Conor Hunt

Everything You Need to Know About Soil

- How is soil made?
    - 1.Weathering of parent material (chemical & mechanical) This adds inorganic components
    - 2. Deposit of sediments by erosion
    - 3. Introduction of living organisms - succession -> the biotic component
    - 4. Decomposition of organic materials and dead organisms

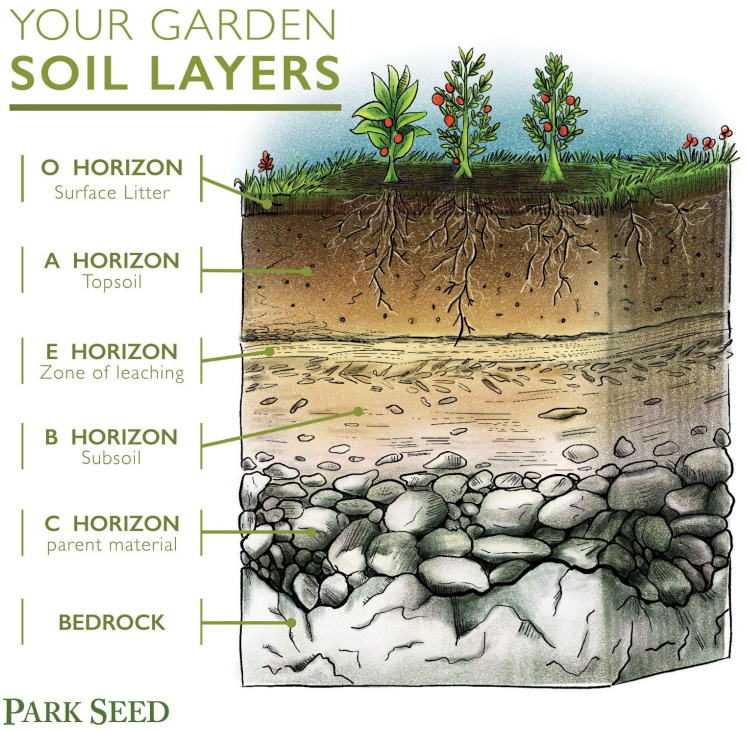
- Soil Composition
    - 45% Mineral Particles, 5% Organic Matter, 25% Air, 25% Water
    - Soil is composed of 3 main ingredients: minerals of different size, organic materials from the remains of dead plants/animals, and pores that can be filled with air or water

- Fertilizer
    - Organic - compost/decomposed organic matter. Good for crops and environment
    - Inorganic - synthetic, and more prone to erosion and runoff.

- Soil develops in response to several factors:
    - Topography - drainage, lope direction, elevation, and wind exposure.
    - Climate - precipitation and temperature
    - Parent material - The nature of the parent rock can either be native to the area or transported to the area by wind, water, or glacier, has a direct effect on the ultimate soil profile
    - Organisms - nitrogen-fixing bacteria, Rhizobium, fungi, insects, worms, snails etc. that help decompose litter and recycle nutrients

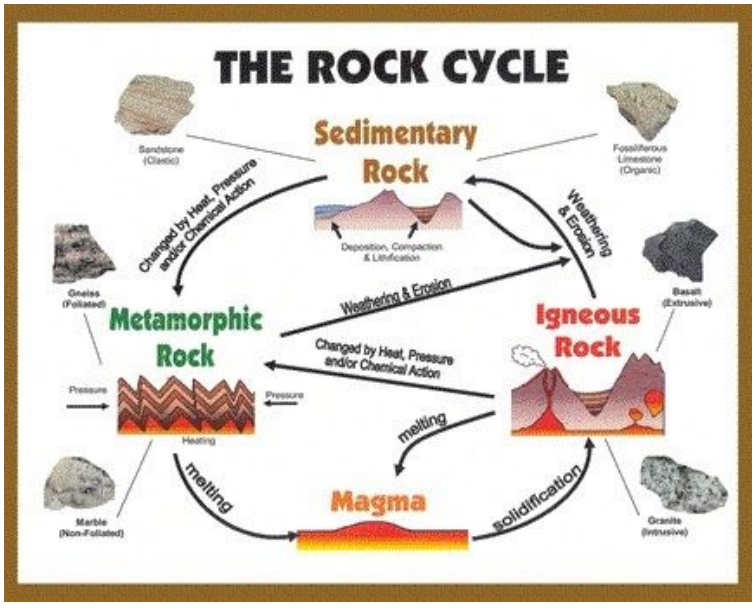
Soil Horizons:

