Soil Interpretations

Erosion and Sedimentation Control Planning and Design Workshop

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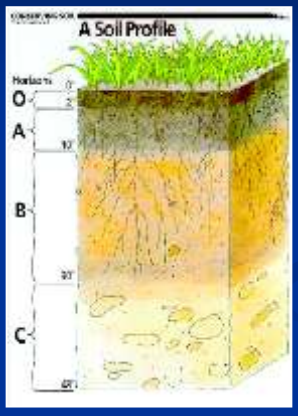
USDA-Natural Resources Conservation Service

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)

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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

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2) Climate (temperature and precipitation)
3) Topography (slope, aspect, slope shape)

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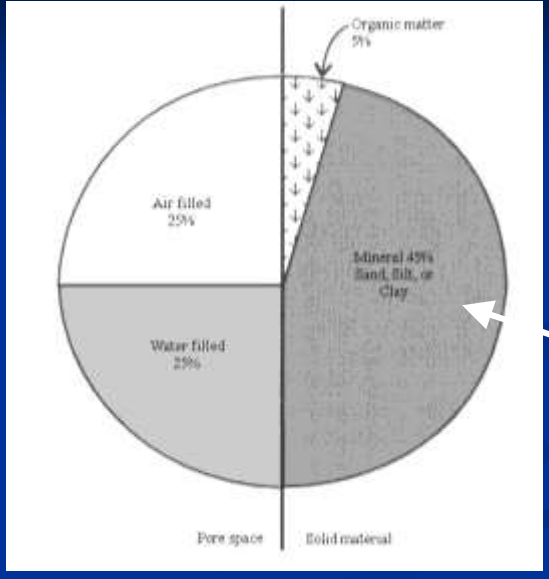
4) Living Organisms (biota)
5) Time

Major Components of Mineral Soils



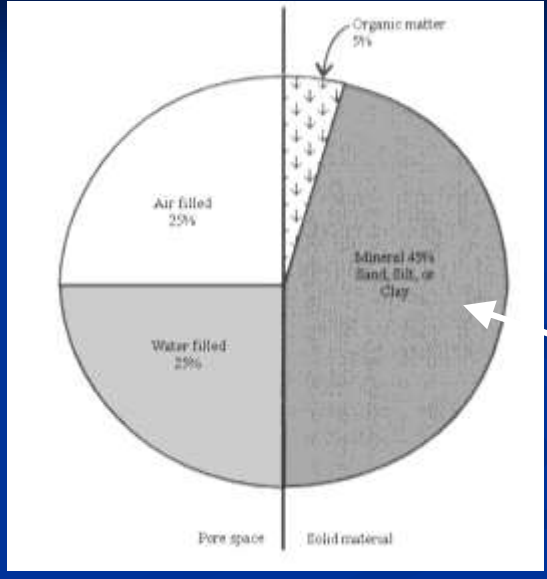
Soil Component: Organic Matter

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



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

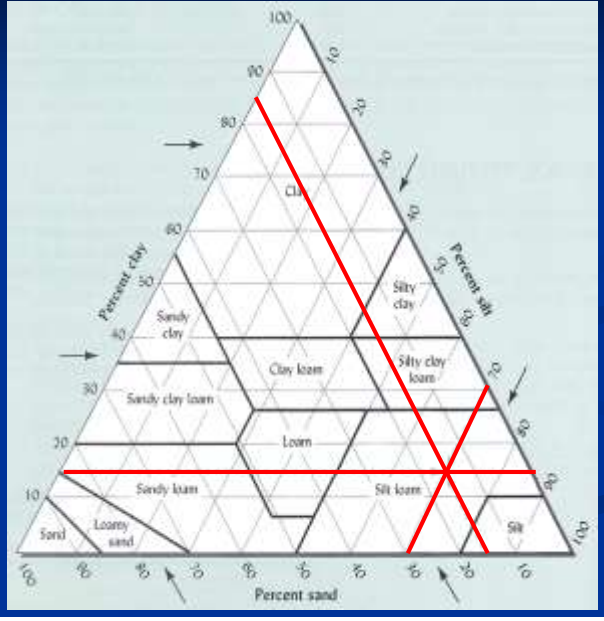
feels floury

Coin

feels sticky

Soil Characteristics: Texture

Silt Loam



Soil Characteristics: Texture

Textural Modifiers for Coarse Fragments

Example:

