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Soils Intro

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Take an apple

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Have it represent the Earth

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Cut out and save …

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¼ of the apple

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This much represents land area.

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Now cut that slice in half, and keep one piece.

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This much represents where people live.

Cut that piece in quarters and keep one ¼. This represents the amount of soil where food can be grown.

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This is 3% (1/32) of the Earth's surface.

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We Study Soil Because It's A(n)

Great integrator

Snapshot of geologic, climatic, biological, and human history

Waste decomposer

Source material for construction, medicine, art, etc.

Filter of water and wastes

Essential natural resource

Home to organisms

Medium for plant growth

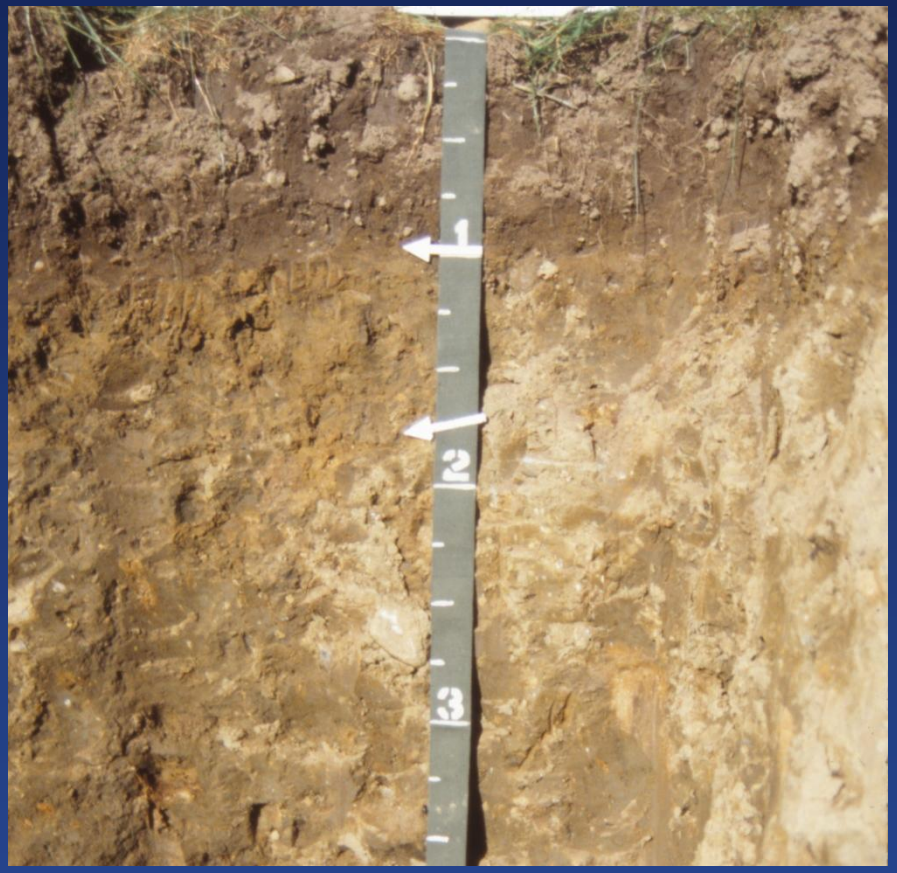
Producer and absorber of gases

Medium of crop production

Five Soil Forming Factors

Topography

Biota



Parent Material

Climate

(The first four factors over) Time

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Glacial Till Parent Material

Sutton Series

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Glaciofluvial Parent Material

Manchester Series

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Alluvium Parent Material

Hadley Series

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Glaciolacustrine Parent Material

Scitico Series

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Organic Parent Material

Natchaug Series

Disturbed Parent Material

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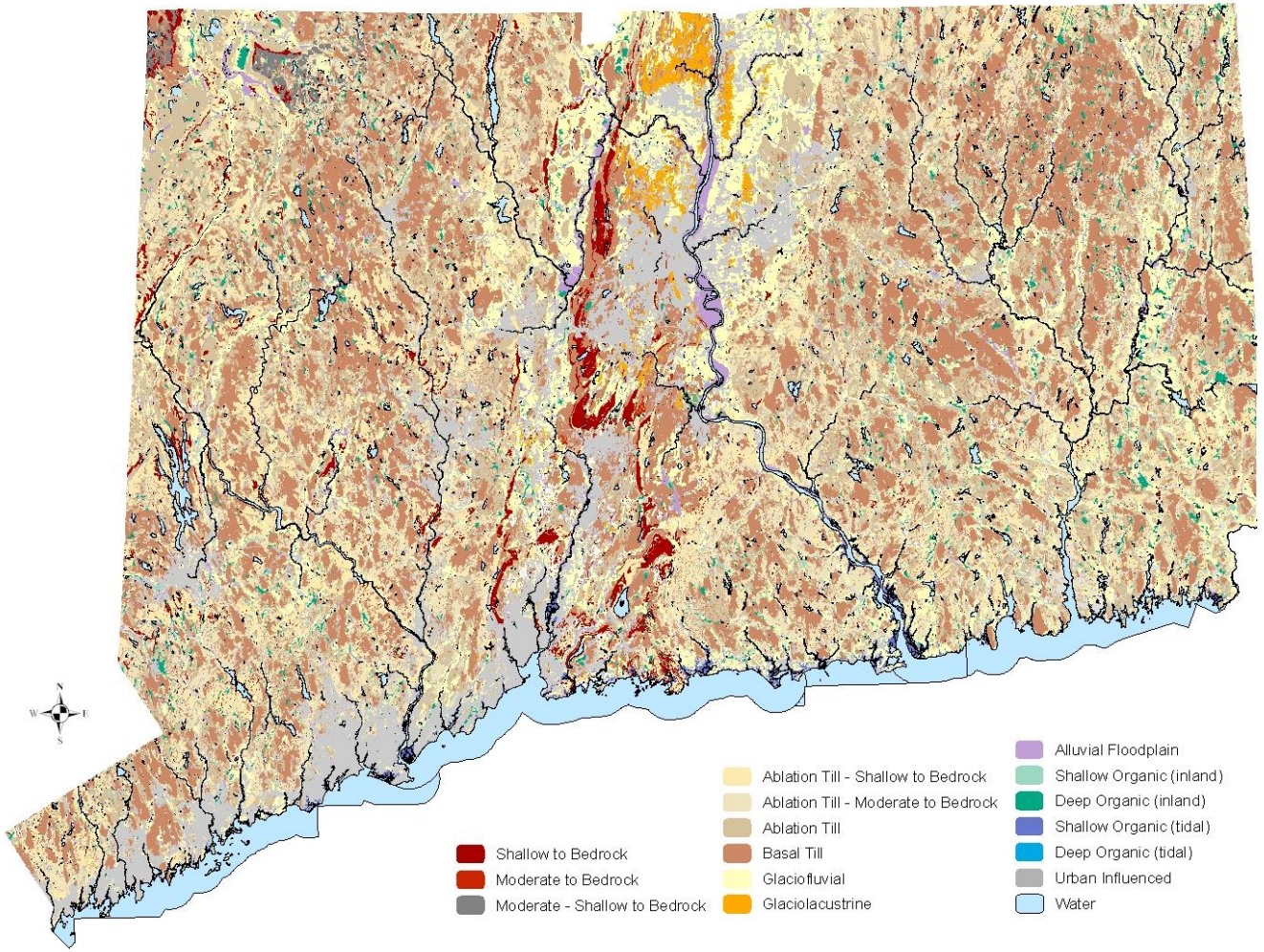
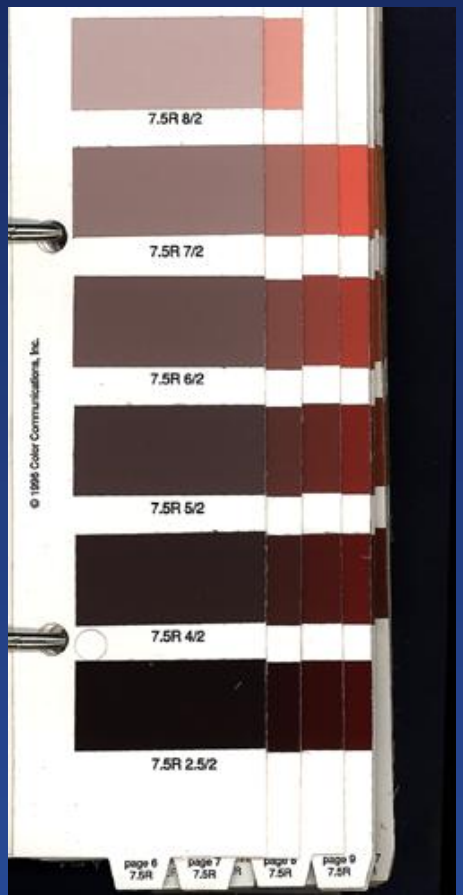
Soil Parent Material

