

# Soils of Rhode Island – What's Under It?

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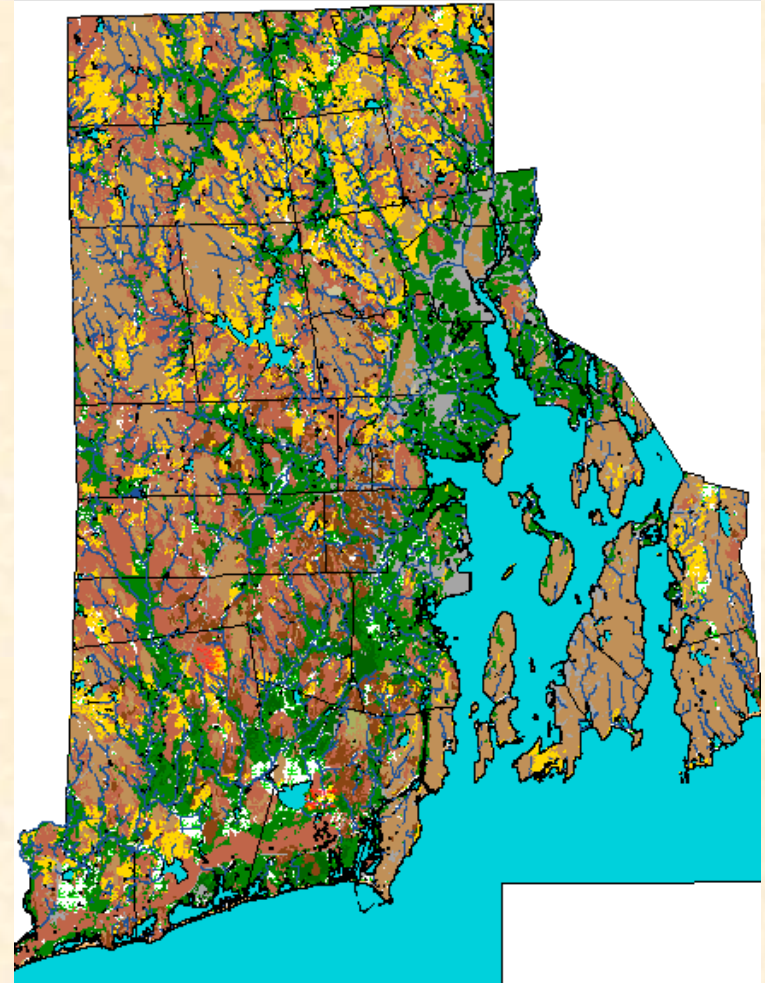
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Warwick, RI.

<http://nesoil.com>

[www.ri.nrcs.usda.gov](http://www.ri.nrcs.usda.gov)

[www.twitter.com/NRCS\\_RI](https://www.twitter.com/NRCS_RI)



# Objective

- Provide an over-view about soils that occur in Rhode Island.
- Discuss the use of a Soil Survey for Forestry and woodland management.
- Show how to use GIS programs for soils and imagery.
- Q & A/Demo.



# Soil Science (Pedology)

The scientific study of soils, including their origins, characteristics, and uses.

- Many different areas – soil chemistry, physics, genesis, classification, morphology.
- A soil scientist can read the layers of earth to tell what has occurred in the past.



Ap- sil

Bw1- sil

Bw2- sil

2C1-glcos

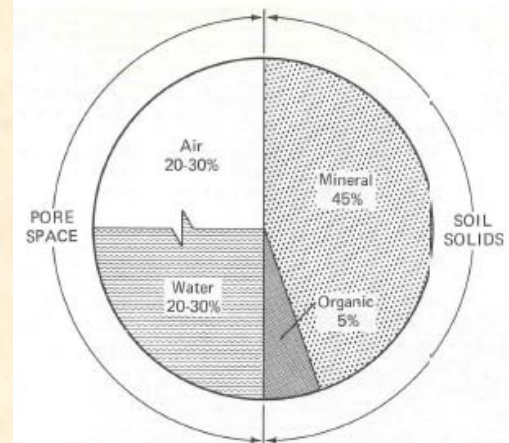
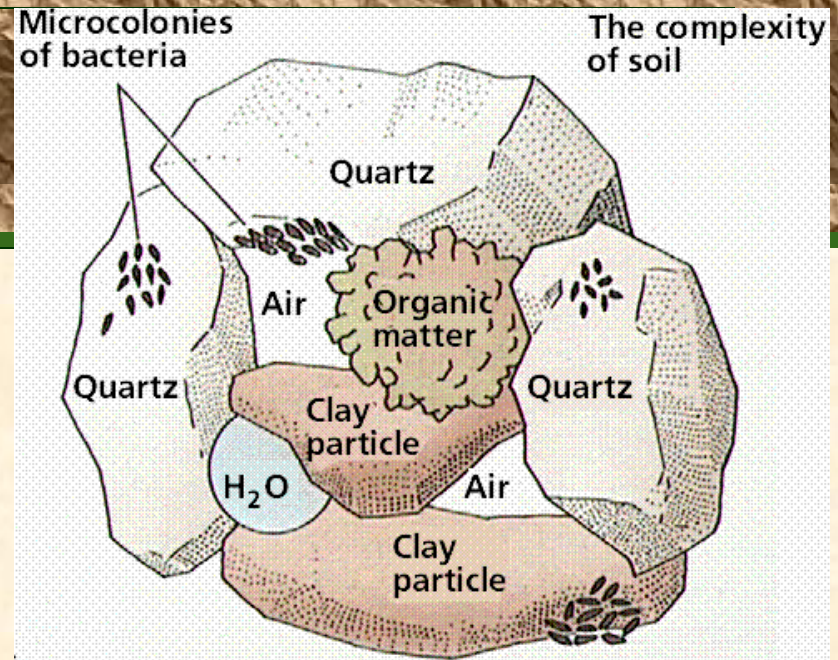
**Narragansett Silt Loam – The (Unofficial) State Soil of RI**

# Soil - Definition

Natural body that occurs on the land surface, occupies space, and is characterized by one or both of the following:

- Horizons formed by pedogenesis (additions, losses, translocations, transformations).
- The ability to support rooted plants in a natural environment.

