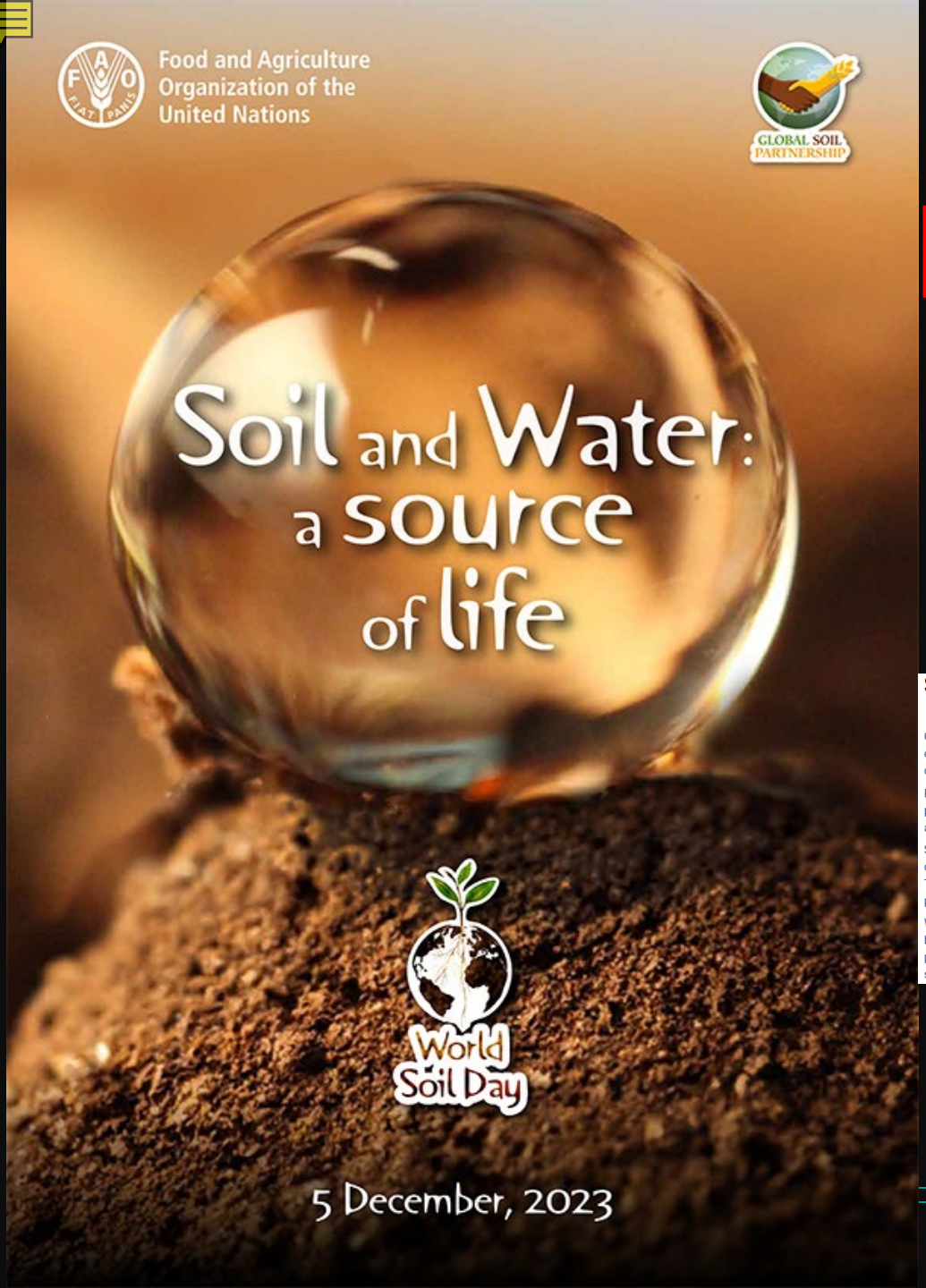


Happy #WSD

Soil and water, a source of life

Our planet's survival depends on the precious link between soil and water. Over 95 percent of our food originates from these two fundamental resources. Soil water, vital for nutrient absorption by plants, binds our ecosystems together. This symbiotic relationship is the foundation of our agricultural systems.

However, in the face of climate change and human activity, our soils are being degraded, putting excessive pressure on our water resources. Erosion disrupts the natural balance, reducing water infiltration and availability for all forms of life.

Sustainable soil management practices, such as minimum tillage, crop rotation, organic matter addition, and cover cropping, improve soil health, reduce erosion and pollution, and enhance water infiltration and storage. These practices also preserve soil biodiversity, improve fertility, and contribute to carbon sequestration, playing a crucial role in the fight against climate change.

World Soil Day 2023 (WSD) and its campaign aim to raise awareness of the importance and relationship between soil and water in achieving sustainable and resilient agrifood systems. WSD is a unique global platform that not only celebrates soils but also empowers and engages citizens around the world to improve soil health.

Did you know?

- 95% of our food comes from soils.
- One cubic meter of healthy soil can retain over 250 liters of water.
- Improper soil and water management practices affect soil erosion, soil biodiversity, soil fertility, and water quality and quantity.
- Healthy soil plays a crucial role as a natural filter, purifying and storing water as it infiltrates into the ground.

NRCS

Jim Turenne
Assistant State Soil Scientist

USDA-NRCS
60 Quaker Lane, Suite 46
Warwick, RI. 02886
401-822-8832
Jim.turenne@ri.usda.gov

https://rienvirothon.org/soils.htm

NRCS

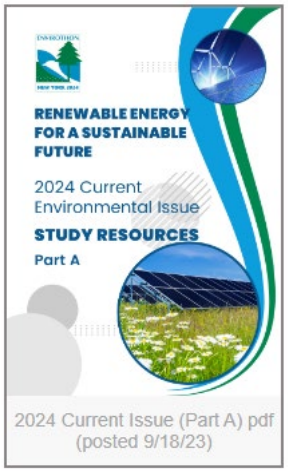
2024 Special Topic – think how soils relate to this topic!

2024 NCF-Envirothon New York

Hobart and William Smith Colleges
Geneva, New York
Dates: July 28 - August 3, 2024

Hosted by New York State Envirothon

Soil study guide May 2024



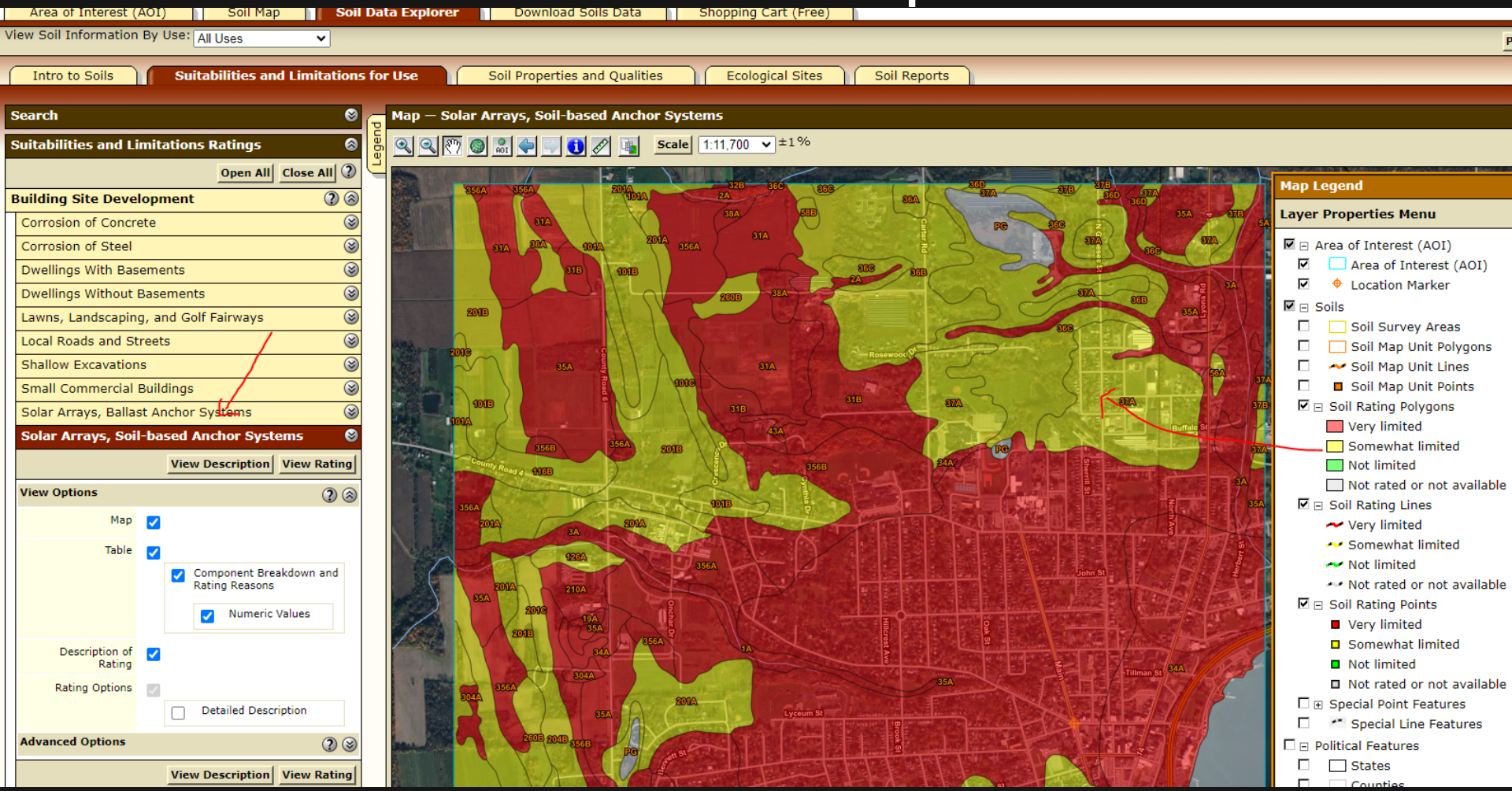
2024 Current Issue (Part A) pdf (posted 9/18/23)

2024 Current Issue Topic

Renewable Energy for a Sustainable Future

https://envirothon.org/wp-content/uploads/2023/09/2024-Current-Issue-Part-A.pdf

2024 Special Topic – think how soils relate to this topic!



https://envirothon.org/wp-content/uploads/2023/09/2024-Current-Issue-Part-A.pdf

Envirothon Competition

- Multiple choice/ fill in questions about soils
  - Review all online material
- Soil pit or soil profile
  - Describe soil horizons, color, texture, parent material
- Use Printed RI Soil Survey from the Web Soil Survey.
- Study EVERYTHING on RI Envirothon site (http://www.rienvirothon.org/soils-resources.htm)

Soil Science (Pedology)

The scientific study of soils, including their origins, characteristics, and uses. Many different “fields” in soil science.