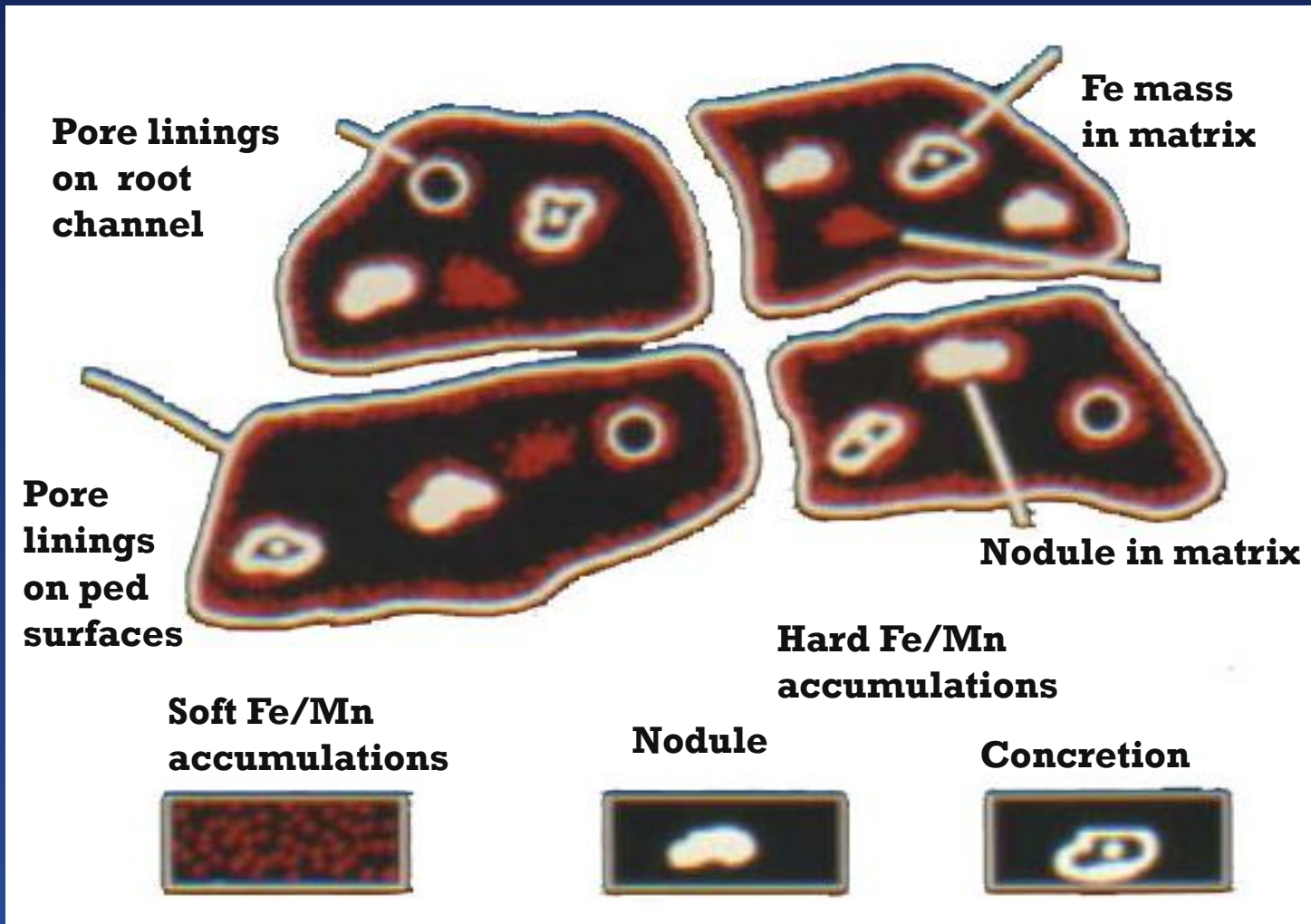


Soil Color



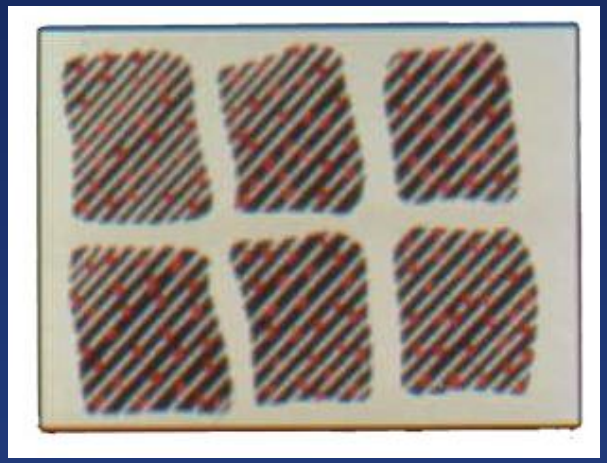
Munsell Notation

Redox Concentrations

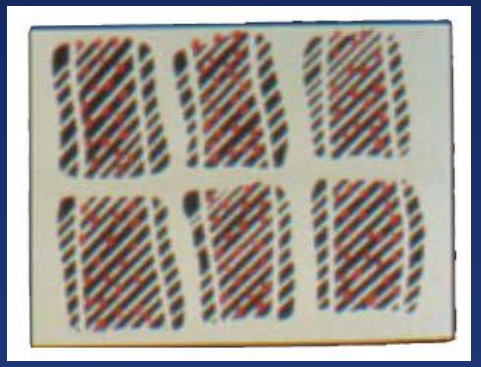


Redox Depletions

No redox depletions
.

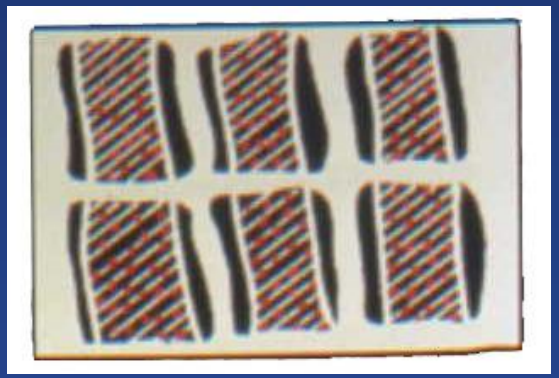


Iron depletions along ped surfaces.



Iron in matrix

Clay in matrix



Clay depletions along ped surfaces.

