

Introduction to |Soil Science and Wetlands – Kids at Wilderness Camp

Presented by:

Mr. Brian Oram, PG, PASEO
B.F. Environmental Consultants
<http://www.bfenvironmental.com>

and

Keystone Clean Water Team
<http://www.pacleanwater.org>



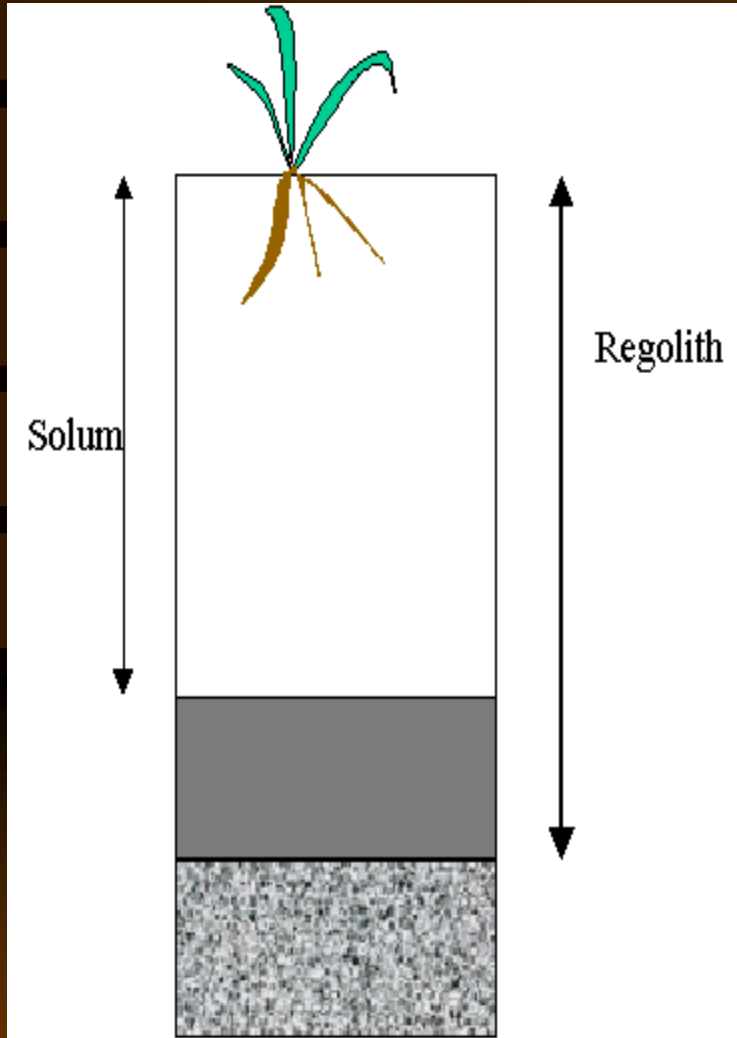
Soils Defined

- Natural Body that Occurs on the Land Surface that are Characterized by One or More of the Following:
 - Consists of Distinct Horizons or Layers
 - The Ability to Support Rooted Plants in a Natural Environment
 - Upper Limit is Air or Shallow Water
 - Lower Limit is Bedrock or Limit of Biological Activity
 - Classification based on a typical depth of 2 m or approximately 6.0 feet

Another Definition of Soils

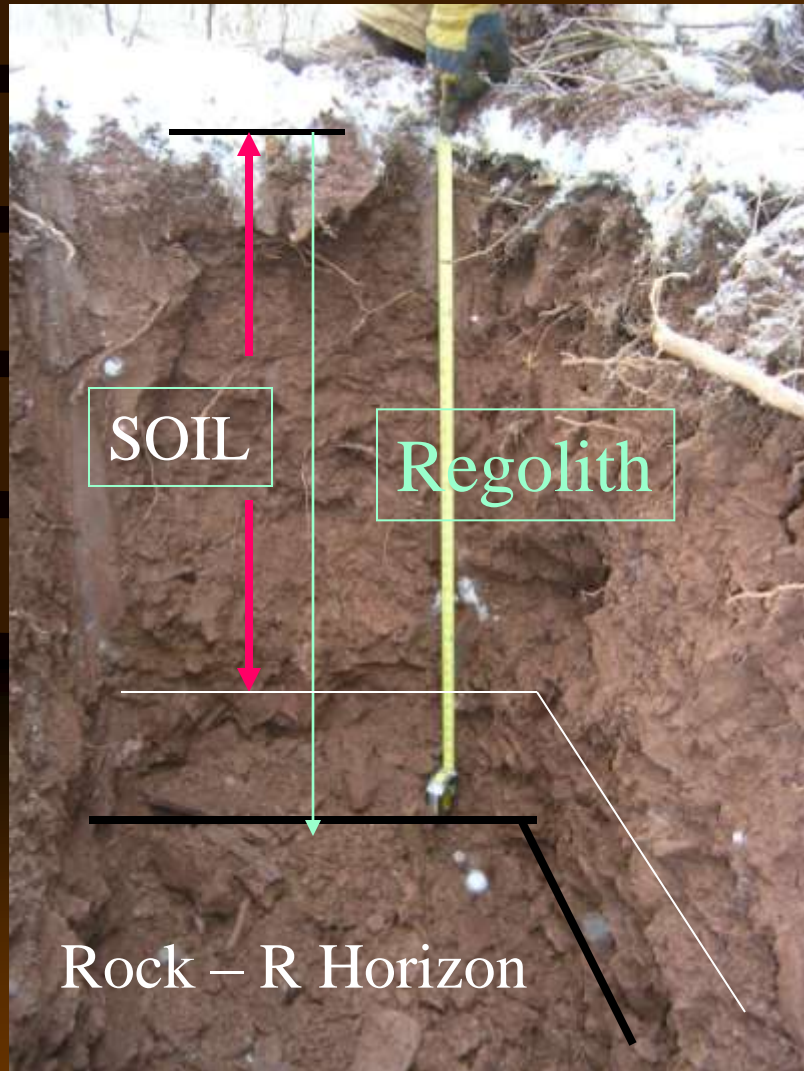
- A Natural 3 - Dimensional Body at the Earth Surface
- Capable of Supporting Plants
- Properties are the Result of Parent Material, Climate, Living Matter, Landscape Position and Time.
- Soil Composed of 4 Components (mineral matter, organic matter, air, and water)

The Regolith – What ?



