Master Gardener Soil Presentation

February 7, 2023

AGRI SERVICE

SUSTAINING THE CYCLES
Organic Recycling
Mulch
Soil Amendments

Healthy Soils
Support
Healthy Plants

Characteristics of "Healthy Soils"

- Granular Structure
- Organic matter suitable for plant palette
- Nutrient and water reservoirs are sufficient to meet plant needs
- Friable, good tilth

"Unhealthy Soils"

- Compacted, poor structure
- Heavy salt load
- Insufficient organic matter present for good plant growth, increased water holding capacity and to support soil life
- Plants subject to increased pathogen and pest pressure

Definition of Soil

- The layer of unconsolidated particle derived from weather rock, organic material, water and air that forms the upper surface over much of the earth and ***supports plant growth***.

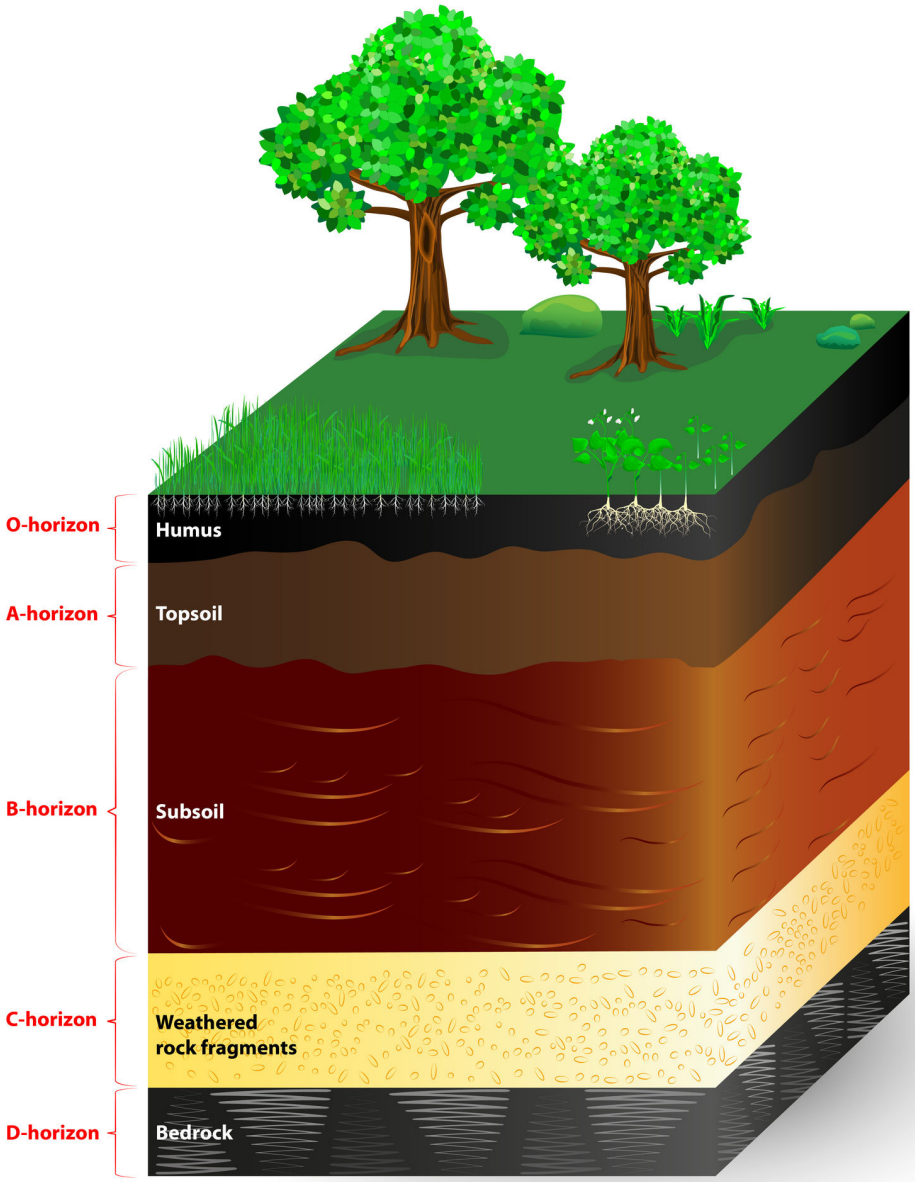
Challenges of Arid and Desert Soils

- High Salts
- Low Organic Matter
- Variable pH
- Sporadic Rainfall
- Salty Water
- Human Activity