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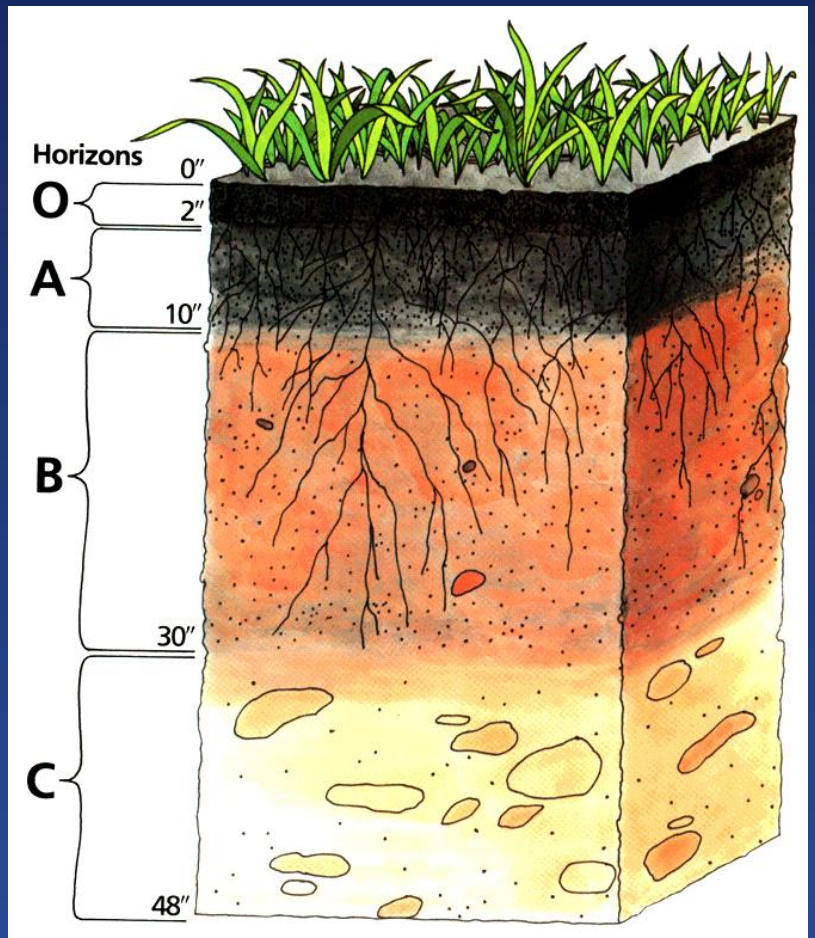
Soil Profile



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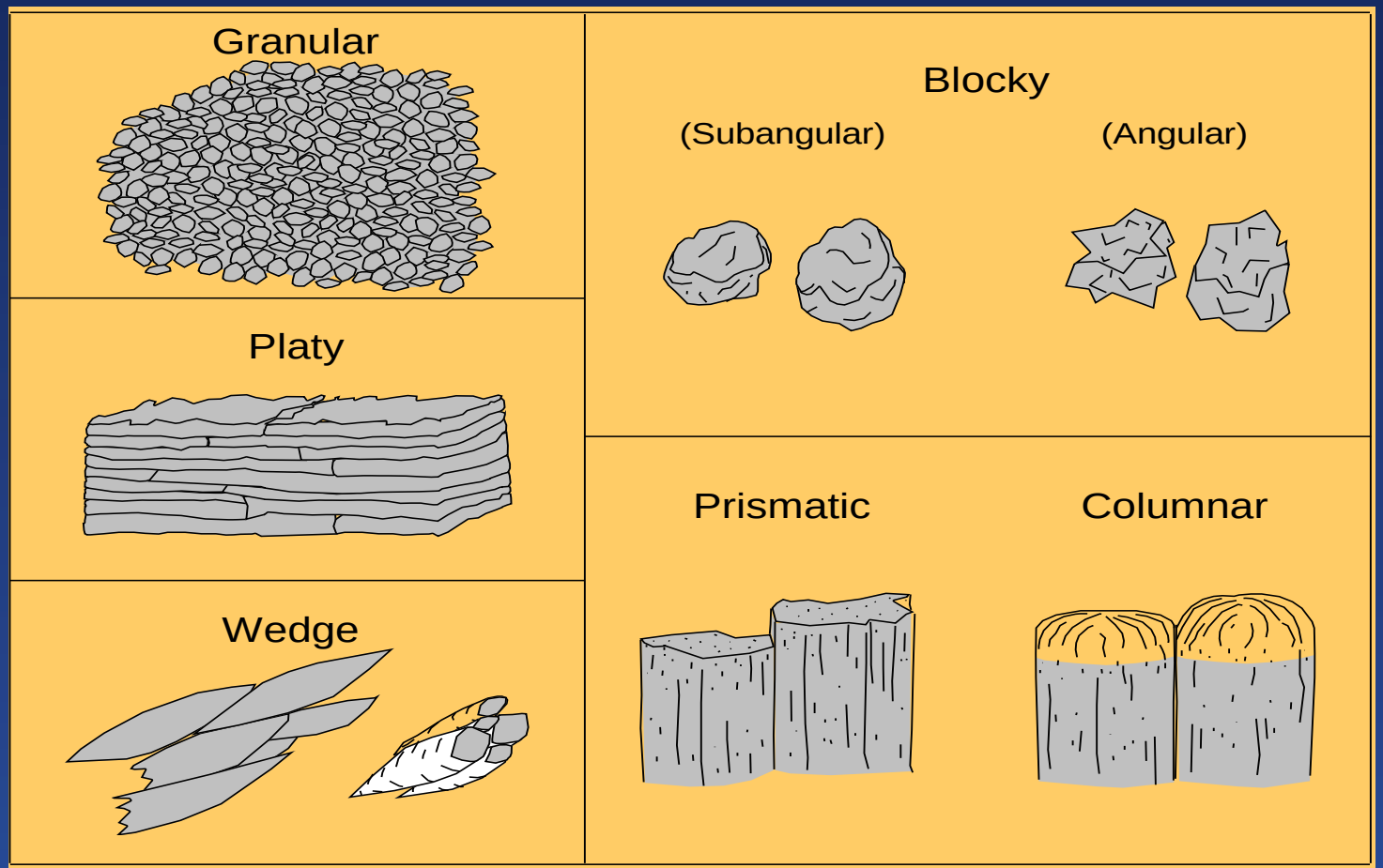
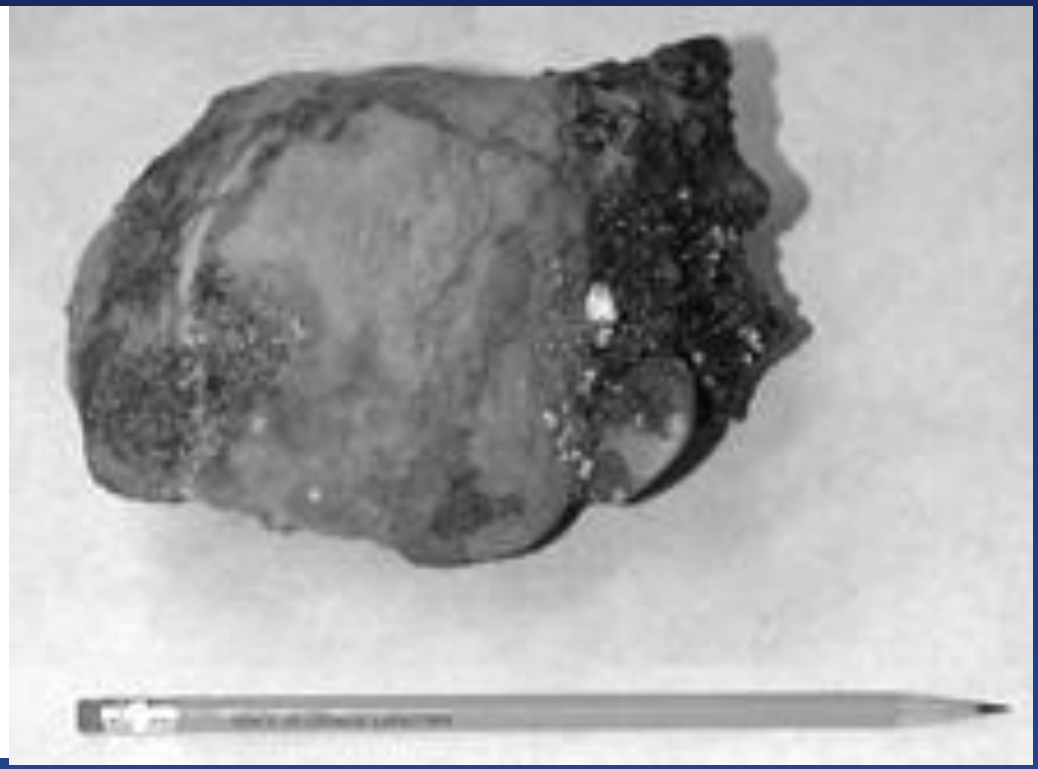
Soil Structure - with structure



