

Soil Interpretations

Erosion and Sedimentation Control Planning and Design Workshop



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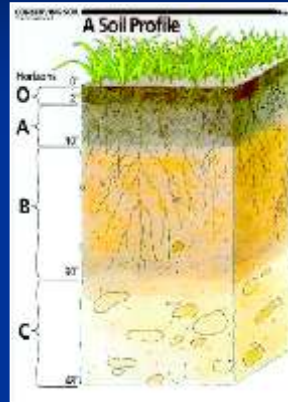
Objectives

- 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

5 Soil Forming Factors

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

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)



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- 1) Parent Material (material from which the soil formed)
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- 4) Living Organisms (biota)

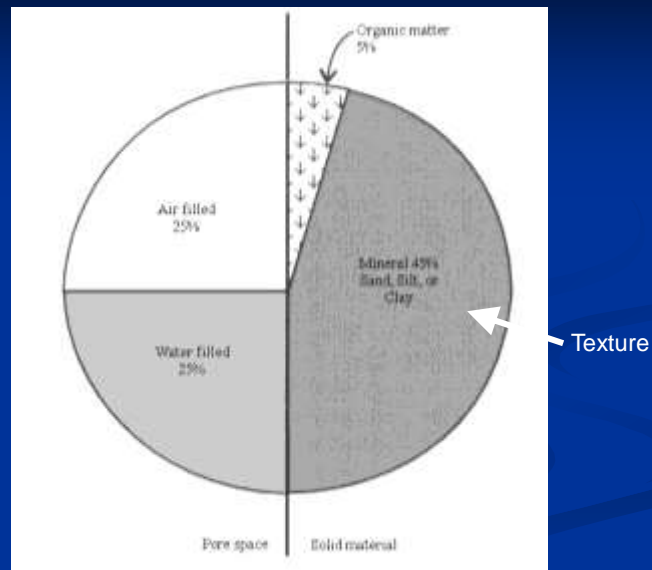


5 Soil Forming Factors

- 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





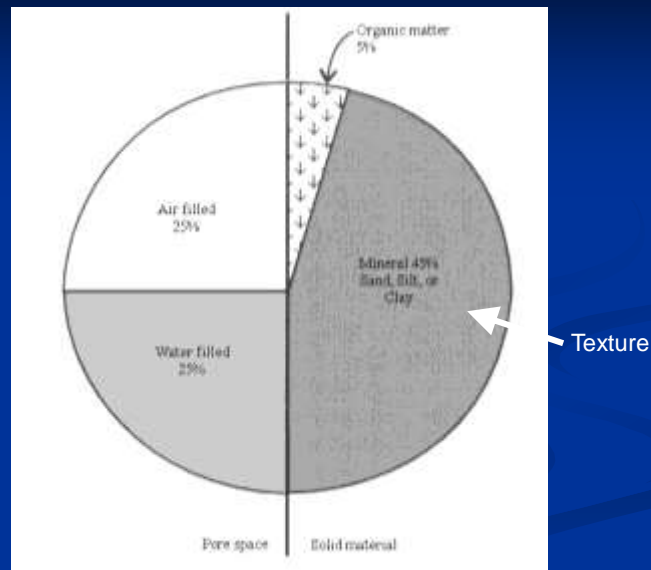
Soil Component: Organic Matter

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



Soil Characteristics: Texture

- Sand: 0.05 to 2 mm

Relative Size of Particles:



