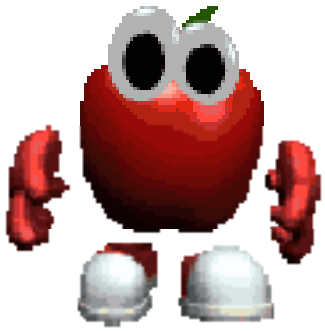
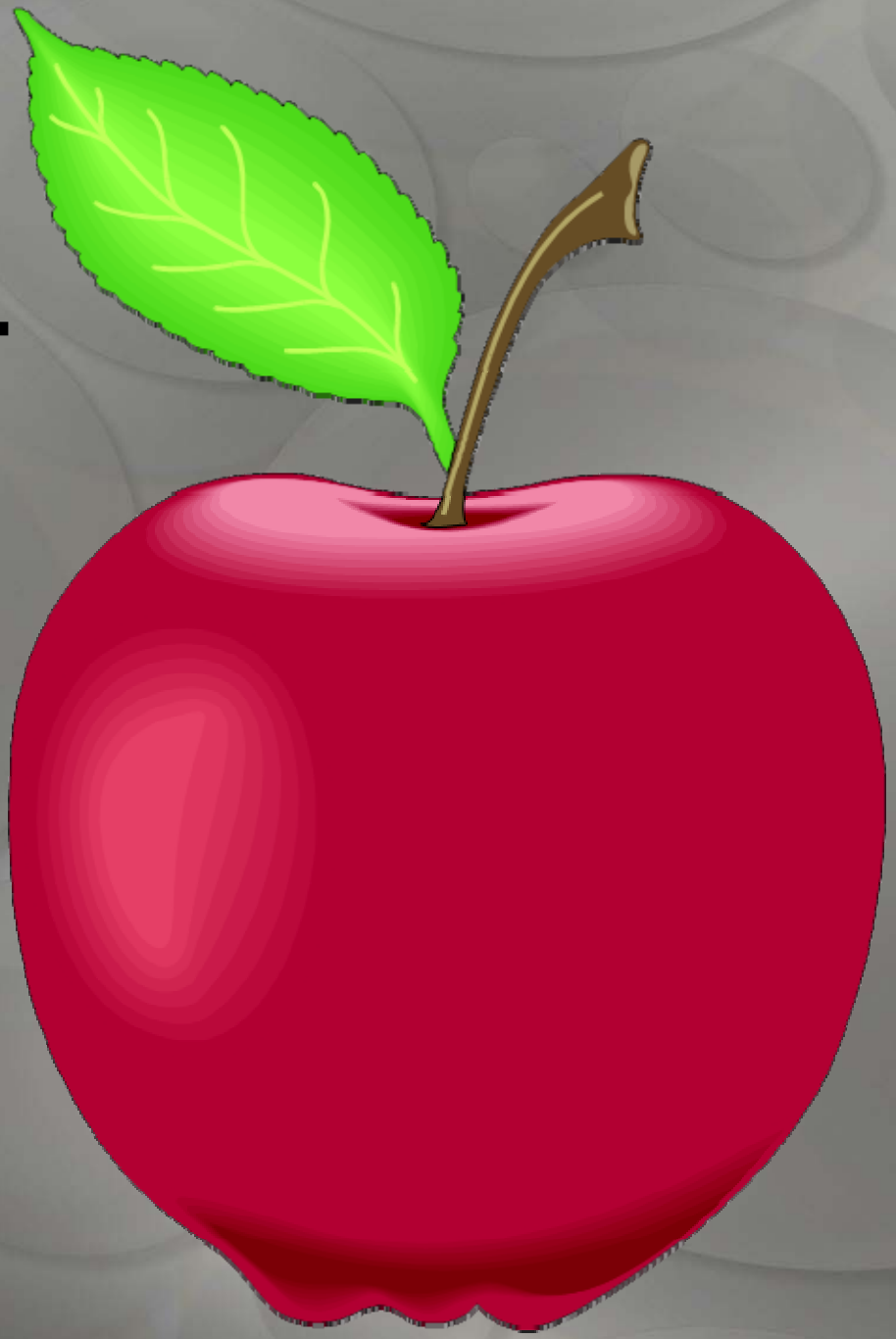
Soils Intro