Gravelly: 15 to < 35%

Very Gravelly: 35 to 60%

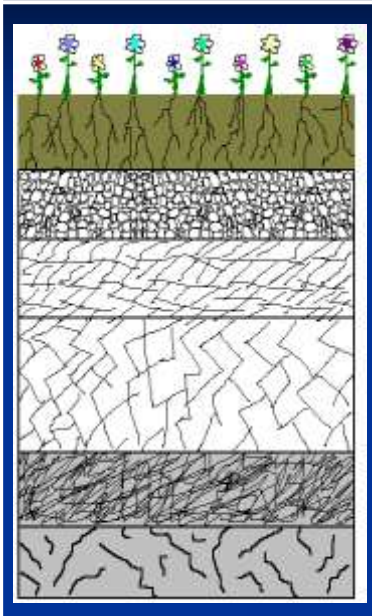
Extremely Gravelly: > 60%

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

Soil Characteristics

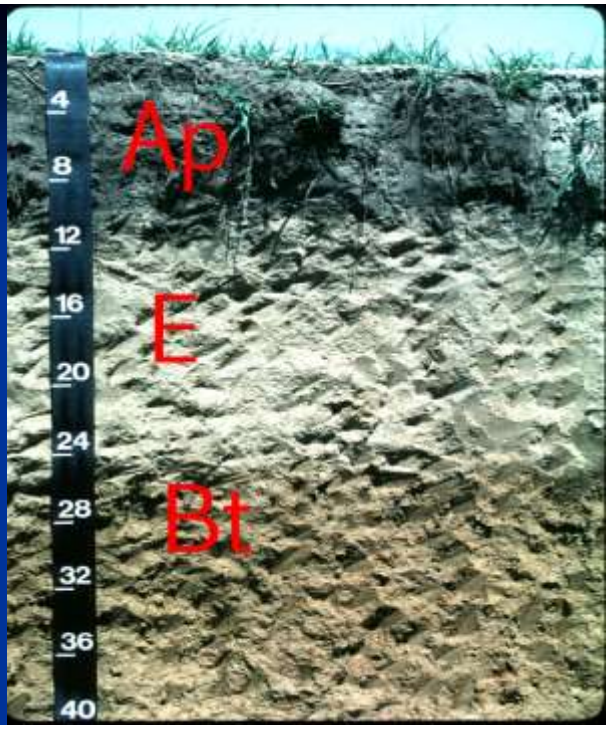
- Soil Horizons
- Depth of soil
- Color of soil
- Texture
- Size and shape of aggregates
- Rock fragments
- Soil reaction
- Landscape position
- Slope

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

Wagram



Soil Color

Example of 10R, 10YR and 5Y Color Pages

Soil Color

Soil Characteristics: Structure

Granular

Platy

Blocky

Prismatic

Columnar

- Aggregates of Sand, Silt, and Clay
- OM increases aggregate stability

- Structure

Vertical faces of soil structure can conduct water easily

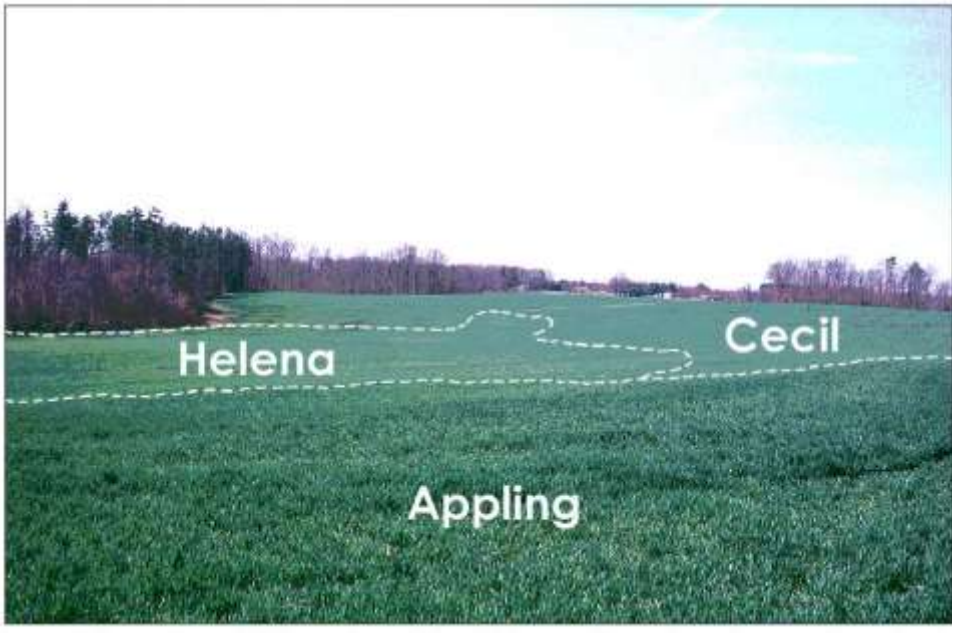
(High clay content can negate this property)