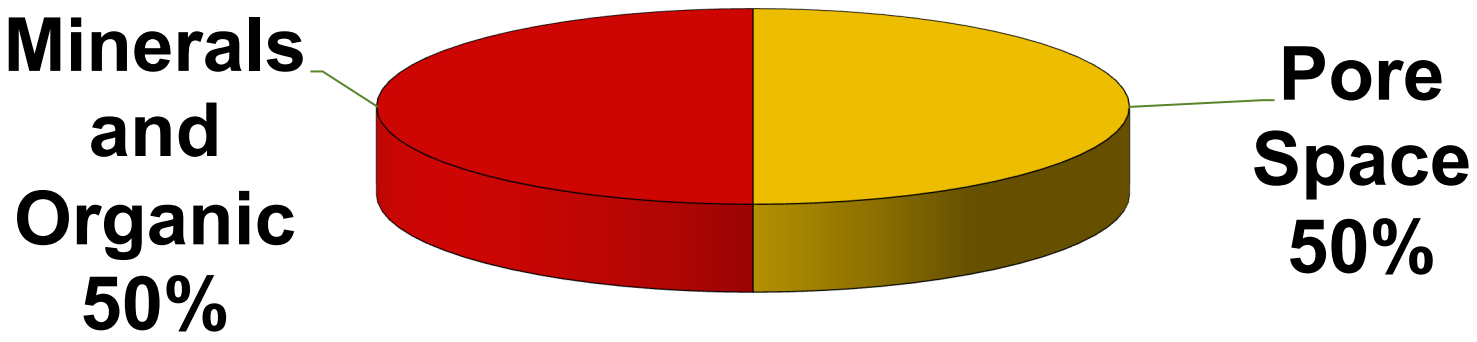
The 5 Factors of Soil Formation

- Parent material
- Topography
- Climate
- Vegetation/organic matter
- Time

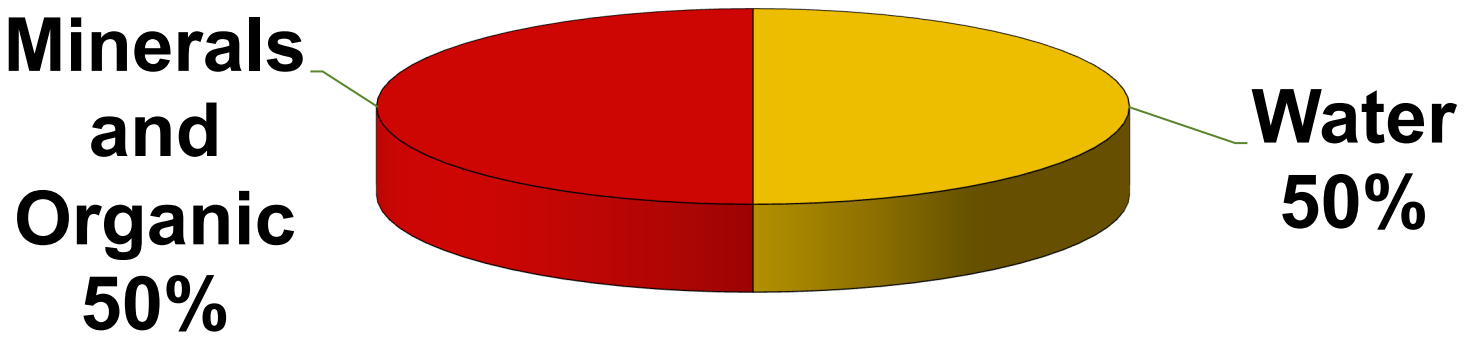
SOIL LAYERS


O-horizon
Humus
A-horizon
Topsoil
B-horizon
Subsoil
C-horizon
Weathered
rock fragments
D-horizon
Bedrock