USDA Natural Resources Conservation Service

Take an apple



Have it represent the Earth

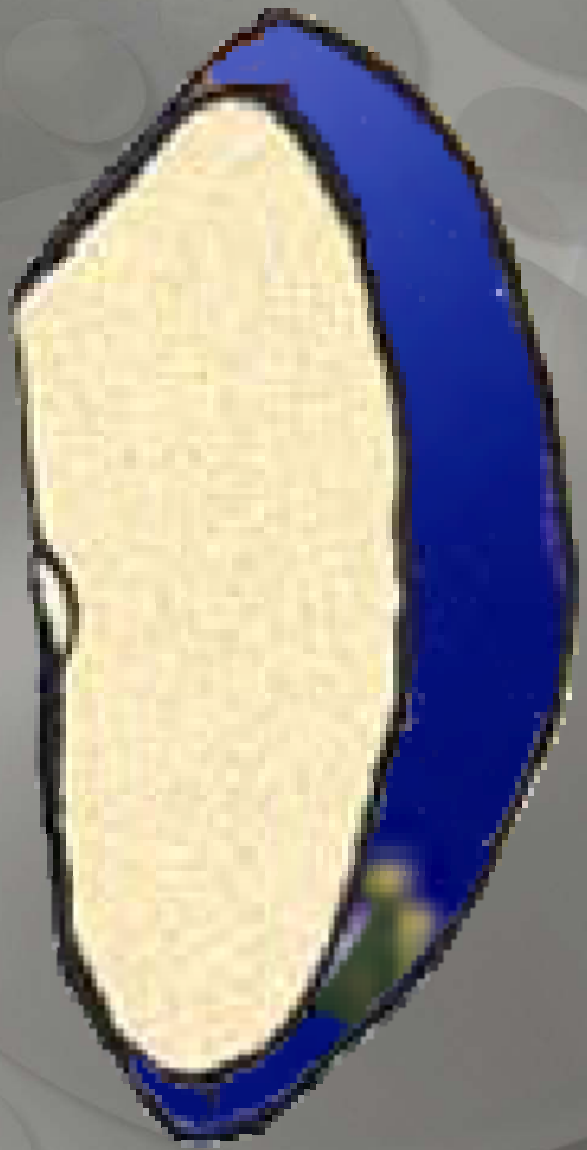
Cut out and save …

¼ of the apple

This much represents land area.

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

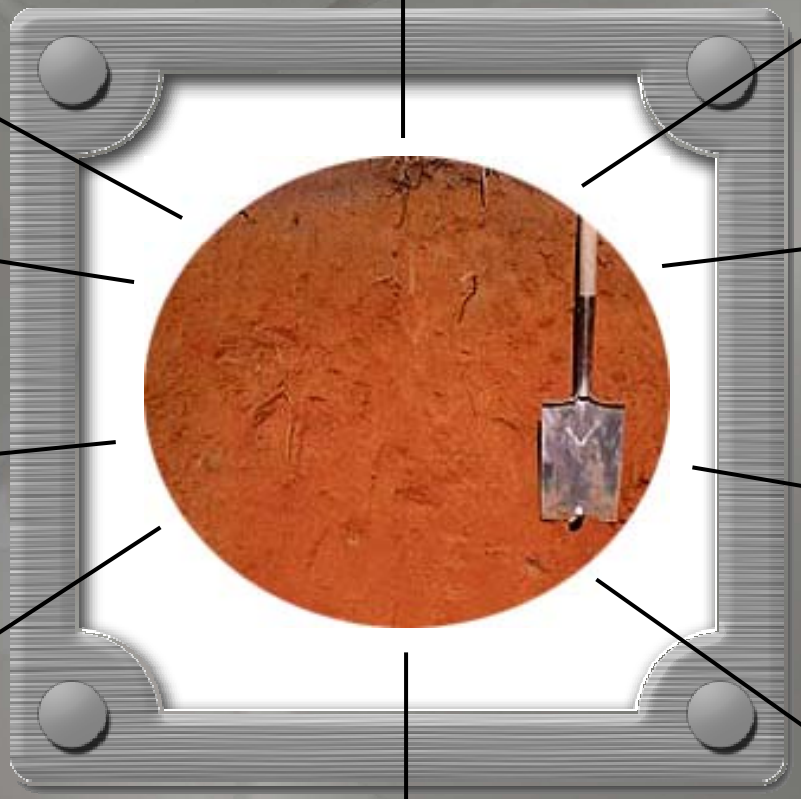
This much represents where people live.



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

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

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 (plants, animals and others)