- **The Regolith is the Unconsolidated material overlying Rock. The Overburden !**
- **This material may be rather thin to hundreds of feet thick and can include material dislodged or weathered from local rock, transported to the area by wind, water, ice, or gravity.**

The Soil or Solum



- The Soil or Solum is the portion of the Regolith that has been influenced by the 5 Soil Formation Factors.
- The processes are controlled by Time, Climate, Topography (Landform and Position), Organisms, and Parent Material.
- Formation Processes are in 4 Broad Categories (additions, losses, translocation, and transformations)- Genetic Soil Forming Processes.

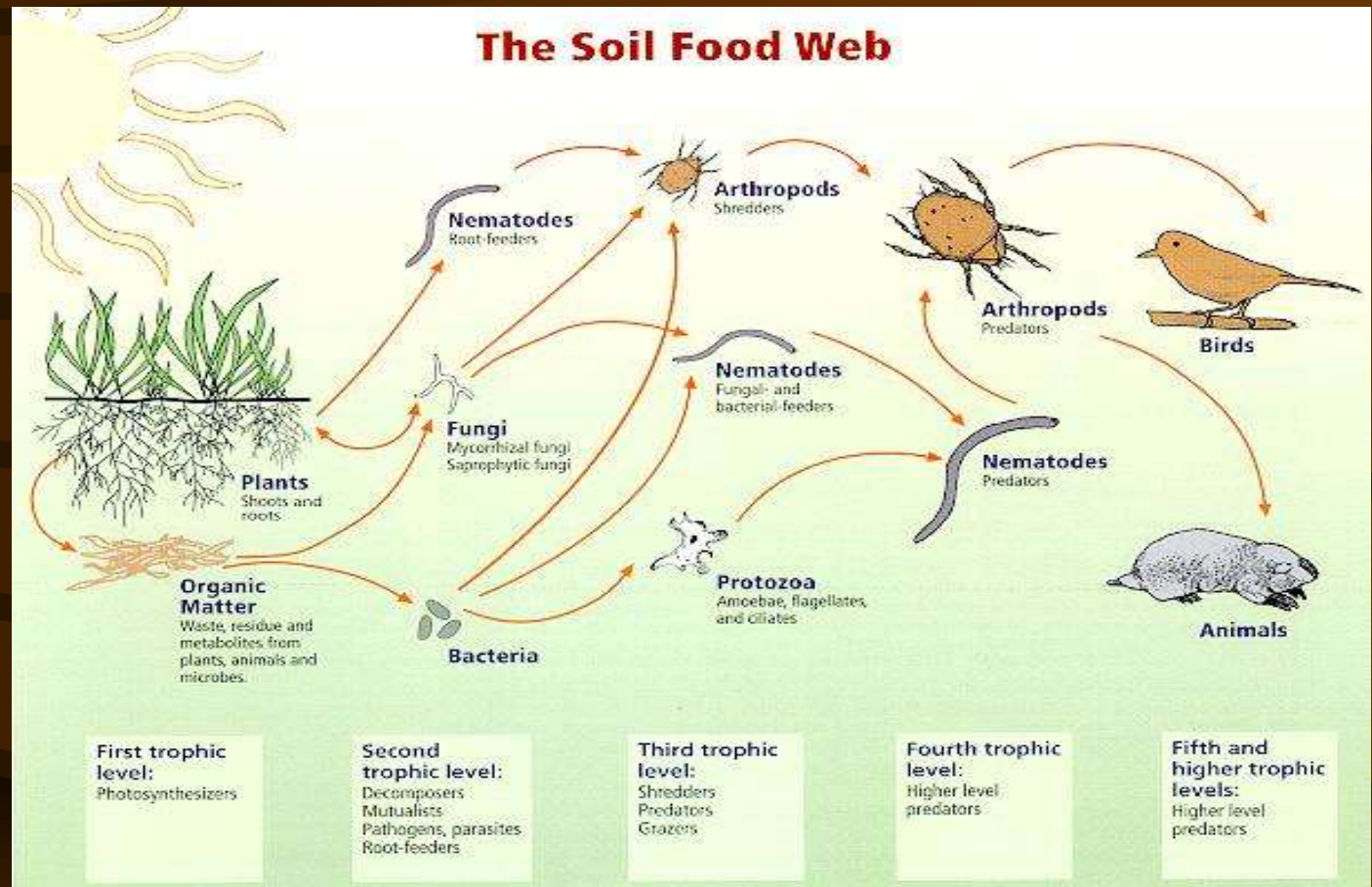
Five Soil Formation Factors

- Organisms
- Climate
- Time
- Topography and Landscape Setting
- Parent Material



Soil Food Web - Organisms

- Micro & Macroscopic
- Decomposition of Organic Matter
- Animals Living in Soil
- Vegetation Types
- Human Activity
- Redoximorphic Feature Formation

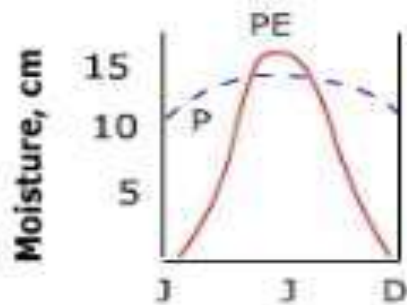


Climatic Elements (Energy & Precipitation)