Barrel

feels gritty

- Silt: 0.002 to 0.05 mm



Plate

feels floury

- Clay: < 0.002 mm

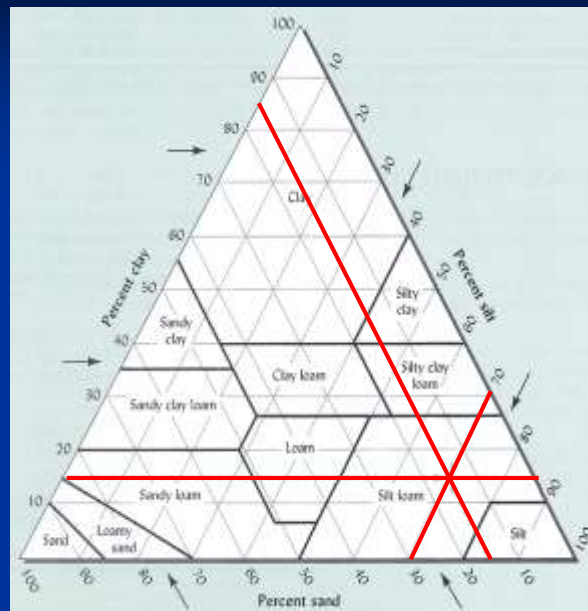


Coin

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



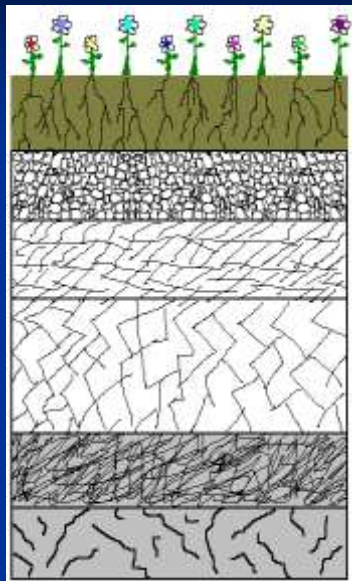


Soil Characteristics

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

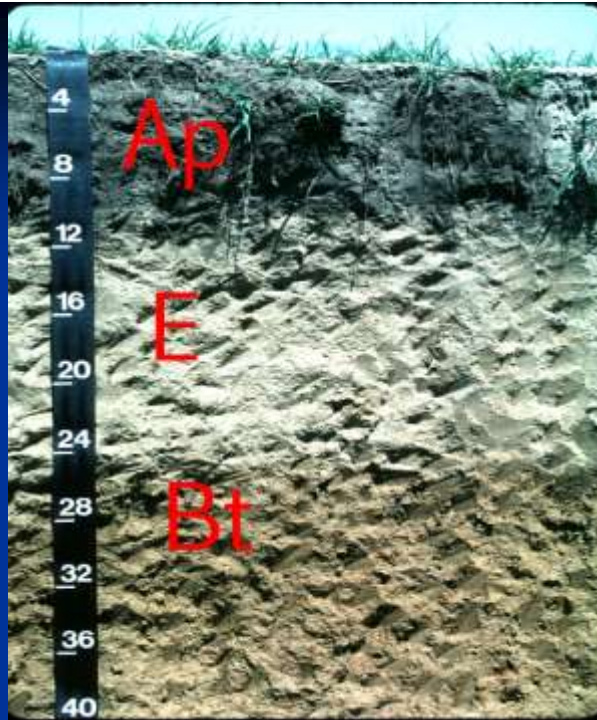


Soil Characteristics: Soil Horizon



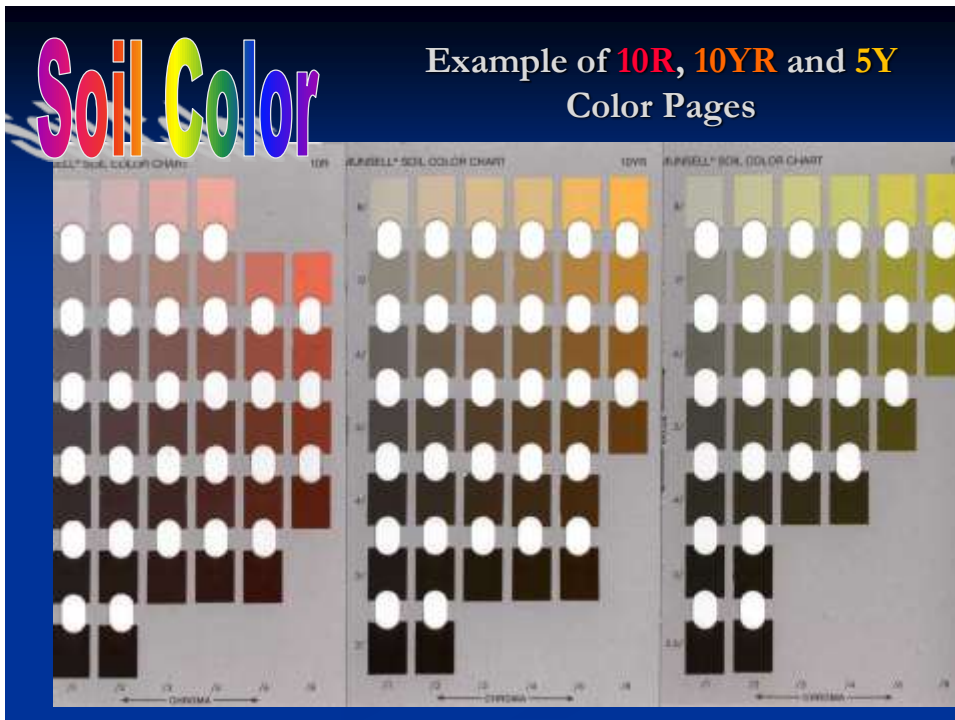
- O – Horizon
 - Duff Layer
- A – Topsoil
 - Granular Structure
- Bw – Subsoil
 - small blocky structure
- Bt – Subsoil
 - More clay accumulation
 - Angular blocky structure
- C – Weathered “parent material”
- R – Hard bedrock