- Platy structure does not allow water to easily move vertically

FIGURE 3-26

Strong thin platy structure.

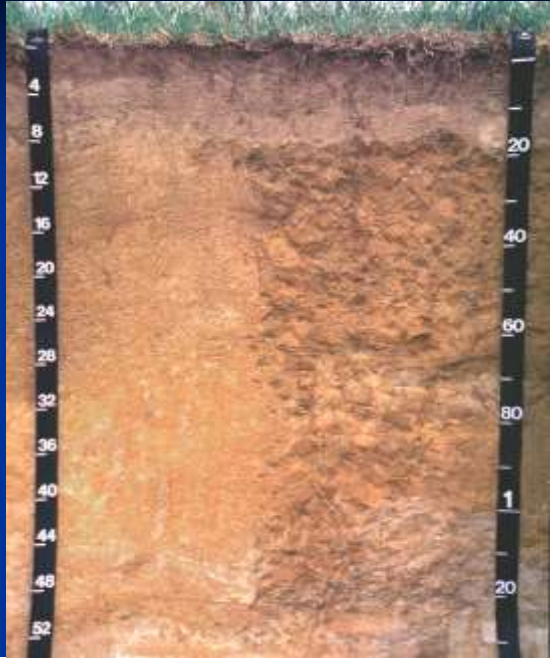
Typical Southern Piedmont Landscape and Soils (MLRA 136)



- Cecil
- Fine, Kaolinitic, thermic Typic Kanhapludults
- Very Deep
- Well Drained

- Appling
- Fine, Kaolinitic, thermic Typic Kanhapludults
- Very Deep
- Well Drained

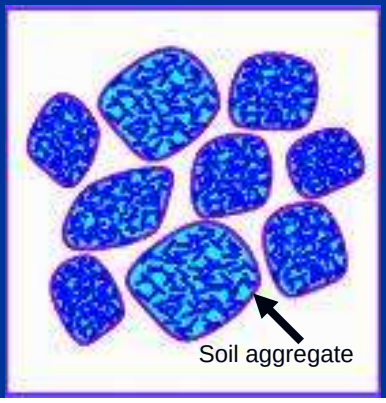
- Helena
- Fine, mixed, semiactive, thermic Aquic Hapludults
- Very Deep
- Moderately well drained



Soil/Water Relationships

Pore Size:

- Macropores >0.08 mm
- Micropores <0.08 mm

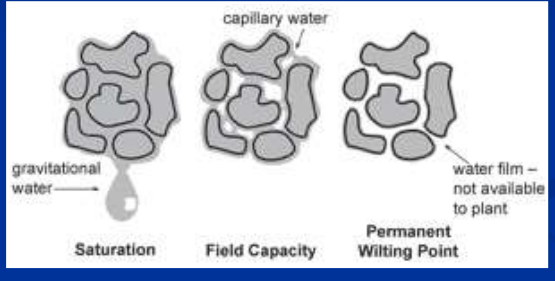


Factors in Pore Size:

•Soil Texture:

•Soil Structure:

Soil/Water Relationships



Water-Holding Capacity≡
Ability of soil to hold water

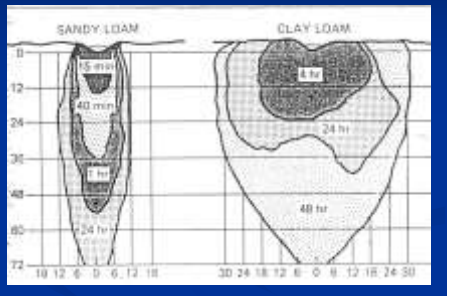
Aeration is equally important
Factors:
Macropores
Connectivity of pores

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

Soil/Water Relationships

Leaching =

Downward movement of nutrients, clay particles and chemicals.