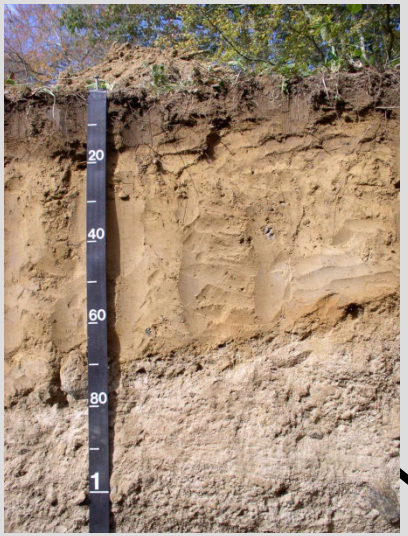
- Why Study Soils?
  - Interpretations – how to best use the land based on the soil resources.
  - Over 80 Interpretations/Suitabilities/Properties on WSS.

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

The Earth's soils contain about **2,500 gigatons** of carbon—that's more than three times the amount of carbon in the atmosphere and four times the amount stored in all living plants and animals.

Why Soils are Important

Great integrator: all parts of ecosystem



Medium of crop production

Producer and absorber of gases

Medium for plant growth

Home to organisms (plants, animals and others)

Essential natural resource

Filter of water and wastes

Source material for construction, medicine, art, etc.

Carbon Sink!

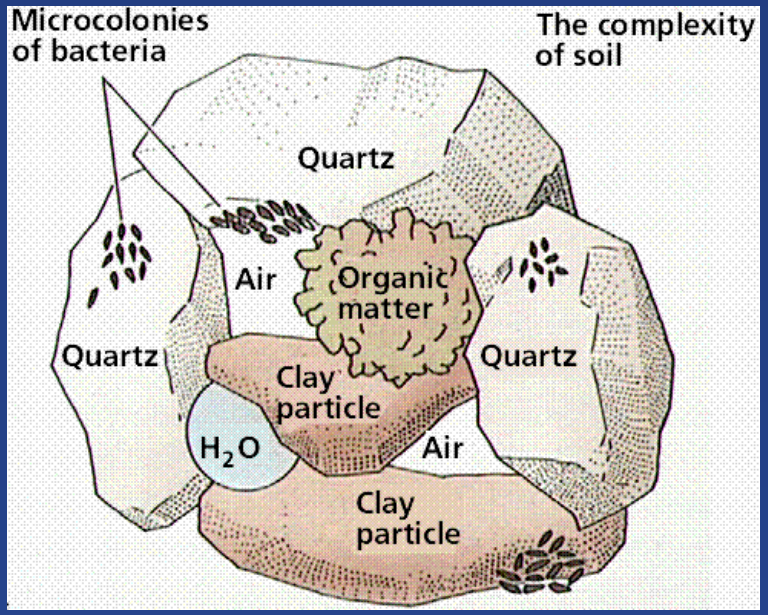
Waste decomposer

Snapshot of geologic, climatic, biological, and human history

Soil - Definition

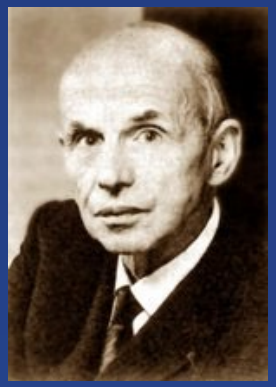
Natural body that occurs on the land (water) surface, occupies space, and is characterized by one or both of the following:

- Horizons formed by pedogenesis (Simonson).
- The ability to support rooted plants in a natural environment.



Dirt is soil removed from its natural environment!

Soil Formation



Topography

Biota

Climate

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.

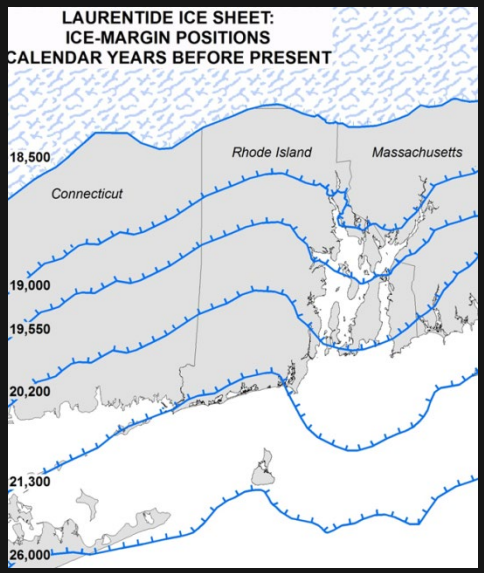
Soil Factor: Parent Materials

Geologic Material the Soil Formed From (or in).

- Types of minerals.
- Reaction of soil.
- Soil Color.
- Chemical/physical properties

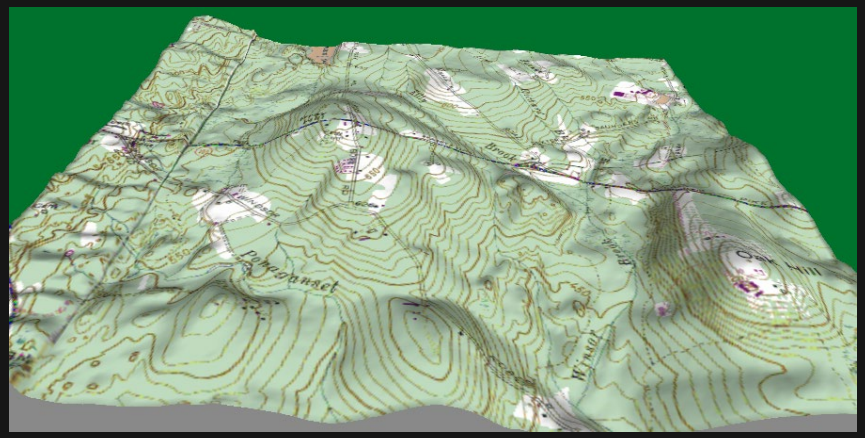
New England Glacial Parent Materials

- Quaternary Period (Ice Age) – 2,580,000 to 11,700 KYBP Pleistocene Epoch–Holocene (11.7K to 0) – Anthropocene?.
- 4 Major advances.
- Last– Wisconsinan advance covered all of New England to Long Island. Ended ~11.7K= Holocene Epoch.
- Soil parent materials – glacial & post glacial



Parent Material: Glacial Till

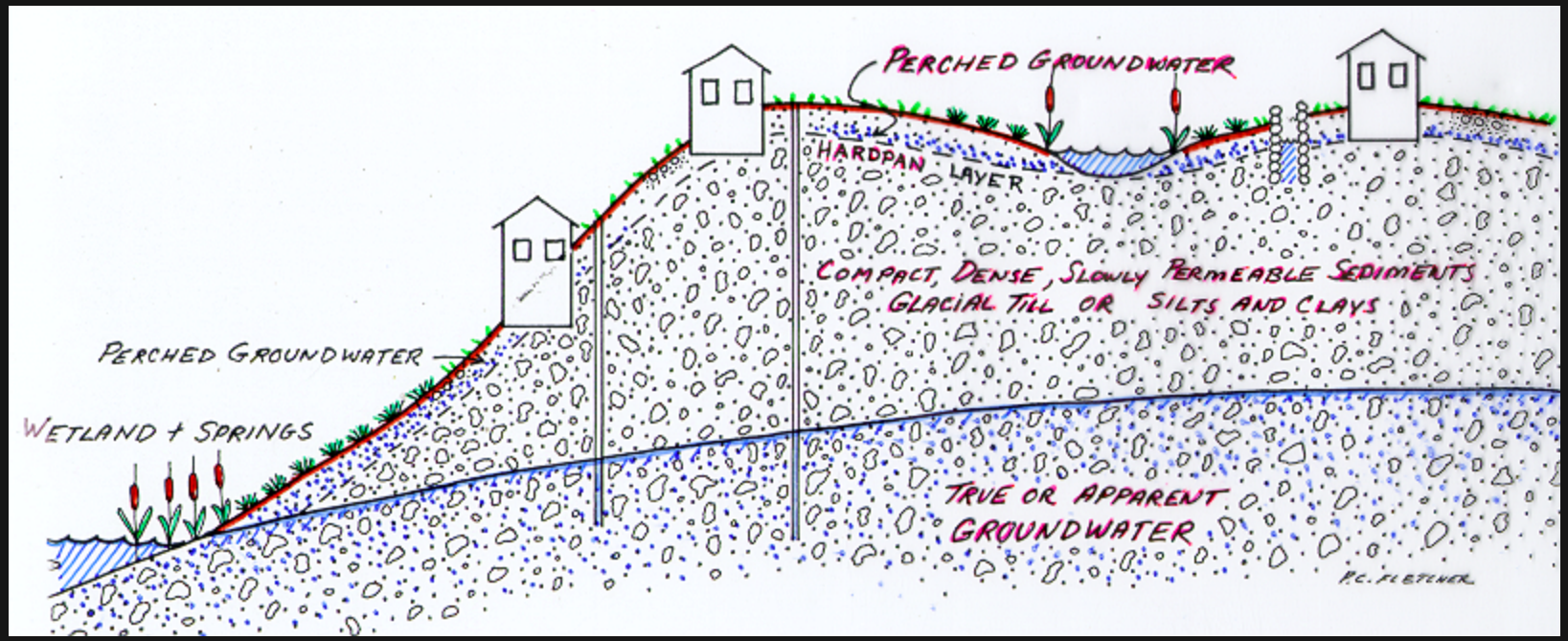
- Unsorted/stratified material deposited beneath and within glacial ice.
- Heterogeneous mixture of all particle sizes (boulder to clay).
- Oldest surficial deposit overlying most bedrock areas.



Till Properties

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

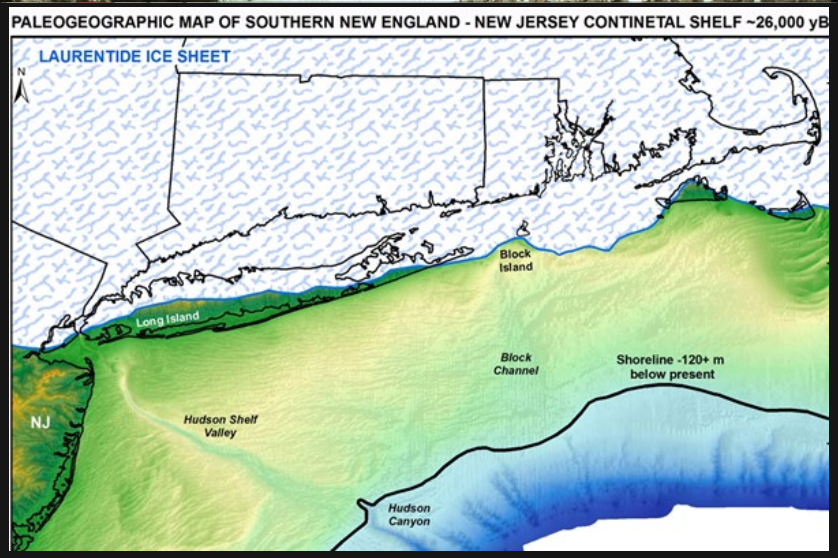
Hydrology in Dense Tills



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

PM: Glacial Fluvial (outwash)

