Soil

Geology

- Study of soil and rocks.

Soil Composition

- **<u>Soil</u>:** a mixture of minerals, water, gases and the remains of dead organisms that covers Earth's surface.

- **<u>Soil Texture</u>:** size of mineral particles

▼ Good soil is usually dark, moist, and dense.

Size of Grains

- **<u>Three Soil Grain Sizes</u>:**
  1. **<u>Sand</u>** – largest particles, loses water easily
  2. **<u>Silt</u>** – medium particles, easily farmed
  3. **<u>Clay</u>** – smallest particles, poor drainage

3 Subcategories of Soil

1) **Loam**
- contains sand, silt, and clay
- best soil for agriculture (loose)

2) **Peat**
- contains more than 20% decaying organic material
- acidic
- used in fertilizer because of its ability to retain water

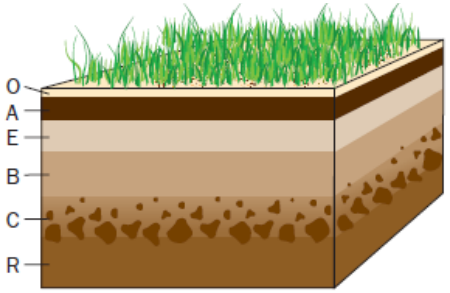
3) **Chalk**
- solid but soft & breaks down easily
- alkaline (basic)
- poor for agriculture

Soil Profiles

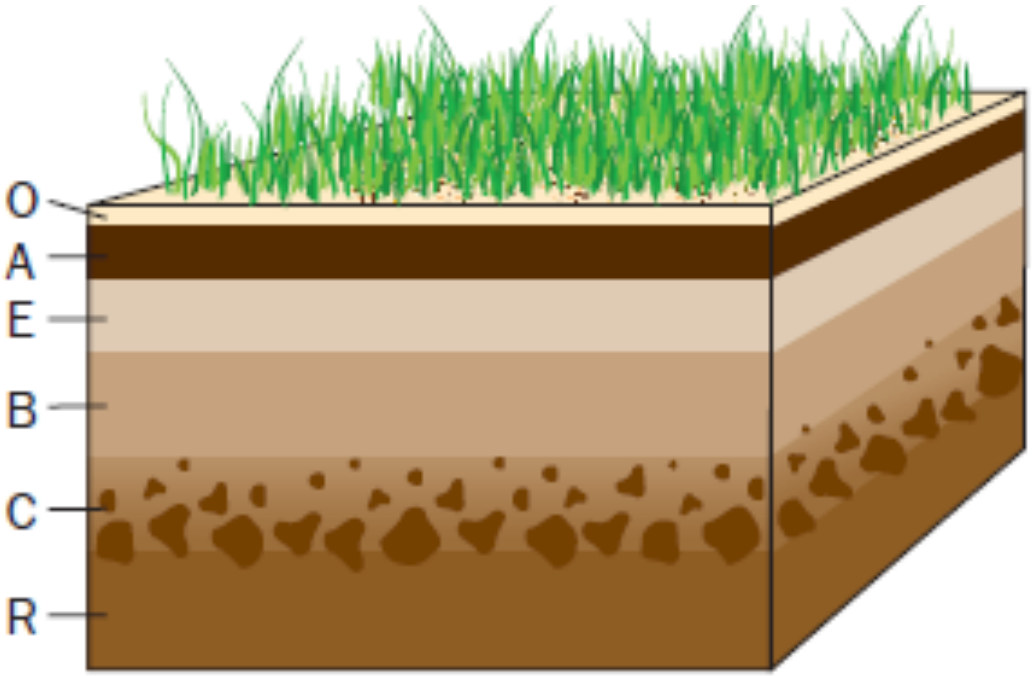
- **Soil Profile:** Soil in a given area will have a unique sequence of layers (horizons) that are parallel to the Earth's surface.