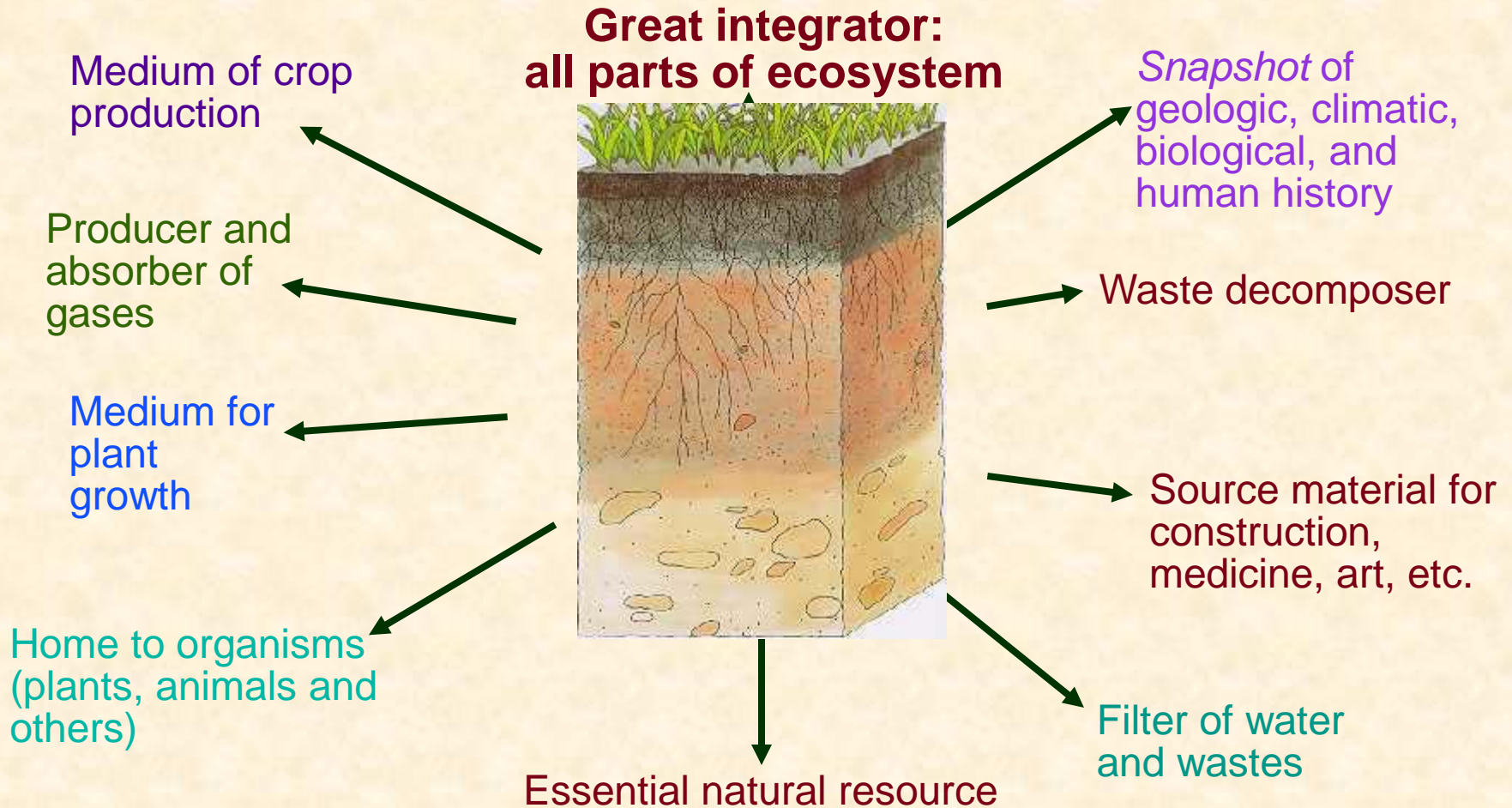
Non-Soil areas include beaches, glaciers, bedrock, urban land, etc.



“Excited skin of the sub-aerial portion of the earth’s surface” – C. C. Nikiforoff

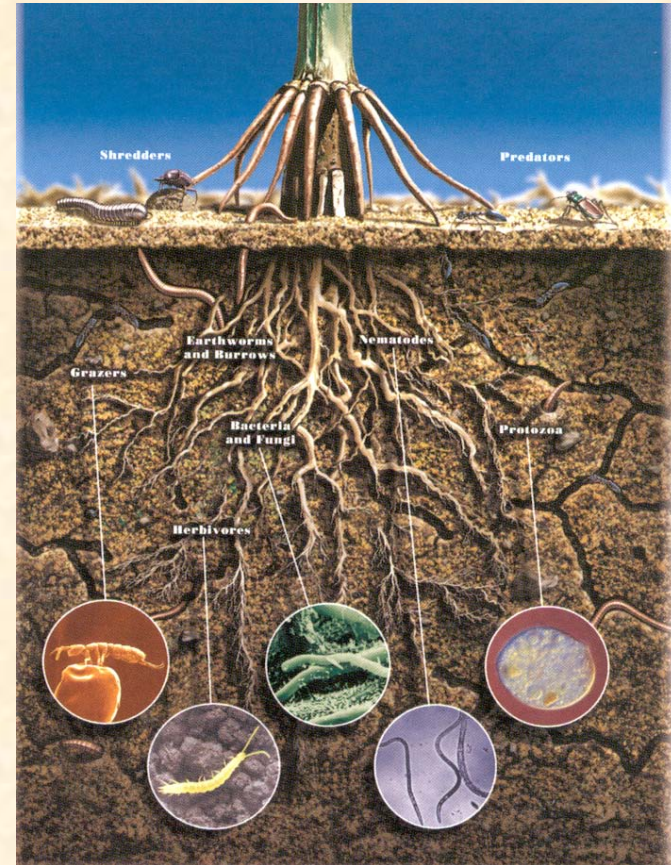
# Why are Soils Important?

## We Study Soil Because It's A(n)



# Soils Importance for Woodlands

1. Soils offer mechanical support.
2. Retain and transmit water and gases.
3. Serve as a habitat for macro/microorganisms.
4. Hold, exchange, and fix nutrients.
5. Limitations for harvesting, plantings, etc.
6. Regulatory Issues.
7. Harvesting the crop.



# Soil Formation

Biota

Climate



Topography

Soil

Parent Material



**(The first four factors over) Time**

These five factors work together to create a unique soil profile made of layers called horizons.