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

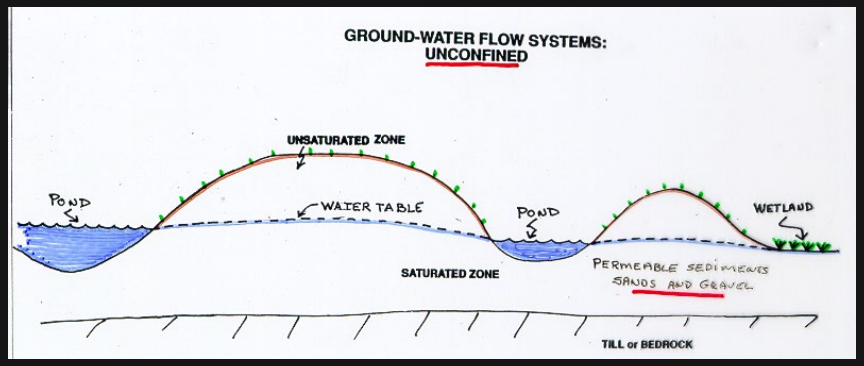


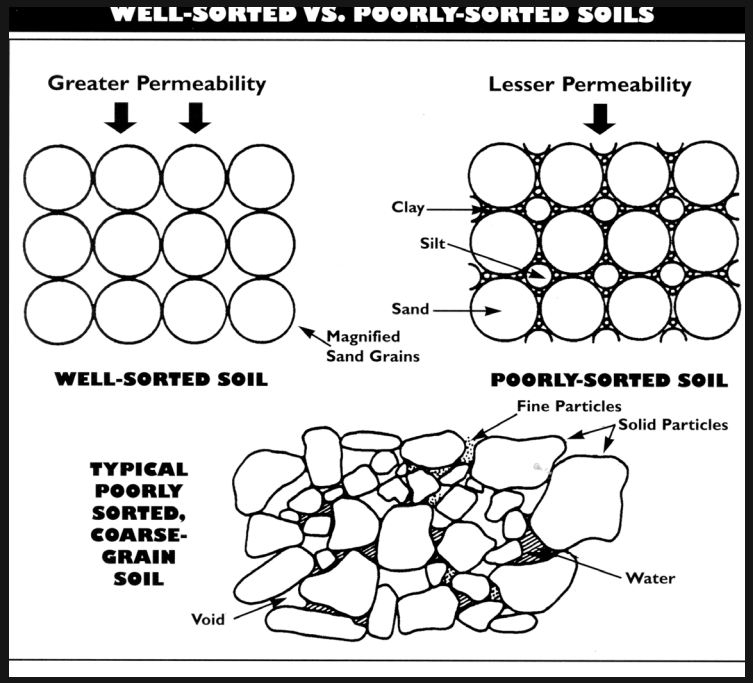
Outwash Properties

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

Outwash Hydrology Concerns

- Apparent watertables, generally easy to interpret hydrology.
- Large pore space causes rapid permeability.
- Aquifer recharge areas.
- Poor filtering capacity.





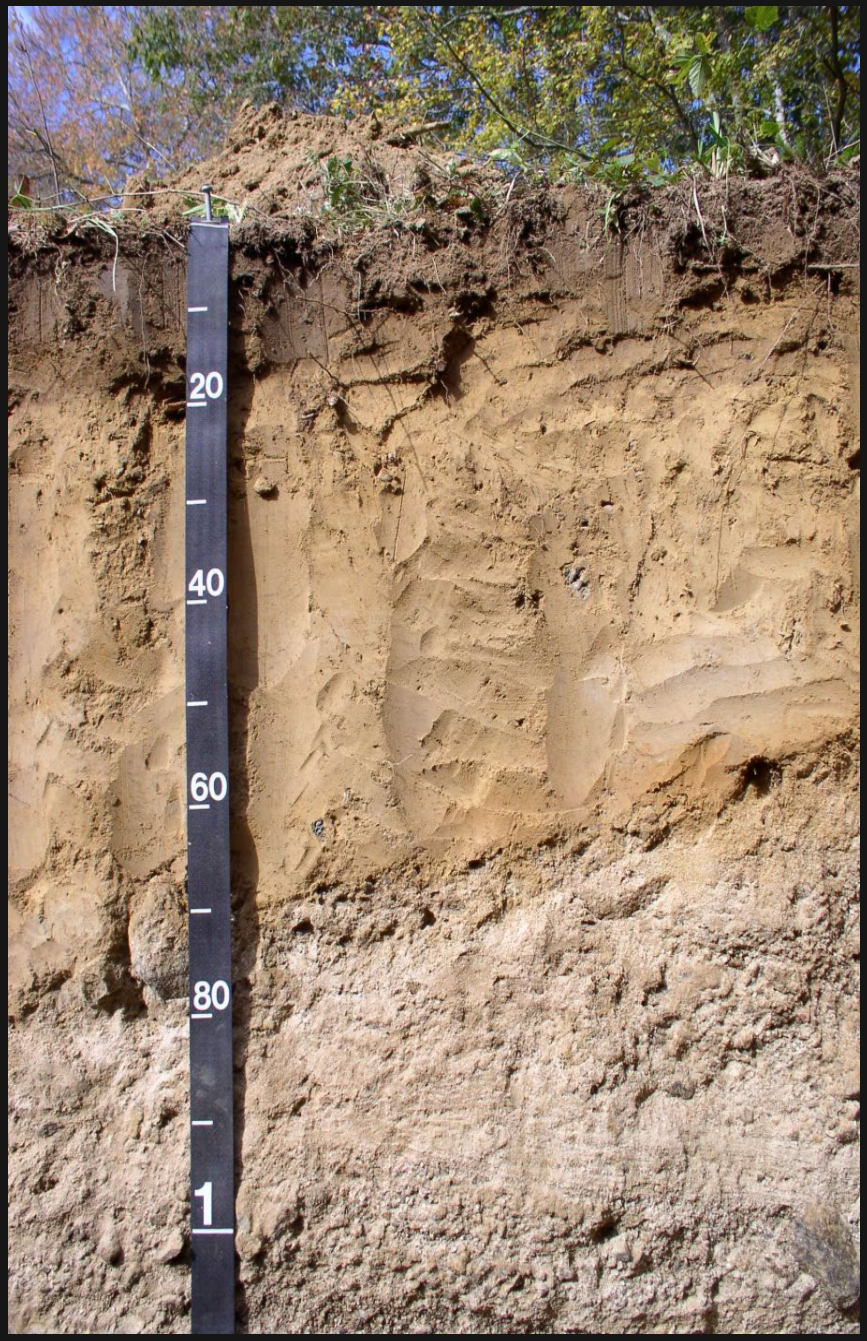
Other parent material ex.

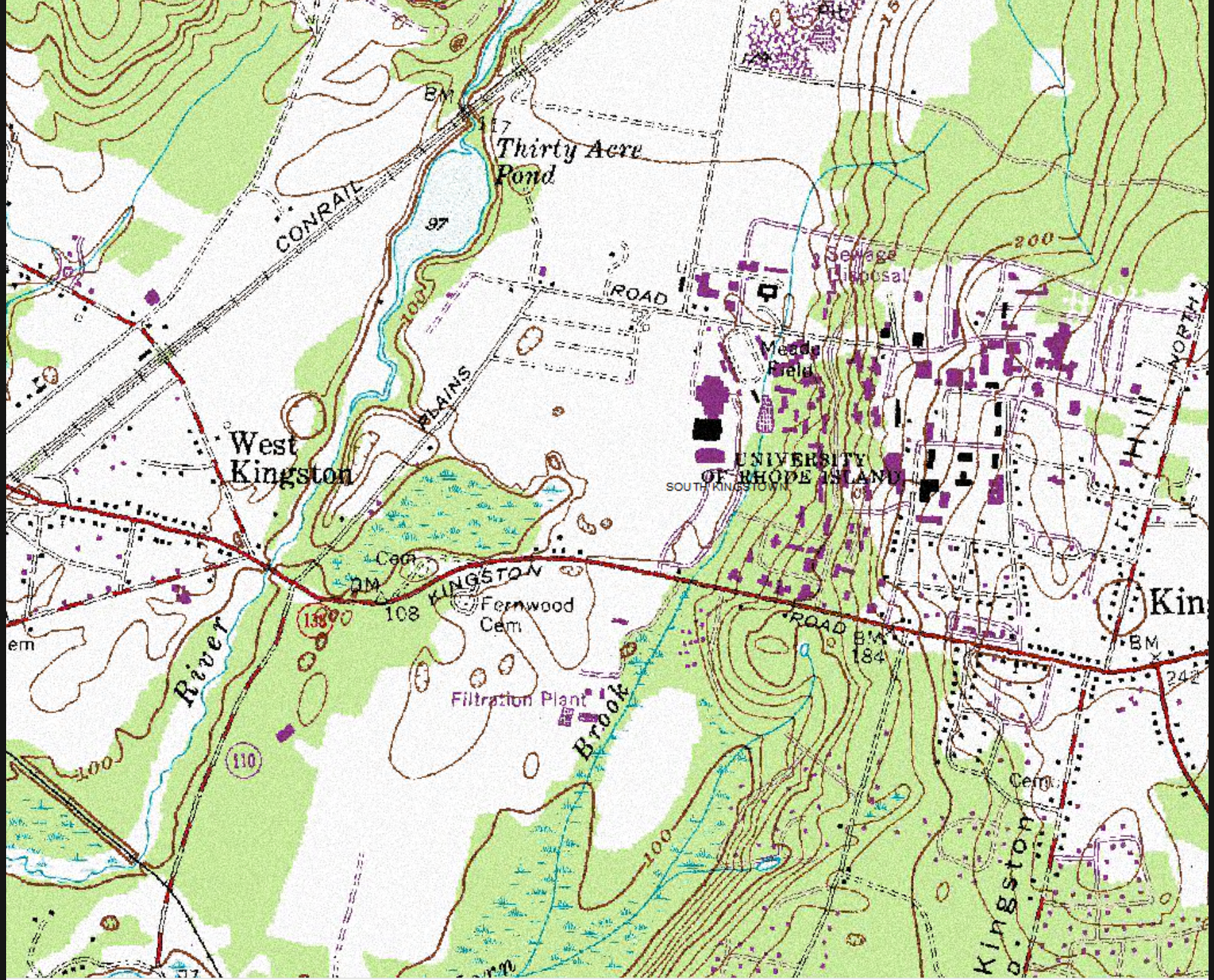
- Lacustrine – glacial lakes now drained(silts).
- Volcanic – ash (Andisols).
- Organic – swamps, marshes, bogs.
- Loess/Eolian – Deposited by the wind.
- Colluvium – Gravity deposits (slides).
- Alluvium – Deposited by flooded rivers.
- Residuum – Formed in place (weathered bedrock).
- HTM – Human Transported Material.

