

Oklahoma Envirothon Soil Science Study Guide

Soil is a dynamic, complex mixture of minerals, organic matter, water, air, and countless microorganisms that forms the upper layer of Earth's surface. It serves as a critical interface between the lithosphere, atmosphere, hydrosphere, and biosphere, making it an indispensable component of the environment. Soil is not a static entity; it undergoes constant physical, chemical, and biological transformations influenced by factors such as climate, topography, vegetation, and human activities. Because of this, the properties of the soil vary from one place to another and these properties change over time as well.

The importance of soil to the environment cannot be overstated. Firstly, soil is the foundation of terrestrial ecosystems, providing a habitat and sustenance for a diverse array of organisms, from microscopic bacteria to towering trees. It supports the growth of vegetation, which in turn helps regulate the climate by sequestering carbon dioxide from the atmosphere and releasing oxygen through photosynthesis. Additionally, soil acts as a reservoir for water, storing and filtering rainfall, which helps prevent erosion, maintain groundwater levels, and mitigate the impacts of floods and droughts.

Furthermore, soil plays a crucial role in nutrient cycling, as it serves as a medium for the decomposition of organic matter and the release of essential elements such as nitrogen, phosphorus, and potassium. These nutrients are vital for the growth and productivity of plants, which form the base of the food chain and sustain all higher trophic levels, including humans. Moreover, soil acts as a sink for pollutants, helping to purify water and air by filtering out contaminants and reducing their harmful effects on the environment and human health.

In essence, soil is the cornerstone of life across terrestrial ecosystems. Its preservation and sustainable management are paramount for ensuring the health and resilience of ecosystems, safeguarding biodiversity, mitigating climate change, and securing the availability of food, water, and other resources for present and future generations.

Lesson 1: What is soil and how does it form?

- Definition of soil
- Formation and Development of soils
 - Factors of Soil Formation (CIORPT)
 - What is weathering?
 - Why do soils differ from place to place?
 - What is a soil profile? What is a soil horizon?
 - How does a soil profile develop?
- What are the functions of soils?
- Materials to study
 - When does rock become soil?
<https://soilsmatter.wordpress.com/2017/08/15/when-does-rock-become-soil/>
 - Soil and the Environment <https://www.soils4teachers.org/soil-and-environment/>
 - Soil! Get the Inside Scoop Teacher's Guide
<https://www.soils4teachers.org/lessons-and-activities/teachers-guide/soil-formation>

Lesson 2: Soils Across Biomes

- What is a biome?
- What soil forming factor (among the CIORPT) has the most dominant effect on the properties of the soils in a:
 - Forest
 - Grassland
 - Tundra
 - Desert
 - Wetlands
- Material to study:
 - Know Soil Know Life (Educator's Guide): Soils and Biomes
https://serc.carleton.edu/kskl_educator/soil_biomes/index.html
 - View the presentation about Soils and Biomes. Click this:



Study the materials in the 19 slides in this presentation.

Lesson 3: Basic Soil Properties that Influence Land Use Decisions

A. Physical Properties

- Physical Property: Soil Color
 - What is soil color? How do we describe soil color using the Munsell Color Book?
 - What does a black, gray, or red soil color indicate?
- Physical Property: Soil texture
 - What is soil texture?
 - What are the size ranges of soils that belong to sand, silt, and clay fractions?
 - Use of the Soil Texture Triangle
 - How does soil texture influence the ability of the soil to store water, store plant nutrients, and treat pollutants?
- Physical Property: Soil Structure:
 - What is soil structure and what are the different types of soil structure?
 - How does soil structure influence water flow and root growth?
- Materials to Study:
 - Know Soil Know Life (Educator's Guide): Physical Properties and Soil Formation
 - https://serc.carleton.edu/kskl_educator/soil_formation/index.html

- View the presentation about Soils Physical. Click this:



. Study the materials in the 31 slides in this presentation.

- Use of the textural triangle: <https://www.soils4teachers.org/files/s4t/lessons/soil-texture.pdf>
- Determining Soil Color: <https://www.envirothonpa.org/documents/munsellcharts.pdf>

B. Chemical Properties

- What is soil pH? How does it affect the availability of plant nutrients?
- What is the normal net charge of the soil?
- How does the charge of the soil influence the ability of the soil to store nutrients and treat pollutants?
- Materials to Study:
 - Chemical Properties of Soil, Soil Fertility and Nutrient Management
 - https://serc.carleton.edu/kskl_educator/soil_chemistry/index.html
 - View the presentation about Soil Chemical Properties. Click this:



Study all 14 slides.

- https://serc.carleton.edu/kskl_educator/soil_chemistry/chap_4_bkgnd.html

C. Soil Biology

- What types of soil organisms can be found in the soil?
- What do soil Microbes do for you?
- How are life above the soil affected by the soil organisms beneath the surface?
- Materials to Study:
 - Know Soil Know Life (Educator's Guide): Soil Biology: The Living Component of Soil

- https://serc.carleton.edu/kskl_educator/soil_biology/index.html



- View the presentation about Soil Biology. Click this: Study all 16 slides.

- https://serc.carleton.edu/kskl_educator/soil_biology/chap_3_bkgnd.html