Soil Structure - structureless

Single Grain



Massive

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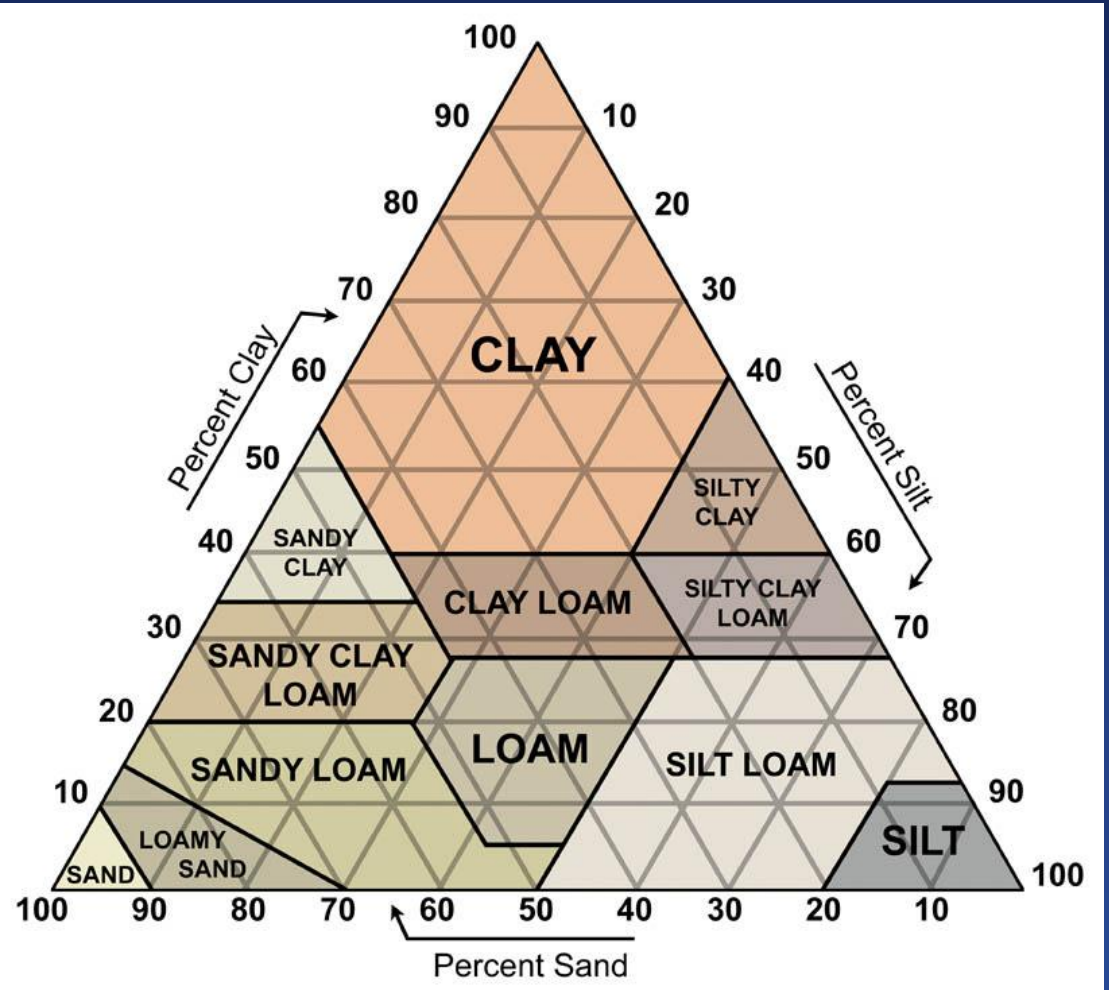
USDA Textural Triangle



Summit

Lower Sideslope

Footslope

Toeslope

Landscape Factors

- Depth to bedrock
- Depth to water table
- Flooding vs. ponding vs. high water table
- Human influence
- Distribution and extent

Soil Catenas of Connecticut

DEPOSIT	LITHOLOGY	TEXTURE GROUP	DRAINAGE CLASS: EXCESSIVELY	SOMEWHAT EXCESSIVELY	WELL	MODERATELY WELL	SOMEWHAT POORLY	POORLY	VERY POORLY
GLACIAL TILL Unstratified Sand, Silt & Rock	GRANITE & SCHIST	SANDY		GLOUCESTER					
	SCHIST, GRANITE & GNEISS	LOAMY		* WESTMINSTER #	** MILLSITE #				
				* HOLLIS [20]	** CHATFIELD				
					CHARLTON	SUTTON [1]		LEICESTER	
					CANTON				
					BICE #	SCHROON #			LOONMEADOW #
					+ PAXTON + MONTAUK	+ WOODBRIDGE		+ RIDGEBURY	+ WHITMAN
					+ SHELBURNE #	+ ASHFIELD #			
	MIXED LIMESTONE & CRYSTALLINE ROCKS				FARMINGTON				
					PYRITIES #	+ HOGANSBURG #		MUDGEPOND [18, 20]	ALDEN [19]
					STOCKBRIDGE	GEORGIA			
					NELLIS [11]	AMENIA			
	RED SANDSTONE, SHALE, CONGLOMERATE & BASALT				* HOLYOKE [29]				
					** YALESVILLE				
					CHESHIRE [24, 29]	WATCHAUG [6]			
					+ WETHERSFIELD	+ LUDLOW		+ WILBRAHAM	+ MENLO
	BROWN MICACEOUS SCHIST			* BRIMFIELD	BROOKFIELD				
	PHYLLITE, SCHIST & SLATE			* TACONIC #	** MACOMBER #				
					+ BERNARDSTON				
					+ LANESBORO #	+ FULLAM #		+ BRAYTON #	
					DUMMERSTON #				
	SHALE, SANDSTONE, BASALT & CRYSTALLINE ROCKS	SILTY / SANDY			+ BROADBROOK [24]	+ RAINBOW			
					NARRAGANSETT	WAPPING			
GLACIOFLUVIAL Stratified Sand & Gravel	ACIDIC CRYSTALLINE ROCKS	SANDY & GRAVELLY	HINCKLEY [17]	MERRIMAC		SUDBURY		WALPOLE [3]	
			BOSCAWEN #					MOOSILAUKE #	
		SANDY	WINDSOR			DEERFIELD			SCARBORO [15, 32]
		LOAMY / SAND & GRAVEL			AGAWAM	NINIGRET			
		SILTY / SAND & GRAVEL			ENFIELD [16]	TISBURY		RAYPOL	
					HAVEN				
					BRANFORD	ELLINGTON			
	ACIDIC, RED SANDSTONE, SHALE, CONGLOMERATE	SANDY & GRAVELLY	MANCHESTER	HARTFORD					
		SANDY	PENWOOD						
	MIXED LIMESTONE & CRYSTALLINE ROCKS	SANDY & GRAVELLY	GROTON						
		LOAMY / SAND & GRAVEL			COPAKE	HERO		FREDON	HALSEY [7]
GLACIOLACUSTRINE Stratified Sand Silt & Clay	MIXED CRYSTALLINE & SEDIMENTARY ROCKS	SILTY				BELGRADE [27]		RAYNHAM [31]	
		LOAMY / CLAYEY				ELMRIDGE [13, 21]		SHAKER [30]	
		SILTY & CLAYEY				BRANCROFT [9]		SCITICO [26]	MAYBID [5, 33]
						BERLIN			
ALLUVIAL Stratified Sand & Silt	GNEISS, SCHIST, GRANITE & QUARTZITE	SANDY	SUNCOOK						
		LOAMY			ONDAWA #	POOTATUCK [23]		RUMNEY #	
		SILTY			OCCUM [4]			RIPPOWAM	
	MIXED CRYSTALLINE & SEDIMENTARY ROCKS				HADLEY [14]	WINOOSKI [12]	BASH [8, 25]	LIMERICK LIM	MEDOMAK # SACO

ORGANIC Peat & Muck	WETLAND TYPE	FIBERS	THICKNESS	SUBSTRATE	SOIL SERIES
	FRESH (INLAND)	FEW	>51"	VARIABLE	CATDEN [10]
					FREETOWN
					BUCKSPORT #
			16-51"	LOAMY	NATCHAUG [22]
			16-51"	LOAMY	WONSQUEAK #
				SANDY	TIMAKWA [2]
	SALT & BRACKISH (TIDAL)	COMMON		SANDY	PAWCATUCK
				VARIABLE	WESTBROOK
			>51"		IPSWICH

\+ Indicates soils underlain by compact till.
* Indicates shallow soils less than 20 inches to bedrock.
** Indicates moderately deep soils 20 to 40 inches to bedrock.
\# Indicates soils with mean annual soil temperature less than 8°C (>1,300 feet in Litchfield County).