# 3 (main) Layers of Earth

● Soil →  
(upper 2 m)

● Surficial Geology (soft rock) →

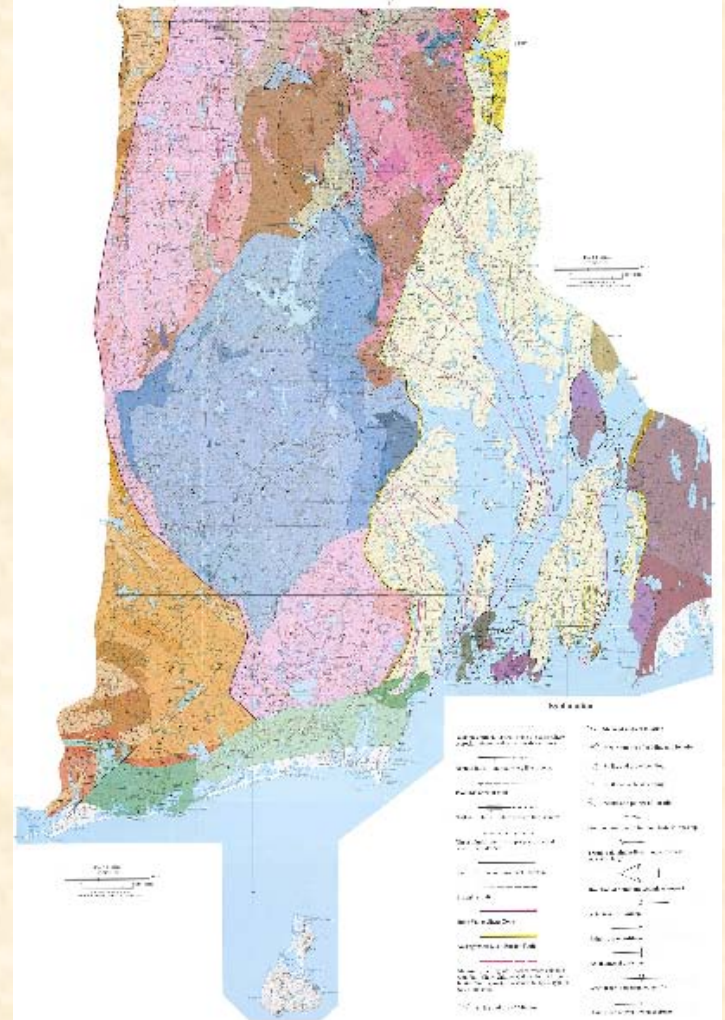
● Bedrock (ledge) →





# Bedrock

- Ranges from surface (outcrop) to 100s feet (BI).
- PreCambrian (>600 million YBP) to Permian (250 MYBP).
- Mainly crystalline granites, gneiss, schist's, except for Narragansett Basin.



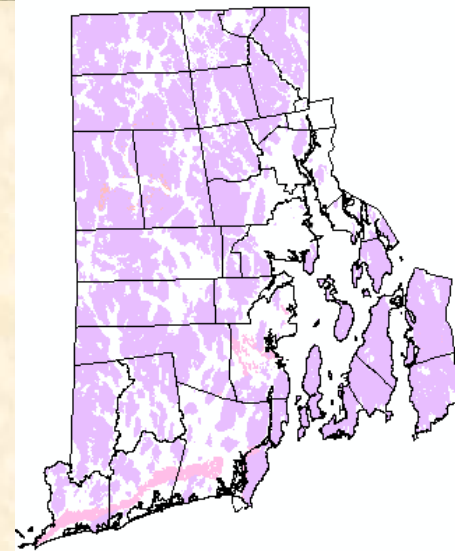
# Surficial Geology

- Pleistocene Epoch (Ice Age) - 1.8 MYBP to 8,000 Years B.P.
- 4 Major advances.
- Last advance - Wisconsinan glaciation covered all of NE.
- Soil parent materials - glacial & post glacial.



# Glacial Till

- Unsorted/stratified material deposited beneath and within glacial ice.
- Heterogeneous mixture of all particle sizes (boulder to clay).
- Oldest surficial deposit overlying most bedrock areas.



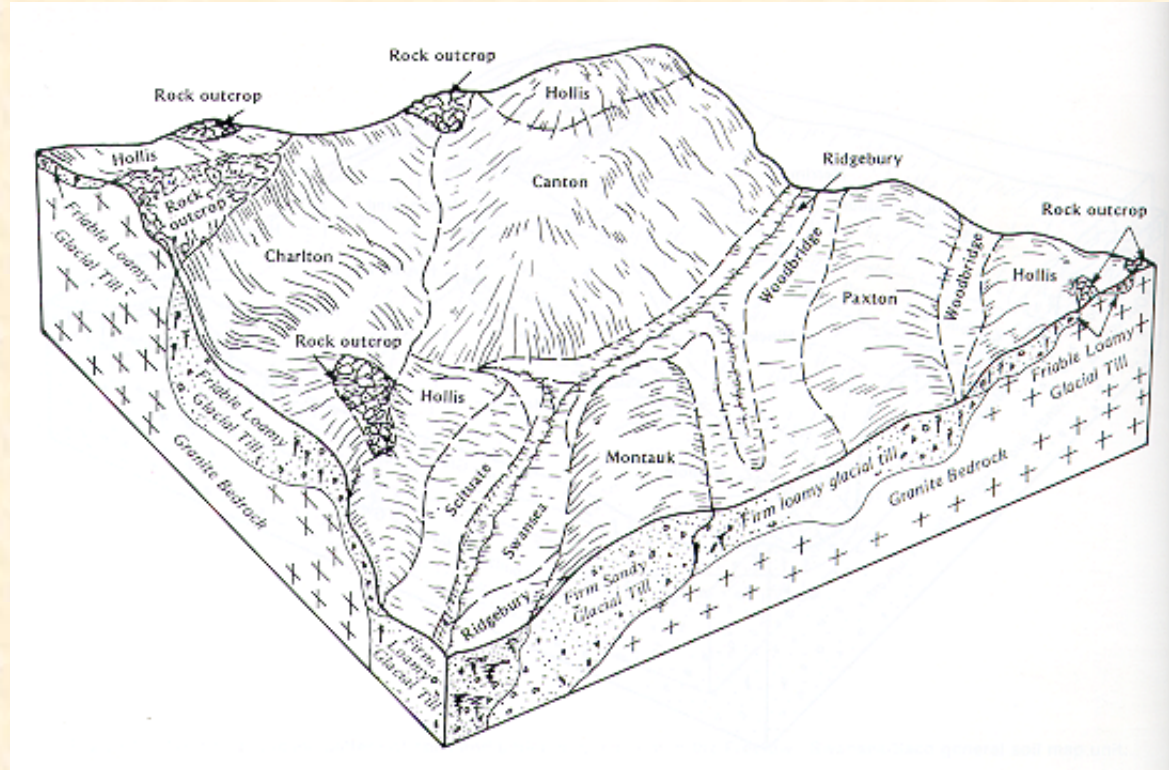
# Till Properties

- Major Types: Basal and Ablation.
- Landforms: Drumlins, moraines, Ice contact.
- Basal till has a dense restrictive layer which impedes downward water movement and root penetration.
- Large angular stones and boulders.