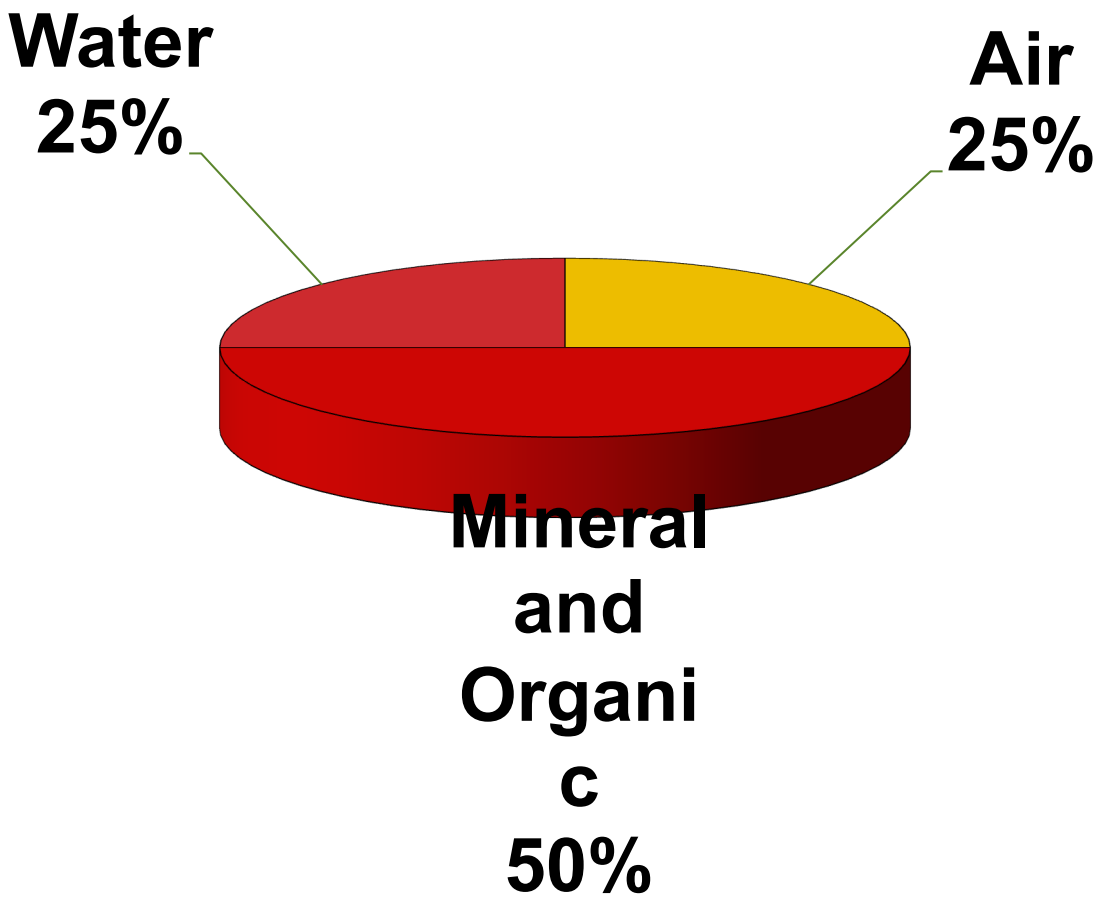
Composition of Soil

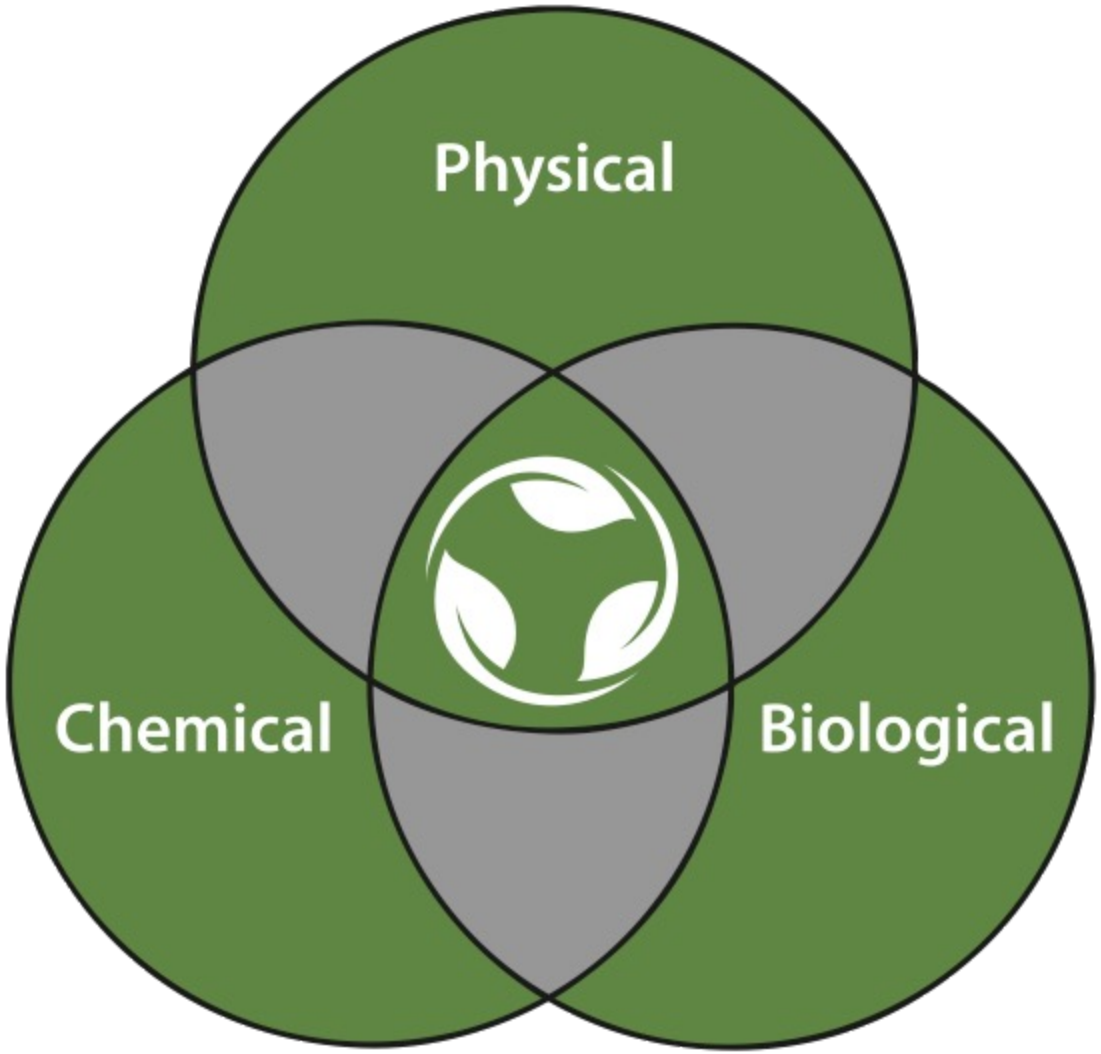


Composition of Soil Saturated



Composition of Soil Field Capacity

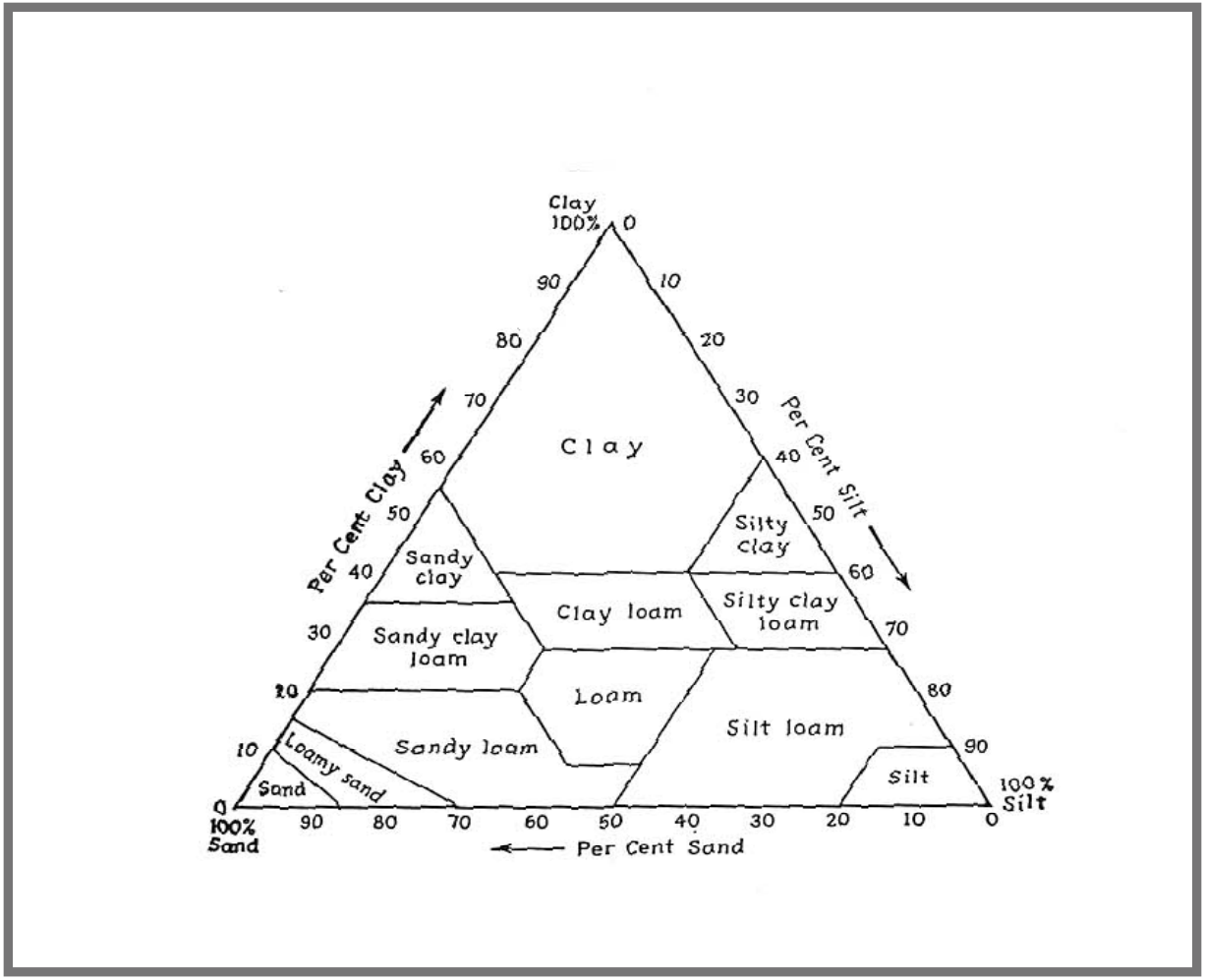



Physical
Chemical
Biological

Physical Characteristics

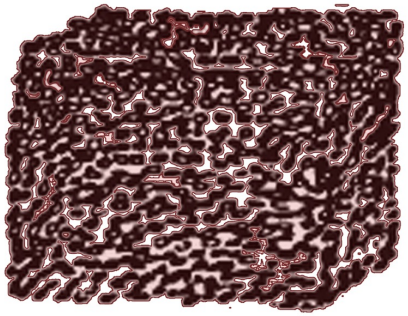
- Texture
  - Percent of Sand, Silt and Clay
  - Percent of Organic Matter