Factors:

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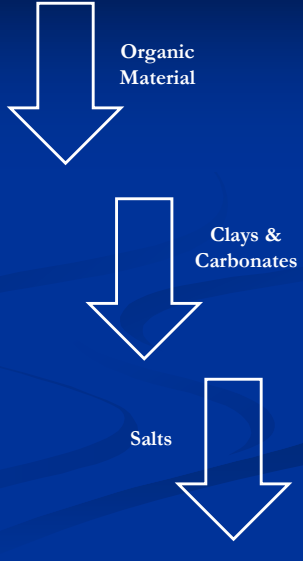


Soil/Water Relationships

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
  - Aeriation

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

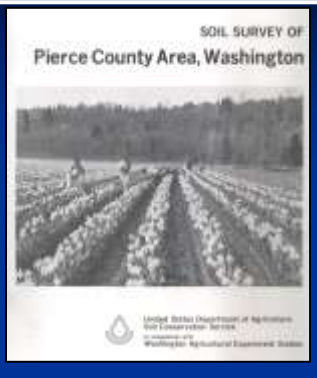
Resources

- 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

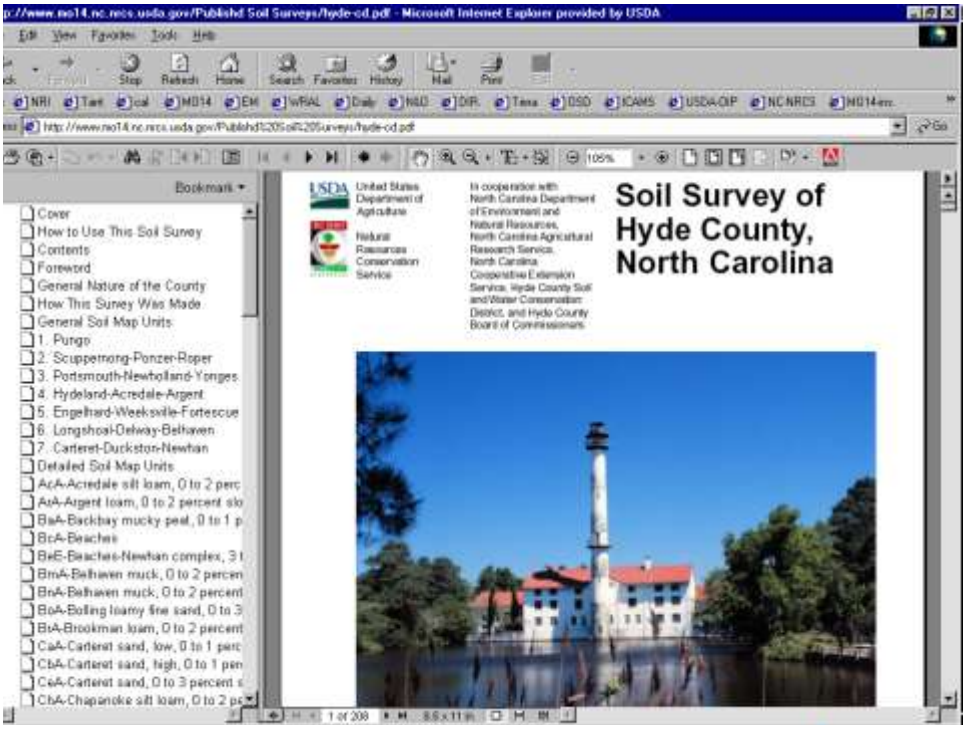
Resources

- http://www.mo14.nc.nrcs.usda.gov
  - Links to a number of related sites with soils information
  - Soils Gallery
  - Collection of soil profiles
  - Other information

Resources



A soil survey includes:
•Maps
•Soil Descriptions
•Soil Properties
•Climate
•Interpretations