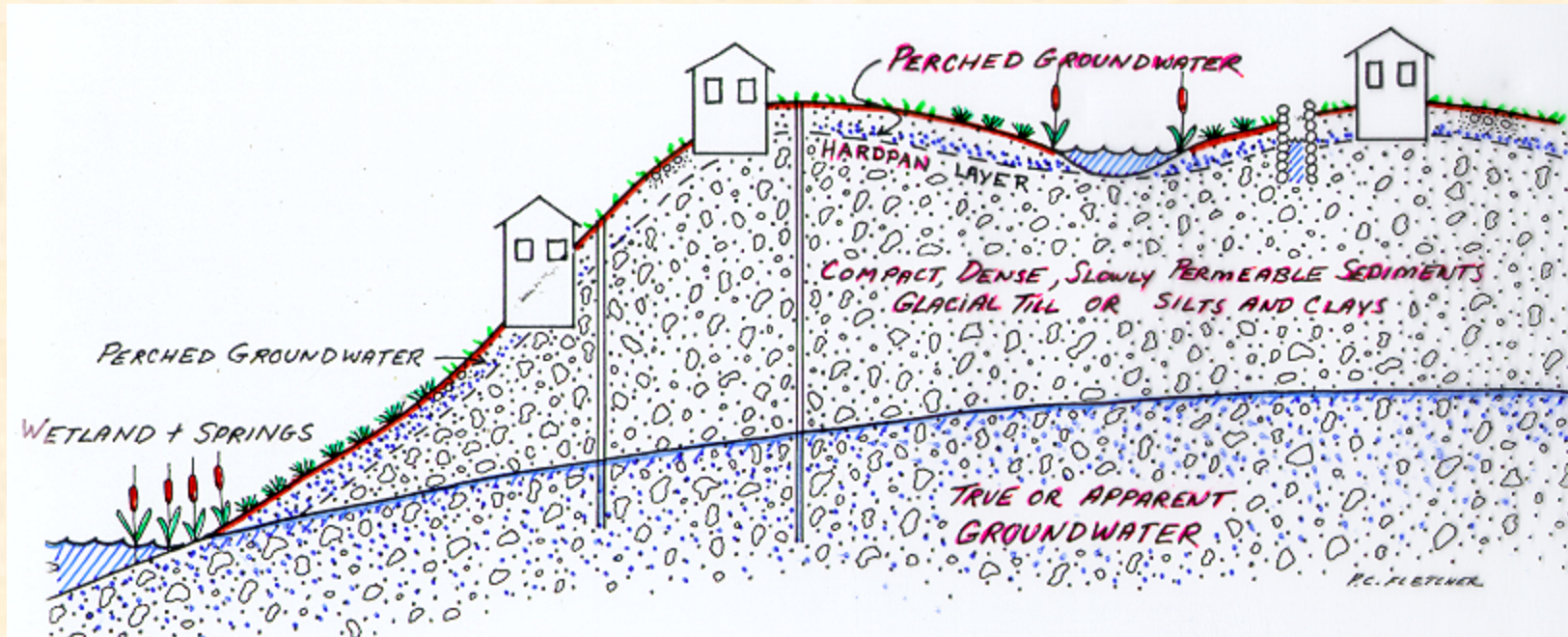


# Bedrock Controlled Landforms

- Mapped in a complex of deep soils and bedrock outcrop:
  - CaC, CaD, CC, CeC, Rk, and Rp



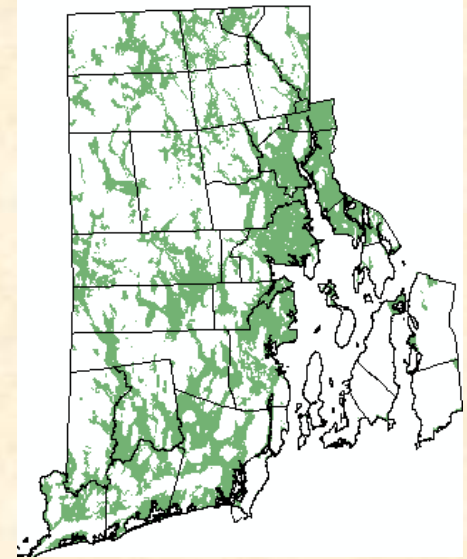
# Hydrology in Tills



Hardpan (dense till) perches water causing wet basements, wetlands on hill tops, shallow rooting – drainage driven by landscape position.

# Glacial Fluvial (outwash)

- Sediments deposited by glacial meltwater.
- Stratified layers of sand, gravel, and fines.
- Types: Proglacial and Proximal (ice contact).
- Landforms: Plains, eskers, kames, deltas.



# Outwash Properties

- Dominantly sand and gravel sized particles.
- Rapid water movement, associated with aquifers.
- Apparent watertable.
- Few limitations for most uses.

