Unit E: Basic Principles of Soil Science

Lesson 1: Determining the Nature of Soil

Important Terms

- Capillary water
- Gravitational water
- Hygroscopic water
- Infiltration
- Leaching
- Mineral matter
- Organic matter
- Percolation
- Permeable
- Pore spaces
- Soil aeration
- Tilth

What is soil and how do its resources help in supporting life?

- Soil is a layer on the earth's crust that provides a combination of resources.
- These resources allow the growth of plants and animals.
- These resources include:
  - Oxygen needed for adequate root growth.
  - Temperature - soil absorbs heat from the sun.
    - It also loses heat to the atmosphere.
    - This allows satisfactory temperatures for plant growth and seed germination.

What is soil and how do its resources help in supporting life?

- Water utilized for growth of plants.
- Carbon utilized in the form of organic matter in the soil.
- Nutrients provided as minerals.
  - They are broken down as nitrogen and recycled through decaying material in the soil.

Why Soils Are Important ?

- Plants grow in and on soil.
- Plants support animal life.
- Plants and animals support human life.
- World population is rapidly increasing, which increases the need for food.
- A large part of the worlds population has inadequate nutrition.

What are the various components found in soil?

- Soil is composed of four primary components.

- They are mineral matter, organic matter, air, and water.

What are the various components found in soil?

- In addition, there are numerous living organisms in the soil, such as bacteria, insect larvae, earthworms, and fungi.
- Soils may vary from one area to another, but most will contain these basic components.

Four primary components of soil

- Mineral matter, which accounts for about 45% of the soil, is partially decomposed rock material.

Mineral Matter

- It is the sand, silt, and clay that is found in the soil.
- These vary in amount depending on the type of soil.
- The amounts of sand, silt, and clay also determine the soils ability to hold water and provide nutrients.

Four primary components of soil

- Organic matter, which accounts for about 5% of the soil, is partially decomposed plant and animal matter.
  - Most organic matter is from plant leaves, roots,and stems.
  - Organic matter gives soil its dark color.
  - Organic matter contributes to the soils fertility as well as improved aeration and water holding capacity.

Four primary components of soil

- ***Air*** (25% of soil volume) represent the space occupied by air.
  - When soils are wet the amount of air will be less.
  - When soils are dry the amount of air will be more.
  - There is a constant fluctuation in the amount of air and water found in the soil.

Four primary components of soil

- Water, which accounts for about 25% of the soil, also part of the pore space in the soil.

Water

- When it rains water will enter the soil or flow off of the soils surface.
- The process of water soaking into the soil is known as infiltration.
- Once water is in the soil, movement downward is known as percolation.
- A quality soil allows both kinds of water movement and is said to be permeable.

Water in the soil may be one of three types:

- Gravitational water - water that drains through the pore spaces in the soil as a result of gravity.
  - Gravitational water flows quickly through soil that has large pores and slowly through soil with small pores.
  - Movement of water is referred to as leaching.
    - As water moves through the soil, it carries dissolved minerals, chemicals, and salts..

Water in the soil may be one of three types

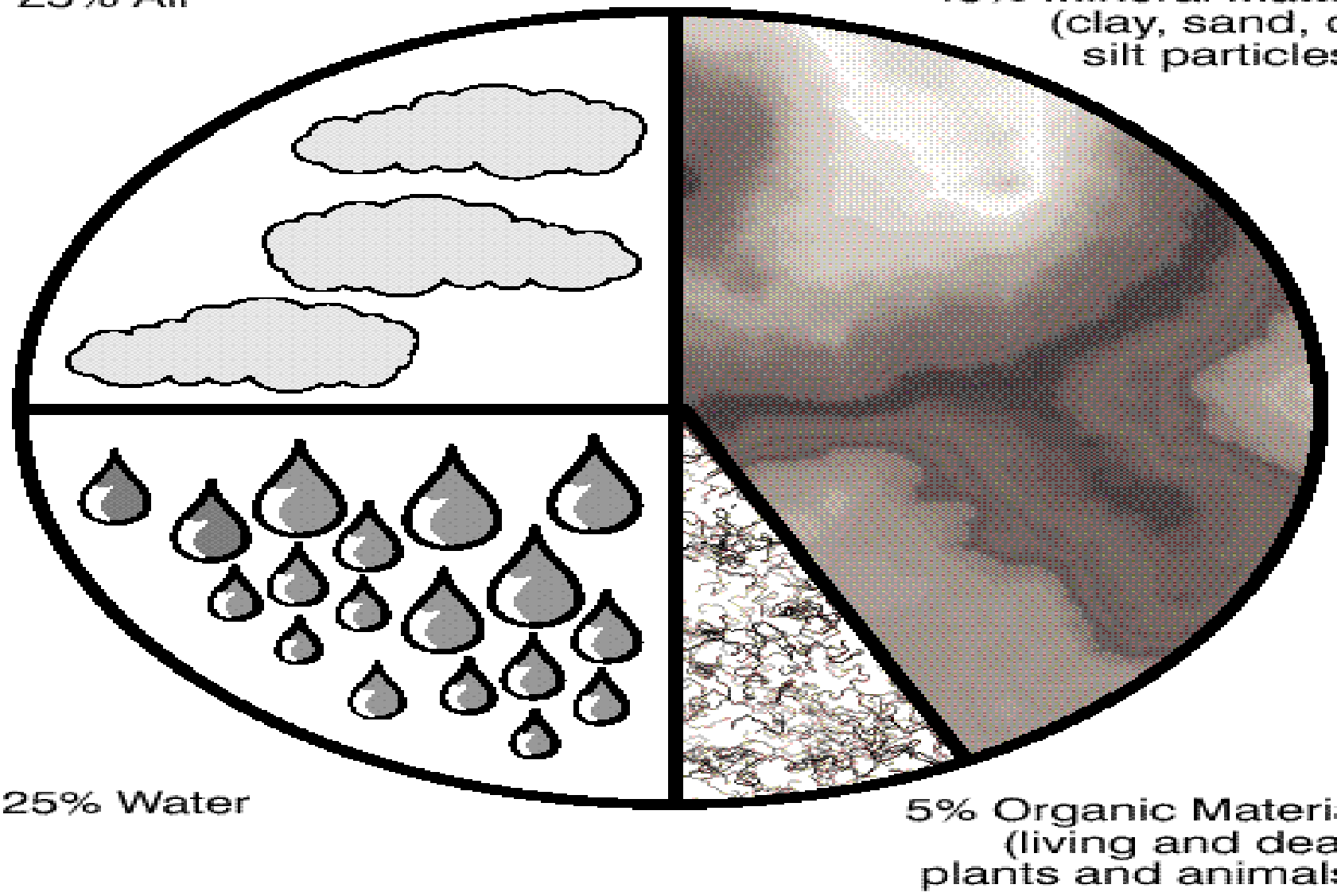
- Capillary water - water that is held between the particles of soil against the forces of gravity.
  - It may move upward or sideways by capillary action.
  - Clay soils hold more capillary water since they have more pore spaces.