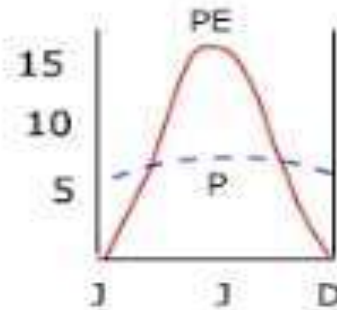


- Annual and Seasonal Rainfall
- Temperature Range
- Biologic Production and Activity
- Weathering (Wind, Water, and Ice-Physical breakdown)
- Translocation of Material

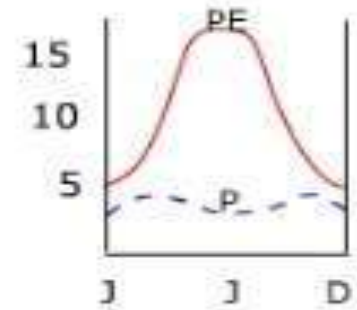
Climate and Soil Development



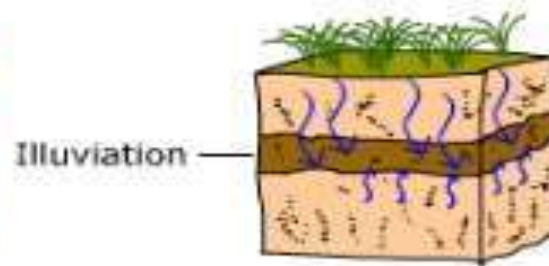
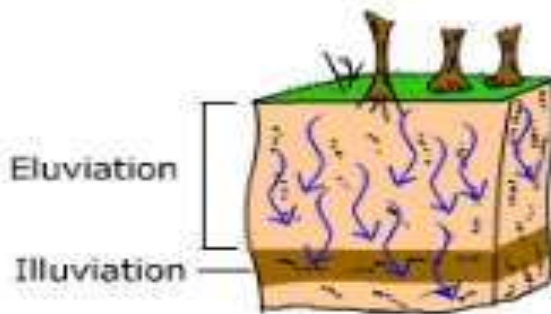
Humid