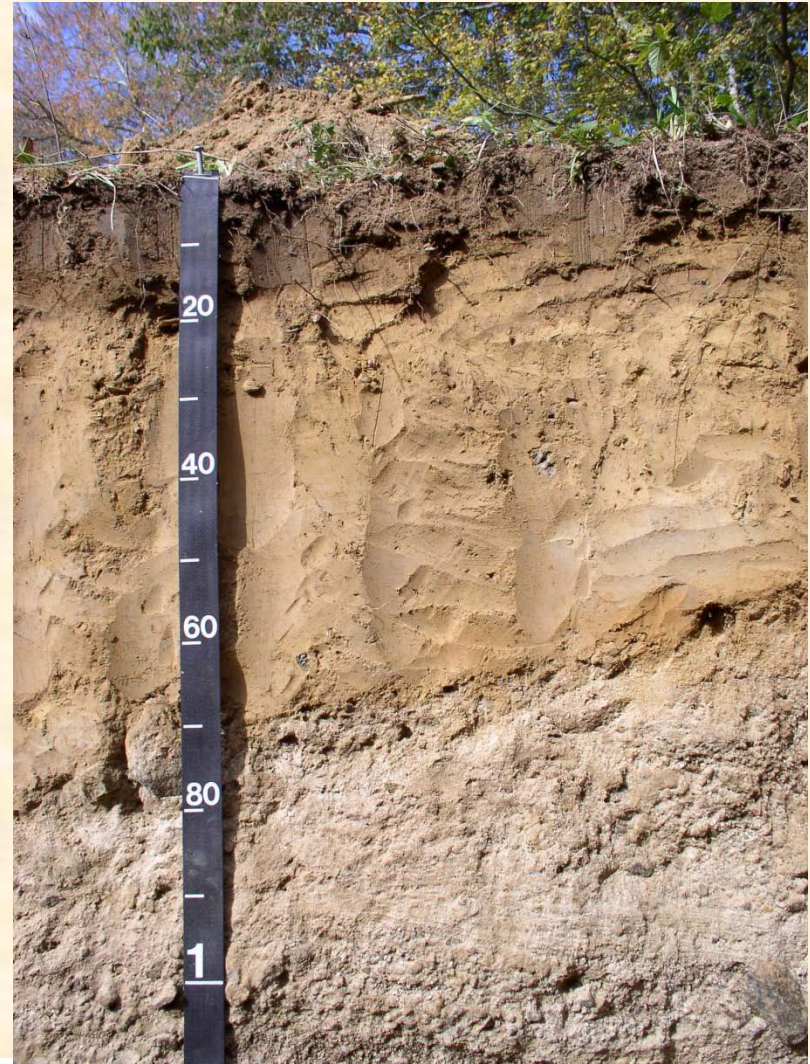




# Post Glacial Deposits

- Material deposited after glacier left (Holocene-10K BP).
- **Eolian** - wind deposited sand to silt sized particles.

Most upland soils in NE have a thin 18-36 inch eolian cap. Deposited rapidly after ice left.



# Post Glacial Deposits

- Organic Soils (Histosols)
- Muck and Peat deposited in bogs, swamps, wetlands.

All organic soil (Freetown and Swansea) are wetland soils.

Low strength, high tree-throw, wetness.

Dominate species: Red Maple, Atlantic White Cedar, White Pine.



# Soil properties related to forestry

- **Physical Characteristics**

- **Soil Texture, Horizons, Color, Consistency, Depth, & Structure**
- **Soil Compaction (Bulk Density)**
- **Soil Moisture**
- **Wetness/drainage**

- **Nutrient Characteristics (Soil Chemistry)**

- **pH**
- **Cation Exchange Capacity (CEC)**
- **Nutrient Availability**
- **Fertility**

# Generalizations for RI Soils

- Little soil development (weak structure, minimal profile development, etc.).
- Most A and B horizons are friable, dense tills have compact layer (15 to 40 inches).
- Low pH – acid soils (except in calcareous areas – Lincoln, RI. And coastal soils).
- Very little clay < 10% (low CEC).
- Large areas of loess overlying glacial deposits.

# Soil Properties: Soil Texture

The way the soil “feels” is called the soil texture.

- The relative proportion (by weight) of sand silt and clay – larger fragments treated separately).
- Sand, silt, and clay are names that describe the size (diameter) of individual mineral particles in the soil.
  - ➔ **Sand** are the largest particles and they feel “gritty”
  - ➔ **Silt** are medium sized, and they feel soft, silky or “floury”
  - ➔ **Clay** are the smallest sized particles, and they feel “sticky”

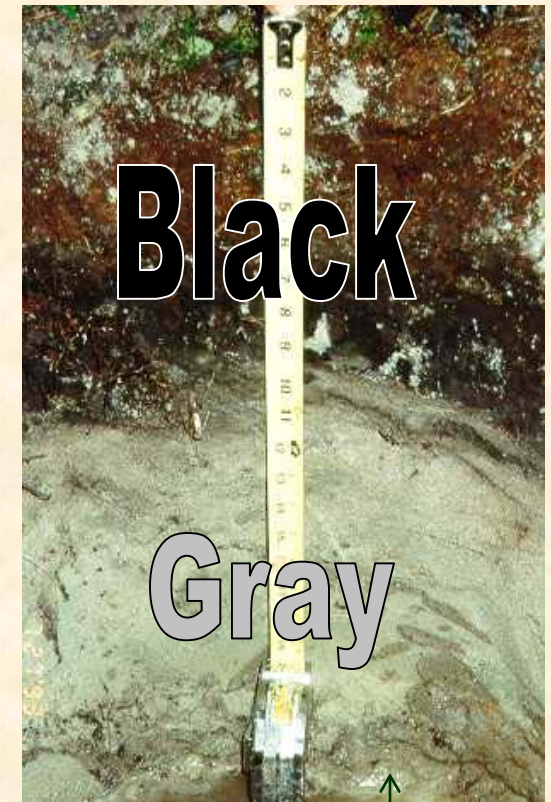
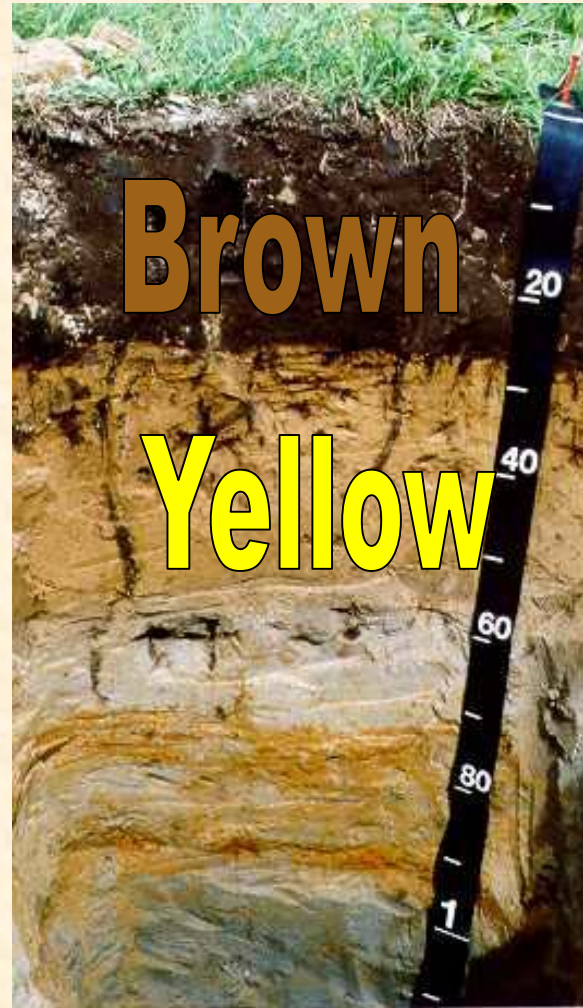


# Soil Properties related to Texture:

- **Porosity**: An index of the relative pore volume in the soil.
- **Infiltration**: The downward entry of water into the immediate surface of soil or other material.
- **Erodibility**: In general, large particles are less erodible, exceptions being clay.
- **Available Water Holding Capacity**: Silt loam textures have highest.
- **Shrink-Swell**: High activity clays have high factors.
- **Soil Formation**: Clayey soils = older.
- **Permeability**: The quality of the soil that enables water to move downward through the profile. Number of in/hr that water moves downward through saturated soil.
- Numerous other properties!