SOIL SERIES NO LONGER USED IN CONNECTICUT

1. Acton
2. Adrian
3. Au Gres
4. Bermudian
5. Biddeford
6. Birchwood
7. Birdsall
8. Bowmansville
9. Buxton
10. Carlisle
11. Dover
12. Eel
13. Elmwood
14. Genesse
15. Granby
16. Hartland
17. Jaffrey
18. Kendaia
19. Lyons
20. Massena
21. Melrose
22. Palms
23. Podunk
24. Poquonock
25. Rowland
26. Scantic
27. Scio
28. Shapleigh
29. Sunderland
30. Swanton
31. Wallington
32. Wareham
33. Whately

Connecticut Department of Environmental Protection and USDA, Natural Resources Conservation Service

August 2003

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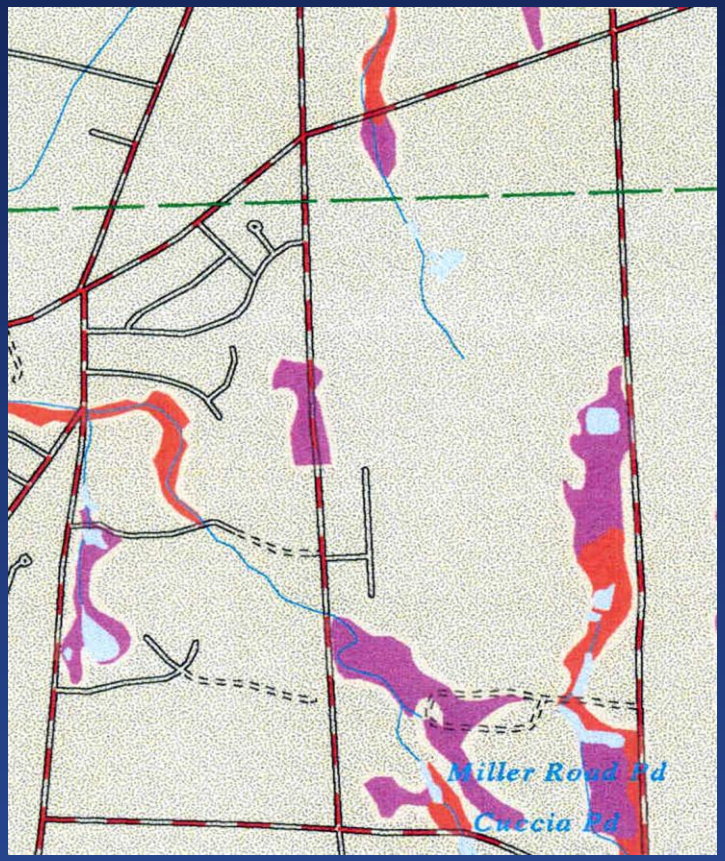
Soil Classification

Why Classify Soils?

- Create meaningful classes based on common properties or behavior
- Organize knowledge and simplify decision-making
- Remove unneeded classes from consideration

Technical Soil Classification



Connecticut Wetland Soils

- group soils by properties that relate to a specific use
- group for land-use regulation or law

Scientific Classification

Soil Taxonomy

- Organize knowledge about soil relationships
- Facilitate communications
- Agriculture based system
- Based on soil formation processes (not parent materials)
- group for most important physical, chemical, and biological properties without reference to any specified use

History of Soil Taxonomy in the U.S.

- Russian soil scientist Dokuchaiev, 1883
- C.F. Marbut, USDA, 1927
- Many changes over the years until current system was adopted in 1965 – recognizing soils as natural bodies; based on easily verified chemical, physical, and biological soil properties.

Criteria in Soil Taxonomy

- Chemical, physical, and biological properties (such as moisture, texture, temperaturestructure, pH, soil depth)
- Presence or absence of certain diagnostic horizons (surface and subsurface horizons)

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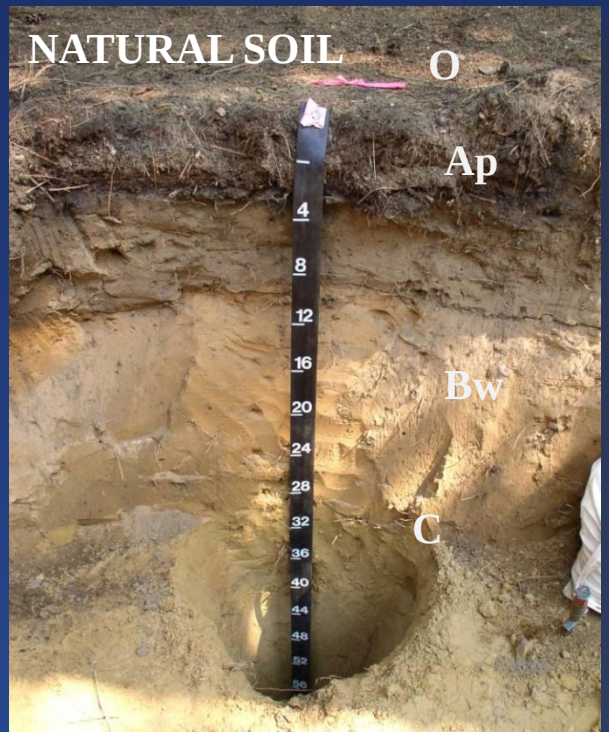
Keys to Soil Taxonomy 10th edition

"u": presence of human-manufactured materials (artifacts). Artifacts are something created or modified by humans usually for a practical purpose.

"^" : indicates mineral or organic layers formed in human transported materials



Soil Taxonomy System

Phylum:	**Order** (12) – Most general, based on soil forming processes
Class:	**Suborders** (68) – Based on similarities in soil formation (climate)
Subclass:	**Great Groups** (>300) – Based on differences between soil horizons (diagnostic horizons)
Order:	**Subgroups** (>2,400) – Profile characteristics
Family:	**Family** (>7,000) – Based on properties that effect management, especially root penetration
Genus:	**Series** (>23,000) – Most specific, based on kind and arrangement of horizons
Species:	**Phase** – Field mapping units (stony, slope), not a category in soil taxonomy

Series - Windsor (state soil)

Mixed, mesic

Family
(Mixed mineralogy,
Mean annual temp 8 –15c)

Typic

Subgroup
(Reflects central concept)

Udipsamments

Great Group
(Humid climate)

SubOrder
(Sandy)

Order
(Entisol)