Semiarid



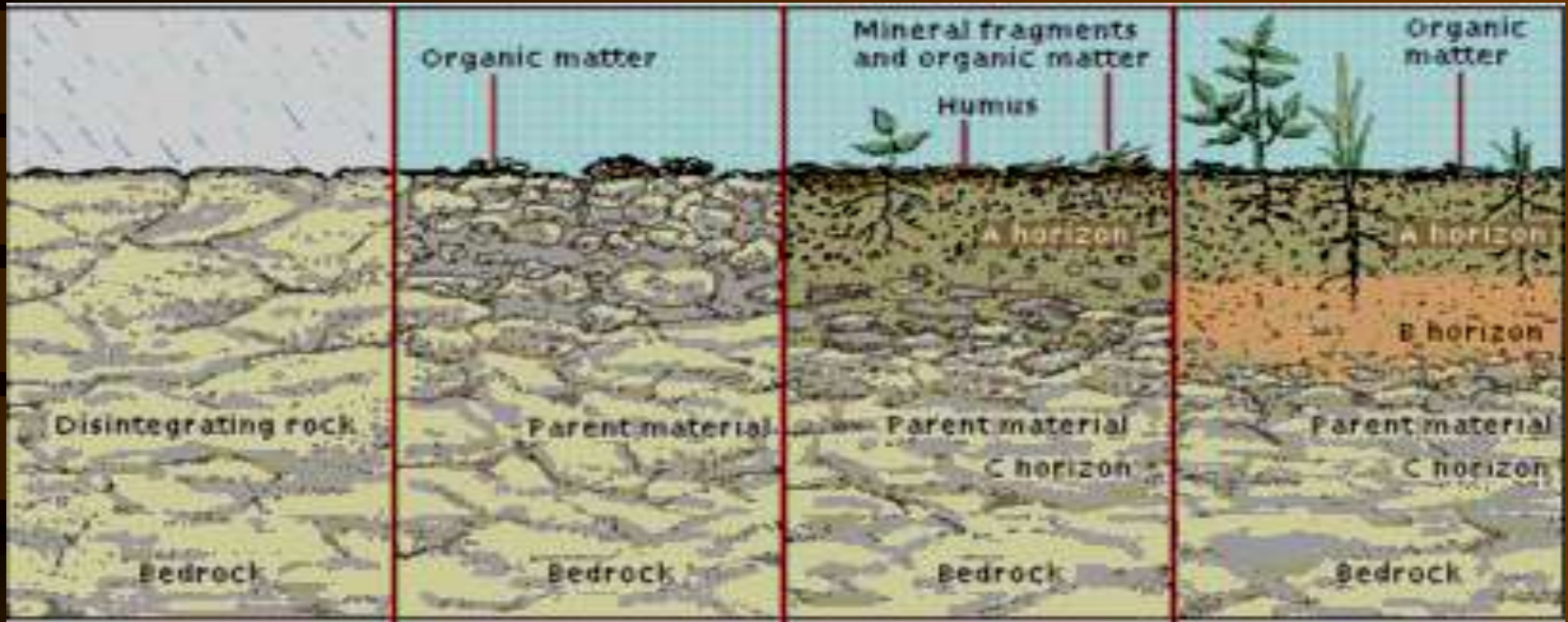
Arid



Illuviation



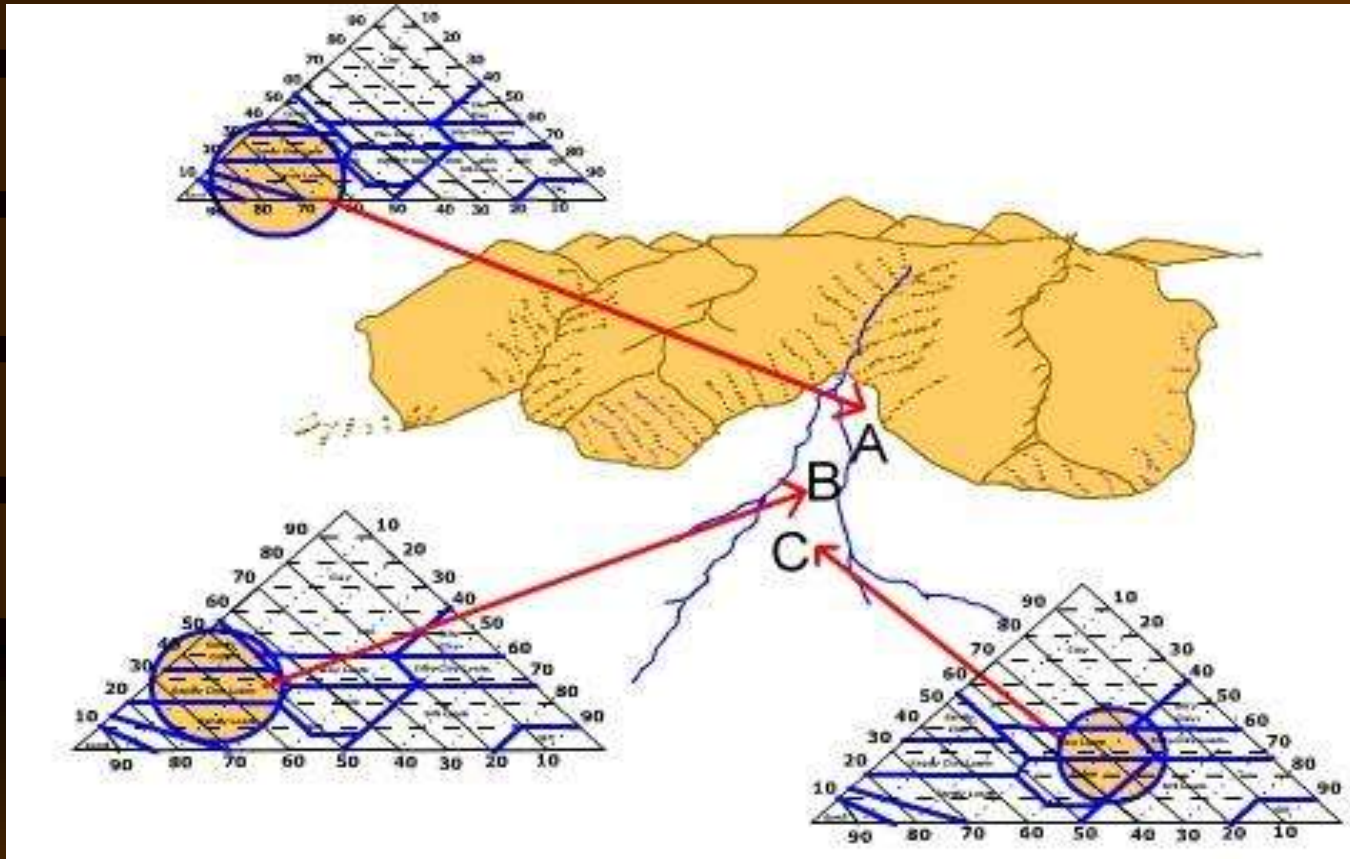
Geologic Time



Time



Landscape and Relief (Soil Texture)