# Soil Property - Color

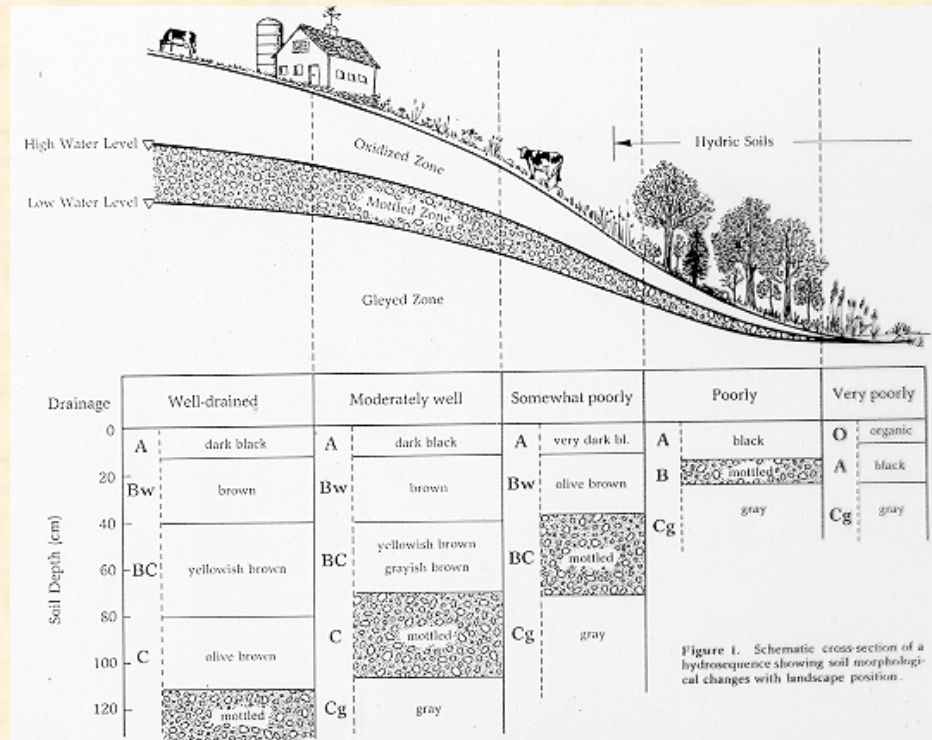
- Easily identified property.
- Used to relate chemical/physical properties such as watertable depth, drainage, chemical constituents, formation, horizons.
- Very important for identifying hydric soils.



Stay Away ↑  
← Happy Fellow

# Soil Drainage

- The frequency and duration of periods of saturation or partial saturation during soil formation.
- Depth to water.
- Restrictive Layers.
- Classes: Excessively, well, moderately well, poorly, very poorly drained.

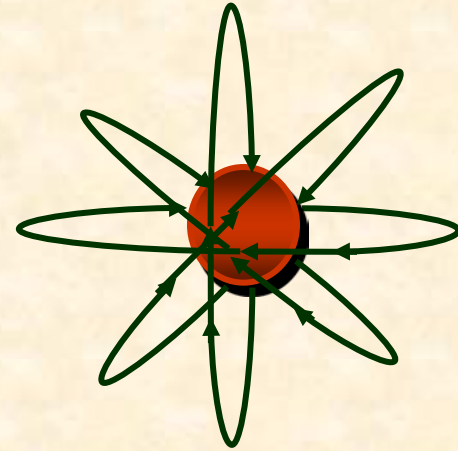




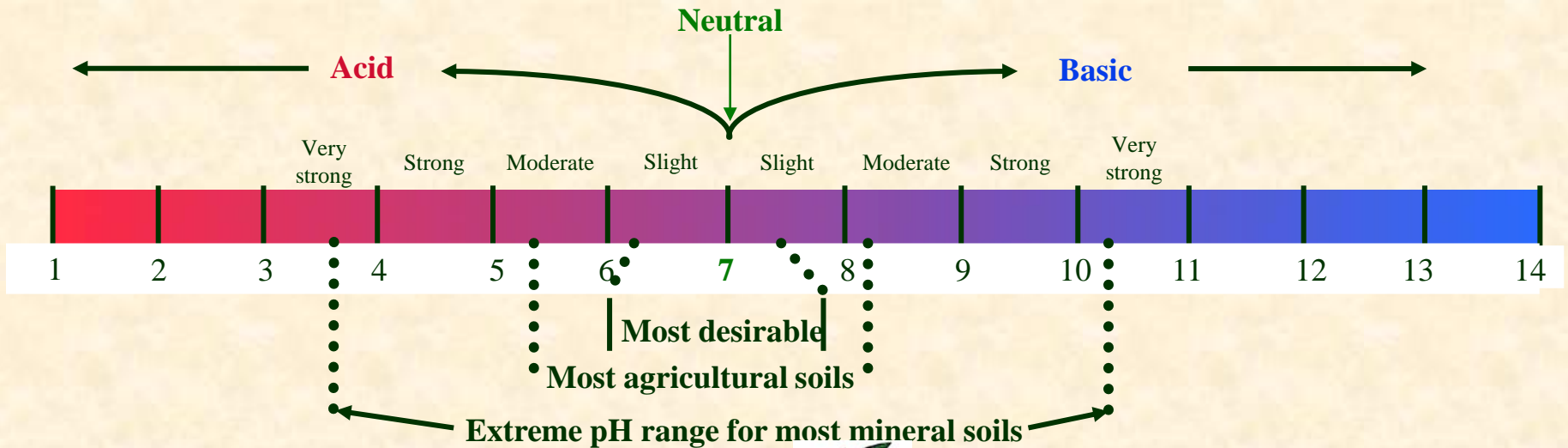
# Chemical Properties

## Soil Chemistry

- pH
- Nutrient Availability
- Cation Exchange Capacity (CEC)