- O - Leaves, waste, live organisms and partially decomposed organic debris including decomposing organisms
- A - weathered rock and some organic matter that has traveled down from the O layer
- E - Leaching, dissolved and suspended materials move downward
- B - Accumulation of clay. It can be rich in nutrients in areas where rainwater leached nutrients from the topsoil.
- C - Partially broken down organic minerals. Large pieces that have not undergone much weathering.
- R - Bedrock



Rocks:

- Three types: Igneous, Sedimentary and Metamorphic



- Physical weathering - Anything factor that breaks a rock down into small parts. Could be water, ice wedging, roots of plants etc.
- Chemical weathering - chemical reactions in/on the rock that allows it to be weathered

Impact:

- In order to be able to grow the food we humans consume, we must have enough arable (suitable for plant growth) soil to meet our agricultural needs. Soil fertility refers to the soil ability to provide essential nutrients like nitrogen, potassium, and phosphorus to plants. Humus is also an important component because it is rich in organic matter.

Monocropping

- Over the history of agriculture, a significant decrease in genetic diversity of crop species has taken place. This creates problems such as: A lack of genetic diversity makes crops more susceptible to pests and diseases.
- The consistent planting of one crop in an area eventually leaches the soil in that area of the specific nutrients that the plant needs to grow. Can be prevented by crop rotation. Big machines on the farm also damage the soil
- Green Revolution setbacks: the use of chemical pesticides resulted in an emergence of new species of insects, also pesticide resistance.

Erosion

- Soil erosion is the movement of weathered rock or soil components from one place to another
- Caused by flowing water, wind and human activity (overcultivation, overgrazing, clear cutting).
- Effects on soil: destroys the soil quality, decreases water-holding capacity of the soil
- Too much water: water cannot percolate through the soil, it runoff the land, taking more soil with it (positive feedback loop).

Salinization

- When humans irrigate, the water they use to spray the crops with is pumped from the ground. This means that there will be traces of salt in the water, so when the crops are sprayed, there is more salt landing on the soil, and ruining the crops.

How to stop soil degradation

- Crop Rotation - Changing the type of crop
- Contour Farming - Plowing and/or planting across a slope following elevation contour lines.
- Terracing - Levels of crops. When it rains, instead of the water carrying away the soil nutrients and plants down the slope, they flow to the next terrace.
- Intercropping - Growing two or more crops in proximity to each other.
- Conservation Tillage - Maintain soil quality by not damaging it apart after seasons.

Soil Conservation

- These practices return organic material to the soil, slow down the effect of wind, and reduce the amount of damage done to the soil by tillage (plowing).
- Use animal wastes (manure) and the residue of plants to increase the amount of organic matter in the soil
- Modify tillage practices to reduce the breakup of soil and to reduce the amount of erosion. These include contour plowing and strip planting
- Use trees and other wind barriers to reduce the force of winds