Wagram



Soil Color

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



Soil Color

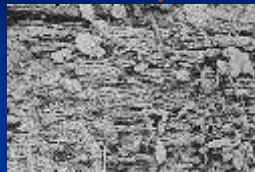


Soil Characteristics: Structure

Granular



Platy



Block



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)



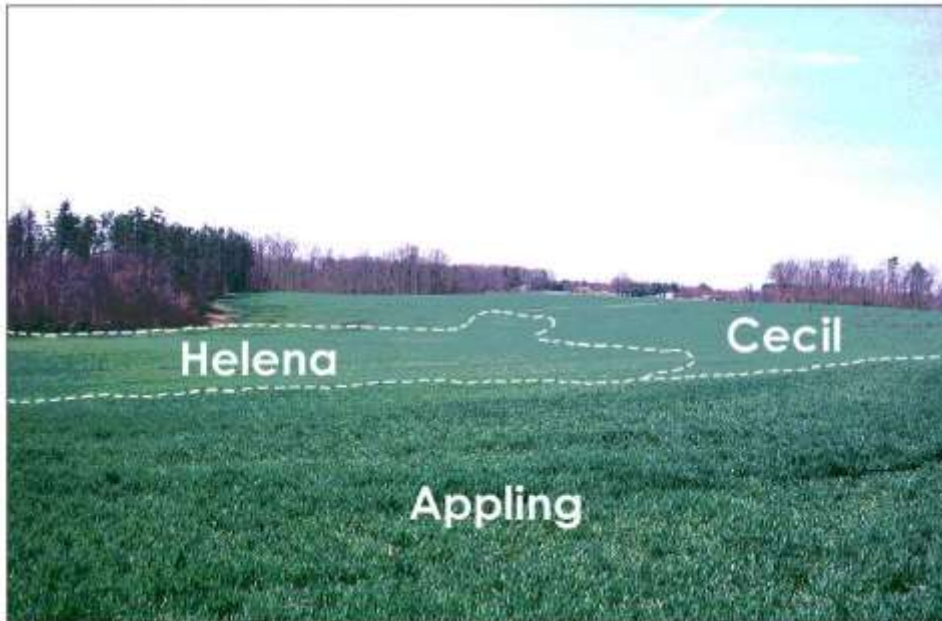
- ◆ Platy structure does not allow water to easily move vertically