Water in the soil may be one of three types

- Hygroscopic water water that forms a thin film around individual soil particles.

- This water is unavailable to plants.

Composition of Average Soil



What living organisms are found in the soil?

Abundant life can be found in soil.

Forms of life in soil include:

- Earthworms
- Insects
- Bacteria
- Fungi
- Other organisms

What living organisms are found in the soil?

- Bacteria and fungi have an important role in the soil.
- They break down organic matter and release nutrients.

What living organisms are found in the soil?

- Earthworms, ants, crawfish, moles, and other organisms improve the soil **tilth**, the ease at which soil can be worked.
- These organisms create openings in the soil as they tunnel.
- This enhances drainage and improves air exchange.

How do plants use soil?

- Anchorage: soil acts to provide a firm support as roots grow throughout the soil.
- Water: soil provides nearly all of the water used by plants. Water is absorbed through the plants roots.

How do plants use soil?

- Oxygen: nearly all living organisms need oxygen.

- Plants release oxygen during photosynthesis but consume oxygen during respiration.

How do plants use soil?

- Plant parts above the ground have an ample supply of oxygen; however, those below the ground (roots) have less oxygen available.
- This increases the need for good **soil aeration**, the exchange of soil and atmospheric air in order to maintain adequate oxygen for plant roots.

How do plants use soil?

- Nutrients: of the 16 nutrients considered to be essential for plant growth, 13 are obtained from the soil.
  - Root hairs absorb the nutrients dissolved in soil water.

Four Basic Plant Uses of Soil

1. Anchorage

2. Water

3. Oxygen

4. Nutrients

What are some uses of soil in agriculture?

- Agriculture depends on soil to grow food, fiber, and ornamental plants for human societies.
- Various uses include:
  - Cropland
  - Grazing land
  - Forest
  - Water structures

What are some uses of soil in agriculture?

- Cropland: this is land on which soil is worked and crops are planted, cared for, and harvested.
  - Most cropland is devoted to annual crops, such as corn, soybeans,cotton, vegetables, etc.

What are some uses of soil in agriculture?

- Grazing land: this is land used for grazing cattle and sheep.
  - It is often planted to perennial forage.

- Forest: this is land used for growing trees which are later harvested for building materials, paper, etc.

What are some uses of soil in agriculture?

- Water structures: ponds and other reservoirs are constructed out of soil.

What are some nonagricultural uses of soil?

- Humans require soil for many other uses besides growing plants.
- Such uses include:
  - Recreation
  - Foundations
  - Waste disposal
  - Building materials

What are some nonagricultural uses of soil?

- Recreation: recreational activities include playgrounds, sports fields, jogging paths, golf courses, parks, campgrounds, and many others.
- Foundations: buildings depend on a solid soil base upon which to be built to remain structurally sound.

What are some nonagricultural uses of soil?

- Waste disposal: soil is often used for the treatment of human sanitary wastes.
- Soil filters some of the material, while microorganisms break down organic portions into less dangerous compounds.

What are some nonagricultural uses of soil?

- Building materials: homes and other structures are occasionally built underground, into hillsides, or even with soil piled over them.
- Earth-sheltered buildings help in lowering heating and cooling costs.

Review and Summary

- Explain how the resources soil provides help in supporting life.
- Explain the contents of soil.
- Describe the biological nature of soil.
- Describe the four ways plants use soil.
- Describe some agricultural uses of soil.
- Describe some nonagricultural uses of soil.