Horizons

- **O:** uppermost layer; made mostly of humus (decaying organic matter)
- **A (topsoil):** dark; mixture of humus and minerals; where seeds sprout and plant roots grow
- **E:** light; mostly sand and silt; as water drips through, it leaches (carries away) most of the minerals and clay
- **B (subsoil):** contains the clay and mineral deposits that have been leached from the layers above
- **C:** partially broken-up rock; plant roots do not grow in this layer; very little humus
- **R:** solid rock

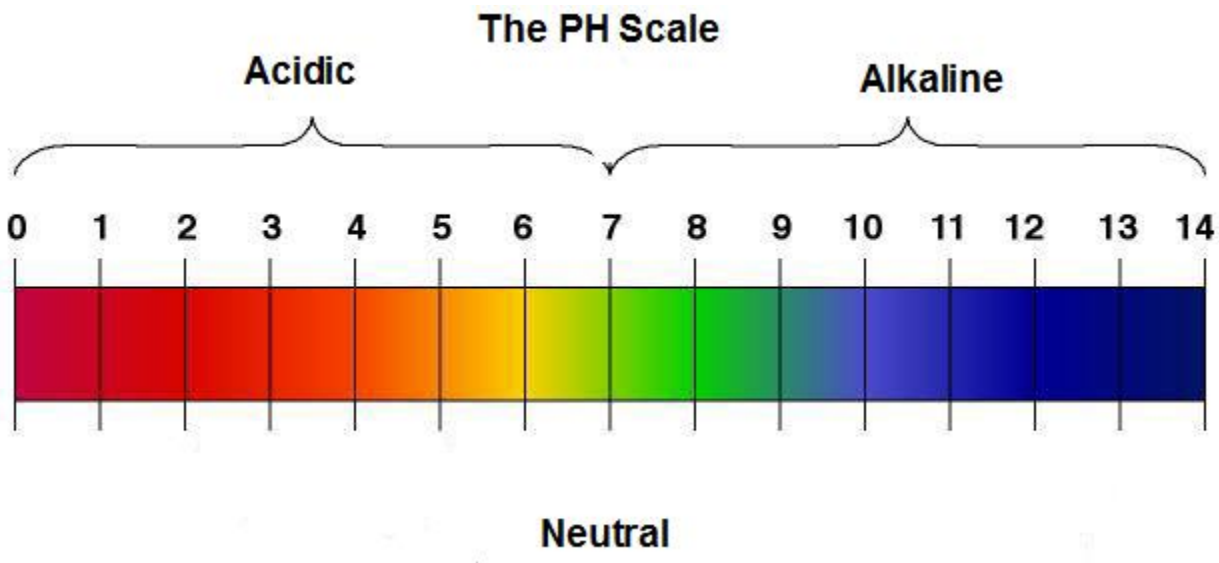


Horizons



Chemistry of the Soil

- The <u>pH of a soil</u> determines if a plant will grow.
  - Acidic (0-6.9), Neutral (7), Basic/Alkaline (7.1-14)



pH of Soil

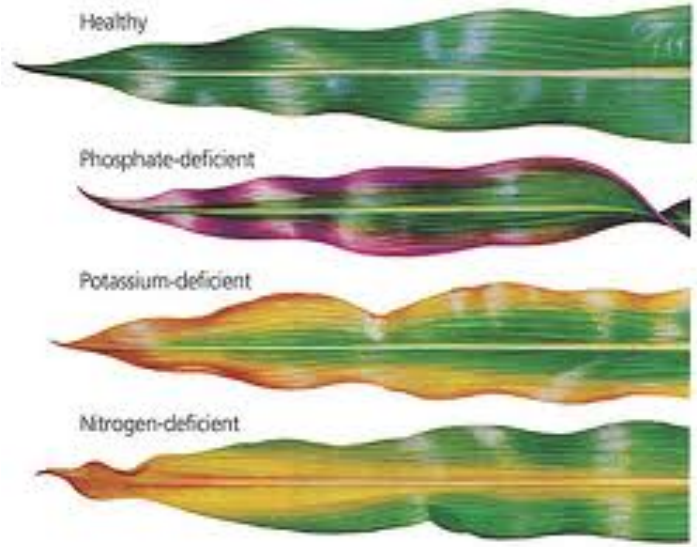
- Minerals & nutrients must dissolve in water to be accessible to plants.
- Most minerals & nutrients are <u>more easily dissolved in acidic soils</u>.
  - Ex. Phosphorus is available when the soil pH is between 6.0 and 7.0.
  - Ex. Nitrogen is available to plants if the pH is between 5.5 and 10.
- <u>Factors that can affect soil pH</u>: rainfall, pollution (acid rain), fertilizer