FIGURE 3-26



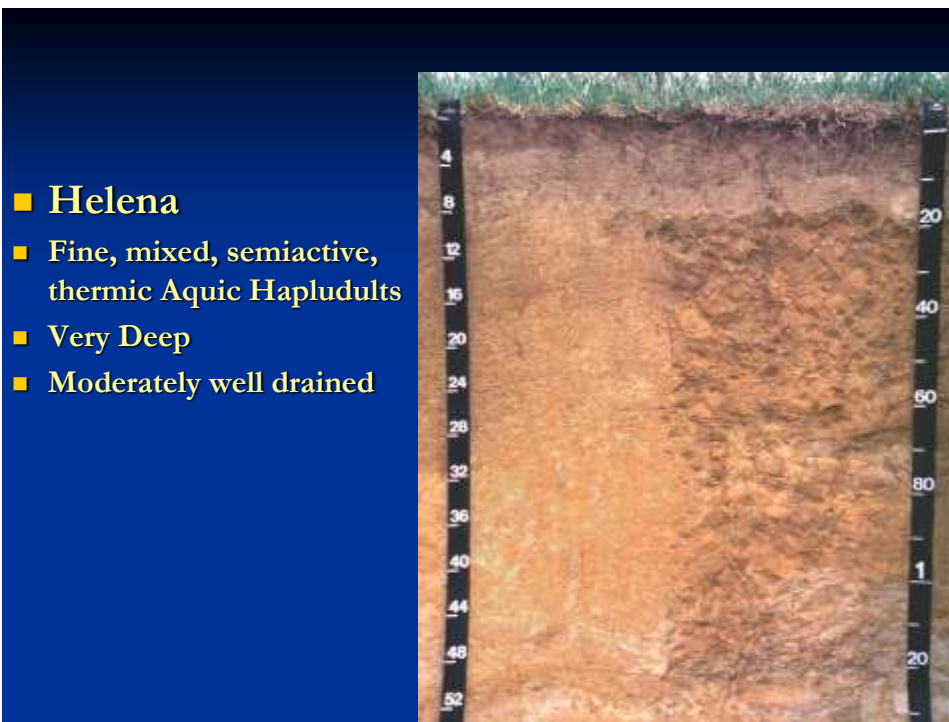
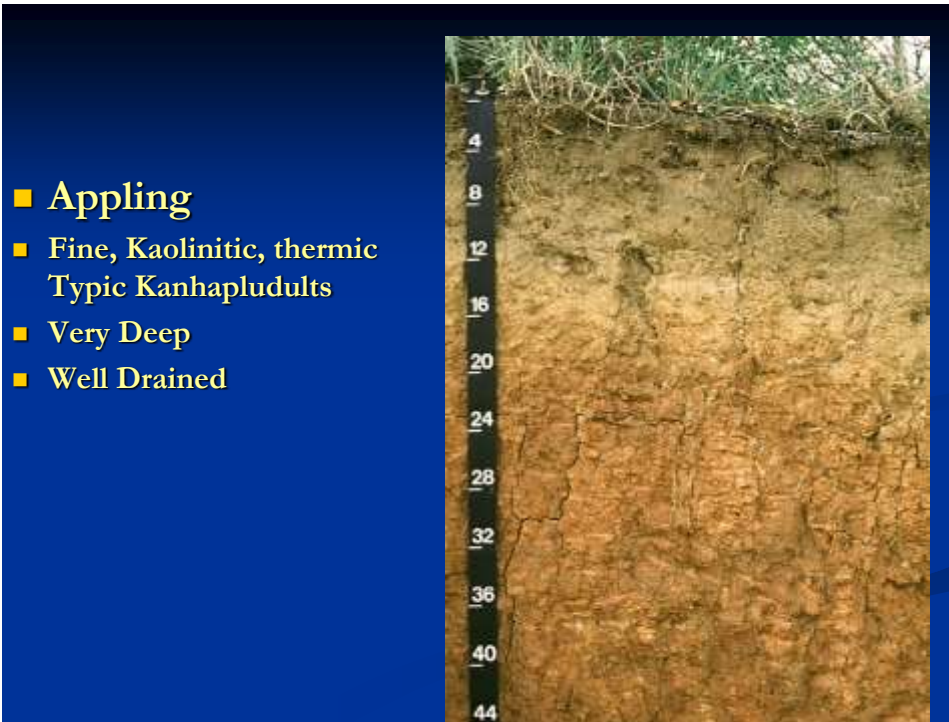
Strong thin platy structure.

Typical Southern Piedmont Landscape and Soils (MLRA 136)



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



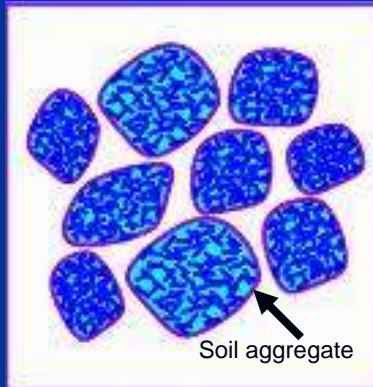


Soil/Water Relationships

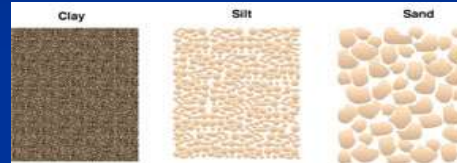
Factors in Pore Size:

Pore Size:

- Macropores >0.08 mm
- Micropores <0.08 mm



•Soil Texture:



•Soil Structure:



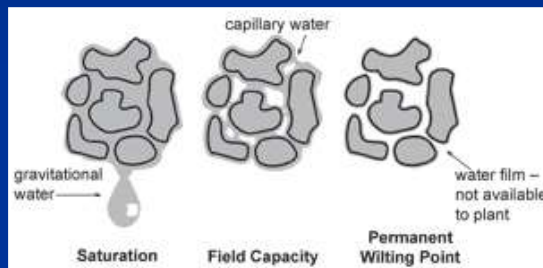
Soil/Water Relationships

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.