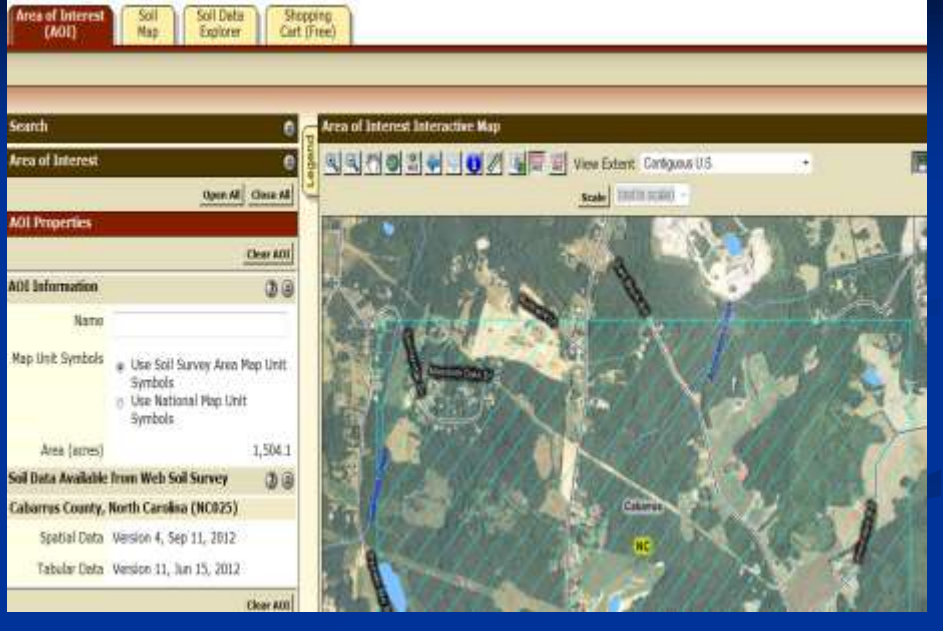
Web Soil Survey

- Provides update soils information
- Easy to use
- Quick site specific interps can be created

Web Soil Survey

- 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



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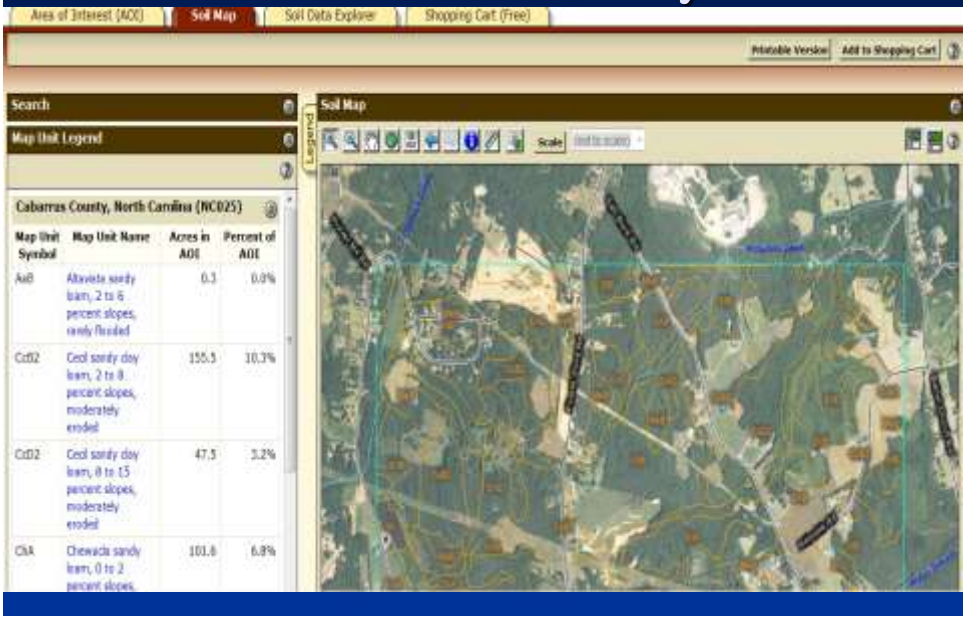