Medium for plant growth

Producer and absorber of gases

Medium of crop production

Five Soil Forming Factors

Biota

Parent Material

Topography

Climate

(The first four factors over) Time

Glacial Till Parent Material

Sutton Series

Glaciofluvial Parent Material

Manchester Series

Alluvium Parent Material

Hadley Series

Glaciolacustrine Parent Material

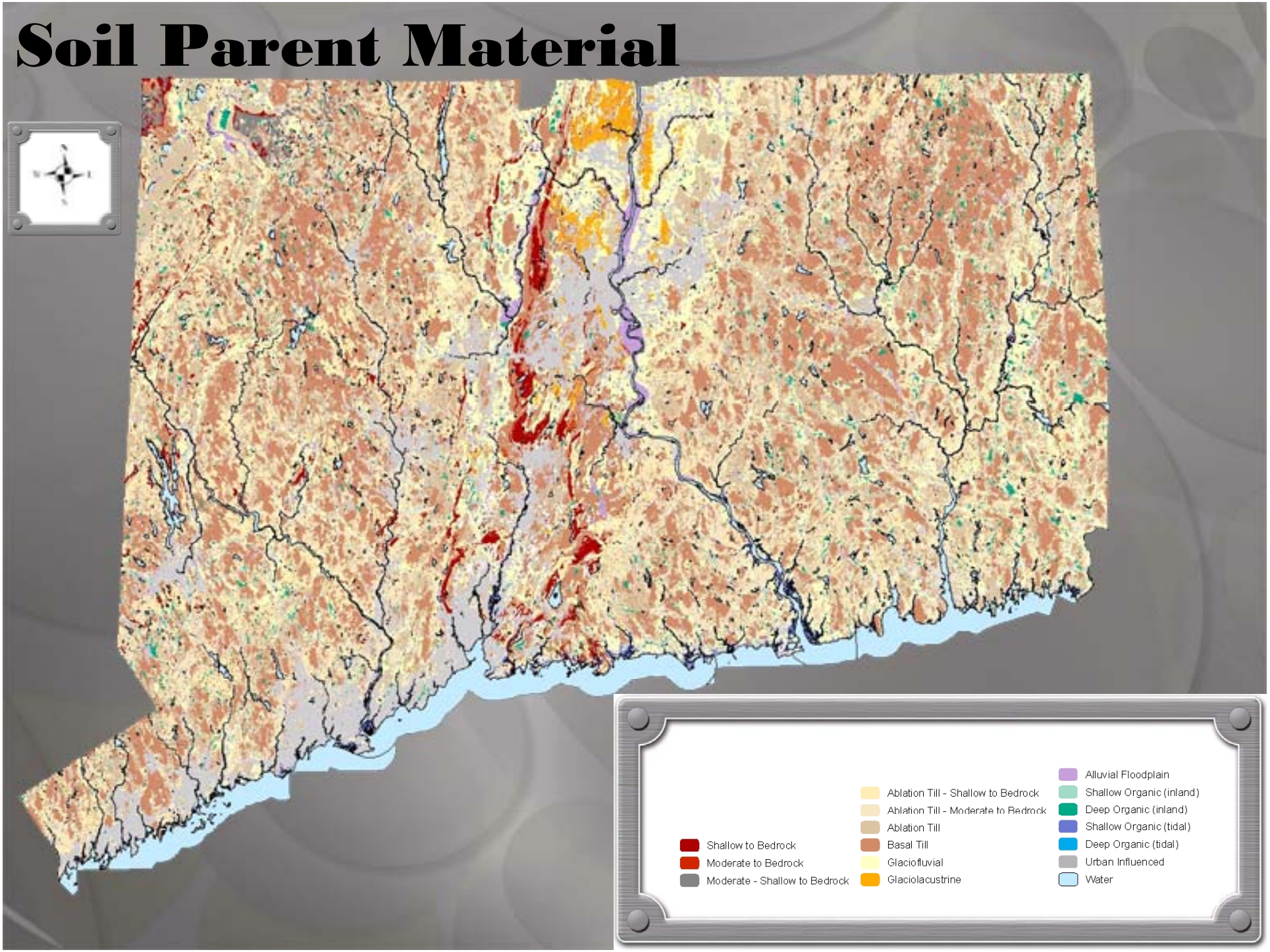
Scitico Series

Organic Parent Material

Natchaug Series

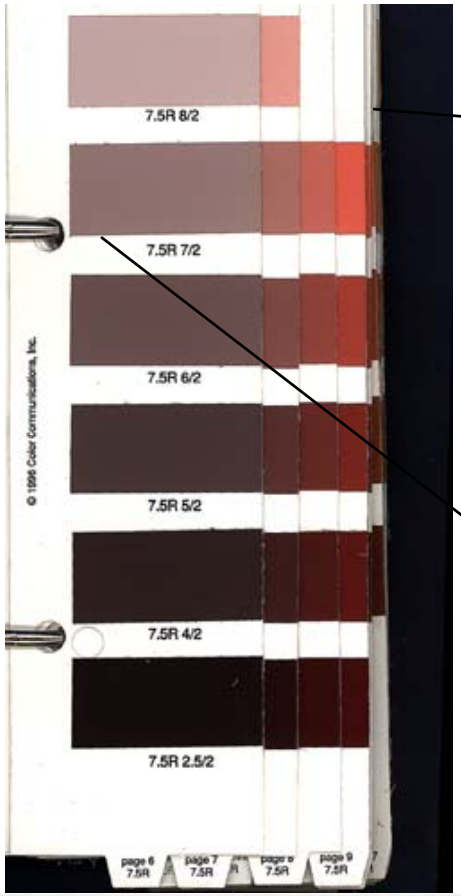
