

## Soils



## Soils

- Definition of Soils
  - A complex mixture of inorganic, decaying organic materials, water, air, and billions of living organisms
  - A three-dimensional unit (individual soil body → length, width, depth) large enough to study all properties and horizons is called a **pedon**

## Soil Formation

- Complex process
- Factors influencing soil formation
  - **Parent Material**: where soil formation takes place (not necessarily derived on site; can be transported and deposited)
    - Derived from geological materials (igneous, sedimentary, or metamorphic rocks)

## Soil Formation

- Complex process
- Factors influencing soil formation
  - **Igneous rocks**: cooled magma
    - (i.e., extrusive/intrusive)
  - **Sedimentary rocks**: forms from materials deposited in lakes and oceans
  - **Metamorphic rocks**: when either igneous or sedimentary rocks are heated or subjected to intense pressure @ considerable depths

## Soil Formation

- Complex process
- Factors influencing soil formation
  - **Climate - Radiant Energy and Water**: daily and seasonal fluctuations in heating and cooling
    - Affects moisture regime and evaporation
    - Temp & H<sub>2</sub>O → biogeochemical reactions
  - **Leaching**: dissolves and removes nutrients out of the soil

## Soil Formation

- Complex process
- Factors influencing soil formation
  - **Topography**: influences the intensity of radiant energy and amount of water that enters the soil (i.e., slopes)

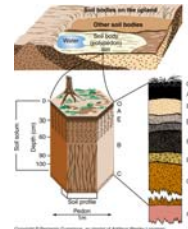
## Soil Formation

- Complex process
- Factors influencing soil formation
  - **Biota**: vegetation, animals, bacteria, fungi
  - Influences nutrient content, organic matter decomposition
- All influenced through **TIME**

## Soil Formation

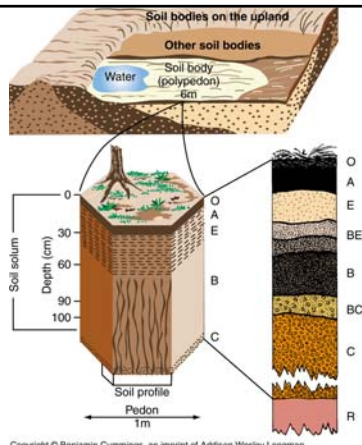
- Complex process
- Factors influencing soil formation
- The Soil Profile: Major Horizons
- Soil Layer → **Horizon**

- Horizons:
- thickness
  - texture
  - structure
  - color



### Horizons:

- O → surface layer
- A → upper layer of mineral soil (topsoil)
- E → Zone of max leaching
- B → Zone of illuviation (collection of leached materials)
- C → contains weathered materials
- R → unweathered bedrock



## Soil Formation

- Complex process
- Factors influencing soil formation
- The Soil Profile: Major Horizons
- Properties of Soil
  - Physical & Chemical

## Soil Formation

- Properties of Soil: **Physical**
  - **Color** → little to do with function
  - **Texture** → proportion of particle size
  - **Depth** → depends of slope, weathering, parent material, vegetation
  - **Moisture** → the amount of water per unit volume a soil can hold is one of its most important characteristics

## Soil Formation

- Properties of Soil: **Chemical**
  - Influenced by parent material, vegetation, moisture, clay organic content, and others
  - Chemical elements → dissolved in solution (constituent of organic matter and absorbed on particles)
  - Soil → Plants → Animals → Biogeochemical cycle

## Soil Formation

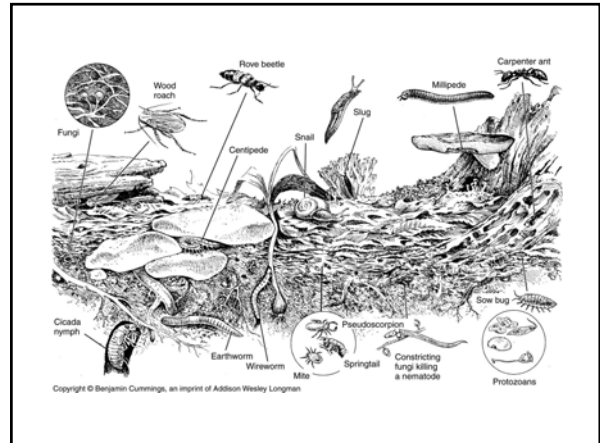
- Properties of Soil: **Physical & Chemical**
  1. The environmental conditions under which the soil is developing
  2. Water availability to plants
  3. Nutrient availability to plants
  4. Soil quality for plants and animals

## Soil Formation

- Complex process
- Factors influencing soil formation
- The Soil Profile: Major Horizons
- Properties of Soil
- The Living Soil
  - Soil as a medium for life
  - Relatively stable structure and chemistry
  - Climate far less variable than above ground

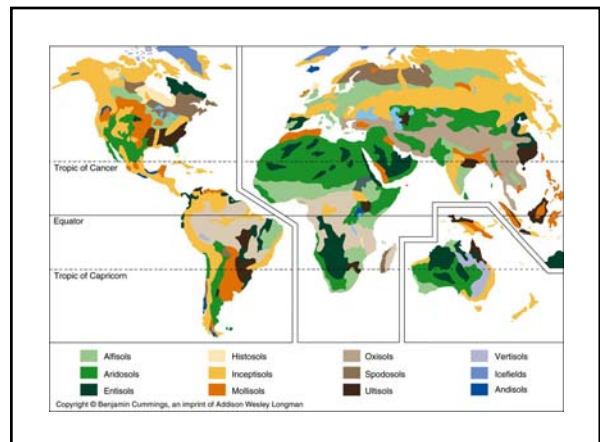
## Soil Formation

- The Living Soil: **Pore spaces**
  - Only a part of the upper soil layer available to most soil animals as living space
  - Water is essential
    - (majority of soil life only active in water)
    - Bacteria, unicellular algae, protozoa, rotifers, nematodes, etc.
    - Restricted movement



## Soil Formation

- Complex process
- Factors influencing soil formation
- The Soil Profile: Major Horizons
- Properties of Soil
- The Living Soil
- Soil Classification and Distribution
  - Soil Orders (12 major)
  - Developed by Soil Conservation Service
  - Natural Resource Conservation Service



## Soil Formation

- Complex process
- Factors influencing soil formation
- The Soil Profile: Major Horizons
- Properties of Soil
- The Living Soil
- Soil Classification and Distribution
- **Mismanaged Soils**
  - Soils have been highly disturbed

## Soil Formation

- **Mismanaged Soils**
  - Filled, overturned, excavations, mining, road construction, etc.
  - Upper horizons **compacted** (reduces pore size; minimize water absorption)
  - **Soil erosion**: carrying away of soil particles by wind and water
  - Agriculture, construction, and road building (major contributors → topsoil disturbance)

## Soil Formation

- **Mismanaged Soils: Soil Erosion**
  - **Sheet erosion**: (less conspicuous) even removal of soil over a field
  - **Rill erosion**: runoff concentrated in streamlets as it flows across the soil surface
  - **Gully erosion**: concentration of surface flow of water into channels that cut deep into the soil