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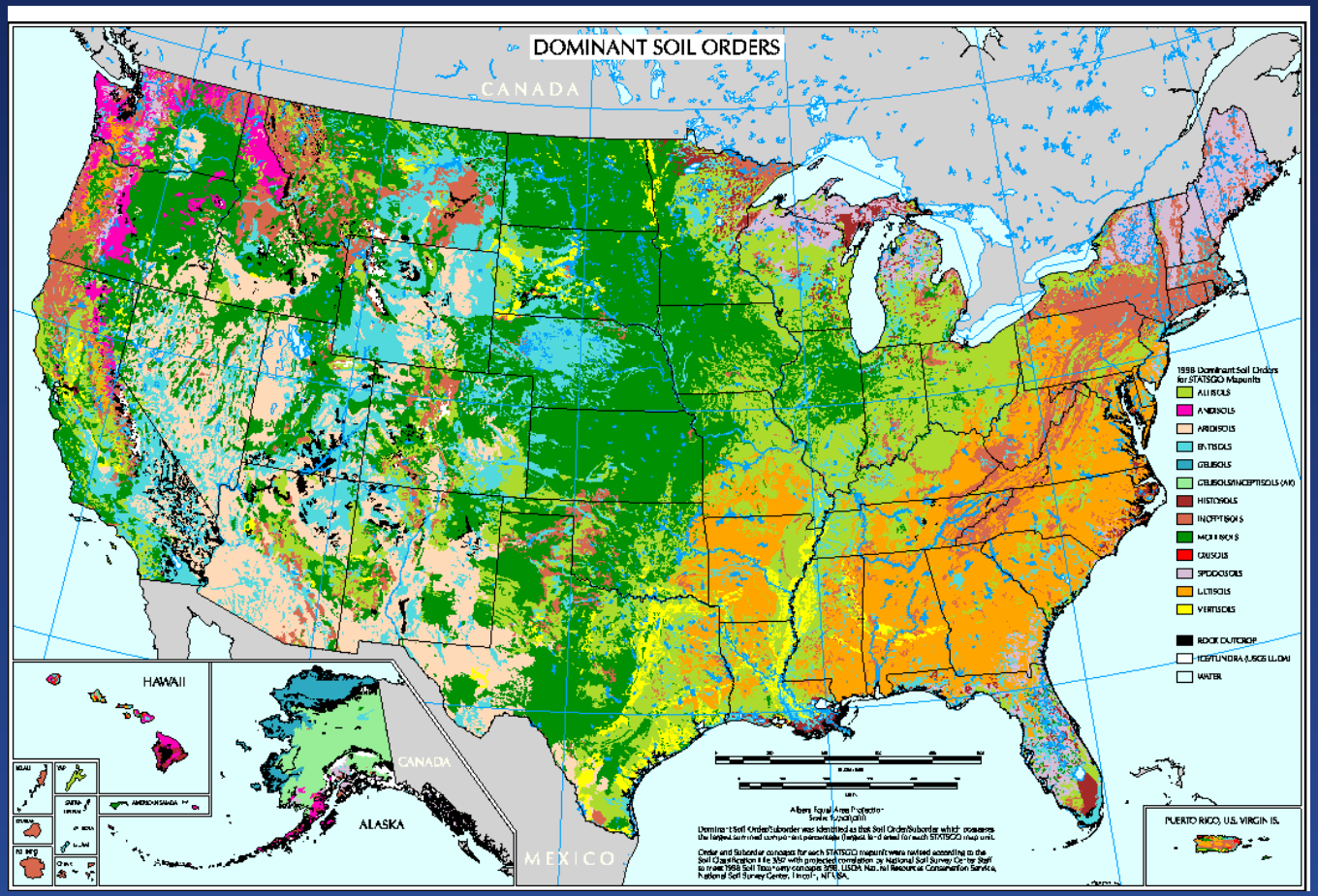
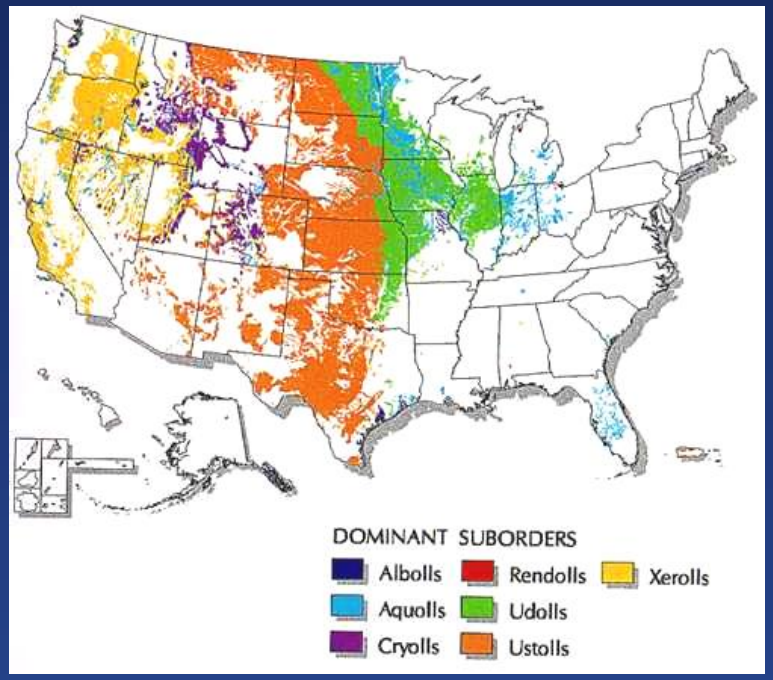
12 Soil Orders

http://soils.usda.gov/technical/classification/orders/

- Entisols
- Inceptisols
- Andisols
- Spodosols
- Mollisols
- Alfisols
- Ultisols
- Oxisols
- Aridisols
- Vertisols
- Histosols
- Gelisols

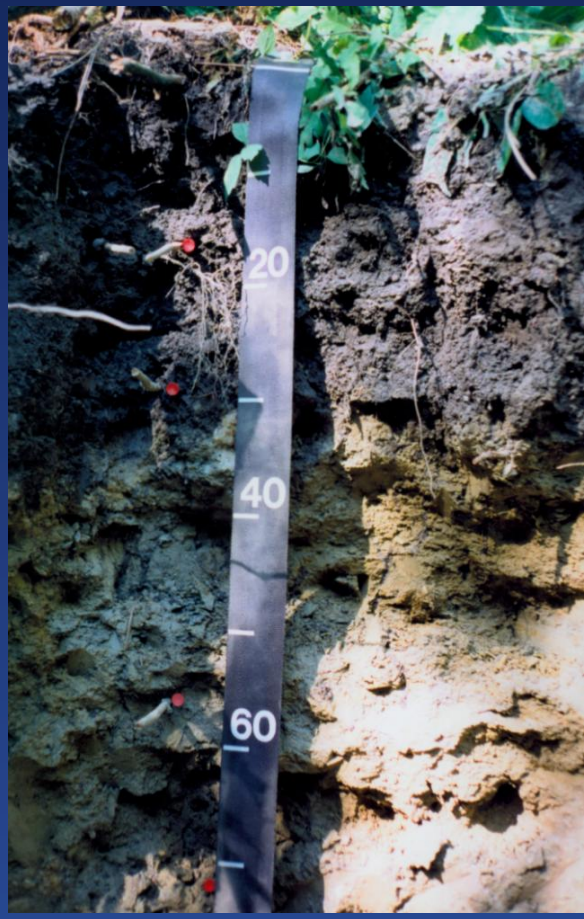


Mollisols

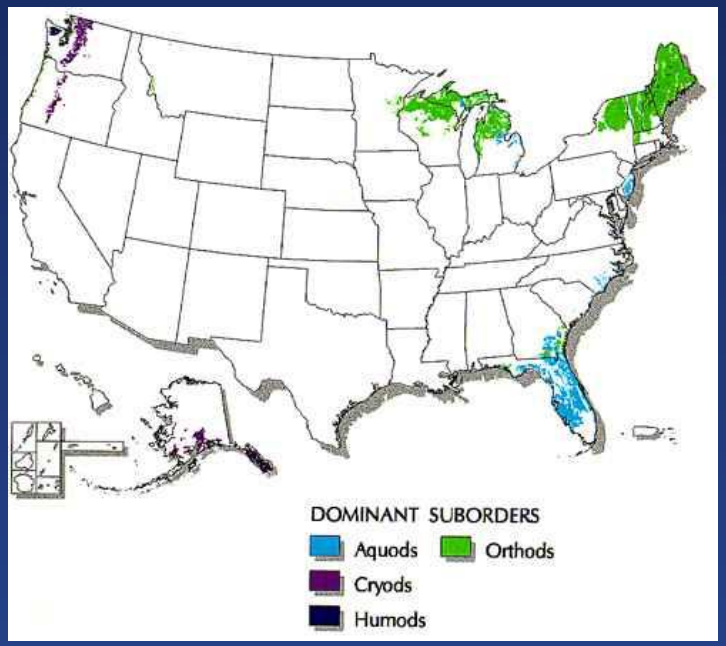


Orders that occur in Connecticut

Fertile soils with dark colored surface horizons high in organic matter. Usually form under grassland. Connecticut has two mapped very poorly drained mollisols. 7% of the world's ice-free land surface.