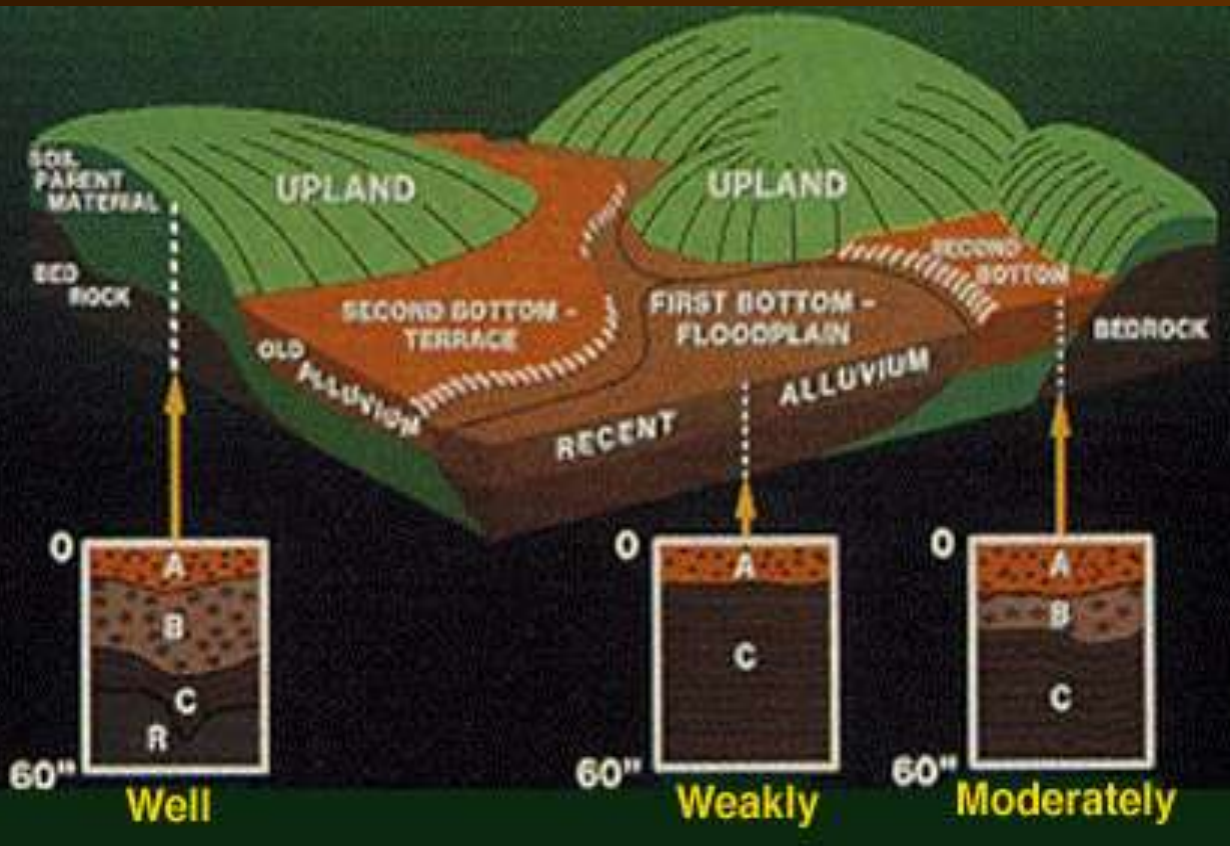


A- Sandy Texture
and
Loamy Sand

B- Sandy
Textures

C- Clay Loam,
Loam, Silt Loam

Landscape and Relief (Drainage)



Water Movement
Soil Drainage
Landscape
Configuration
(Convex, Concave)
Elevation
Water Movement

Parent Material

- Geological Materials
 - Minerals and Rocks
 - Glacial Materials
 - Loess (wind blown)
 - Alluvial Deposits
 - Marine Deposits
 - Organic Deposits
- Influences
 - Minerals Present
 - Colors
 - Chemical Reactions
 - Water Movement
 - Soil Development



Glacial Material



Bedrock

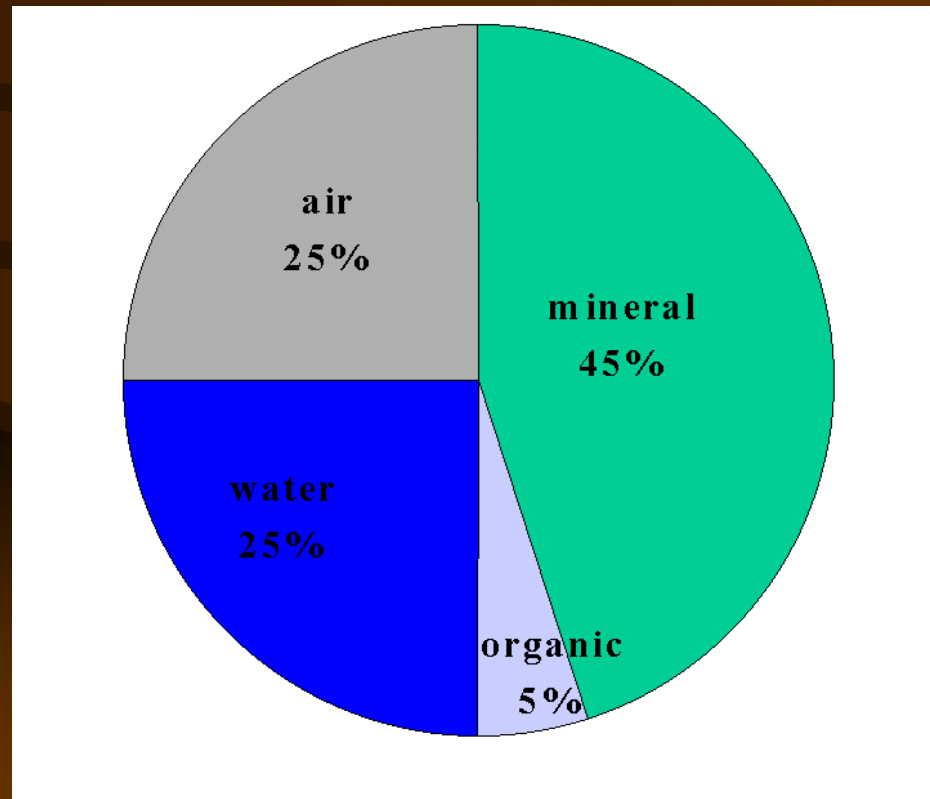
Major Components of Soil

Pore Space (50%)