Effects of Nutrient Deficiencies in Plants

Figure 12-4. *Effects of nutrient deficiencies in plants.*

Nutrient Deficiency	Appearance of Plants
Nitrogen	Leaves of plants are yellow
Phosphorus	Small, frail plants with reddish leaves
Potassium	Leaves at bottom of plant dying from lack of chlorophyll (no longer green)
Calcium	Stems and leaves droop, unable to support upright position

Magnesium Deficiency



Sand Formation

- Small grains of sand are formed by the <u>weathering</u> of rocks by wind and water.
  - <u>If weathered by wind (air)</u>, lose jagged edges quickly & become rounded as grains strike each other directly.
  - <u>If weathered by water</u>, become rounded more slowly because water acts as a buffer so that grains collide more gently.

Sand Grain Classification

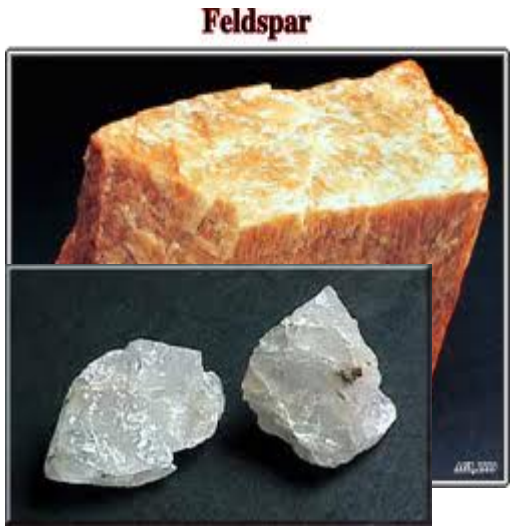
- <u>Young (immature)</u>
  - Contains a large portion of clay
  - Grains have a high % of fragmented edges
  - Found close to where it was formed, usually where not exposed to waves or currents
  - Ex. bottom of bays and lagoons, swamps, river floodplains

- <u>Old (mature)</u>
  - Do not contain clay and have fewer fragmented edges (mostly rounded)
  - Found in beaches & desert dunes where much weathering by water and air has taken place.

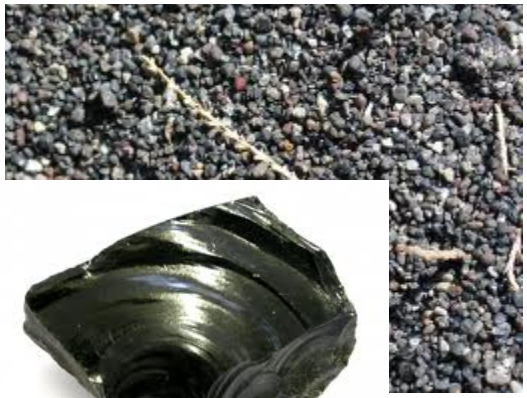
Mineral Composition of Sand

Most common mineral found in sand is quartz.

1. Continental
   - Mostly of quartz, micas, feldspars, and dark-colored minerals like hornblende or magnetite
   - Feldspar – temperate or polar climate or high altitude (weathers away quickly in warm, tropical climates)
   - High % of quartz – sand is very old (quartz weathers slowly)



2. Volcanic
   - Dark from basalt or green olivine
   - Originates from mid-ocean volcanoes (ex. Hawaii)
   - Young, contains very little quartz, except for obsidian (black).



(cont'd)

3. <u>Skeletal (Biogenic)</u>
   - Remains of marine animals (microorganisms, shells, coral)
   - Contains large amounts of calcium carbonate which bubbles which mixed with acid.

4. <u>Precipitate</u>
   - When water that contains minerals evaporates, the minerals precipitate (or crystallize) out of solution.
   - Calcium carbonate precipitates out of seawater forming particles that look like layers of an onion forming <u>oolites</u>.
   - Oolite sand particles are formed from the process of deposition, rather than weathering.