Disturbed Parent Material

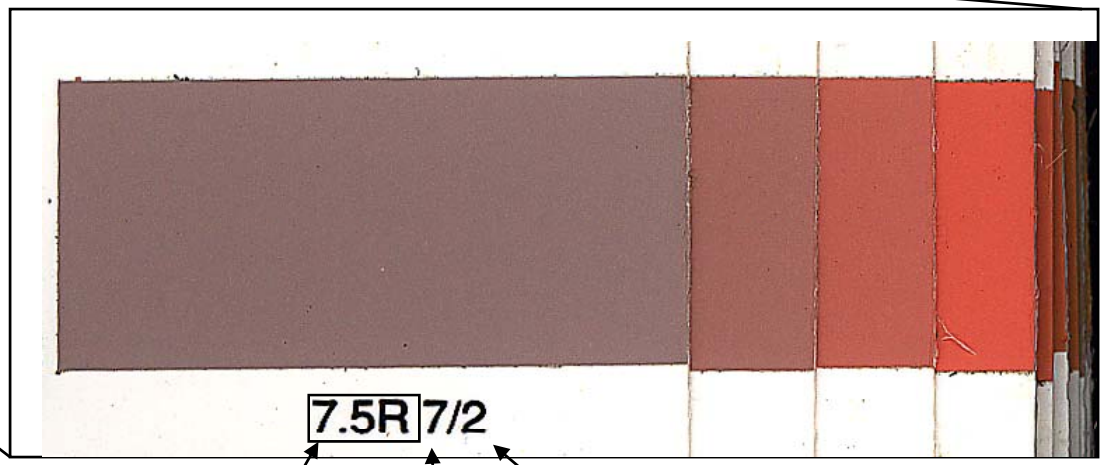
Soil Parent Material



Soil Color

Munsell Notation



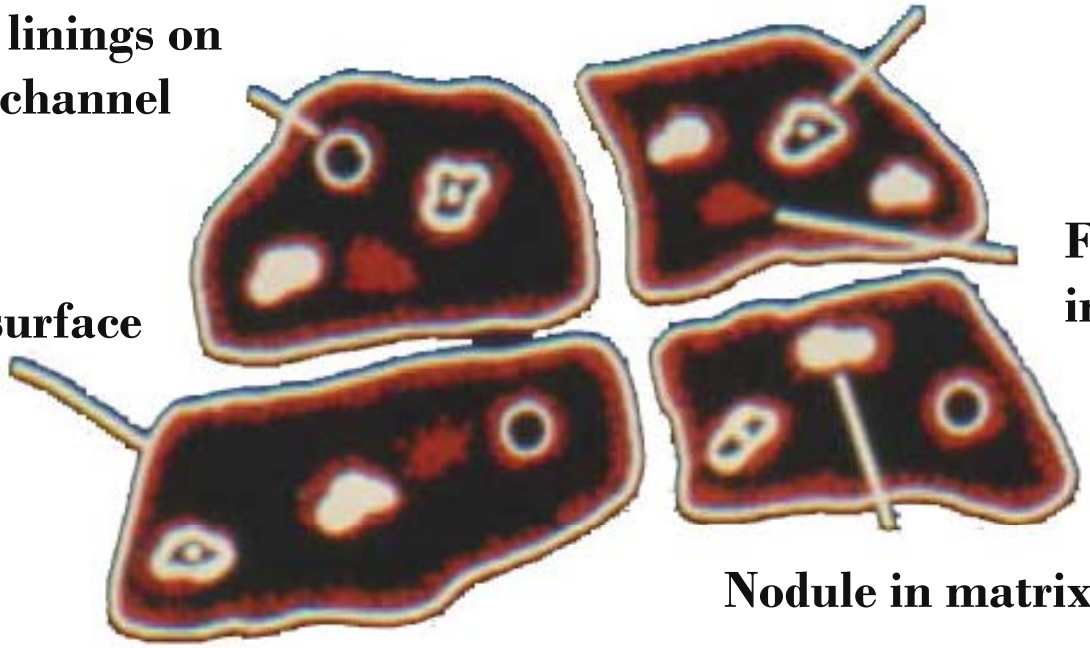


Hue Value Chroma

Redox Concentrations

Pore linings on root channel

and ped surface



Fe mass in matrix

Nodule in matrix

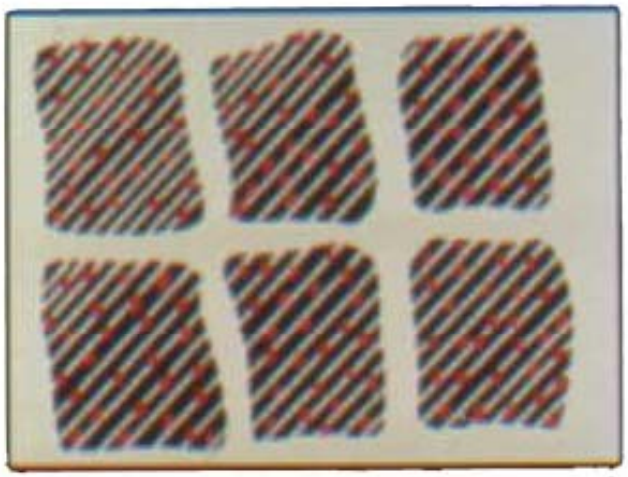
Soft Fe/Mn accumulations

Hard Fe/Mn accumulations

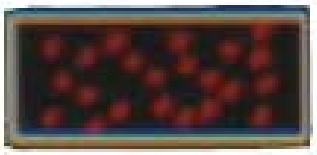
Modules

Concretions

Redox Depletions

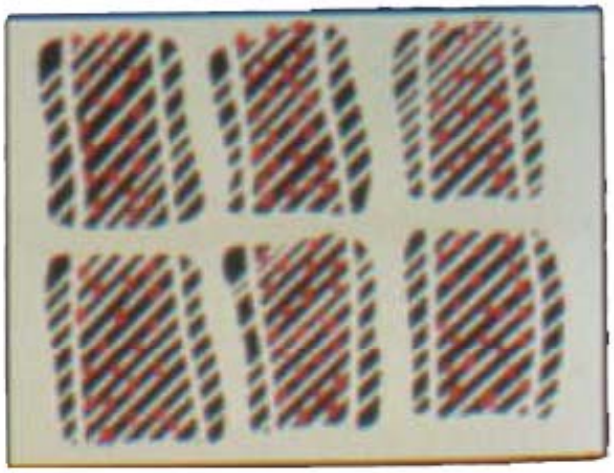


A. No redox depletions.