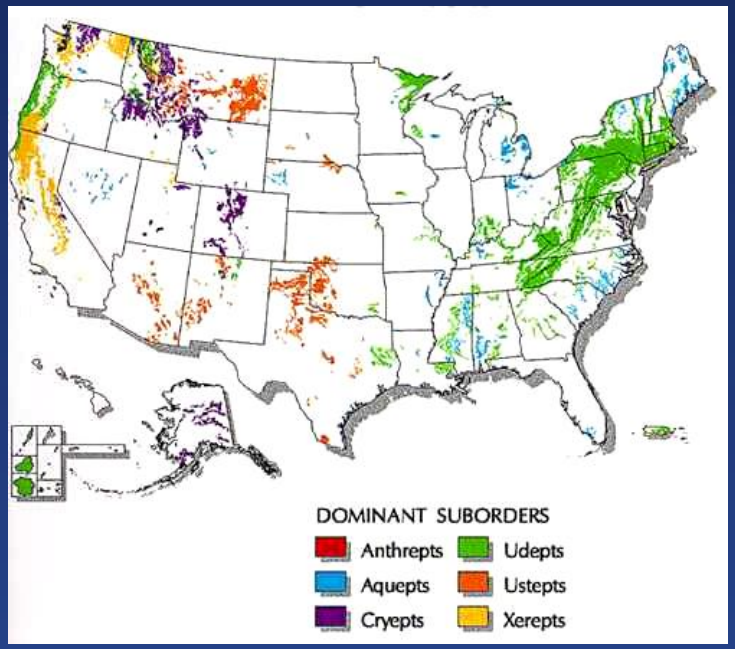
Spodosols



Orders that occur in Connecticut

Soils formed from weathering processes that strip organic matter and aluminum, with or without iron, from the surface layer and deposit them in the subsoil. Spodosols tend to be acidic and unfertile. Rare in CT. 4% of the world's ice-free land surface.

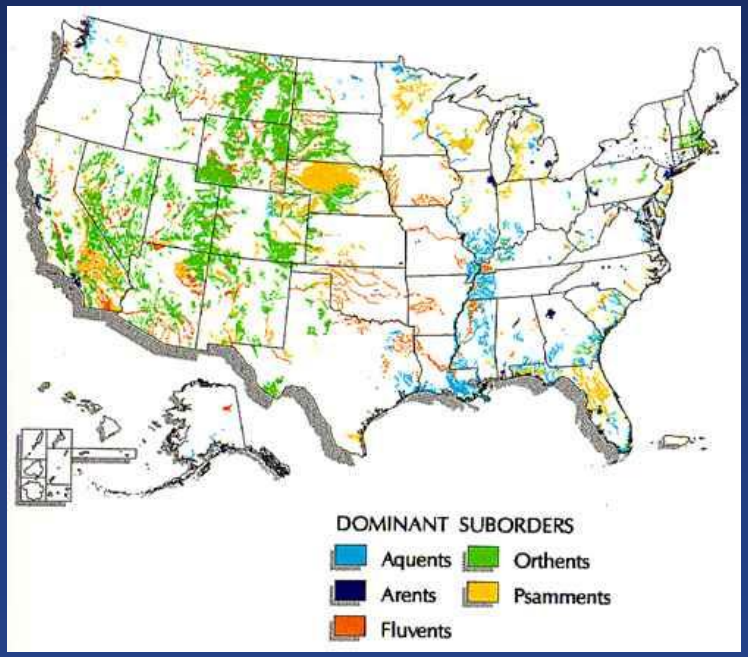
Inceptisols



Orders that occur in Connecticut

Soils of semiarid to humid environments with only moderate degrees of weathering and soil development. The most common soil order in CT. 10% of the world's ice-free land surface.

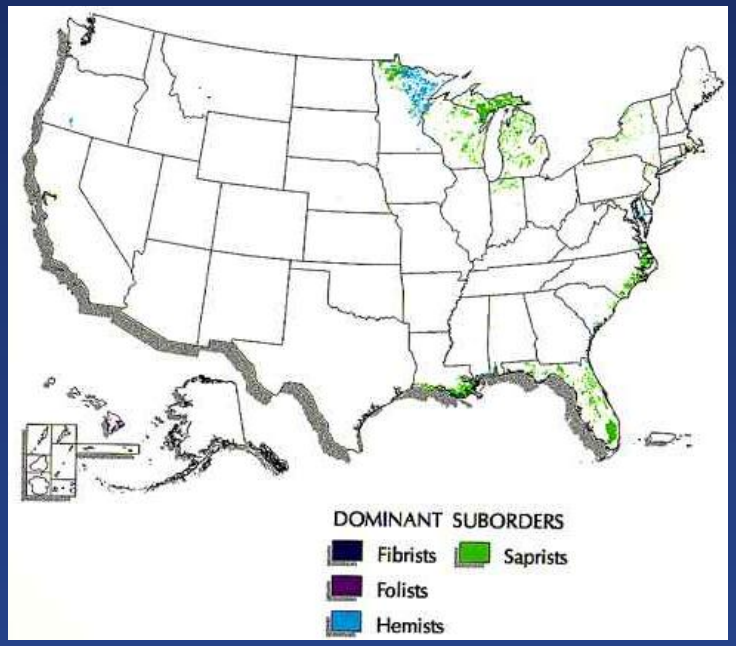
Entisols



Soils with little or no evidence of horizon development. Found on dunes, Floodplains and steep slopes. 16% of the world's ice-free land surface.

Orders that occur in Connecticut

Histosols



Orders that occur in Connecticut

Soils with high organic matter and no permafrost. Most are saturated year round and are found in bogs, swamps, etc. 1% of the world's ice-free land surface.

Aquic Conditions

Identifying the aquic moisture regime requires that soils

1) are saturated
2) are reduced
3) have redoximorphic features
    - *redox concentrations*
    - *redox depletions*

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Soil Saturation

When soils are saturated, soil pores fill with water and anaerobic conditions (lack of free oxygen) exist.

When these conditions exist during the growing season iron, manganese, and sulfur are reduced by soil micro-organisms.