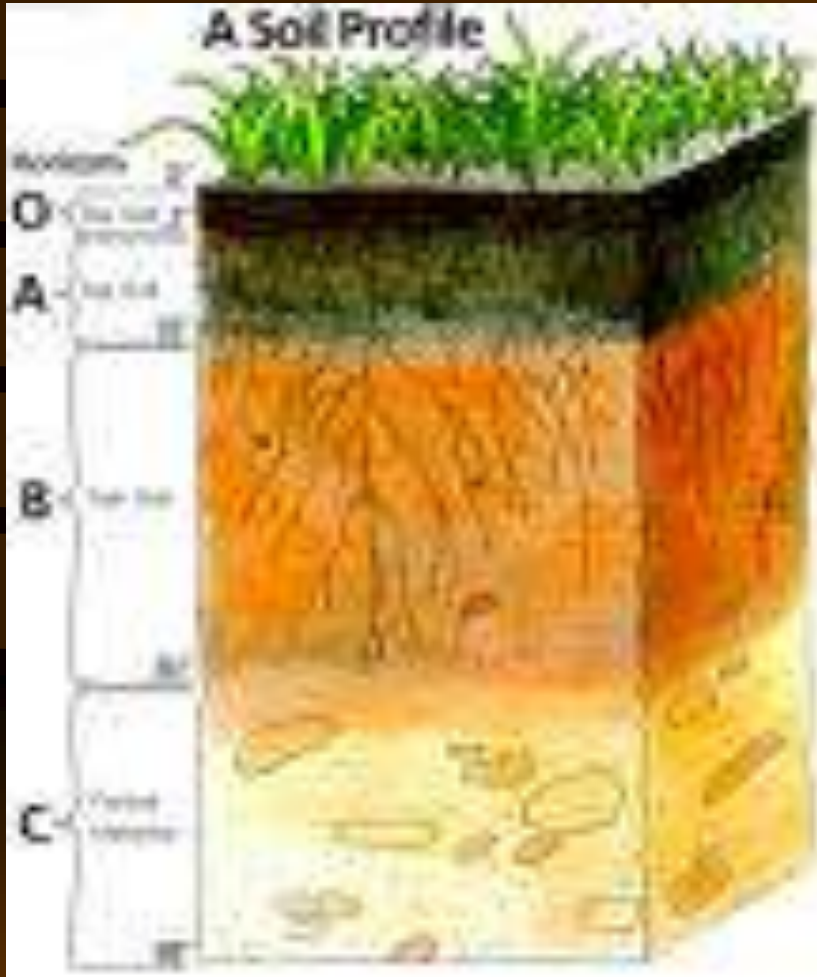
- This may contain air and/or water

Soil Space (50%)

- Organic Matter
- Mineral Matter



Soil Horizons



- Layer of Soil Parallel to Surface
- Properties a function of climate, landscape setting, parent material, biological activity, and other soil forming processes.
- Horizons (A, E, B, C, R, etc)

Image Source: University of Texas, 2002

Master Soil Horizons

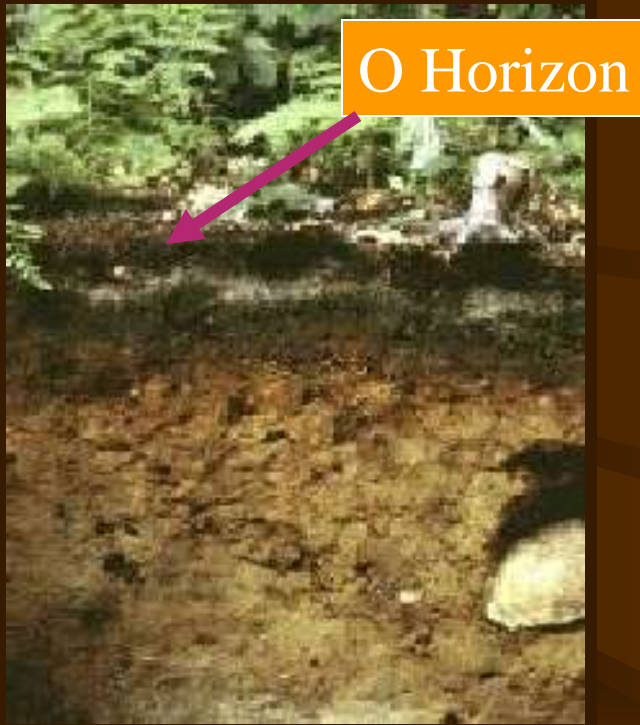
- O Horizon- leaf litter / humus
- A Horizon- organic accumulation in mineral soil
- E Horizon- leached horizon (elluviation)
- B Horizon- zone of illuviation
- C Horizon – unconsolidated parent material
- R Horizon – lithic material (Rock)>



Not All the Master Horizons Will Be Present in All Profiles

Soil Horizons

O- Organic Horizons



Dark in Color Because of
Humus Material - 1,000,000
bacteria per cm³

- Organic Layers of Decaying Plant and Animal Tissue
- Aids Soil Structural Development
- Helps to Retain Moisture
- Enriches Soil with Nutrients
- Infiltration Capacity function of Organic Decomposition
- Organic Matter Critical in Maintaining Water Stable Peds

Soil Horizons

A Horizons: “Topsoil”



- Mineral Horizon Near Surface
- Eluviation Process Removes Humic and Minerals from O Horizon into A horizon

Subordinates

- Ap - Plowed A Horizon
- Ab - Buried Horizon
- Soil dark in color, coarser in texture, and high porosity

Soil Horizons: B Horizons

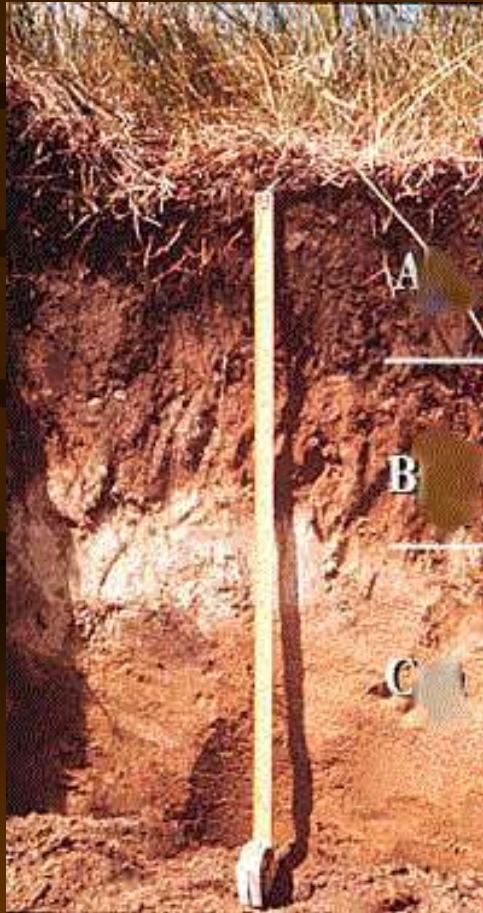
Zone of Maximum Accumulation



- Mineral Horizon
 - Illuviation is Occurring - Movement into the Horizon
 - B Horizon Receives or Accumulates Organic and Inorganic Materials from Upper Horizons.
 - Color Influence by Organic, Iron, Aluminum, and Carbonates
- Subordinantes
- Bw - Weakly Colored or Structured
 - Bhs- Accumulation of illuvial organic material and sesquioxides
 - Bs- Accumulation of sesquioxides
 - Bt- Translocation of silicate clay
 - Bx- Fragipan Horizon, brittle

C- Horizons

Distinguished by Color, Structure, and Deposition



- Mineral Horizon or Layer, excluding Rock
- Little or No Soil-Forming
- May be Similar to Overlying Formation
- May be Called Parent Material
- Layer can be Gleyed (Redoximorphic Feature)
- Developed in Place or Deposited
- May be Weathered Parent Material

R- Horizons



- Hard, Consolidated Bedrock (Lithic Material)
- Typically Underlies a C Horizon, but could be directly below an A or B Horizon.