- Structure
  - Arrangement of Particles
- Compaction
- Drainage

Soil Texture

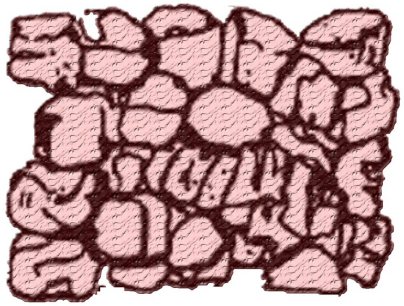


Soil Structure

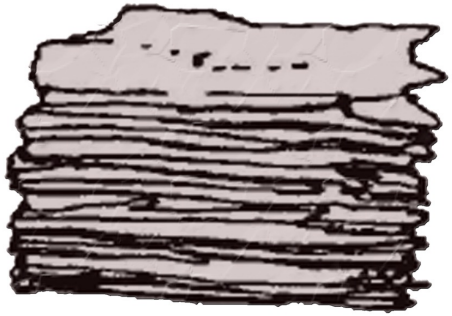
Single Grain
Rapid Infiltration



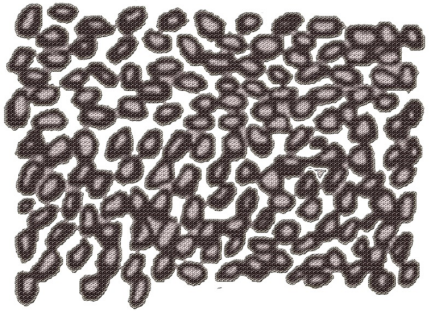
Blocky
Moderate-Slow infiltration



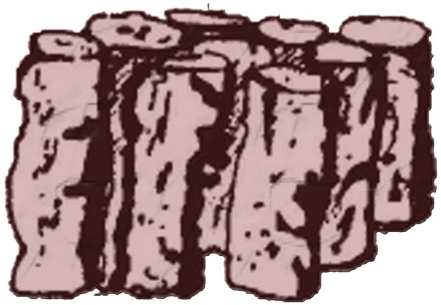
Platy
Slow-Very Slow Infiltration



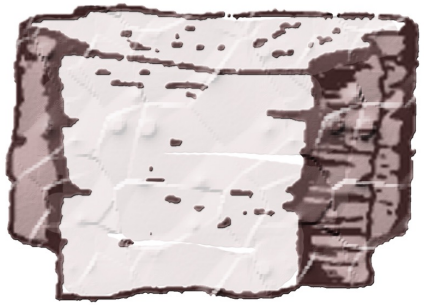
Granular
Rapid-Moderate Infiltration



Prismatic
Moderate-Slow Infiltration



Massive
Very Slow Infiltration



Importance of Soil Structure

Micro-Aggregates

- clay microstructures, silt-size microaggregates, particulate organic matter, plant and fungus debris, and mycorrhizal fungus hypha
- Relatively stable
- Building blocks for macro-aggregates