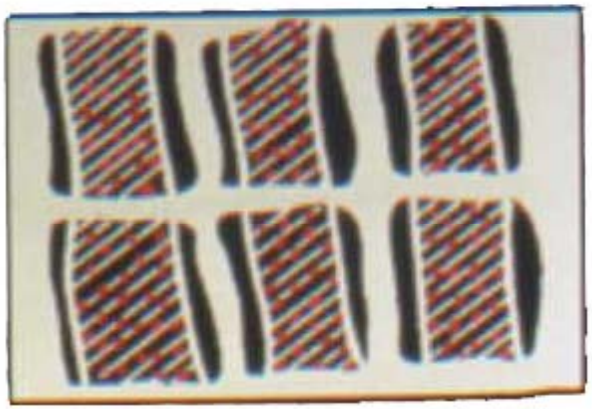


Fe(II)
in Matrix

Clay in
Matrix

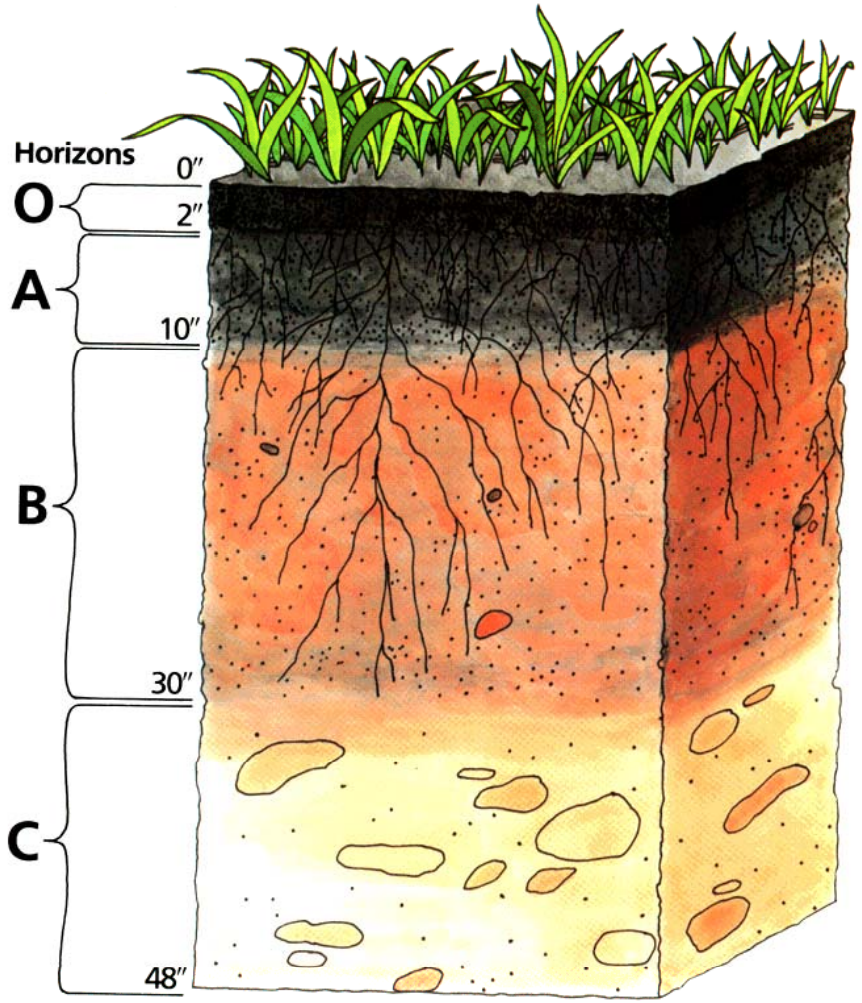


B. Fe depletions along ped surfaces.



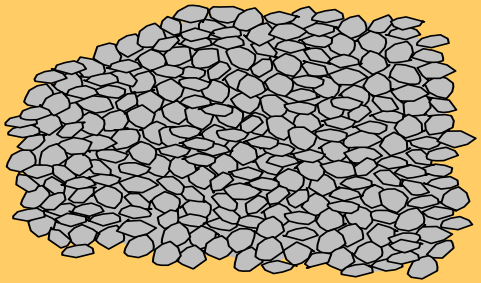
C. Clay depletions along ped surfaces.

A Soil Profile



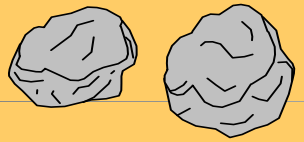
Soil Structure - With Structure

Granular

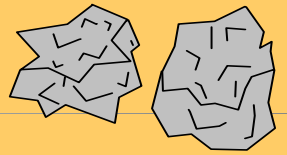


Blocky

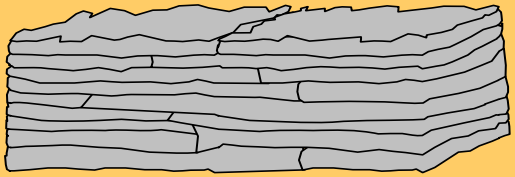
(Subangular)



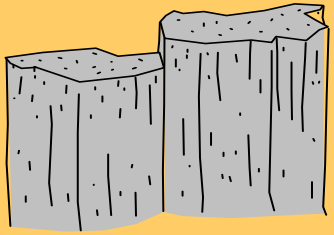
(Angular)