Where is the Color?

- Think of the soil ped as an M&M. An M&M has a hard outer shell and then a chocolate center.
- Ok – Well the uncoated soil separates (sand, silt, and clay) are gray and the minerals (Fe, Mn, Silicates, Carbonates, and Organics) create the outer shell or coating.

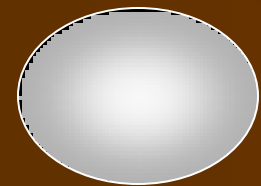
Under Reducing Conditions



Brown Soil
Coating Fe_2O_3



Fe^{+2} in Matrix, Less
 Fe^{+3}



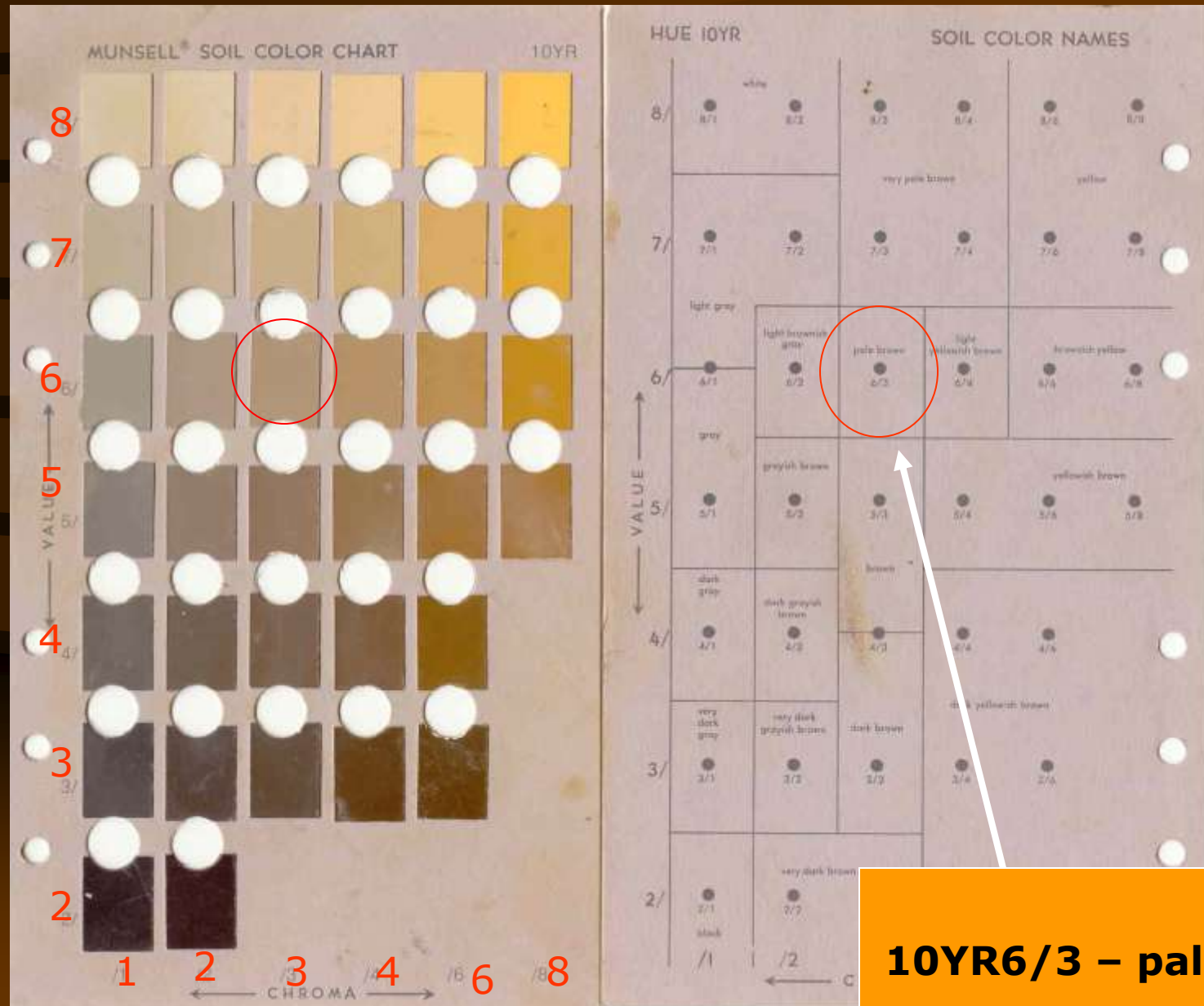
Gray – Low Chroma Soil
Iron Leached from Matrix

Reduced matrix



Does the soil have reduced Iron? Add a,a'-dipyridyl dye - A red color - positive for reduced iron

What is the Soil Color ? 10YR Page



10YR6/3 – pale brown

General Criteria for Hydric Soils

- Organic Soils
- Mineral Soils with High Water Table
(permanent and seasonal)
- Ponded Soils
- Flooded Soils

Criteria 1- All Histosols (Organic Soils)

- All Histosols, except Folists
- Contains 12-18% organic carbon by weight (saturated) or at least 20% organic carbon (unsaturated)
- 40 cm thick
- Includes:
 - Fibrists (fibric organic material)
 - Hemists (hemic organic material)
 - Saprists (sapric organic material)



Greater
Decomposition

Folists

- Are Histosols or organic soils that formed over shallow bedrock or fragmental material in cool, humid climates, that are saturated only for a few days after heavy rain.
- Primary Location – Hawaii and Alaska

Criteria 2- Saturation

- Somewhat poorly drained with a water table equal to 0.0 ft from surface during the growing season, or.