Post Glacial Deposits

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

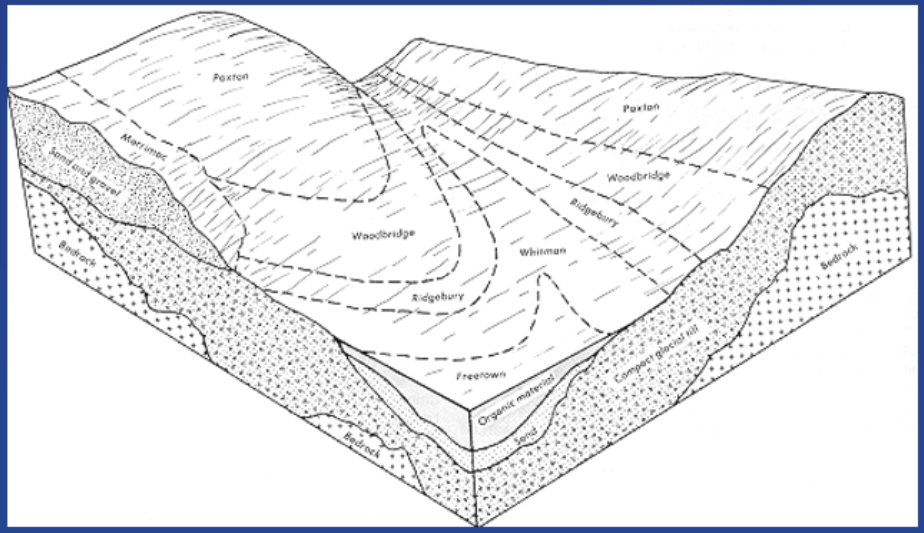
Most upland soils in NE have a thin 18–36-inch eolian cap. Deposited after ice left.

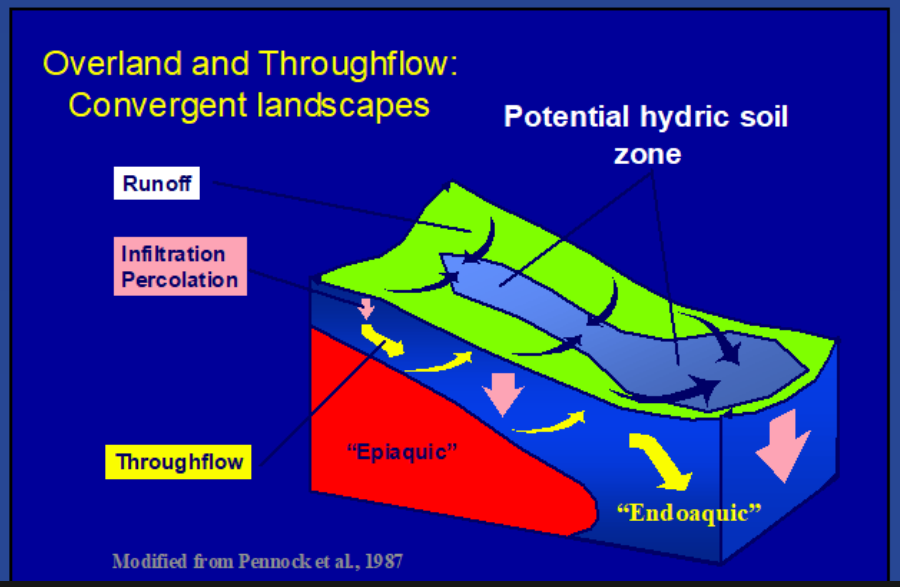



BM
117
Thirty Acre Pond
CONRAIL
97
100
ROAD
200
Sewage Disposal
Meade Field
PLAINS
West Kingston
UNIVERSITY OF RHODE ISLAND
SOUTH KINGSTON
Cem
DM
108
KINGSTON
Fernwood Cem
138
River
ROAD
BM
184
BM
242
Filtration Plant
Brook
110
100
Cem
Kingston
NORTH

Soil Forming Factor: Relief and Landscape Factors

- Position on the landscape (convex/concave).
- Elevation.
- Aspect.
- Slope.
- Water movement
- Most wetlands on concave landforms.

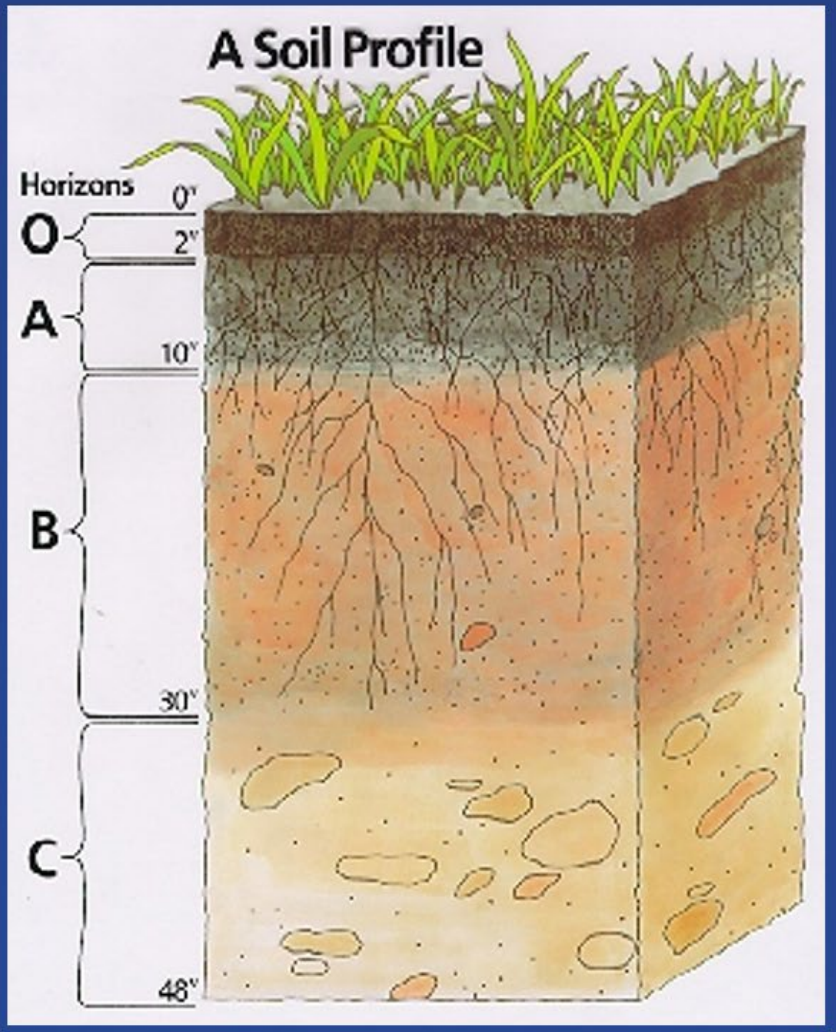


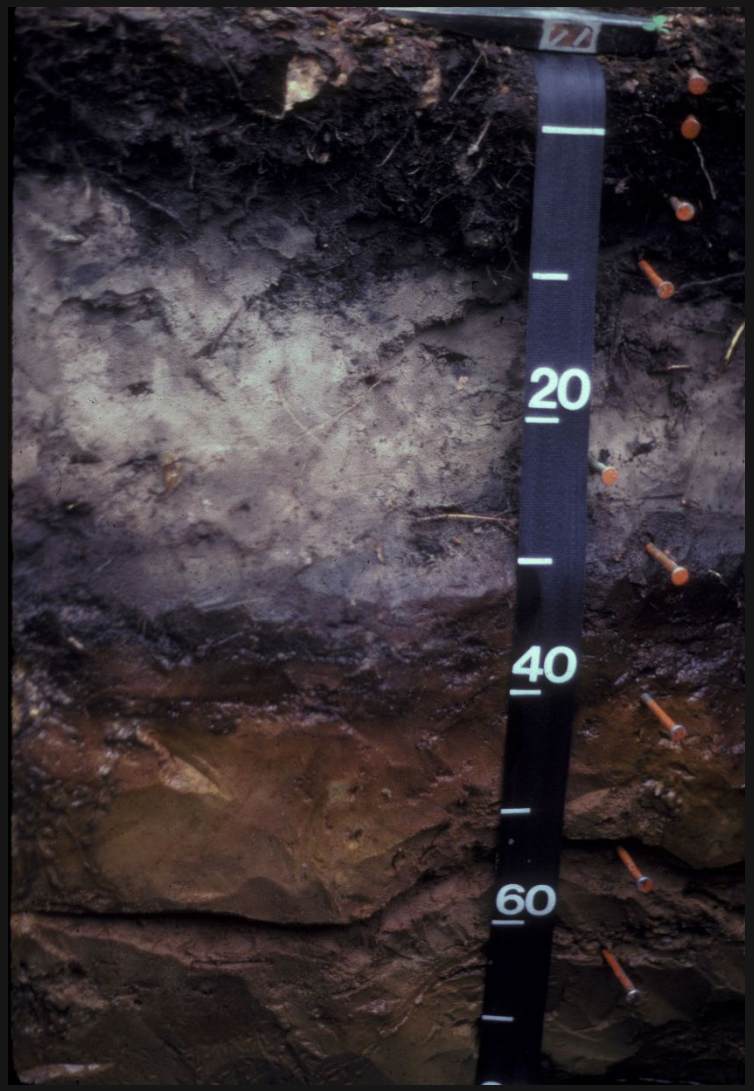


Property: Soil Horizons

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil forming processes.

Used to classify the soil and make interpretations.

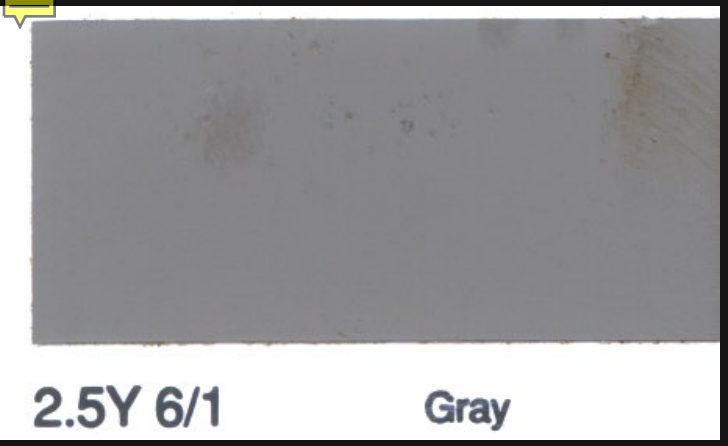




O = Organic (>~12% Soil Organic Carbon).
A = Mineral horizon, mixed with organic material (humus, etc.).
B = Illuvial horizon – something moved in or changed by ped processes.
C = Unweathered/altered parent material (glacial in RI).
R = Hard bedrock.

Soil Color

- Easily identified property.
- Used to relate chemical/physical properties such as water table depth, drainage, chemical constituents, formation, horizons.
- Use Munsell color notation: Hue Value Chroma: 10YR 5/6
- Redoximorphic Features – used for ESHWT.
- Used for hydric soil indicators.



