**Soils - Learning Objectives New Hampshire Envirothon**

Our soil resources are important to everyone. They play a critical role in our environment and wise land use. It is important for society to properly protect this vital resource and to understand the functions of the soil and their value in influencing our quality of life.

In terms of soil quality, our soil resources serve three primary roles within our environment. 1) They serve as a medium for plant growth and to regulate the movement and uptake of nutrients. 2) They serve as an environmental buffer to pollutants and 3) they serve to regulate the flow of precipitation within a watershed, whether it percolates into the soil, becomes overland flow into lakes and streams, is taken up by plants, or evaporates back into the atmosphere.

Understanding the soil component is a very important aspect in any natural resource assessment. Soil interpretations are based on the various soil properties found at a site. Each soil will have its own unique set of properties and each horizon (layer) in the soil may have a unique set of properties, as well. There may be only one or two layers in some soils or there may be many layers, with many differences. The ability to read and evaluate a soils map is a valuable tool in site assessment.

Important soil properties are: Depth, Texture, Structure, Consistency, pH, Bulk density, Available water holding capacity, Flooding frequency, Color, and Slope.

There are over three hundred different soils identified in New Hampshire and well over 18,000 soils in the United States. The development of each soil’s unique set of properties is influenced by five soil forming factors that contribute to make one soil different from another:

Time – how long the soil has been developing

Parent Material – where the soil material came from

Biotics – organic material and microbial influence

Topography – slope and aspect

Climate – temperature and rainfall

Learning Objectives:

**Soil Basics**

Define the five soil-forming factors and describe their influence on a particular soil.

Identify different types of parent material and how they are formed (such as glacial deposits, alluvial, lacustrine, and marine deposits, and organic deposits).

Describe the following soil properties and explain their importance: Texture, Structure, Permeability, Slope, Cation Exchange Capacity, Consistency, pH, Bulk density, Available water holding capacity, Flooding frequency, Color, and Depth to Bedrock.

Identify various soil development processes (additions, losses, translocations, and transformations) and describe their effects on soil.

Describe how different soil components (mineral composition, organic matter, particle size) affect the properties of a soil.

Describe the importance of organic matter in various forms (litter, humus) to soil health, structure, and fertility.

Identify the different particle sizes in a soil (sand, silt, and clay) and describe how their proportions influence soil properties.

Use a soil triangle to evaluate the texture of a soil.

Identify the different soil structures and explain the impact of soil structure on other soil properties.

Describe how pH affects nutrient availability and soil health.

Identify drainage class and describe characteristics and properties of hydric soils.

Describe the main characteristics of the major soil orders.

**Landform and Soil Relationships**

Explain the impact of geomorphology on landforms and landscapes, and how these processes relate to soil formation.

Describe how geology influences topography and relief.

Describe the characteristics of the three major types of rocks (igneous, sedimentary, and metamorphic) and give examples of each.

Describe how the parent material determines components of a soil.

Explain the importance of different types of weathering (mechanical and chemical) in soil formation.

Identify the main landforms and geological features of New Hampshire.

**Soil Health and Biology**

Describe the role soil organisms (including microorganisms and fungi) in the overall health and functioning of the soil.

Describe how soil properties can influence the plant communities found on a particular soil.

Explain how soils impact the biodiversity of an ecosystem, and how biodiversity in an ecosystem may impact the soil.

Connect a variety of soil processes to observed soil characteristics. (For example, the addition of organic matter resulting in darker topsoil and improved soil structure.)

Explain the importance of pore space, types of pores (macropores and micropores), and pore connectivity in relation to soil health and vegetation growth.

Explain the interactions of soil with the water cycle, including infiltration, runoff, and reservoirs such as aquifers.

Describe the ecosystem services provided by soil, such as water filtration, carbon sequestration, and nutrient cycling.

Describe the impact of changes in climate on soil ecology.

**Land Use**

Describe how soils and their associated ecosystems can be impacted by pollution.

Describe common agricultural or urban practices and their effects on soil health.

Explain how human development on floodplains impacts the soil formation and ecology around streams and rivers.

Explain how certain types of soil are better suited than others for specific human uses (construction, farming, recreation, septic systems, landfills).

Identify different types of erosion and recommend management practices to prevent and mitigate erosion.

Explain the causes of soil compaction and recommend management practices to prevent and mitigate compaction.

Apply knowledge of soil properties and characteristics to make recommendations for management.

Explain the requirements for a Prime Farmland designation and identify potential soils.

Describe the importance of historic events relevant to soil conservation (such as the 1930’s Dust Bowl).

**Maps**

Read and interpret a topographic map.

Read and interpret a soil map, including the Map Unit Descriptions.

Understand map units and their inclusions.

Interpret aerial photographs to determine various soil properties and interpretations (slope, drainage class) and in the context of land use.

Use a soil survey (online or paper copy) to assess soil properties and conditions, such as drainage class and limitations on selected uses.

**Field Skills**

Identify characteristics of a soil pit or soil sample, including horizons, color, structure, texture, and special features.

Evaluate a soil profile for soil properties and characteristics, land use history, water table level, and management recommendations.

Measure slope using a clinometer or other field tool.

Utilize field tools to provide on-site soil analysis, including: Shovels, Munsell soil color chart, Compass, Clinometer

Determine the drainage class for a particular soil.

Identify and describe a hydric soil.

Explain how GPS and GIS can help soil scientists with field analysis.

**Soils, Land Use and Society**

Understand traditional and modern relationships between the land and the people.

Understand land use issues facing marginalized communities (Native and Indigenous peoples, people of color, and other minority communities).

Identify major legislation (local and national) pertaining to soils and land use and describe how they provide protection for natural resources.

Identify key organizations and agencies that oversee soil resource protection and land use management, such as local conservation districts, state agencies, and national environmental and conservation agencies.

Recommend Best Management Practices (BMPs) for soil health and analyze which BMPs are best suited to specific soils, substrate types, climatic conditions, and land uses.

Identify opportunities, privileges, and choices associated with a clean and healthy environment.