Criteria 2- Saturation- Part I

- Poorly drained to very poorly drained and have either:
 - Water table equal to 0.0 ft during the growing season if textures are coarse sand, sand, or fine sand in layers with 20 inches, or



Criteria 2- Saturation- Part II

- Poorly drained to very poorly drained and have either:
 - Water table at less than or equal to 0.5 ft from the surface during the growing season if permeability is equal to or greater than 6 in/hr in all layers within 20 inches, or

Criteria 2- Saturation – Part III



Poorly drained to very poorly drained and have either:

- Water table at less than or equal to 1.0 ft from the surface during the growing season if permeability is less than 6 in/hr in all layers within 20 inches, or

Criteria 3 - Ponding

- Soils that are frequently ponded for long or very long duration during the growing season
 - Frequently > 50 times in 100 years
 - Long duration is 7 to 30 days
 - Very long duration is > 30 days
 - Growing season – based on local soil temperature / moisture regimes

Criteria 4 - Flooding

- Soils that are frequently flooded for long or very long duration during the growing season
 - Frequently > 50 times in 100 years
 - Long duration is 7 to 30 days
 - Very long duration is > 30 days
 - Growing season – based on local soil temperature / moisture regimes

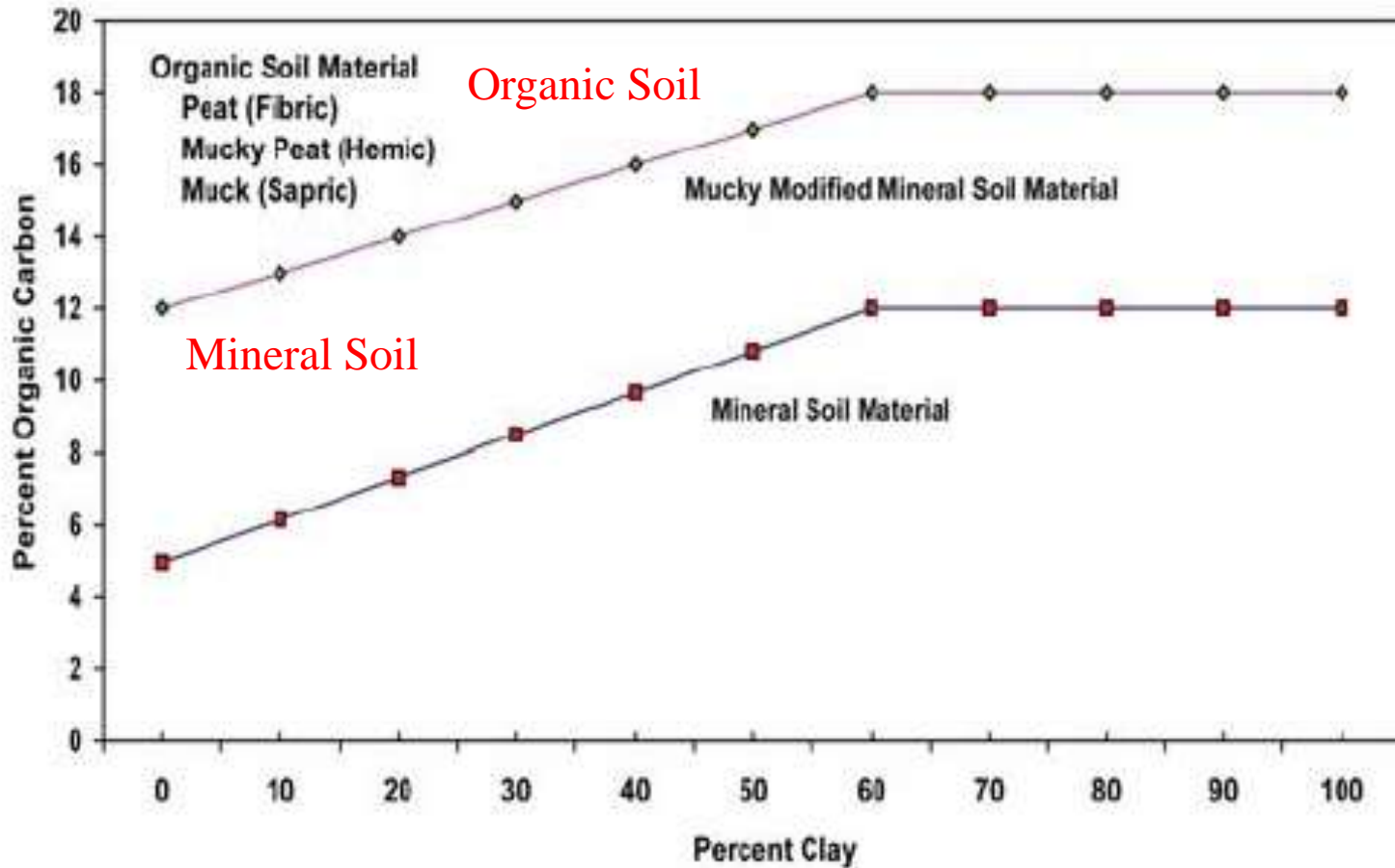
Soil Type

– Organic Soils

• Mineral Soils



Difference Between Organic and Mineral Soils



Introduction to |Soil Science and Wetlands – Kids at Wilderness Camp

Presented by:

Mr. Brian Oram, PG, PASEO
B.F. Environmental Consultants
<http://www.bfenvironmental.com>

and

Keystone Clean Water Team
<http://www.pacleanwater.org>