Acts and Historic Events

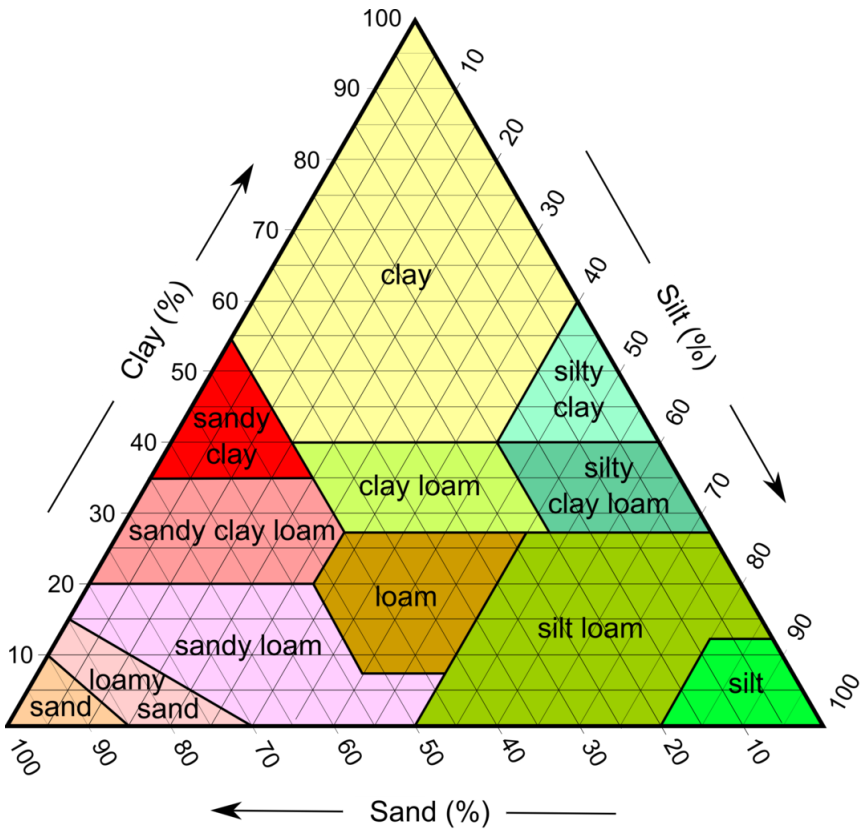
- Dust Bowl: Occurred in the 1930s in Oklahoma, Texas, and Kansas. It was caused by plowing the prairies and resulted in the loss of natural grasses that rooted the soil. Drought and winds that occurred blew most of the topsoil away, causing people to leave the Area.
- Soil + Water Conservation Act (1977) - Soil and water conservation programs established to aid landowners and users. Also sets up conditions to continue evaluating the condition of US soil, water, and related resources.
- Food Security Act (1985) - This act discouraged the conversion of wetlands to non-wetlands. 1990 federal legislation denied federal farm supplements to those who converted wetlands to agriculture, and provided a restoration of benefits to those who unknowingly converted lands to wetlands.
- Conservation Reserve Program pays farmers to not grow on highly erodible land.

Sand, Silt and Clay

- There are 3 main types of soils: sand, silt, and clay. The best soil for most plants for optimum growth is Loam, an even mixture of sand, silt and clay. (see triangle graph below)
- Recall Percolation Lab
    - Best Soil was those found under trees
- Clay is 0.002 mm in diameter
- Silt is 0.002-0.05 mm
- Sand is 0.05-2 mm
- Best mixture for play growth is a bit of all three, called loam.

SOIL COMPONENTS

COMPONENT	DESCRIPTION
Clay	Very fine particles. Compacts easily. Forms large, dense clumps when wet. Low permeability to water; therefore, upper layers become water logged.
Gravel	Coarse particles. Consists of rock fragments.
Loam	About equal mixtures of clay, sand, silt and humus. Rich in nutrients. Holds water but does not become waterlogged.
Sand	Sedimentary material coarser than silt. Water flows through too quickly for most crops. Good for crops and plants requiring low amounts of water.
Silt	Sedimentary material consisting of very fine particles between the size of sand and clay. Easily transported by water.


clay
silty clay
sandy clay
clay loam
silty clay loam
sandy clay loam
loam
silt loam
sandy loam
silt
loamy sand
sand
Clay (%)
Silt (%)
Sand (%)
100
90
80
70
60
50
40
30
20
10