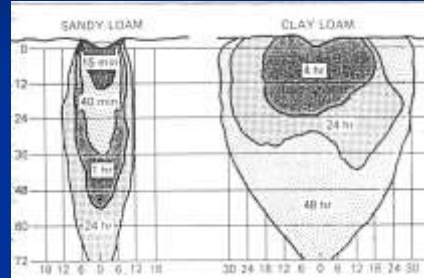
Soil/Water Relationships

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:

- Texture
- Compaction
- Structure and Stability
- Water content
- OM
- Pores



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.

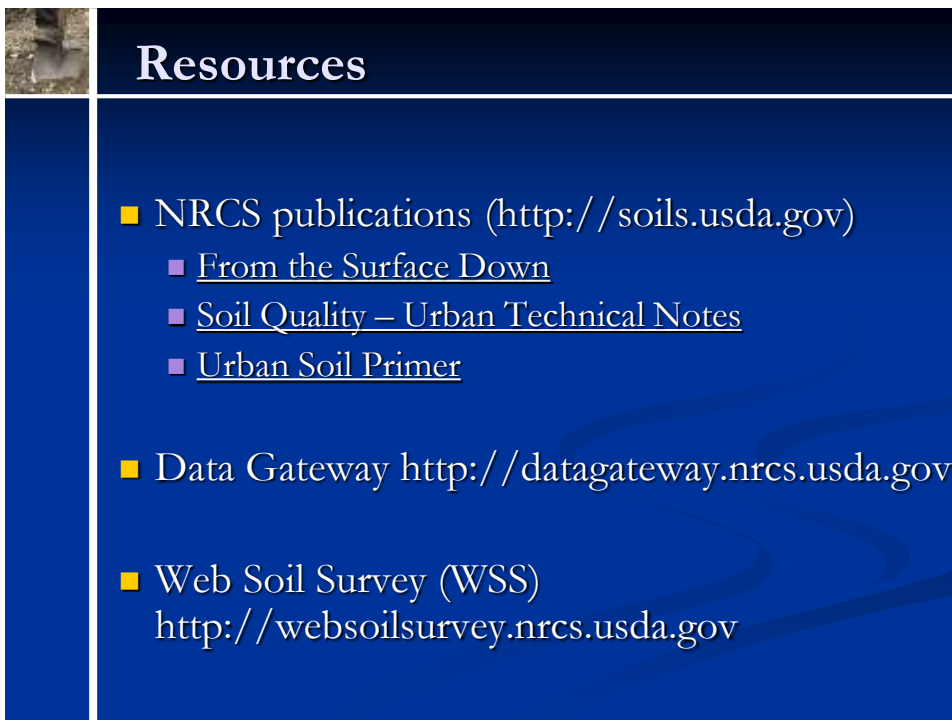
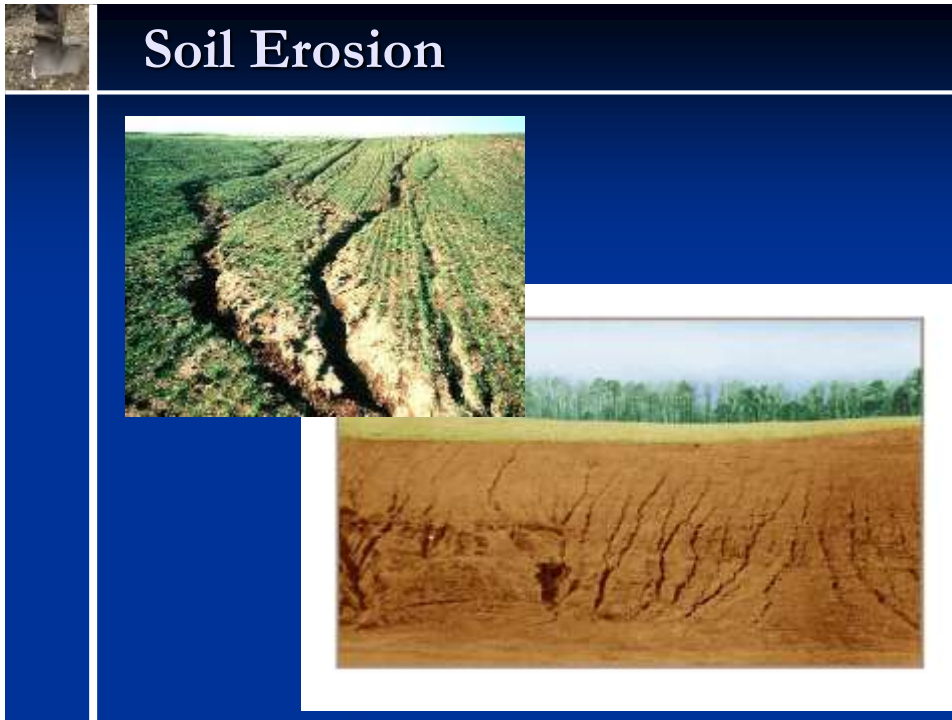
- Loss of nutrients and nutrient holding capacity, results in a less fertile soil
- As organic matter is lost, soil density increases and compaction occurs. Compaction lowers the infiltration rate of water and reduces the available water holding capacity.
- The surface organic matter is also the food 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.