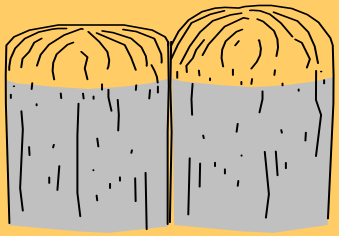
Platy



Prismatic



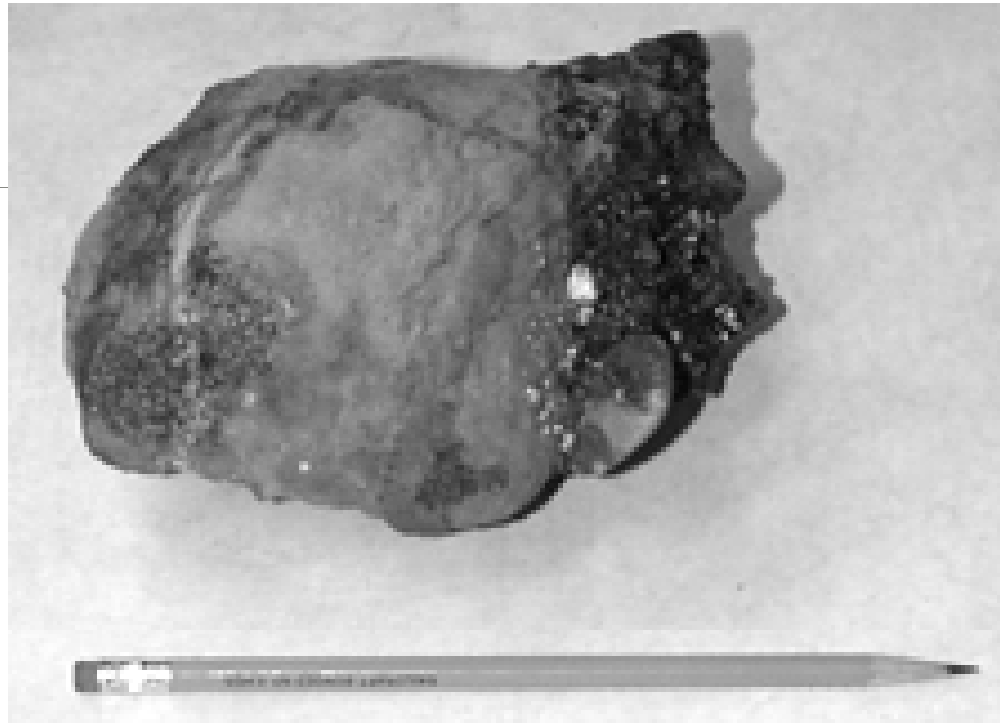
Columnar



Wedge

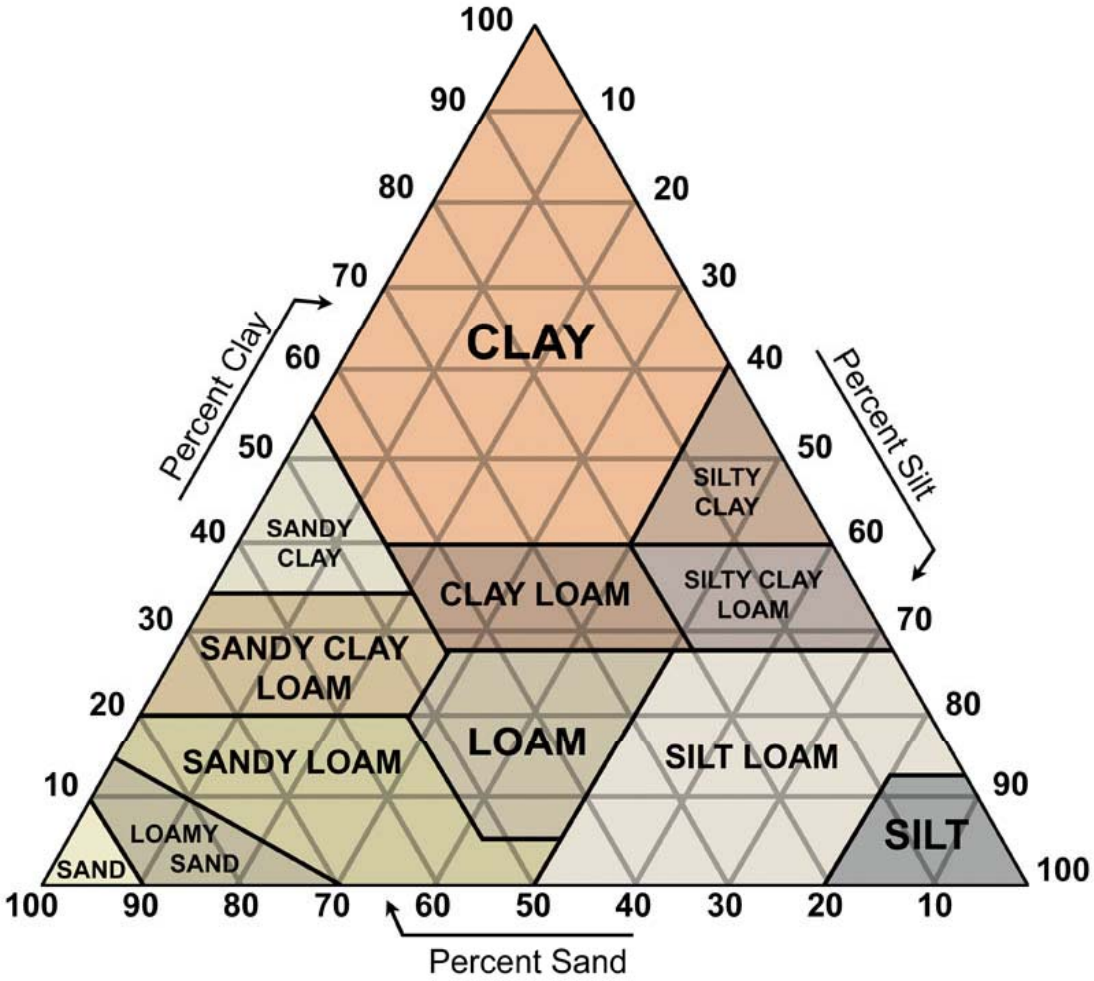
Soil Structure – Without Structure

Single Grain



Massive

USDA Textural Triangle



Landscape Factors

- Depth to bedrock
- Depth to water table
- Flooding vs. ponding vs. high water table
- Erosion &water quality concerns
- 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 CANTON	SUTTON [1]		LEICESTER	
					BICE #	SCHROON #			LOONMEADOW #
					+ PAXTON + MONTAUK + SHELBURNE #	+ WOODBRIDGE + ASHFIELD #		+ RIDGEBURY	+ WHITMAN
					FARMINGTON				
	MIXED LIMESTONE & CRYSTALLINE ROCKS				PYRITIES # STOCKBRIDGE NELLIS [11]	+ HOGANSBURG # GEORGIA AMENIA		MUDGEPOND [10, 20]	ALDEN [19]