Importance of Soil Structure

Macro-Aggregates

- Bound by fungi hyphae, root fibers, and polysaccharides
- Reduce bulk density of the soil
- Are less stable than micro-aggregates, easily subject to compaction

Importance of Soil Structure

Macro-aggregates provide macro-pores

- Drainage
- Ability to leach
- Air space
- Reduces water molds and root rot

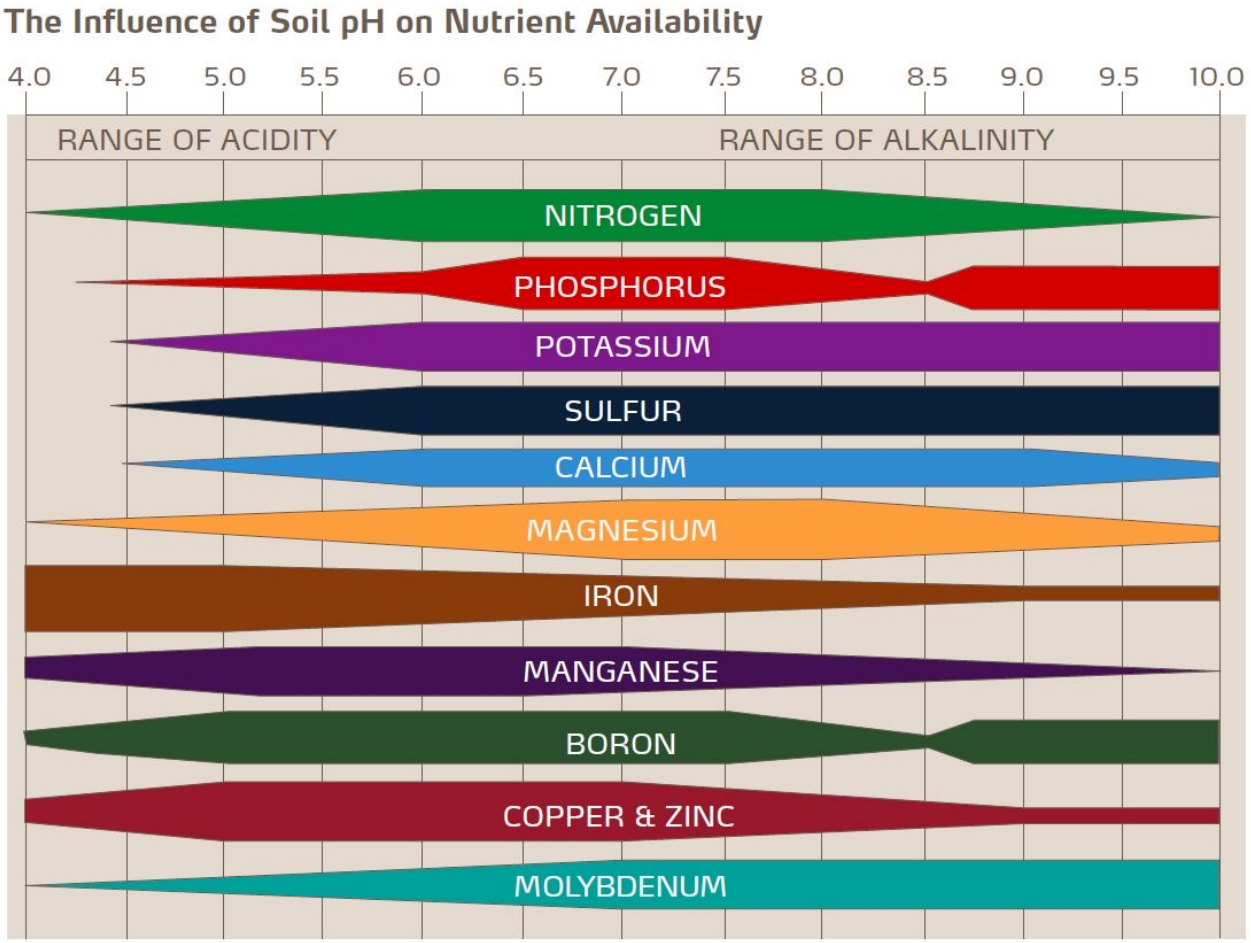
Improving Soil Structure

- Add compost to top 6 to 8 inches of soil prior to planting
  - Well composted
  - ½ to ¾ inch minus
  - C:N ratio of less than 20
- Use mulch to prevent compaction
  - 2 inches thick
  - Keep away from crown on plants
- Avoid working soil when wet

Chemical Characteristics

- pH
- Salinity
- Nutrients

Soil pH
Hydrogen Ions in the Soil Solution



Adjusting Soil pH

Amendments are should be mixed into the soil prior to planting. For perennials, using small amounts broadcast on the soil surface and then watered in.

- If pH is too high, add Soil Sulfur
- If pH is too low, add Soil Lime

Macronutrient Deficiency Symptoms

- Nitrogen
  - Overall stunting and slow growth
  - yellowing of plants older leaves
- Phosphorus
  - Overall stunting and slow growth
  - Purplish coloration
  - Poor fruit, root or seed development

Macronutrient Deficiency Symptoms

- Potassium
  - Weak stalks
  - Poor water regulation
  - Tip burn and necrosis on older leaves
  - Poor seed and fruit production

Micro Nutrient Deficiency Symptoms

Generally shows on new growth

- Copper
  - Stunted growth
  - Dieback of terminals
- Zinc
  - Interveinal chlorosis on new leaves
  - Rosetting of new growth
  - Reduced internodal length

Micro Nutrient Deficiency Symptoms

Iron and Manganese symptoms are often confused.

- Iron
  - Stunted growth
  - Interveinal chlorosis on new leaves
- Manganese
  - Interveinal chlorosis on new leaves, not as deliniated as iron