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


SOIL SURVEY OF
Pierce County Area, Washington

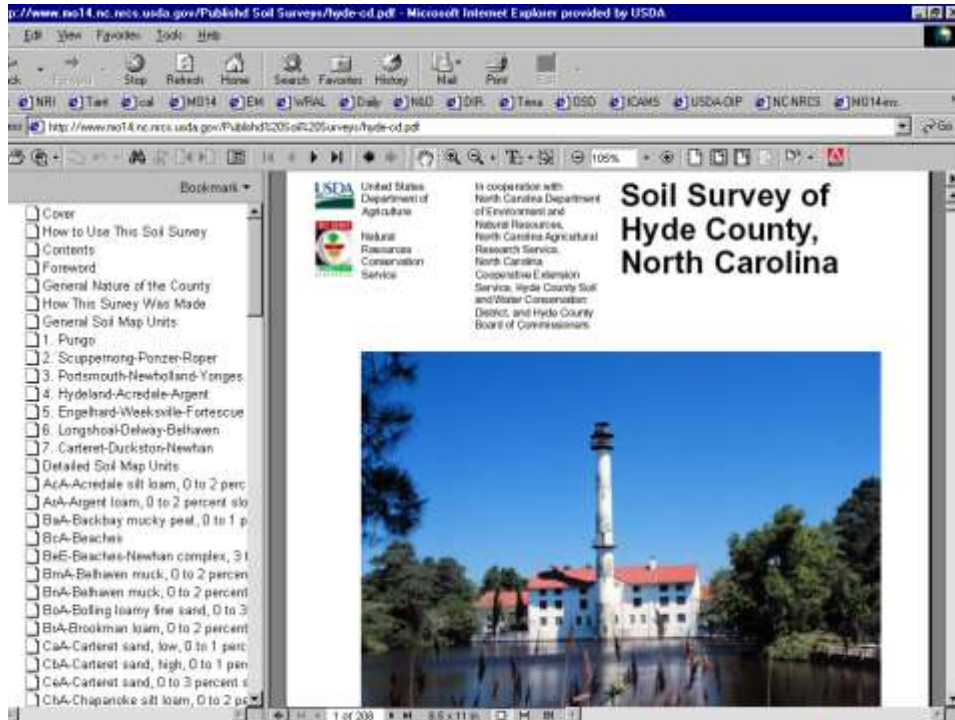


United States Department of Agriculture
Soil Conservation Service
Washington Agricultural Experiment Station

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



Web Soil Survey

Area of Interest (AOI) | **Soil Map** | Soil Data Explorer | Shopping Cart (Free)