Hue – dominate spectral series 10YR

Value – amt of light reflected white to black

Chroma – strength of the hue

Hue V/C

Soil Properties: Texture

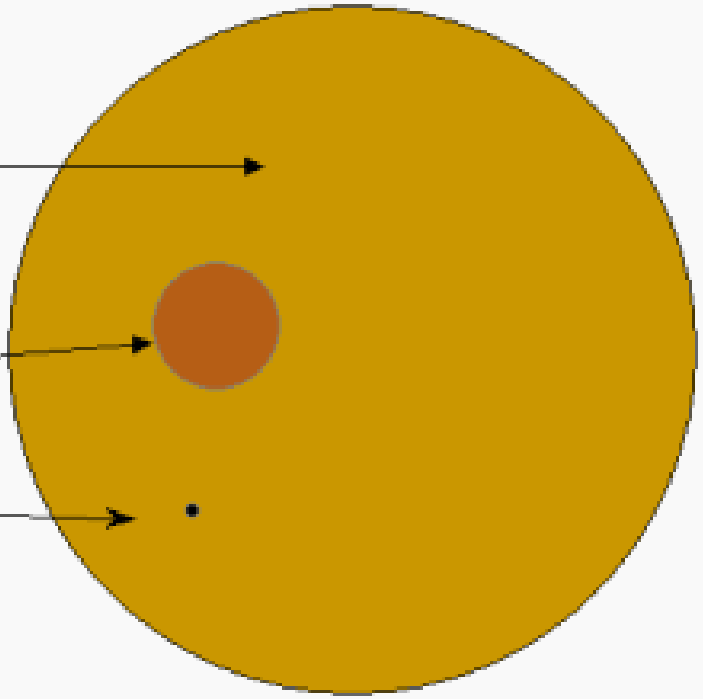
Soil Texture: The relative proportions of sand, silt, and clay particles in a mass of soil (material less than 2mm in size).

Very Coarse Sand = 2 to 1 mm

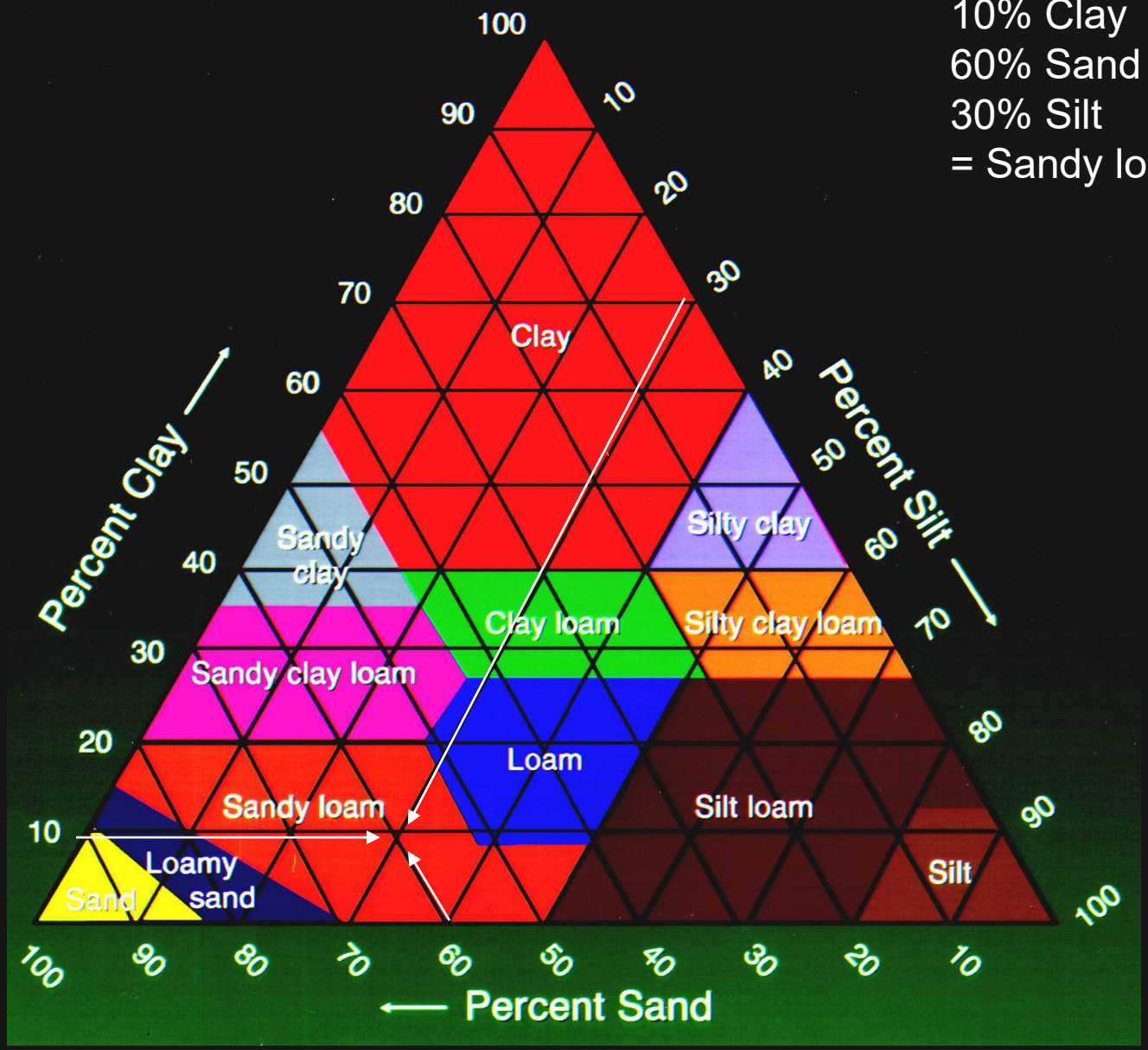
Very Fine Sand = 0.1 to 0.5 mm

Silt = 0.05 to 0.002 mm

Clay = < 0.002 mm



10% Clay
60% Sand
30% Silt
= Sandy loam



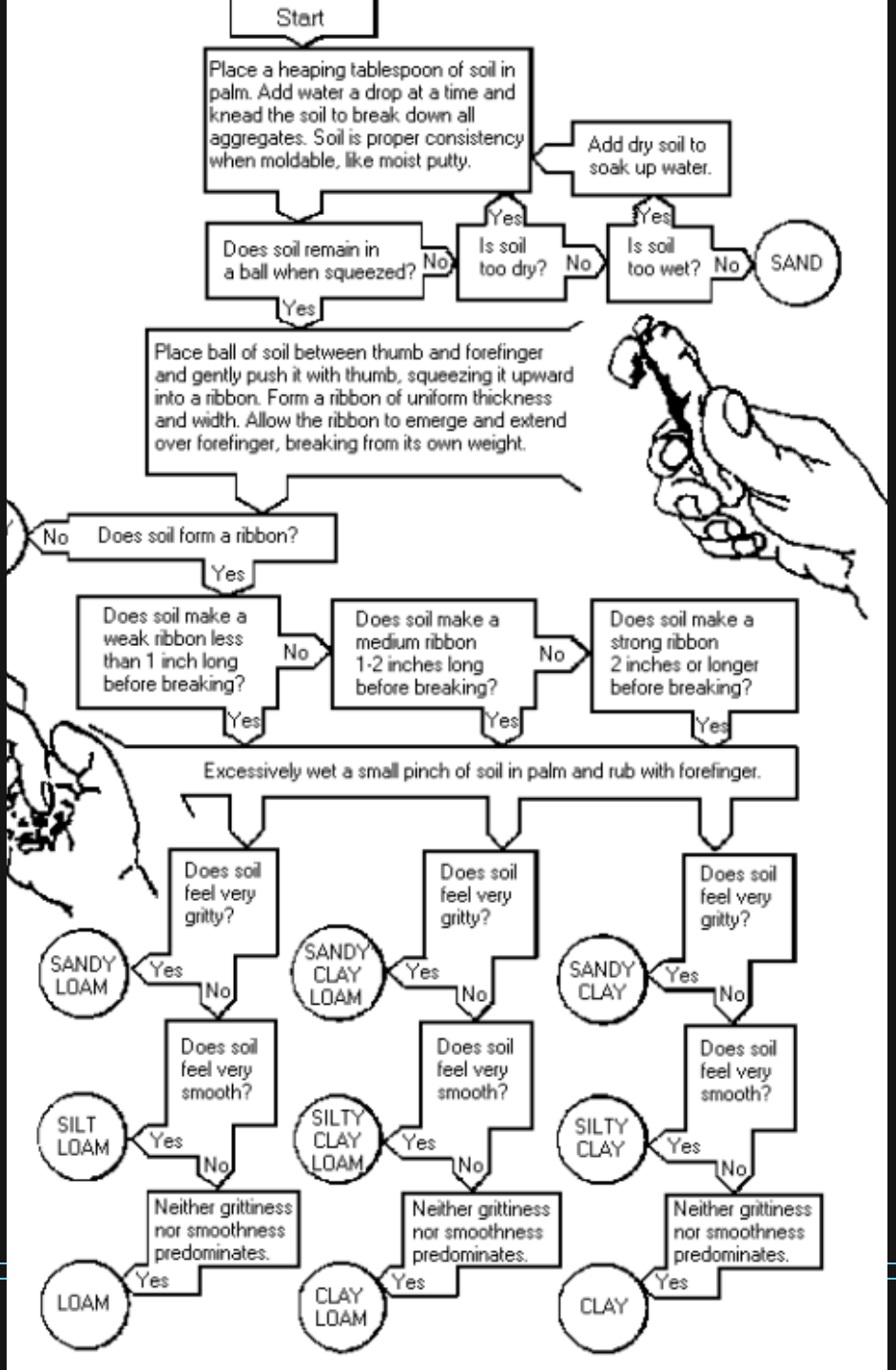
Review “Soil Texture by Feel” flowchart.

Soil texture is estimated in the field by calibrating your fingers (college course).

Only consider materials <2mm larger particles are rock fragments.

Sand = gritty feel
Silt = smooth but not sticky
Clay = sticky and forms long ribbons.

Most in RI = sand, loamy sand, sandy loam, silt loam, some loams.



Importance of Soil Texture

- Material larger than 2 mm are coarse fragments (gravel, cobble, stone, boulder).
- **Importance:** Soil formation, mechanics, water movement, erosion, CEC, shrink-swell, etc.
- **Clay:** High specific surface area, net negative charge (isomorphic), high pore, expansion.
- Most textures in NE have very little clay.