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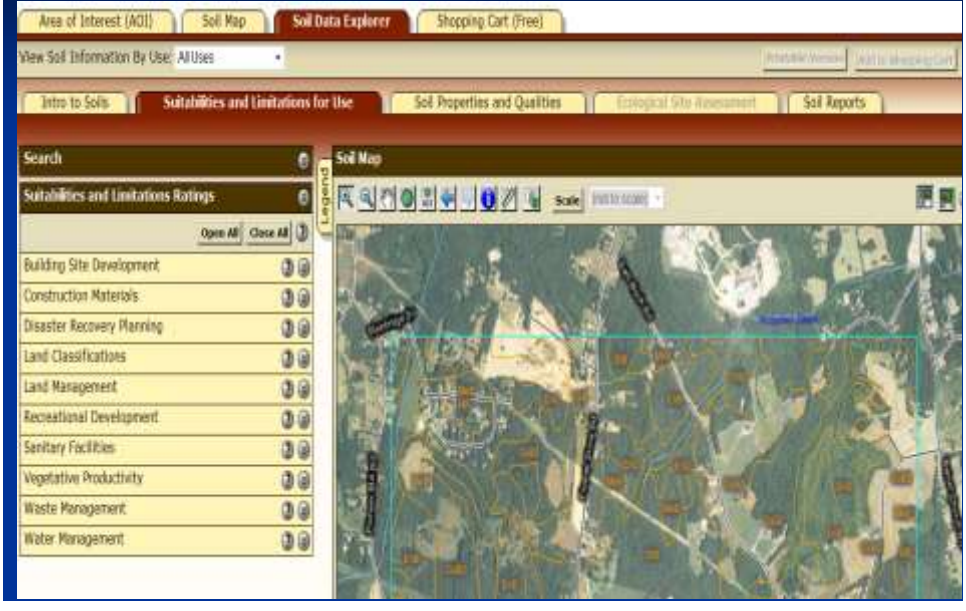


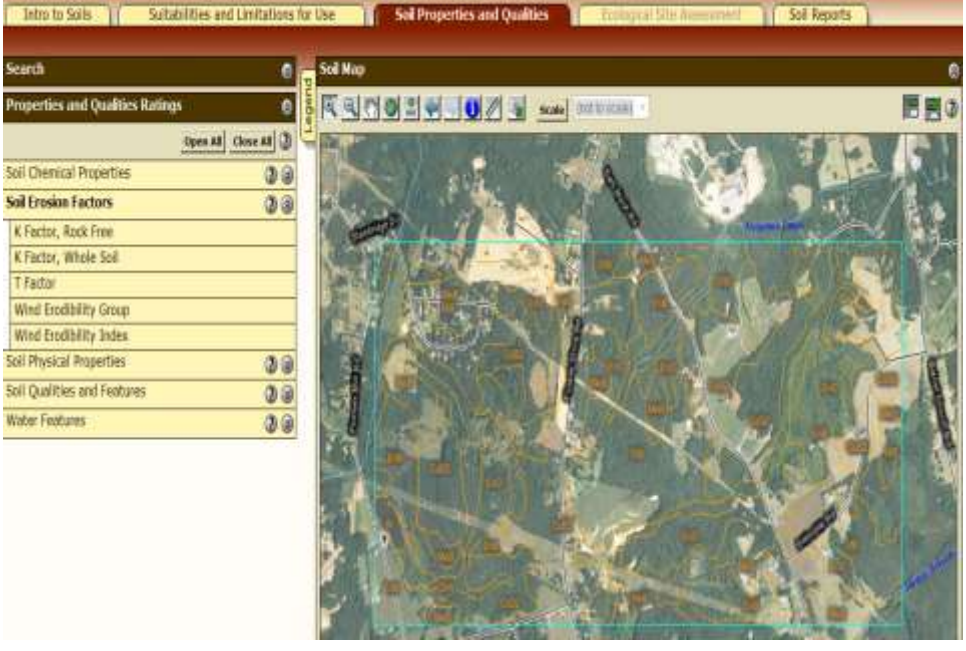
Web Soil Survey

Tables – Soil Rutting Hazard – Summary By Map Unit

Summary by Map Unit — Cabarrus County, North Carolina (NC025)