Soil & Water Chemistry

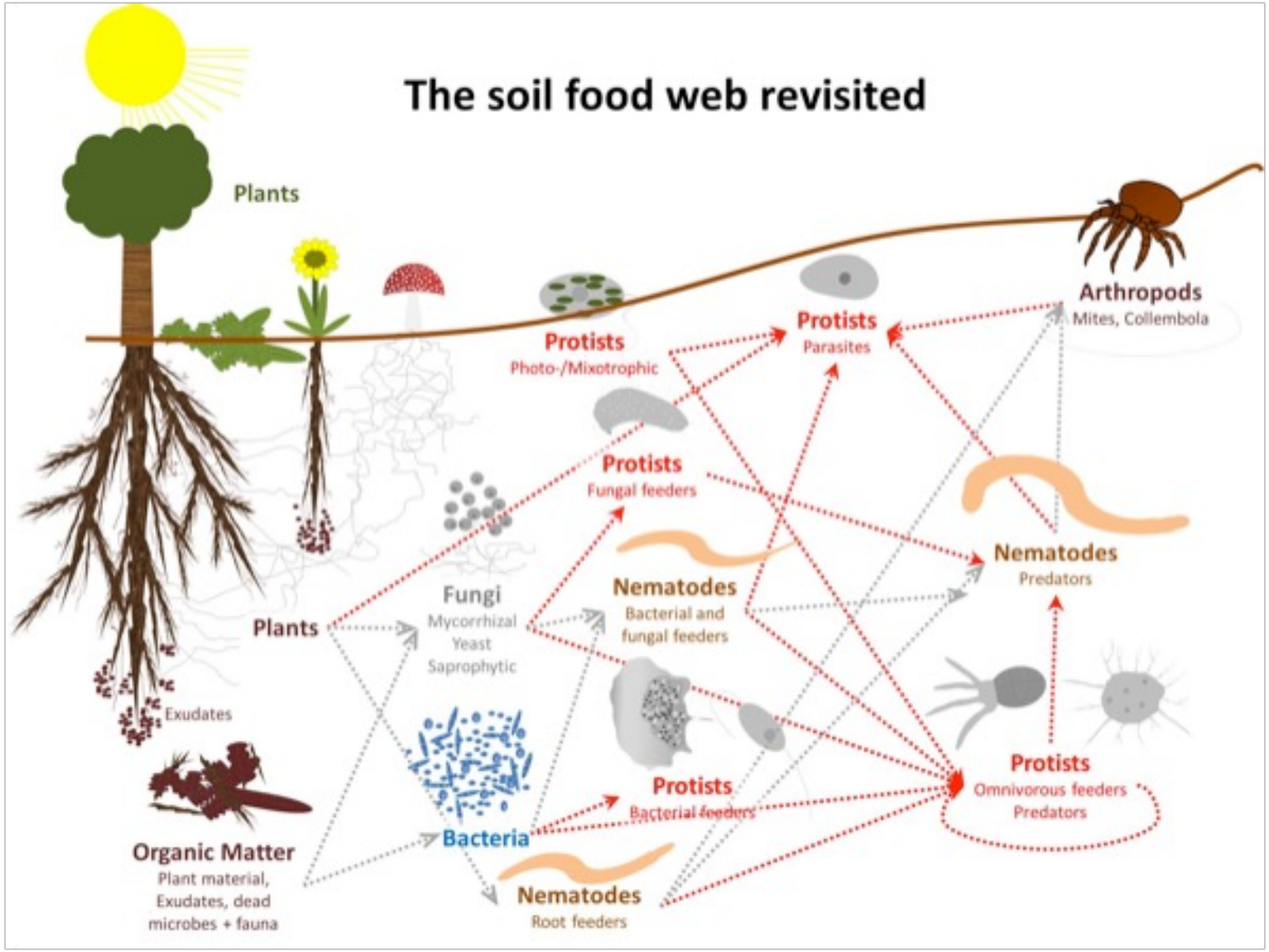
Total Salts in the Soil/Water Solution

Beneficial

- Potassium, Calcium , Magnesium
- Sulfates, Nitrates

Damaging

- Sodium
- Chloride
- Boron in excess


The soil food web revisited
Plants
Arthropods
Mites, Collembola
Protists
Photo-/Mixotrophic
Protists
Parasites
Protists
Fungal feeders
Nematodes
Predators
Fungi
Mycorrhizal
Yeast
Saprophytic
Nematodes
Bacterial and
fungal feeders
Plants
Exudates
Protists
Omnivorous feeders
Predators
Protists
Bacterial feeders
Bacteria
Organic Matter
Plant material,
Exudates, dead
microbes + fauna
Nematodes
Root feeders

Soil Organisms

- Bacteria, Fungi, Actinomicetes and algae
- Earthworms, insects
- Specialized micro-organisms
  - Mycorrhizae
  - Nitrogen fixing bacteria

Soil Humus

- Like clay has the ability to attract water and plant nutrient cations
- Reduces leaching
- Aids in the formation of soil aggregates
- Gives soil its dark brown color

Soil Sampling

Your Soil Analysis results are only as good as your sampling technique.

- Sample after finish grading
- Each sample should consist of 12 to 20 cores
- Make sure the lab knows that you are planting drought/salt tolerant plants

Fertilizers

- Organic v Inorganic
- Liquid v Granular
- Slow Release v Conventional
- Soil Applied v Foliar

Fertilizer Label

- First number is Nitrogen
- Second number is Phosphate