Soil Drainage

- Depth to water or evidence of water
- Classes: Excessively, well, moderately well, poorly, very poorly drained

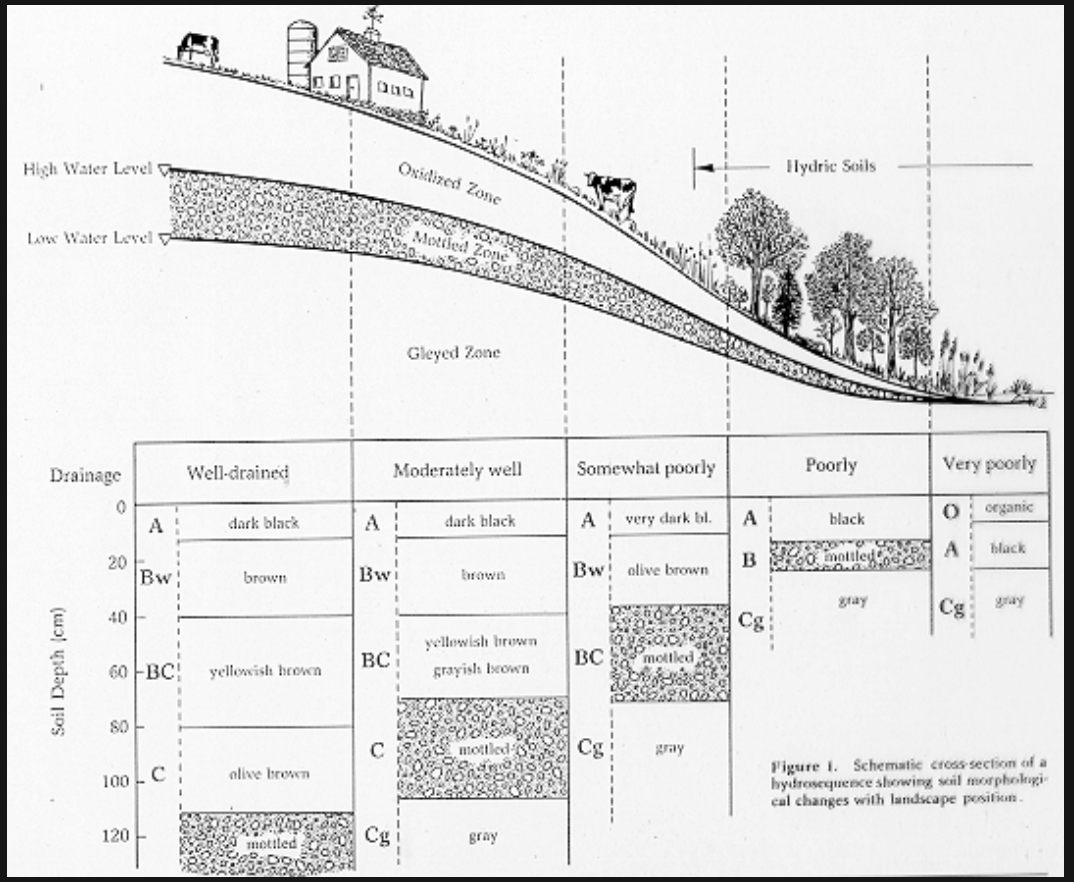
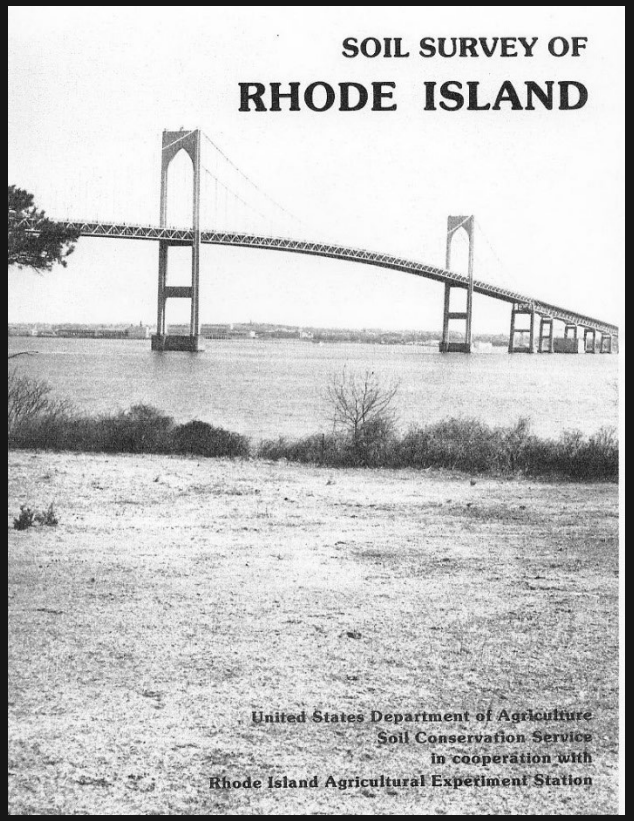


Figure 1. Schematic cross-section of a hydrosequence showing soil morphological changes with landscape position.

Soil Surveys

- A cooperative undertaking of the USDA and various Federal, State, and Local agencies and the State Agricultural Experiment Station of a State's Land Grant College.
- The NRCS (formerly SCS) provides leadership for the NCSS. Maintains information about soils of the world and assists in understanding, classification, and wise use of soil resource.
- Soil Conservation Act 1936 – Authority for soil surveys made on private lands….
- Over 100 years mapping, collecting data, developing over 90 interpretations for land-uses, limitations, suitability, chemical/physical properties, ecological data…
- Result of extensive field work by "ground pounders"



Demo at end of PPT

View Soil Information By Use: All Uses

Printable

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Sites | Soil Reports

Search

Suitabilities and Limitations Ratings

Open All | Close All

- Building Site Development
- Construction Materials
- Disaster Recovery Planning

Land Classifications

- Conservation Tree and Shrub Group
- Ecological Classification ID
- Ecological Classification Name
- Farmland Classification
- **Hydric Rating by Map Unit**

View Description | View R...

View Options

- Map
- Table
- Description of Rating
- Rating Options
  - Detailed Description

Advanced Options

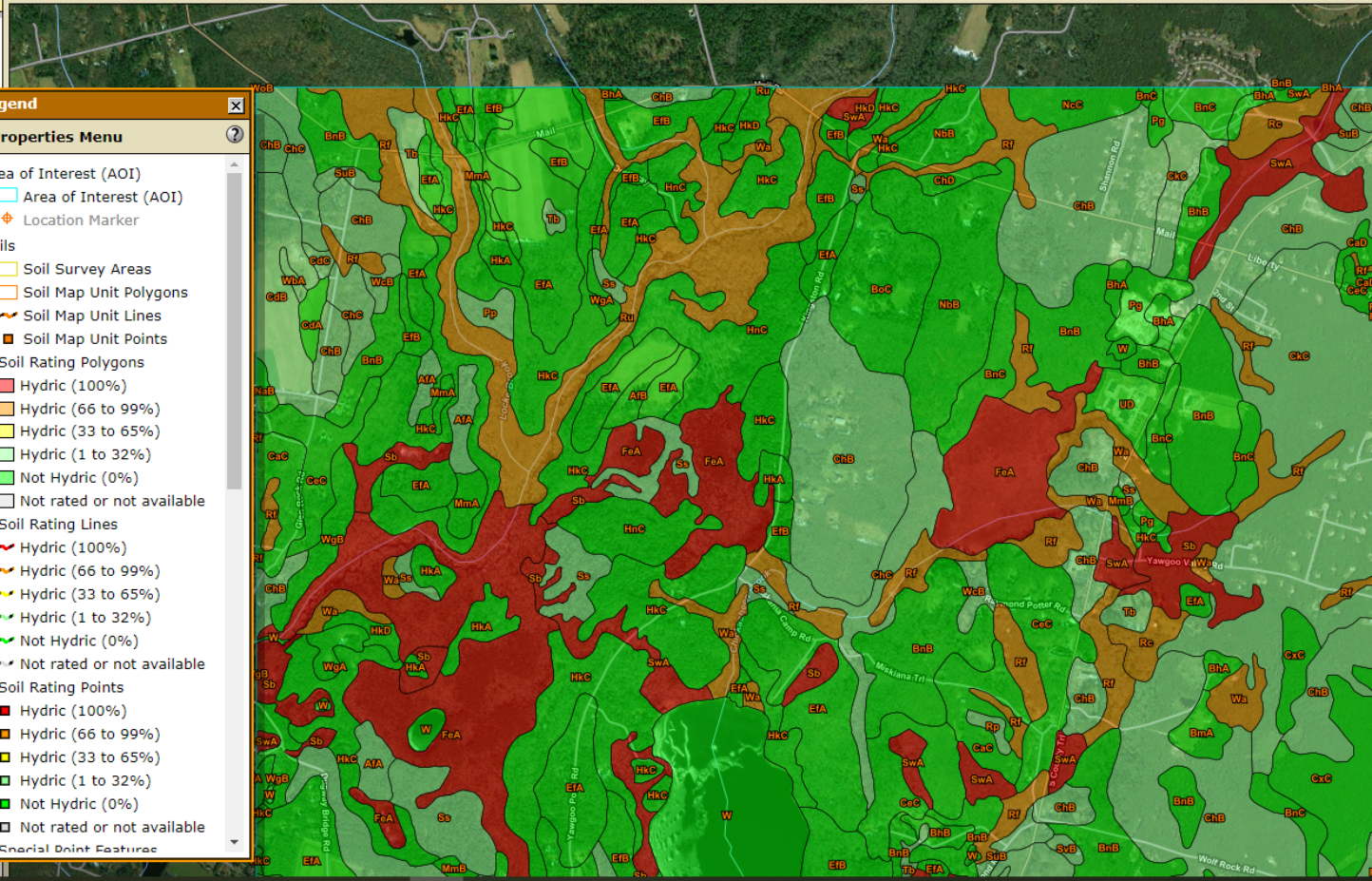
View Description | View R...

- Irrigated Capability Class
- Irrigated Capability Subclass
- National Commodity Crop Productivity Index
- NCCPI Corn Productivity
- NCCPI Small Grains Productivity
- NCCPI Soybeans Productivity
- NH Forest Soil Group
- Nonirrigated Capability Class
- Nonirrigated Capability Subclass
- NRCS Ecological Site ID

Legend

Map — Hydric Rating by Map Unit

Scale (not to scale)



Special Topic

Renewable Energy:
Soil productivity, forest biomass production, geothermal.

Organic soils – study for Chapman Swamp found there is enough fuel grade peat to power Westerly for 20 years. Many freshwater ponds (subaqueous soils) could be dredged for fuel and improve the deepwater habitats.

Soils used to anchor solar structures, turbines, etc.

Sequester carbon – largest terrestrial carbon pools.