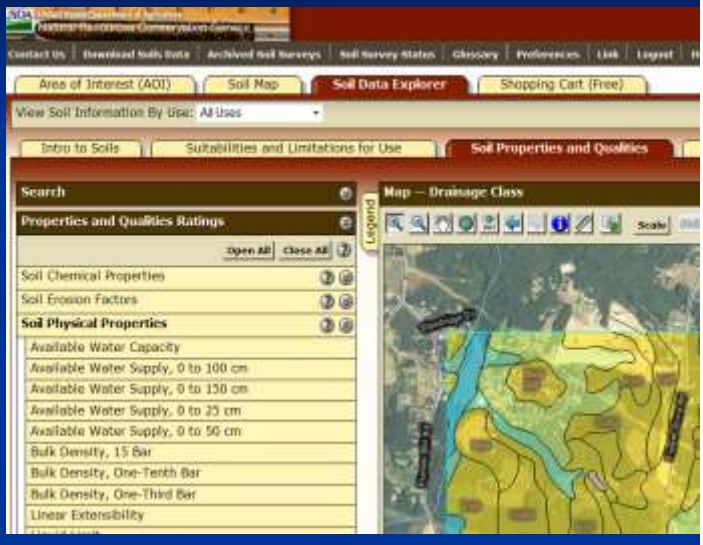
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
AaB	Altavista sandy loam, 2 to 6 percent slopes, rarely flooded	Moderate	Altavista (90%)	Low strength (0.50)	0.3	0.0%
CcB2	Cecil sandy clay loam, 2 to 8 percent slopes, moderately eroded	Severe	Cecil, moderately eroded (88%)	Low strength (1.00)	155.5	10.3%
			Vance, moderately eroded (4%)	Low strength (1.00)		
CcD2	Cecil sandy clay loam, 8 to 15 percent slopes, moderately eroded	Severe	Cecil, moderately eroded (92%)	Low strength (1.00)	47.5	3.2%
ChA	Chewacla sandy loam, 0 to 2 percent slopes, frequently flooded	Severe	Chewacla (85%)	Low strength (1.00)	101.6	6.8%
			Wehadkee, undrained (5%)	Low strength (1.00)		
			Riverview (3%)	Low strength (1.00)		
CuB2	Cullen clay loam, 2 to 8 percent slopes, moderately eroded	Severe	Cullen, moderately eroded (80%)	Low strength (1.00)	165.6	11.0%
			Mecklenburg, moderately eroded (8%)	Low strength (1.00)		
CuD2	Cullen clay loam, 8 to 15 percent slopes, moderately eroded	Severe	Cullen, moderately eroded (80%)	Low strength (1.00)	98.8	6.6%
			Mecklenburg, moderately	Low strength		

Web Soil Survey



Web Soil Survey

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



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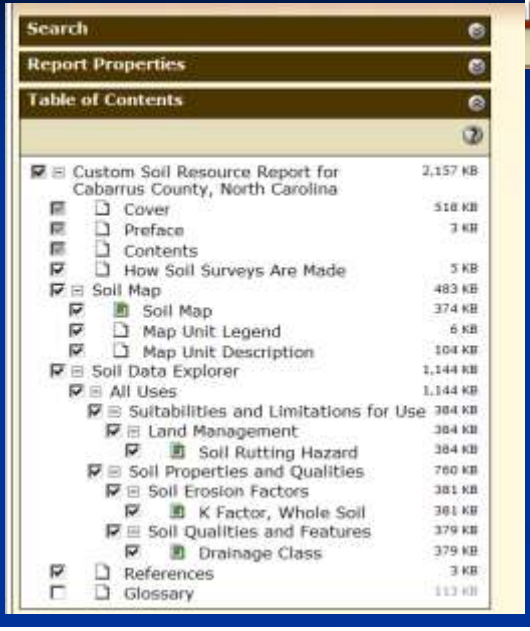

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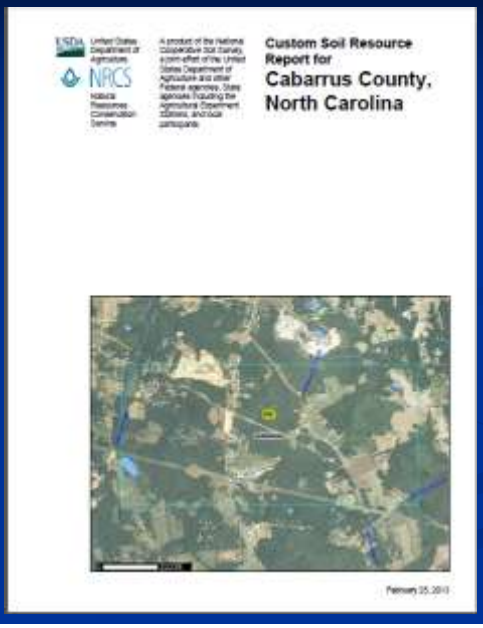

Questions?