  - Multiply by .33 for elemental phosphorus
- Third number is Potash
  - Multiply by 0.83 for elemental potassium

Calculating Application Rate

The following information is needed

- How much of the nutrient do you want to apply per 1000 square feet
- The square footage of the area to be treated
- The composition of the fertilizer to be used
- Liquid-the weight per gallon

Fertilizer Timing

- Time to plant needs not a calendar schedule
- Small amounts of fertilizer during the growing season are more effective that one or two heavy applications

Backyard Composting

- Hot Composting
  - Grass
  - Yard Trimmings
  - Food Materials
- Soil Amendments and Mulch
- Vermicomposting
  - Food Waste
  - Great Fertilizer

Hot Composting

- Location: 3’x3’x3’ pile and space to turn
- Materials: ½ Green and ½ Brown by volume
- Temperature of at least 140 degrees F for weed seed and pathogen kill
- Turn several times while hot to aerate and expose outer area
- Make sure the pile has the moisture content of a wrung out sponge

Greens and Browns

Ingredient	C:N ratio
Greens	
alfalfa hay	12:1
food wastes	15:1
grass clippings	19:1
rotted manures	20:1
fruit wastes	35:1
Browns	
cornstalks	60:1
leaves	60:1
straw	80:1
sawdust	500:1
wood	700:1

Percolation v Infiltration

- **Infiltration** is the ability of water to enter the soil.

- **Penetration** is the movement of water in soil after field capacity has been reached.