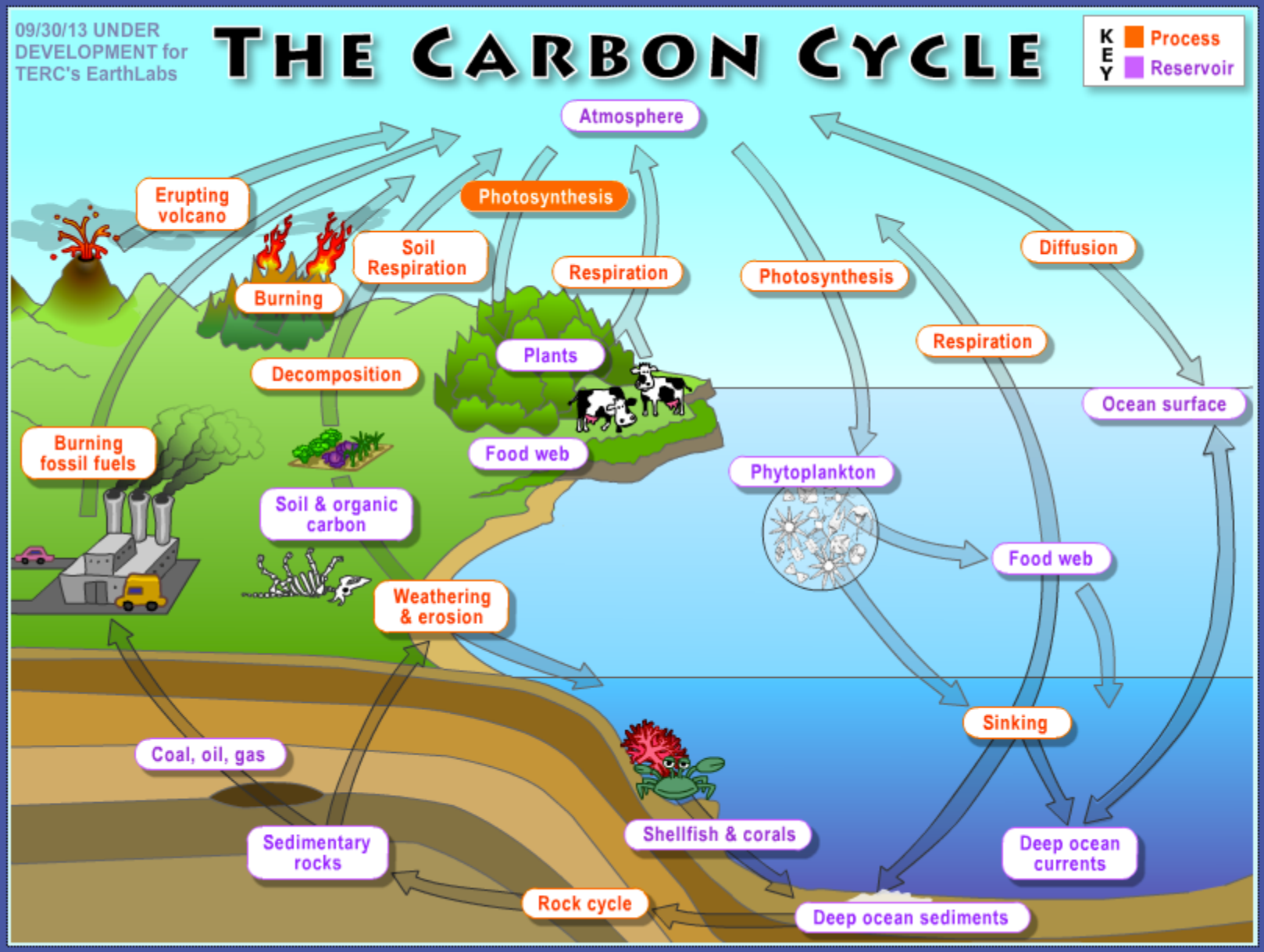
Urban soils – ability to support trees to cool the impervious areas.

Check the study guide when posted, email me with any questions.

https://drive.google.com/drive/folders/1DUFq5S3pZ1nJ44Z0MOddOf12engYYJIf

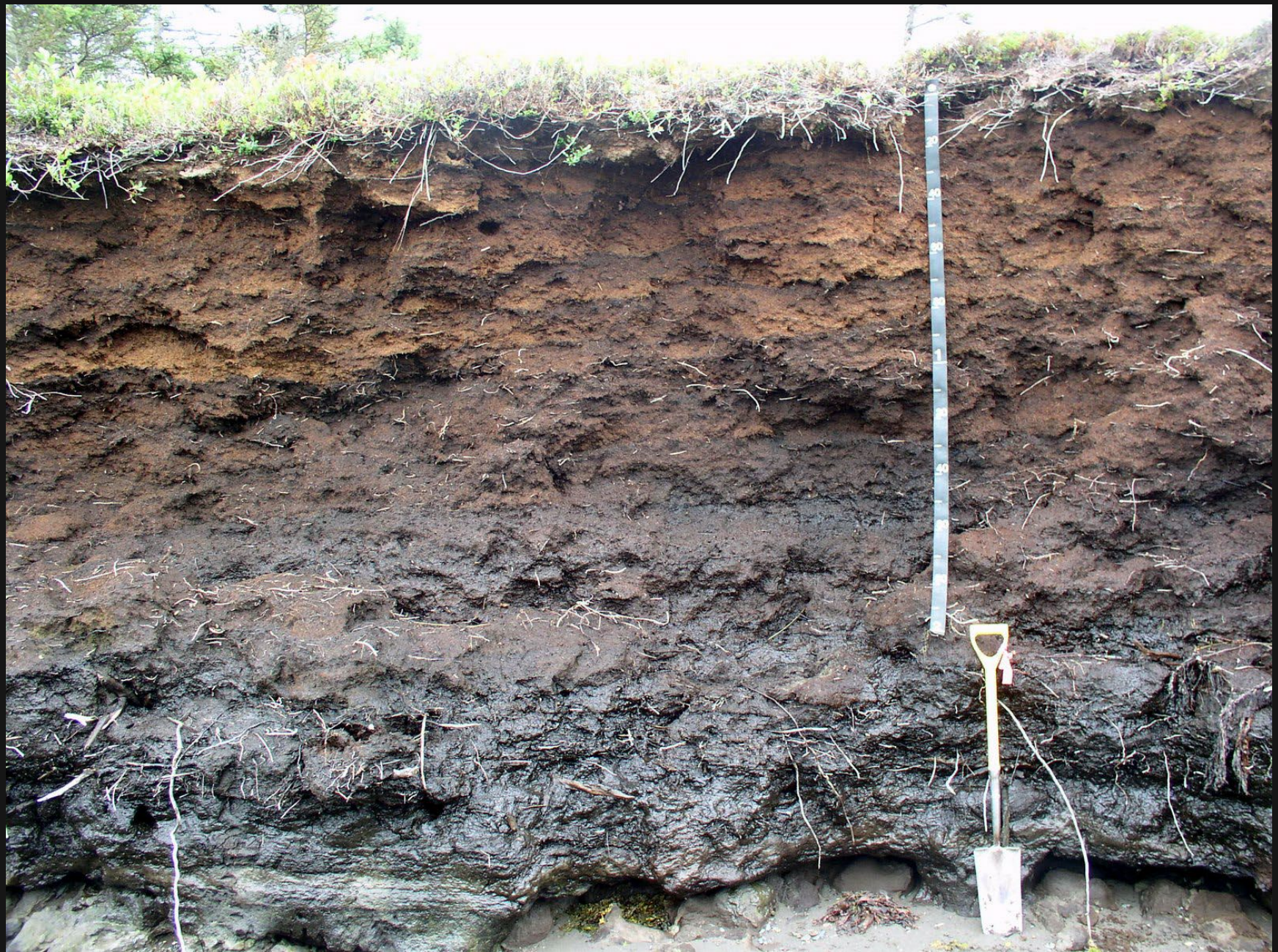
Questions?

If you want to start a fight…
Put two soil scientists in a soil pit!


09/30/13 UNDER DEVELOPMENT for TERC's EarthLabs
THE CARBON CYCLE
KEY
Process
Reservoir
Atmosphere
Erupting volcano
Photosynthesis
Soil Respiration
Respiration
Burning
Photosynthesis
Diffusion
Respiration
Plants
Decomposition
Ocean surface
Burning fossil fuels
Food web
Phytoplankton
Soil & organic carbon
Food web
Weathering & erosion
Sinking
Coal, oil, gas
Shellfish & corals
Deep ocean currents
Sedimentary rocks
Rock cycle
Deep ocean sediments

See New Brunswick Peat Resources

(https://www2.gnb.ca/content/gnb/en/departments/erd/energy/content/minerals/content/Peat.html)



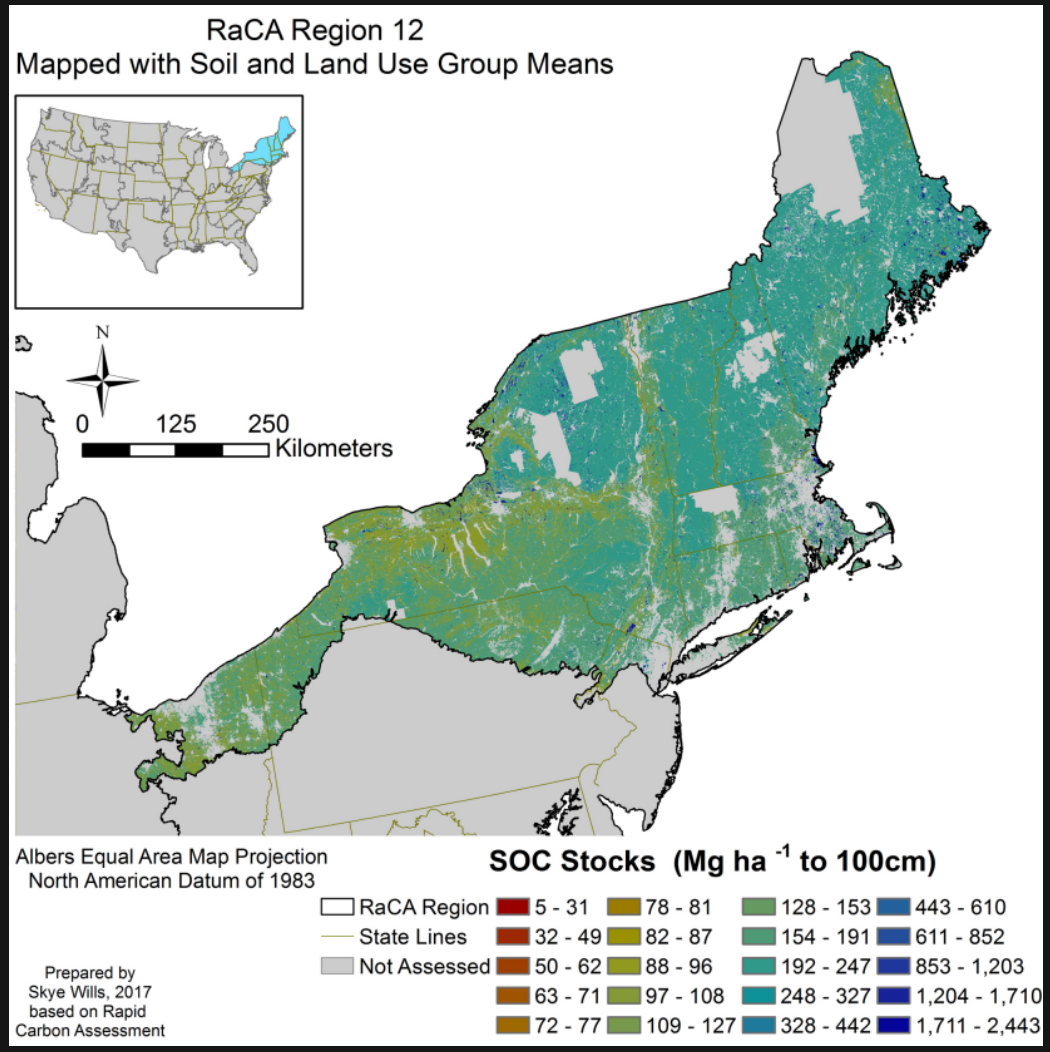
Rapid Soi Carbon Assessment – RaCA - https://www.nrcs.usda.gov/resources/data-and-reports/rapid-carbon-assessment-raca

Nation-wide assessment in 2010 to collect Soil Organic Carbon (SOC) to 1m depth to improve our soils data for climate studies.

Over 7,000 samples collected in New England, all analyzed at URI.

Data added to Web Soil Survey to create maps of Carbon Pools (see Carbonscpaes.org)

NRCS carbon programs.



NEWS | 09 January 2018

Climate scientists unlock secrets of 'blue carbon'

Results from soil survey could bolster efforts to monitor and protect wetlands around the globe.