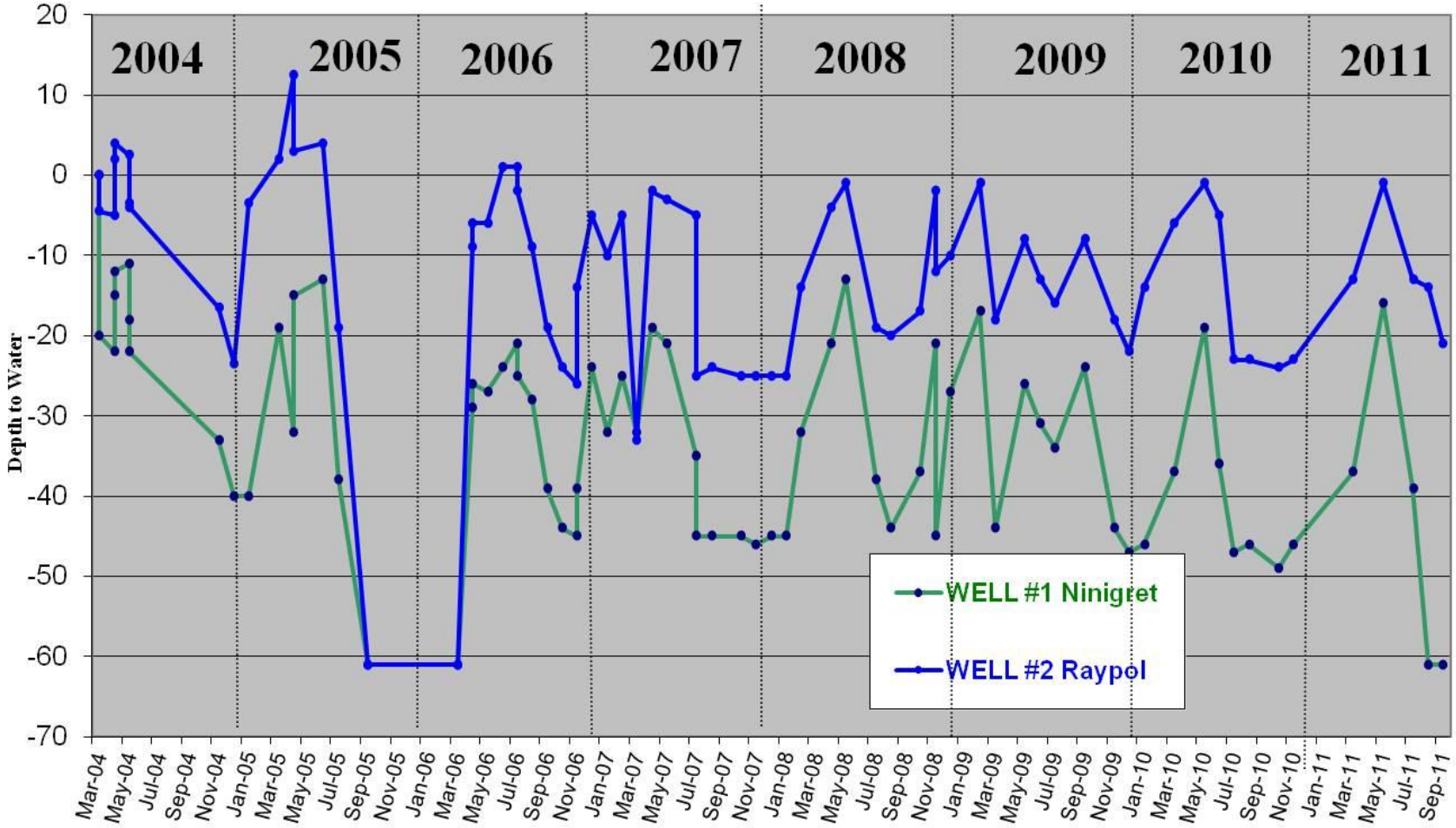
Indicators of Saturation

Low Oxygen → Carbon (muck) accumulation

Iron and Manganese Reduction → Redoximorphic features

Sulfur → Rotten egg odor

TAC Well Data



Aquic Conditions and Soil Drainage Class

- National criteria for aquic classifications in soil taxonomy
- Drainage classes are locally assigned classifications based on conditions
- In Connecticut, soils that have an aquic suborder are considered poorly or very poorly drained

Series - Whitman Fine Sandy Loam

Loamy, mixed, active, acid, mesic, shallow

(Family)

Typic

(Subgroup)

Humaquepts

Order

Suborder

Great Group

Mineral *vs.* Organic Wetland Soils

Some wetland soils are mineral soils, some are organic soils, and some are mineral soils with organic surface layers (histic epipedons).

As a general rule, mineral soil material in Connecticut has less than 12% organic carbon by weight.

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Organic Soils

Organic soil material has more than 12% organic carbon by weight. In Connecticut, if a soil is an organic soil it is also a wetland soil.

Natchaug series
Loamy, mixed, euic, mesic Terric Haplosaprists

Classification of Connecticut Wetland soils

- Most have aquic soil conditions at or near the soil surface (Aquents, Aquepts, etc.)
- Also included are flood plain and alluvial soils of any drainage class (Fluvents, Fluvaquents, etc.)
- All Histosols in Connecticut are wetland soils (Haplosaprists, Sulfihemists, etc.)

Disturbed soils with aquic moisture regimes qualify as CT wetland soils.

Fill over tidal marsh soil

Due to the variability of filled and graded areas, it is difficult to determine without detailed site analyses what fill thickness would remove a particular area from consideration as an inland wetlands under Connecticut law.

However, as a GENERAL RULE OF THUMB, areas with more than two (2) feet of earthy fill placed over wet mineral soils or more than three (3) feet of earthy fill placed over wet organic or tidal marsh soils would be excluded from the wetlands category.

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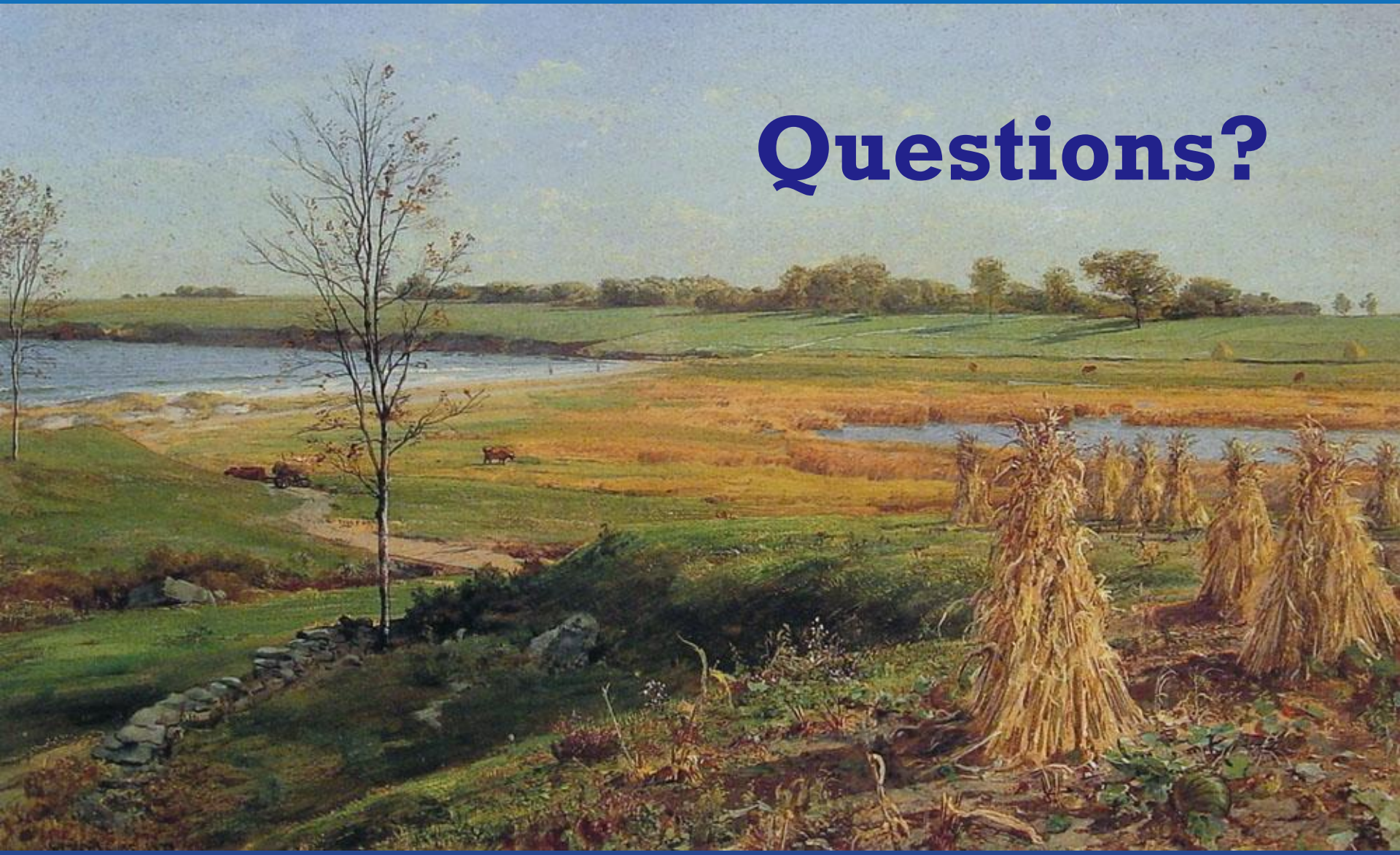
Questions?



Connecticut Shoreline in Autumn (John F. Kensett

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