



## TOPICS

### FACTORS THAT FACTORS CONTROLLING SOIL FORMATION

### SOIL FORMATION PROCESS

**Soil forms when weathered parent material interacts with *environment*. Soil *environment* includes:**

- Climate and weather
- Animals
- Microbes
- Human use
- Hazards (natural and unnatural)
- Topographical relief

**Some processes occur in soil that play an important role in soil development, such as:**

- 1- Weathering:** Weathering is the breaking down or dissolving of rocks and minerals on Earth's surface, Processes that form the soil. It is divided into three types:
  - I. **Physical (mechanical)** = Wind and rain; no chemical changes in the parent material.
  - II. **Chemical** = Substances chemically interact with (PM) (chemically changed)
  - III. **Biological** = Organisms break down (PM) and produce soil through physical or chemical means.

**Soil parent material** = The material has formed soil and may be rock that has weathered in place, or material that has been deposited by wind, water, or ice.

- 2- Decomposition** = the natural process of dead animal or plant tissue being rotted or broken down into simpler matter. (eg. Humus).



## Factors that affecting the soil formation

### The Jenny equation

Soil scientist, Hans Jenny has suggested that type of soil found on any site is dependent upon the interaction of five factors:

- Parent material
- Climate
- Biotic influences (plants, animals and micro-organisms)
- Topography (slope and aspect)
- Time.

Any of the physical, chemical or biological processes taking place in the soil as a result of these factors are called **pedogenic processes**

$$S = F (P, Cl, O, R, T...) \text{ Jenny equation}$$

**1- Parent material (P):** Parent material is the rock that soils are derived from. These include igneous, (both plutonic – granite and volcanic – basalt), sedimentary and metamorphic rocks.

The major primary minerals are:

- **Quartz,**
- **Feldspars**
- **Mica**

The parent material determines soil **color, texture, structure, mineral composition and permeability/drainage**

**2- Climate (CI):** The term climate refers generally to **rainfall** and **temperature** variables. **It largely determines**

- **Speed, character of soil development.**
- **Type and rate of weathering.**
- **Living organisms and plants found in an area.**

**3- Organisms (plants and animals):** Plants and animals play important roles in soil formation.



- Type of vegetation influences soil type
- Base pumping
- Sources of organic matter
- Nutrient recycling
- Vegetation prevents erosion

**Organisms helping soil development range from microscopic bacteria to large animals including human.**

**Microorganisms such as bacteria and fungi assist in the decomposition of plant litter. This litter is mixed into the soil by macro organisms (soil animals) such as worms and beetles.**

- **Soil horizons are less distinct when there is much soil organism activity.**

#### **4. Topography (R):**

- **Topography has an important effect in how soils form because it governs the movement of water.** Topography consists of three parts: **elevation, slope, and aspect.**
- Slope is the tilt or inclination of the land.
- Elevation is the height above mean sea level.
- Aspect is the direction the slope is facing.

As slopes increase, soils become shallower and have thinner and fewer horizons. This is because the steeper the slope the greater the runoff and the greater the erosion.

**5. Time (T):** The amount of time that parent materials have been subject to weathering and soil forming processes influences soil properties or Duration of exposure parent material to weathering.

- Residual parent materials have generally been subjected to soil forming processes longer than transported parent materials.



#### 4 basic processes in the soil

- 1- **Additions:** Materials can be added to the soil in many ways. Natural ways include rainfall, dust settling, animal wastes, tree leaves in the fall etc.
- 2- **Losses:** Losses are removal of components from the soil profile. Leaching can first translocate components deeper in the profile but in extreme cases where the component is removed it is referred to as a leaching loss. Erosion is another example of a loss.
- 3- **Translocation:** Translocation is moving components within the soil profile but not leaving the profile
- 4- **Transformation:** It changes one component to another

**Soil is constantly changing due to the 4 processes. This means soil is dynamic in a constant state of change**