Jeff Tollefson

Tidal wetlands such as this marsh in Oregon can store large amounts of carbon. Credit: WestWindGraphics/Getty

That's the surprising message from a new analysis of some 1,900 soil cores collected around the United States during the past few decades. "In terms of carbon stocks, all tidal wetlands are very, very similar," says Lisamarie Windham-Myers, an ecologist with the US Geological Survey (USGS) in Menlo Park, California, who is leading a 3-year, US$1.5-million assessment of coastal carbon funded by NASA. "The variability that everybody expected just doesn't exist."

Estimates from a century's worth of soil surveys by the US Department of Agriculture (USDA) showed more variation, but those figures were based on data collected by people who were often thinking more about agriculture on land. In the Mississippi delta, for instance, many early measurements were limited to surface sediments that are rich in carbon, and estimates of the soil density below the surface may have been too high. As a result, Windham-Myers says, the USDA overestimated carbon stocks in the region.

My Final Plea for CBC assessment

Turenne, Jim - NRCS, Warwick, RI

To Lindbo, David - NRCS, Washington, DC; Hoover, Dave - NRCS, Lincoln, NE; 'ton
Al Averill - United States Department of Agriculture (al.averill@ma.usda.gov); Shav

You forwarded this message on 3/5/2018 9:19 AM.

Hi Folks, I know I sound like a broken record so this will be my last call for action!

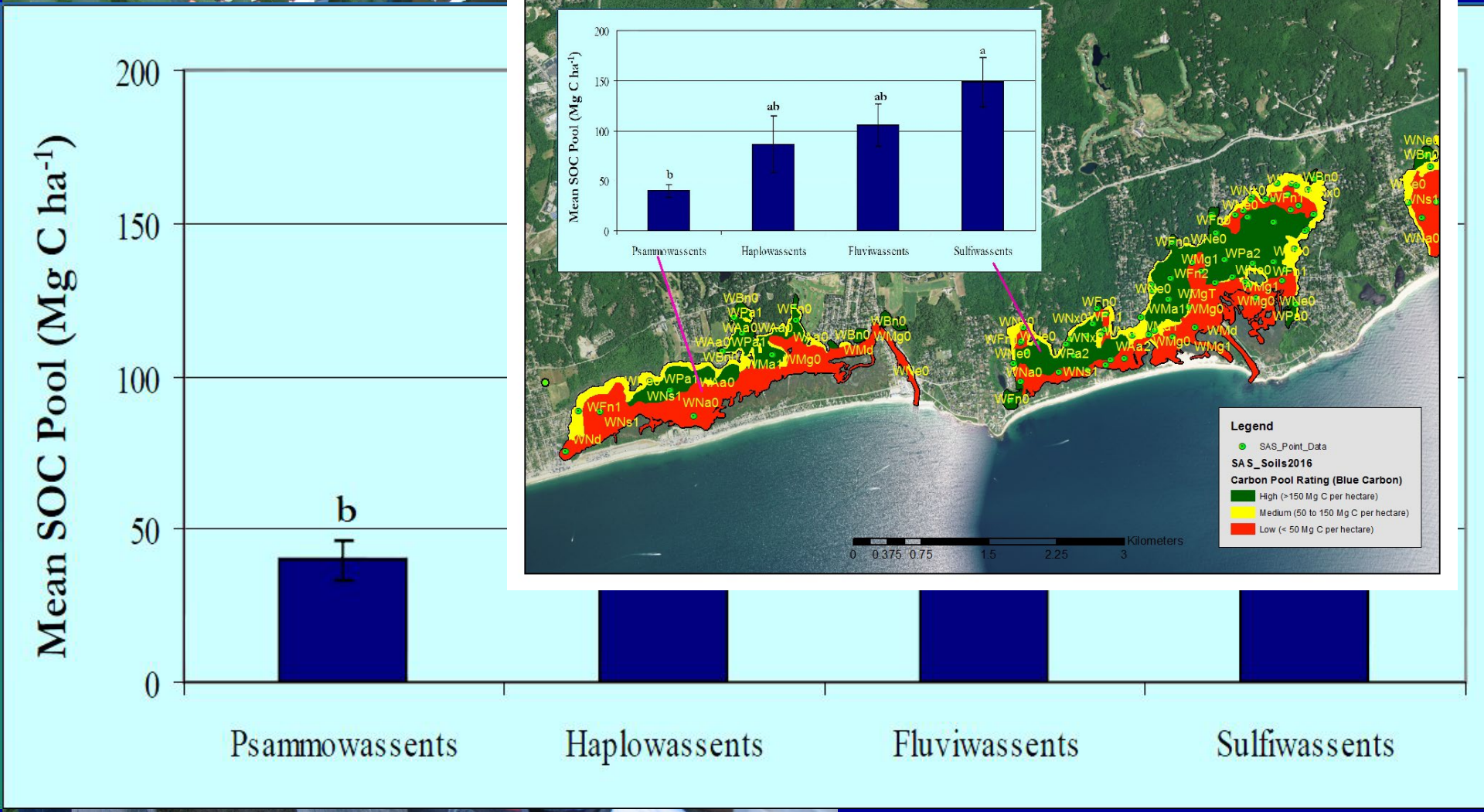
Quick background: Coastal blue carbon (CBC) is pretty much the top story in the scie
deficiencies using SSURGO for carbon pool estimates (first shot across our bow), the

National·Coastal·Blue·Carbon·Assessment·Project¶

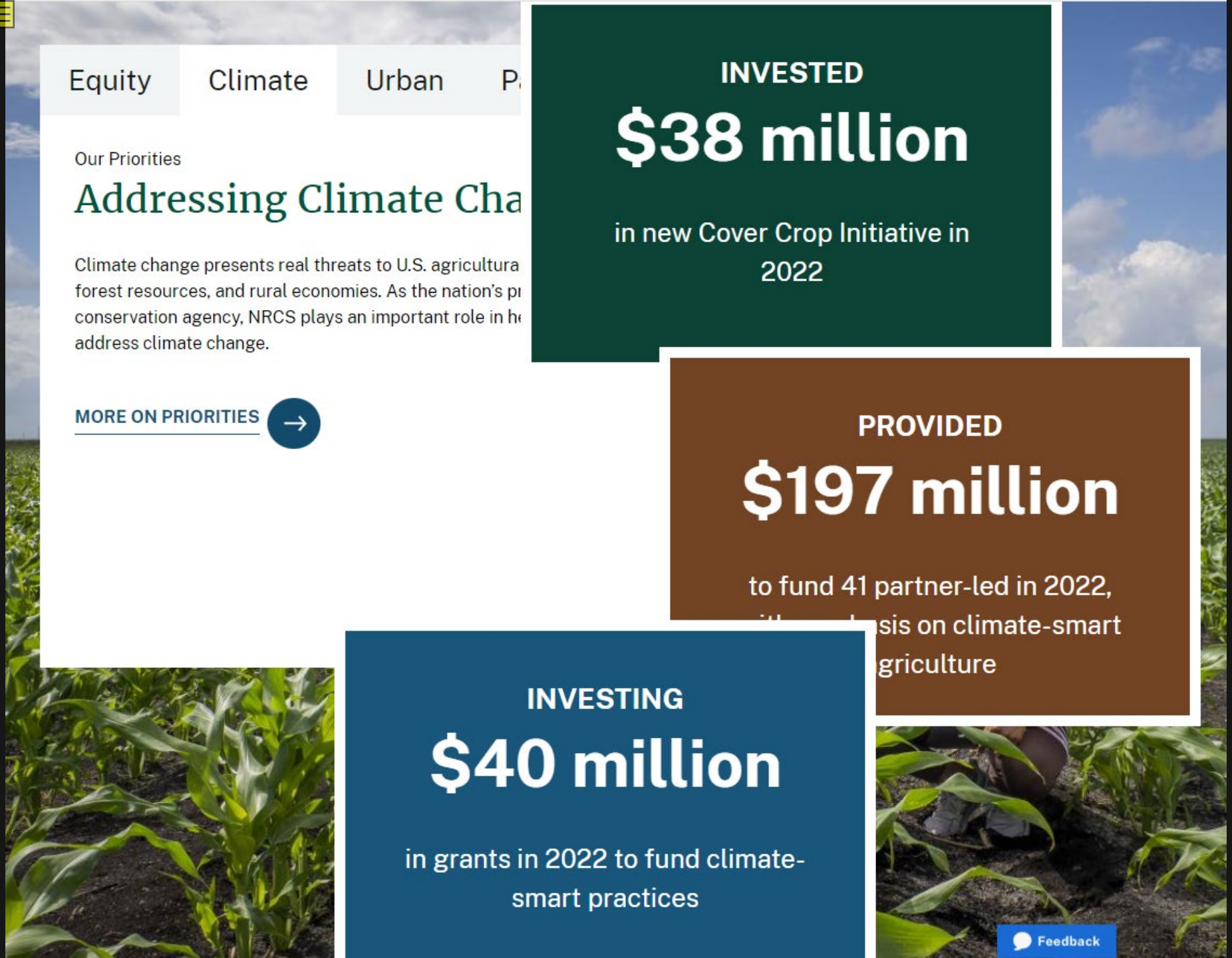
USDA NRCS
United States Department of Agricult
Natural Resources Conservation Service

The·National·Coastal·Blue·Carbon·Assessment·(NCBCA)·is·a·nationwide·effort·by·the·United·States·Department·of·Agriculture,·Natural·Resources·Conservation·Service·(USDA·NRCS),·Soil·Science·Division·(SSD),·to·inventory·blue·carbon·soil·stocks·in·coastal·ecosystems·with·a·focus·on·mangroves,·coastal·tidal·marshes·and·seagrass·meadows.·These·habitats·store·large·amounts·of·carbon,·called·blue·carbon,·within·the·soil.··¶

https://umd.zoom.us/rec/share/g2BNur-TKmNPO8IFQgr4r0_POljVjjzolRhUjFGv665PFerF39jilt0UXuuyoVqU.ItBLi_MMn_DV2HJv


Mean SOC Pool (Mg C ha-1)
200
150
100
50
0
b
Psammowassents
Haplowassents
Fluviwassents
Sulfiwassents

Soil Coastal Blue Carbon Pool Rating
Mean SOC Pool (Mg C ha-1)
200
150
100
50
0
b
ab
ab
a
Psammowassents
Haplowassents
Fluviwassents
Sulfiwassents
Legend
SAS_Point_Data
SAS_Soils2016
Carbon Pool Rating (Blue Carbon)
High (>150 Mg C per hectare)
Medium (50 to 150 Mg C per hectare)
Low (< 50 Mg C per hectare)
Kilometers
0 0.375 0.75 1.5 2.25 3


Equity
Climate
Urban
P
Our Priorities
Addressing Climate Cha
Climate change presents real threats to U.S. agricultura
forest resources, and rural economies. As the nation's pr
conservation agency, NRCS plays an important role in h
address climate change.
MORE ON PRIORITIES
INVESTED
$38 million
in new Cover Crop Initiative in 2022
PROVIDED
$197 million
to fund 41 partner-led in 2022,
sis on climate-smart
griculture
INVESTING
$40 million
in grants in 2022 to fund climate-smart practices
Feedback

QUESTIONS?