Printable Version | Add to Shopping Cart

Search

Map Unit Legend

Cabarrus County, North Carolina (NC025)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Au0	Albavista sandy loam, 2 to 6 percent slopes, rarely flooded	0.3	0.0%
Cd02	Ced sandy clay loam, 2 to 8 percent slopes, moderately eroded	155.5	10.3%
Cd02	Ced sandy clay loam, 8 to 15 percent slopes, moderately eroded	47.5	3.2%
CsA	Chewach sandy loam, 0 to 2 percent slopes	101.8	6.8%

Soil Map

Web Soil Survey

Area of Interest (AOI) | Soil Map | **Soil Data Explorer** | Shopping Cart (Free)

View Soil Information By Use: All Uses | Printable Version | Add to Shopping Cart

Intro to Soils | **Suitabilities and Limitations for Use** | Soil Properties and Qualities | Ecological Site Assessment | Soil Reports

Search

Suitabilities and Limitations Ratings:

	Open All	Close All
Building Site Development	0/0	0/0
Construction Materials	0/0	0/0
Disaster Recovery Planning	0/0	0/0
Land Classifications	0/0	0/0
Land Management	0/0	0/0
Recreational Development	0/0	0/0
Sanitary Facilities	0/0	0/0
Vegetative Productivity	0/0	0/0
Waste Management	0/0	0/0
Water Management	0/0	0/0

Soil Map

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%) Vance, moderately eroded (4%)	Low strength (1.00) Low strength (1.00)	155.5	10.3%
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%) Wehadkee, undrained (5%) Riverview (3%)	Low strength (1.00) Low strength (1.00) Low strength (1.00)	101.6	6.8%
CuB2	Cullen clay loam, 2 to 8 percent slopes, moderately eroded	Severe	Cullen, moderately eroded (80%) Meckdenburg, moderately eroded (8%)	Low strength (1.00) Low strength (1.00)	165.6	11.0%
CuD2	Cullen clay loam, 8 to 15 percent slopes, moderately eroded	Severe	Cullen, moderately eroded (80%) Meckdenburg, moderately	Low strength (1.00) Low strength	98.8	6.6%

Web Soil Survey

Intro to Soils Suitabilities and Limitations for Use **Soil Properties and Qualities** Ecological Site Assessment Soil Reports

Search

Properties and Qualities Ratings

Open All Close All

- 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

The map displays a detailed view of a rural area with various soil types and erosion factors. The map includes a legend, a scale bar, and navigation tools. The soil types are color-coded, and erosion factors are indicated by different symbols and colors. The map shows a network of roads and fields, with soil types and erosion factors overlaid on the landscape.

Web Soil Survey

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

The screenshot shows the 'Soil Data Explorer' tab selected. The interface includes a search bar, a 'View Soil Information By Use: All Uses' dropdown, and a list of soil properties under 'Soil Physical Properties'. A map on the right shows the 'Drainage Class' for the selected area.

Property Name	Value
Available Water Capacity	
Available Water Supply, 0 to 100 cm	
Available Water Supply, 0 to 130 cm	
Available Water Supply, 0 to 25 cm	
Available Water Supply, 0 to 50 cm	
Bulk Density, 15 Bar	
Bulk Density, One-Tenth Bar	
Bulk Density, One-Third Bar	
Linear Extensibility	

Web Soil Survey

The screenshot shows the 'Shopping Cart (Free)' tab selected. The interface includes a search bar, a 'Report Properties' section, and a table of contents for the selected report. The table lists various report components and their file sizes.

Report Component	File Size
Custom Soil Resource Report for Cabarrus County, North Carolina	2,157 KB
Cover	510 KB
Preface	3 KB
Contents	
How Soil Surveys Are Made	5 KB
Soil Map	483 KB
Soil Map	374 KB
Map Unit Legend	6 KB
Map Unit Description	104 KB
Soil Data Explorer	1,144 KB
All Uses	1,144 KB
Suitabilities and Limitations for Use	384 KB
Land Management	384 KB
Soil Rutting Hazard	384 KB
Soil Properties and Qualities	780 KB
Soil Erosion Factors	381 KB
K Factor, Whole Soil	381 KB
Soil Qualities and Features	379 KB
Drainage Class	379 KB
References	3 KB
Glossary	113 KB

Web Soil Survey

USDA United States Department of Agriculture
NRCS National Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies, and other agencies including the Agriculture Department, Wildlife, and Natural Resources.

Custom Soil Resource Report for Cabarrus County, North Carolina

February 25, 2013

Questions?