

# Unit A: Principles of Soil

## Lesson 4: Formation of Soil

# Terms

- Alluvium
- Bedrock
- Chemical Weathering
- Climate
- Glacial Till
- Loess
- Native Vegetation
- Organic Matter
- Outwash
- Parent Material
- Physical Weathering
- Prairie Soils
- Timber Soils
- Topography

# Five factors involved in soil formation

- ◉ There are five primary factors that affect the process of soil formation and development.
  - › Parent material—type of rock material the soil is formed from.
  - › Climate—temperature and moisture characteristics of the area in which the soil was formed.
  - › Living organisms—the organisms, including plant material, that live within the soil.
  - › Topography—slope characteristics of the soil.
  - › Time or weathering—age of the soil and its climate

# Parent Material

- *Parent materials* are formed by the disintegration and decomposition of rock. They are classified according to the way they were moved and scattered.
- Many soils have been formed from material originally moved by glaciers. Soils of glacial origin are classified as follows:

# Types of Parent Material

1. **Loess**—occurred from the blowing of the soil after the glaciers melted and dried. Loess is the most desirable single soil parent material. This is due to its well-balanced mineral content, medium texture, and excellent water-holding capacity.

# Types of Parent Material

2. **Outwash**—occurred when the glaciers melted. The melt waters carried the gravelly materials away to be deposited below the glacial ridges. Sandy outwash was carried further downstream and the finer materials, silt and clay, were deposited in lakebeds or slow moving water along streams.

# Types of Parent Material

3. ***Glacial till***—have not been layered from the effects of wind or water as the other two types of glacial soils. It often contains a variety of sizes of soil particles. Pebbles and various sizes of boulders are common in till.

# Types of Parent Material

- Some soils are formed as a result of recent sediments deposited by streams as they flood. It is referred to as alluvium. *Alluvium* is generally a water-borne material deposited on bottomlands



# Types of Parent Material

- **Bedrock**—shale, sandstone, or limestone bedrock; weathered bedrock can provide soil parent material.

# Types of Parent Material

- ***Organic matter***—occur where formerly shallow ponds supported swamp vegetation. The wet conditions slowed decay of the dead plants so that organic matter could accumulate. The two types of organic soils are referred to as peat and muck. Muck is more decomposed than peat.

# Topography and how it affects soil formation

- *Topography* refers to the slope characteristics of a soil. It includes the degree or steepness, length, shape, and direction of a slope. These factors influence the amount of rainwater runoff, or the amount that enters the soil or collects in small depressions on the soil surface. Soils on steep slopes have higher amounts of runoff and erosion than those on level topography.

# Topography and how it affects soil formation

- The amount of moisture in the soil during its development affects the rate of weathering and the development of subsoil colors. Soils in depressions and on nearly level topography are likely to have poor or very poor natural drainage. Soils on moderately sloping to steep topography are usually well drained



# Organisms affect on soil development

- Organisms that live in soil—like plants, insects, and microbes—actively affect soil formation. The greatest affect on the development of soil is from plants that once grew in it. This is referred to as ***native vegetation***. It determines the kind and amount of organic matter in the soil. For example, two common types of native vegetation in the Midwest are tall prairie grass and deciduous-hardwood forests. Soils in these areas are referred to as prairie soils and timber soils.

# Organisms affect on soil development

- ***Prairie soils*** have a dark and deep surface layer. This is because roots from the prairie grass filled the top of the soil to a depth of 1 to 2 feet or more. Partial decay of these roots over a long period of time gave these soils a high organic matter content.

# Organisms affect on soil development

- ***Timber soils*** tend to have a thin, moderately dark layer. This is due to organic matter accumulating on the surface where decay occurs more rapidly. When tilled, this dark material is mixed with the soil below to produce a lighter color



# Organisms affect on soil development

- Other living matter that influences the development of soil includes various kinds of animal life. Earthworms, crawfish, ground squirrels and other burrowing animals, and various insects which incorporate organic matter into the soil are examples.

# How time and weathering affect properties of soil

- There are two types of weathering:
  - **Physical weathering**—the effects of climatic factors such as temperature, water, and wind. Freezing and thawing is a major contributor to physical weathering
  - **Chemical weathering**—changes the chemical makeup of rock and breaks it down. Rainwater is mildly acidic, and can slowly dissolve many soil minerals. Some minerals react with oxygen in the atmosphere. Oxidation further acts to decompose rock.

# How time and weathering affect properties of soil

- Weathering causes soil to:
  - > Develop—occurs rapidly, plant nutrients are released, and organic matter accumulates. Soils will develop faster in humid regions than in arid regions
  - > Mature—soil is at peak productivity with a high amount of organic matter. Water begins leaching away nutrients and plant growth starts to decline. This results in less organic matter
  - > Age—minerals continue to break down and clay is leached into the subsoil. The soil becomes lighter in color from less organic matter.

# How climate affects the development of soil

- ***Climate*** refers to rainfall, freezing, thawing, wind, and sunlight
  - › These factors are either directly or indirectly responsible for the breakdown of rocks and minerals, the release of plant nutrients, and many other processes affecting the development of soils

# How climate affects the development of soil

- › In areas characterized by hot summers and cold winters, the climate enhances the weathering process through freezing and thawing. Soils in humid regions are subject to more leaching than soils in dry regions
- › Rainfall wears the rock away a little at a time. Wind also wears the rock away



# Review/Summary

- What are the 5 factors involved in soil formation?
- What are the different types of parent material?
- How does topography affect soil formation?
- What and how do organisms affect soil development?
- How does time and weathering affect the properties of soil?
- How does climate affect the development of soil?