	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] BOSCAWEN #	MERRIMAC		SUDBURY		WALPOLE [3] MOOSILAUKE #	
		SANDY	WINDSOR			DEERFIELD			SCARBORO [15, 32]
		LOAMY / SAND & GRAVEL			AGAWAM	NINIGRET			
		SILTY / SAND & GRAVEL			ENFIELD [16] HAVEN	TISBURY		RAYPOL	
	ACIDIC, RED SANDSTONE, SHALE, CONGLOMERATE				BRANFORD	ELLINGTON			
		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 # OCCUM [4]	POOTATUCK [23]		RUMNEY # RIPPOWAM	
	MIXED CRYSTALLINE & SEDIMENTARY ROCKS	SILTY			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

Soil Classification

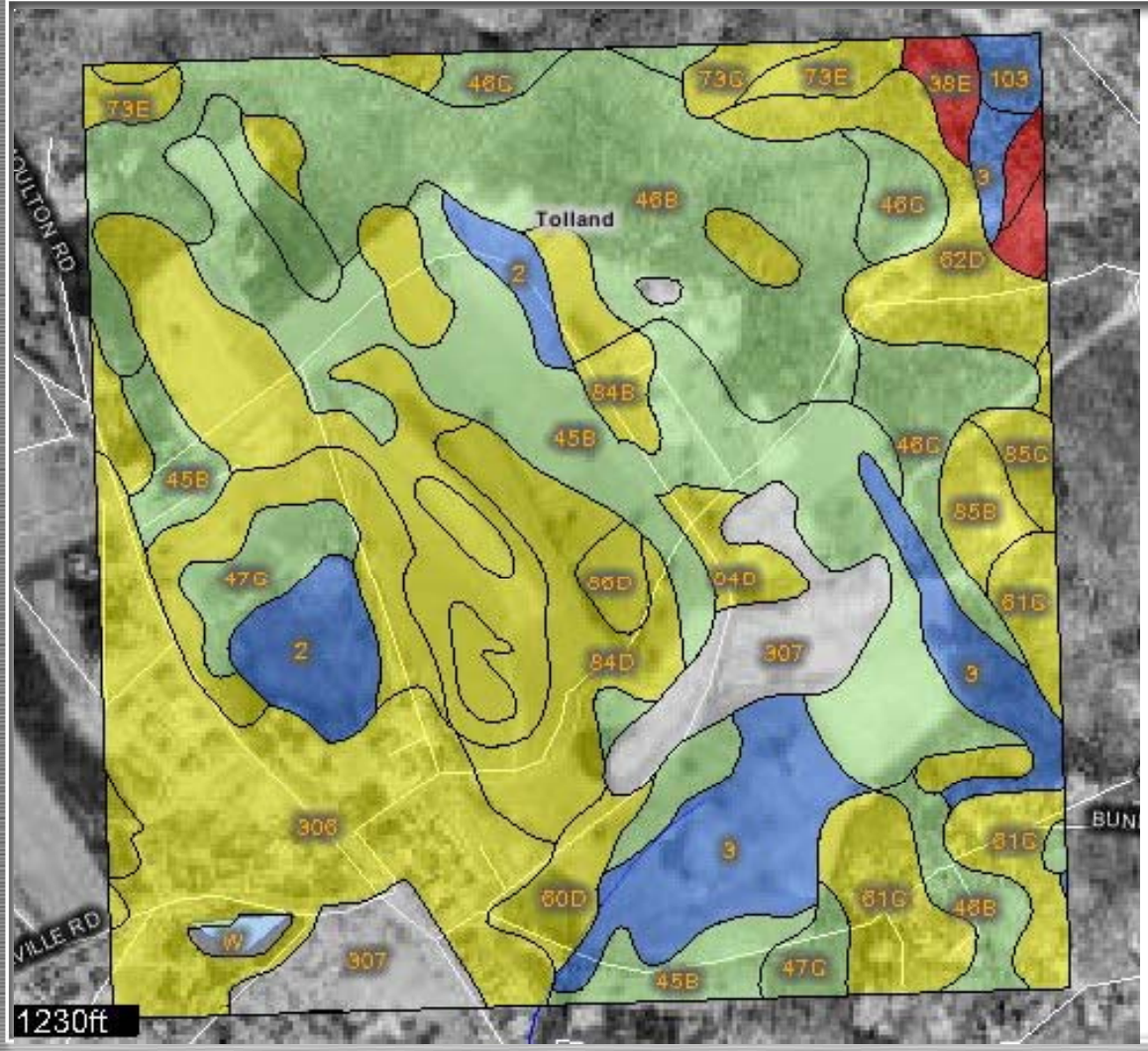
Why Classify Soils?

