Soil Interpretations
Erosion and Sedimentation Control Planning and Design Workshop

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Objectives

- What is soil?
- 5 soils forming factors
- Components of soil
- Soil characteristics
- Soils and water relationships
- Soil Erosion
- Resources
What is Soil?

Soil is loose material on the surface of the earth which nourishes and supports plant life.

Soil occurs in layers called Horizons.

Pedology is the study of soil.

What is soil?

- A dynamic natural body that covers the surface of the earth
- Medium for plant growth
- Composed of mineral and organic solids, gases, liquids, and living organisms
- Recycling system for nutrients and organic wastes
- Engineering medium
- System for water supply and purification
5 Soil Forming Factors

1) Parent Material (material from which the soil formed)

- Eolian
- Residuum
- Alluvium
- Outwash
- Colluvium

2) Climate (temperature and precipitation)

- Annual Precipitation: 37 to 60 inches
- MAAT: 59 to 66 degrees F
- MAST: 59 to 72 degrees F
- Frost Free Days: 200 to 240 days
5 Soil Forming Factors

1) Parent Material (material from which the soil formed)
2) Climate (temperature and precipitation)
3) Topography (slope, aspect, slope shape)
4) Living Organisms (biota)
5 Soil Forming Factors

1) Parent Material (material from which the soil formed)
2) Climate (temperature and precipitation)
3) Topography (slope, aspect, slope shape)
4) Living Organisms (biota)
5) Time

Major Components of Mineral Soils
Soil Component: Organic Matter

A small percent OM can have a large effect.

Organic Matter:
- Usually results in darker soil color
- Contributes to soil structure
  - sugars excreted by microbes stabilize aggregates
- Increases soil aeration
- Increases soil water-holding capacity
- Increases CEC (cation exchange capacity)
- Source of nutrients
- Lowers bulk density (compaction)

Major Components of Mineral Soils

![Diagram showing the major components of mineral soils: Organic matter, Air, Water, Solid material, and Pore space.](image)
Soil Characteristics: Texture

- Sand: 0.05 to 2 mm
- Silt: 0.002 to 0.05 mm
- Clay: < 0.002 mm

Relative Size of Particles:
- Barrel feels gritty
- Plate feels floury
- Coin feels sticky
Soil Characteristics: Texture

Textural Modifiers for Coarse Fragments

Example:
- Gravelly: 15 to < 35%
- Very Gravelly: 35 to 60%
- Extremely Gravelly: > 60%

Rock fragments
- 35 to 50% above 20 inches
- 60 to 85% below 20 inches
Soil Characteristics

- Soil Horizons
- Depth of soil
- Color of soil
- Texture
- Size and shape of aggregates
- Rock fragments
- Soil reaction
- Landscape position
- Slope

Soil Characteristics: Soil Horizon

- O – Horizon
  - Duff Layer
- A – Topsoil
  - Granular Structure
- Bw – Subsoil
  - Small blocky structure
- Bt – Subsoil
  - More clay accumulation
  - Angular blocky structure
- C – Weathered “parent material”
- R – Hard bedrock
Example of 10R, 10YR and 5Y Color Pages
Soil Color

Soil Characteristics: Structure

- Granular
- Platy
- Block
- Prismatic
- Columnar

- Aggregates of Sand, Silt, and Clay
- OM increases aggregate stability
Vertical faces of soil structure can conduct water easily. (High clay content can negate this property)

Platy structure does not allow water to easily move vertically.

Strong thin platy structure.
- Cecil
  - Fine, Kaolinitic, thermic Typic Kanhapludults
  - Very Deep
  - Well Drained
- **Appling**
  - Fine, Kaolinitic, thermic
  - Typic Kanhapludults
  - Very Deep
  - Well Drained

- **Helena**
  - Fine, mixed, semiactive, thermic Aquic Hapludults
  - Very Deep
  - Moderately well drained
Soil/Water Relationships

Factors in Pore Size:

**Pore Size:**
- Macropores >0.08 mm
- Micropores <0.08 mm

**Factors in Pore Size:**
- Soil Texture:
- Soil Structure:

Soil/Water Relationships

**Water-Holding Capacity**
- Ability of soil to hold water

**Aeration** is equally important
- Factors:
  - Macropores
  - Connectivity of pores

Soil texture greatly influences the quantity of water a soil can hold.
Soil/Water Relationships

**Permeability**
Movement of water (and gases) within and through soils.

**Factors:**
- Texture
- Compaction
- Structure and Stability
- Water content
- OM
- Pores

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**Leaching**
Downward movement of nutrients, clay particles and chemicals.

**Factors:**
- Texture
- Compaction
- Structure and Stability
- Water content
- OM
- Pores

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Soil/Water Relationships

**Infiltration**
Downward entry of water into the soil.

**Factors:**
- Texture
- Compaction
- Structure and Stability
- Vegetation cover
- Water content
- Frozen surface
- OM
- Pores

**Increase Infiltration:**
- Decrease compaction
- Maintain plant cover
- Increase OM

Decreased infiltration can lead to increased runoff and erosion.