# pH Ranges Under Natural Soil Conditions



cranberry: 4.2-5.0



cucumber: 5.5-7.0

white pine: 4.5-6.0

carrot: 5.5-7.0

black walnut: 6.0-8

apple: 5.0-6.5



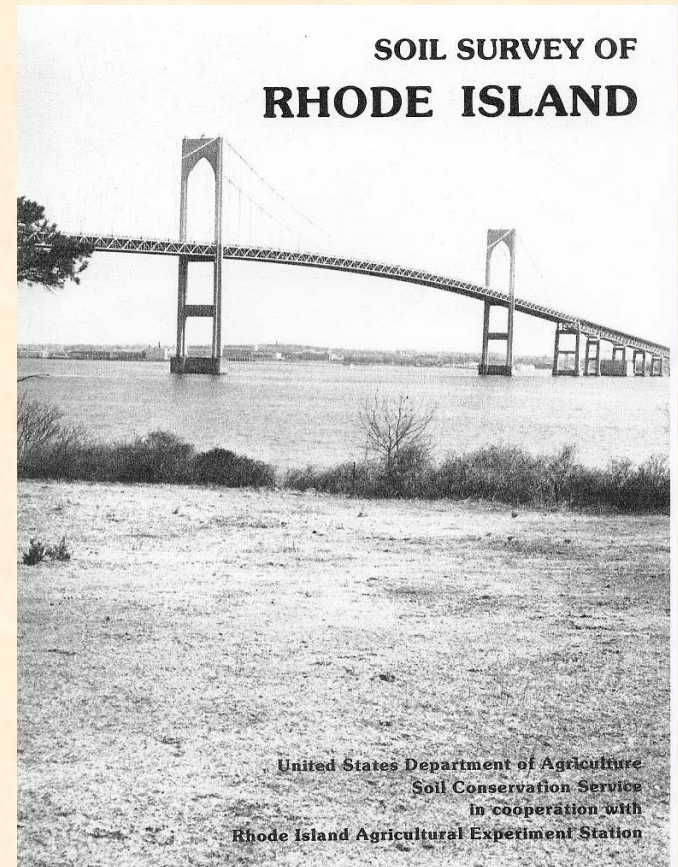
spinach: 6.0-7.5

tomato: 5.5-7.5



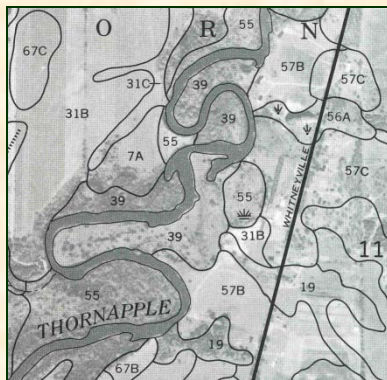
# Soil Surveys

- A soil survey describes the characteristics of the soils in a given area, classifies the soils according to a standard system of classification, plots the boundaries of the soils on a map, and makes predictions about the behavior of soils.
- Extensive field work!



# Soil Surveys

- Soil surveys consist of: a narrative description of the soils, properties, and uses, and other info about the area.
- Soil maps with boundaries delineated on an aerial photo.
- Tables listing properties.



**47B—Perrinton loam, moderately wet, 1 to 8 percent slopes.** This nearly level to gently rolling, moderately well drained soil is on low knolls and ridges. Individual areas are irregular in shape and range from 3 to 180 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The next 6 inches is dark brown, mottled, firm silty clay loam mixed with light brownish gray loam. The subsoil is dark brown, mottled, firm silty clay about 12 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca and poorly drained Lenawee soils. Ithaca soils are slightly lower on the landscape than the Perrinton soil. Lenawee soils are in depressions. Included soils make up 10 to 15 percent of the unit.

Forestland Productivity				
State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties				
Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of Wood Fiber	
Cu ft/ac				
<b>MA:</b>				
Agawam	Eastern white pine	70	120	Eastern white pine, Norway spruce,
	Northern red oak	65	43	White spruce
	Red pine	70	43	
	Sugar maple	—	0	
<b>BC:</b>				
Birchwood	Eastern white pine	65	114	Eastern white pine
	Northern red oak	60	43	
<b>EA:</b>				
Bridgehampton	Eastern white pine	75	143	Eastern white pine, European larch,
	Northern red oak	70	57	White spruce
	Sugar maple	—	0	
<b>DC:</b>				
Deerfield	Eastern white pine	65	114	Eastern white pine, European larch,
	Northern red oak	55	43	Red pine

# Forestry Soil Interpretations



Page 48 of RI Soil Survey, Table 17 on page 129.

## Part 537.2 - National Soil Information System (NASIS) Interpretations

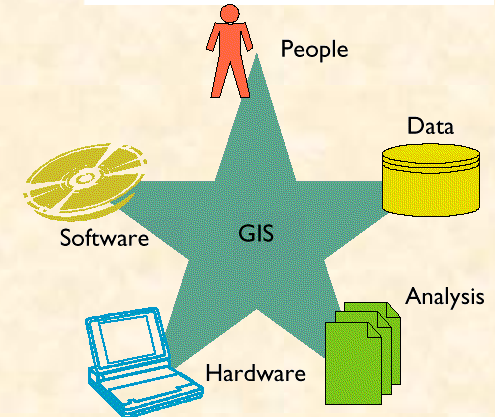
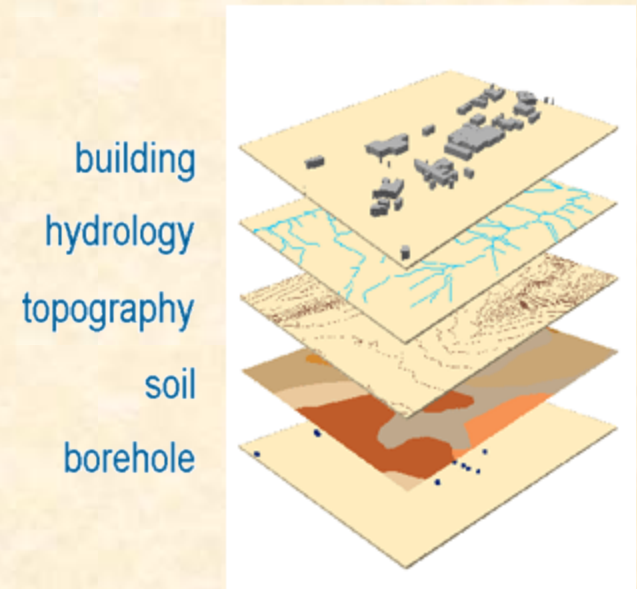
537.20	General.....	.....
537.21	Vegetation and Productivity .....	.....
	(a) Trees to Manage .....	.....
	(1) Description .....	.....
	(2) Element Values .....	.....
	(b) Forest Productivity - CMAI .....	.....
	(1) Description .....	.....
	(2) Element Values .....	.....
	(c) Forest Productivity - Other.....	.....
537.22	Criteria-Based Interpretations.....	.....
	(a) Potential Erosion Hazard (Road/Trail).....	.....
	(b) Potential Erosion Hazard (Off-Road/Off-Trail).....	.....
	(c) Soil Rutting Hazard.....	.....
	(d) Road Suitability (Natural Surface).....	.....
	(e) Log Landing Suitability.....	.....
	(f) Construction Limitations for Haul Roads and Log Landings .....	.....
	(g) Harvest Equipment Operability.....	.....
	(h) Mechanical Site Preparation (Surface).....	.....
	(i) Mechanical Site Preparation (Deep) .....	.....
	(j) Hand Planting Suitability.....	.....
	(k) Mechanical Planting Suitability .....	.....
	(l) Potential Damage to Soil by Fire .....	.....
	(m) Potential Seedling Mortality.....	.....
	(n) Conservation Tree/Shrub Suitability Groups (CTSG) .....	.....

