrologic and Carbon Cycles Video</a> (LO 3.5) <a href="#">Nitrogen and Phosphorus Cycles Video</a> (LO 3.5)
<b>KT 4: Soil Dynamics</b> <i>HS-ESS2-5</i>	LO 4.1: Define erosion and relate it to deposition and compaction. LO 4.2: Describe the mechanisms of erosion. LO 4.3: Explain how soil texture and structure relate to erosion rates. LO 4.4: Evaluate the impact of tillage on soil organic matter, biology, bulk density, and erosion rates. LO 4.5: Explain the benefits and drawbacks of tillage. LO 4.6: Relate soil compaction to bulk density. LO 4.7: Explain the mechanisms that cause compaction and the seasonal conditions that make it more likely. LO 4.8: Describe how soil compaction impacts plants, hydrology, and erosion rates.	Soil Management 101 A Guide for the Oral Scenario of the New Mexico Envirothon (LO 4.3-4.8) Soil Bulk Density Educators Guide (LO 4.6-4.8) Soil Erosion Causes and Effects (LO 4.1-4.8)	
<b>Key Topic 5: New Mexico Soils and Field Skills</b> <i>HS-ESS1-5, HS-ESS1-6, HS-PS1-2, HS-ESS2-5, HS-ESS3-2, MS-ESS3-3 NM, HS-SS-2 NM, HS-LS2-7, HS-ESS3-4, HS-ETS1-2, HS-ETS1-3</i>	LO 5.1: Differentiate between master horizons (O, A, E, B, C, R) using the horizon criteria in the Field Book. LO 5.2: Identify the texture of a soil using the textural triangle and hand-texturing methods. LO 5.3: Characterize soil structure in the field. LO 5.4: Characterize soil color using the Munsell Color Book and proper notation. LO 5.5: Compare methods for identifying compacted soil layers in the field and laboratory. LO 5.6: Identify evidence of soil-forming processes based on observations of a soil profile. LO 5.7: Describe how calcium carbonate moves through soil profiles, how to identify it in the field, and how it influences pH and nutrient availability. LO 5.8: Identify signs of erosion in the field and evaluate landforms for erosion vulnerability. LO 5.9: Apply soil management and erosion prevention strategies to New Mexico land management scenarios. LO 5.10: Perform hand texturing in the field and support your conclusions with observations. LO 5.11: Identify the size ranges for different particle size classes in the Field Book.	A Brief Guide to Parent Material and Landforms (LO 5.6) A Brief Supplement on Characterizing Soil Profiles (LO 5.1, 5.4) Considering Soils for the Oral Scenario (LO 5.8-5.9) Guide to Texture by Feel (LO 5.2) Elementary Soils Concepts (LO 5.3) Field Book for Describing and Sampling Soils (LO 5.1-5.3, 5.5, 5.7-5.8-5.11) From the Surface Down (LO 5.1, 5.6) NRCS Soil Education The Color of Soil (LO 5.4) Soil Color Lesson, Soil Science Society of America (LO 5.4) Soils of New Mexico (LO 5.7) <a href="#">Texture by Feel Procedure</a> (LO 5.2)	