Soil Erosion:

- Texture
- Structure
- Organic Material
- Bulk Density

**Resulting in changes in:**
- Water-holding capacity
- Permeability
- Infiltration
- Aeration
Soil Erosion:

K-Factor –

- soil erodibility factor which represents both susceptibility of soil to erosion and the rate of runoff.
  - Soils high in clay have low K values, because they resistant to detachment.
  - Coarse textured soils, such as sandy soils, have low K values, because of low runoff even though these soils are easily detached.
  - Medium textured soils, such as the silt loam soils, have a moderate K values, because they are moderately susceptible to detachment and they produce moderate runoff.
  - Soils having a high silt content are most erodible of all soils. They are easily detached; tend to crust and produce high rates of runoff.

Soil Erosion:

T-Factor –

- Soil loss tolerance expressed in tons per acre per year.
  - Soil loss tolerance is the maximum amount of soil loss in tons per acre per year, that can be tolerated and still permit a high level of crop productivity to be sustained economically and indefinitely.
  - Soil loss tolerance values of 1 through 5 are used. These values represent the tolerable tons of soil loss per acre per year where food, feed and fiber plants are to be grown. T values are not applicable to construction sites or other non-farm uses of the erosion equation.
**Soil Erosion: On-site Impacts**

The loss of topsoil, either by actual removal with heavy equipment or erosion by wind and water.

- Loss of nutrients and nutrient holding capacity, results in a less fertile soil
- As organic matter is lost, soil density increases and compaction occurs. Compaction lowers the infiltration rate of water and reduces the available water holding capacity.
- The surface organic matter is also the food source and habitat for beneficial microorganisms and insects. The loss of this material drastically reduces the soils natural ability to control disease and pest outbreaks, increasing the need for pesticides

**Soil Erosion: Off-site Impacts**

Erosion has off-site environmental and economic impacts.

- Erosion creates two major water quality problems in surface waters and drainage ways: excess nutrients and excess sediment. These problems adversely impact the health and biological diversity of water bodies.
Soil Erosion

Resources

- NRCS publications (http://soils.usda.gov)
  - From the Surface Down
  - Soil Quality – Urban Technical Notes
  - Urban Soil Primer

- Data Gateway http://datagateway.nrcs.usda.gov

- Web Soil Survey (WSS)
  http://websoilsurvey.nrcs.usda.gov
Resources

  - Links to a number of related sites with soils information
  - Soils Gallery
  - Collection of soil profiles
  - Other information

A soil survey includes:
- Maps
- Soil Descriptions
- Soil Properties
- Climate
- Interpretations
Web Soil Survey

- Provides update soils information
- Easy to use
- Quick site specific interps can be created
Enter in a specific address, a county, or a Latitude and Longitude

Select an Area of Interest (AOI) no bigger than 10,000 acres
Web Soil Survey
### Web Soil Survey

#### Tables — Soil Rutting Hazard — Summary By Map Unit

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Component name (percent)</th>
<th>Rating reasons (numeric values)</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AaB</td>
<td>Altavista sandy loam, 2 to 6 percent slopes, rarely flooded</td>
<td>Moderate</td>
<td>Altavista (90%)</td>
<td>Low strength (0.50)</td>
<td>0.3</td>
<td>0.0%</td>
</tr>
<tr>
<td>CxB2</td>
<td>Cecil sandy clay loam, 2 to 8 percent slopes, moderately eroded</td>
<td>Severe</td>
<td>Cecil, moderately eroded (88%)</td>
<td>Low strength (1.00)</td>
<td>155.5</td>
<td>10.3%</td>
</tr>
<tr>
<td>CxD2</td>
<td>Cecil sandy clay loam, 8 to 15 percent slopes, moderately eroded</td>
<td>Severe</td>
<td>Cecil, moderately eroded (92%)</td>
<td>Low strength (1.00)</td>
<td>47.5</td>
<td>3.2%</td>
</tr>
<tr>
<td>ChA</td>
<td>Chewacla sandy loam, 0 to 2 percent slopes, frequently flooded</td>
<td>Severe</td>
<td>Chewacla (85%)</td>
<td>Low strength (1.00)</td>
<td>101.6</td>
<td>6.8%</td>
</tr>
<tr>
<td>CrB2</td>
<td>Cullen clay loam, 2 to 8 percent slopes, moderately eroded</td>
<td>Severe</td>
<td>Cullen, moderately eroded (80%)</td>
<td>Low strength (1.00)</td>
<td>165.6</td>
<td>11.0%</td>
</tr>
<tr>
<td>CrD2</td>
<td>Cullen clay loam, 8 to 15 percent slopes, moderately eroded</td>
<td>Severe</td>
<td>Cullen, moderately eroded (80%)</td>
<td>Low strength (1.00)</td>
<td>98.8</td>
<td>6.6%</td>
</tr>
</tbody>
</table>

### Web Soil Survey

#### Search

Properties and Qualities Ratings
- Soil Chemical Properties
- Soil Erosion Factors
  - K Factor, Rock Free
  - K Factor, Whole Soil
  - T Factor
  - Wind Erodibility Group
  - Wind Erodibility Index
- Soil Physical Properties
- Soil Qualities and Features
- Water Features

#### Soil Map

[Map Image]
Web Soil Survey

- Run different reports and interpretations on the soils
- Once done select Shopping Cart
Web Soil Survey

Questions?