# Forestry Interpretations

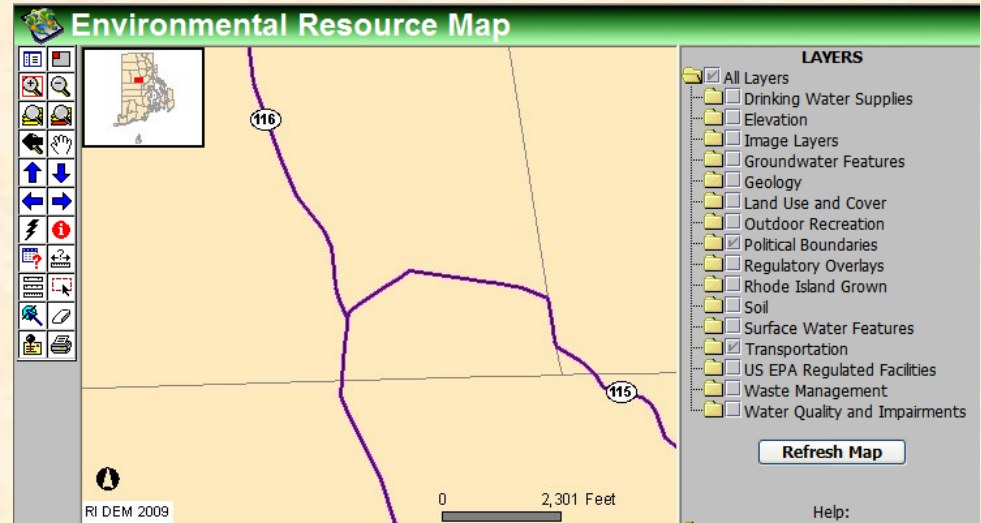
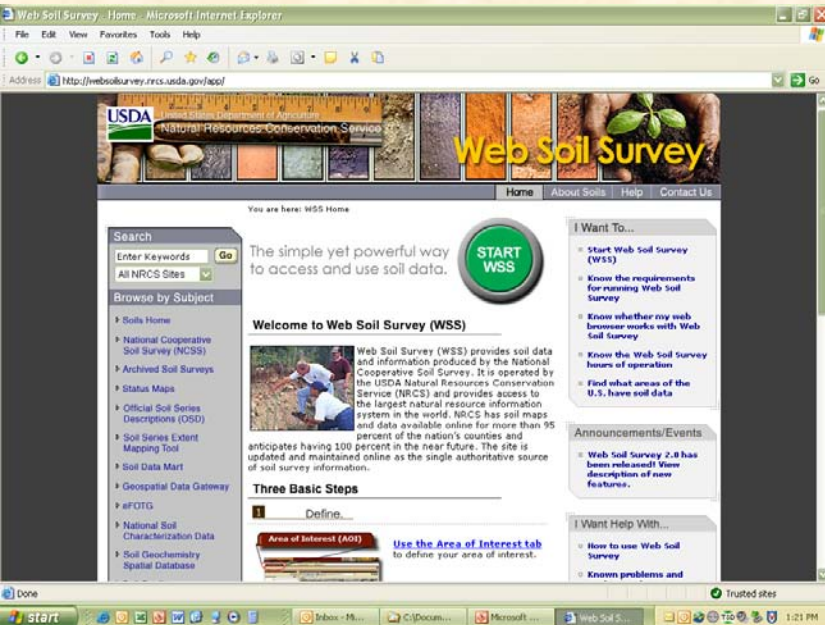
- Ordination symbol: 1 to 5 and letters (x, w, d, r, etc.).  
Carlisle Soil 5w = low productivity due to wetness,  
Bridgehampton = 3O - high.
- Site Index: Ave. height (feet) a tree species grows in 50 years (Red Maple = 55 on Charlton Soils).
- Erosion hazard, Equipment Limitations, Seedling mortality, windthrow hazard, common trees, trees to plant.
- ...This soil is suitable for woodland wildlife habitat and openland wildlife habitat. It is too dry to provide wetland wildlife habitat. Capability class I; woodland group 4o.

# Geographic Information Systems

- GIS is a system of hardware, software, data, personnel, and procedures to help manipulate, analyze and present geographically referenced data (Computer Cartography).
- Rapidly replacing paper maps.



# Web Soil Survey and IMS sites



DEM IMS Site:

<http://www.dem.ri.gov/maps/index.htm>

Web Soil Survey:

<http://websoilsurvey.nrcs.usda.gov>

Official source for soil survey data/maps.

Numerous interpretive maps.

Learning curve

Has soils along with other resource inventory maps (wetlands, etc.)

Imagery – new 4”, topos.



# Other GIS/Imagery Sources

- RI Digital Atlas -  
<http://www.edc.uri.edu/atlas/>
- ESRI – free ArcGIS Explorer-  
<http://www.esri.com/software/arcgis/explorer/index.html>
- Google Earth – [www.earth.google.com](http://www.earth.google.com)
- Bing – [www.bing.com/maps](http://www.bing.com/maps)
- ArcGIS Online: [www.arcgis.com](http://www.arcgis.com)

# End – Questions??