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

Two Major Classifications

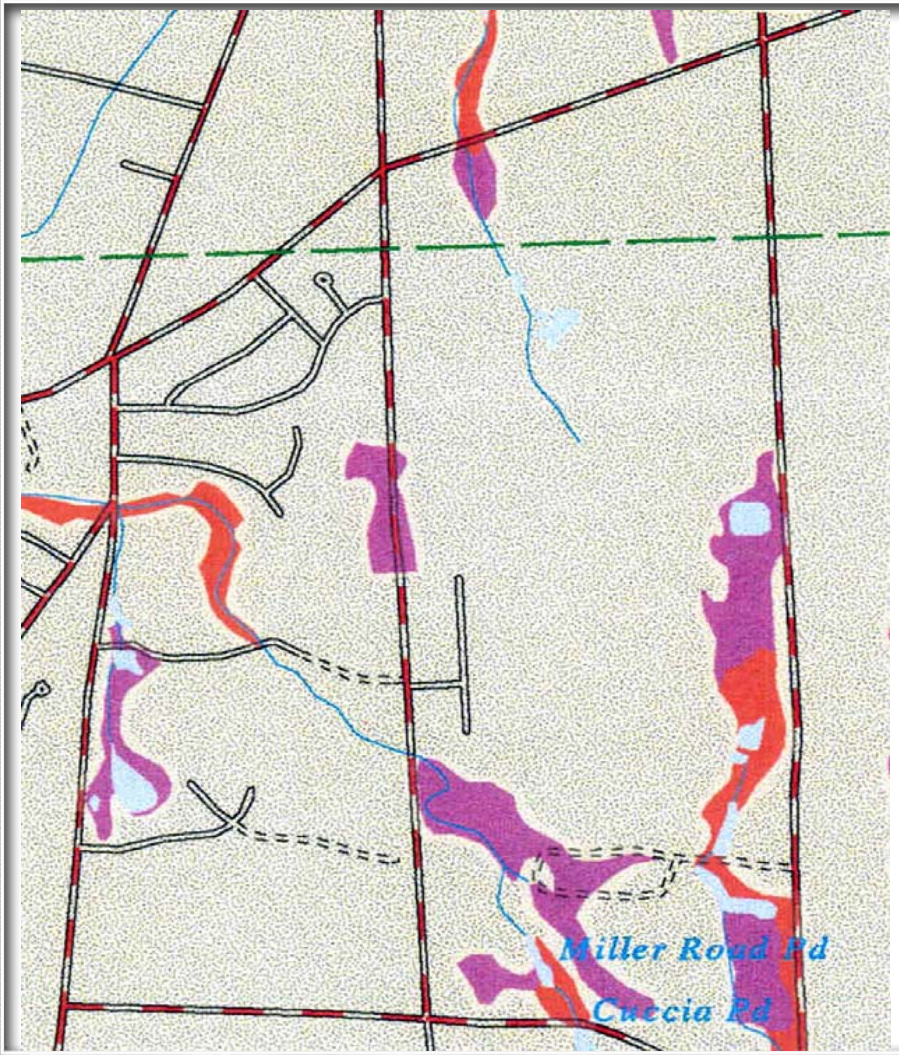
- **Technical**
  - grouping soils by properties that relate to a specific use
  - grouping for land-use regulation or law
- **Natural or Scientific**
  - grouping for most important physical, chemical, and biological properties without reference to any specified use

Technical Soil Classification



Drainage Class

Technical Soil Classification



Connecticut Wetland Soils

Natural or Scientific Classification

Soil Taxonomy

- Organize knowledge about soil relationships
- Group soils similar in genesis
- Facilitate communications
- Agriculture based system
- Based on soil formation processes (not parent materials)

History of Soil Taxonomy in the U.S.

Historical Perspective

- Russian soil scientist Dokuchaev, 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 Used in Soil Taxonomy

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

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 –15^{c})

Typic

Subgroup

(Reflects central concept)

Udipsamments

Great Group

(Humid climate)

SubOrder

(Sandy)

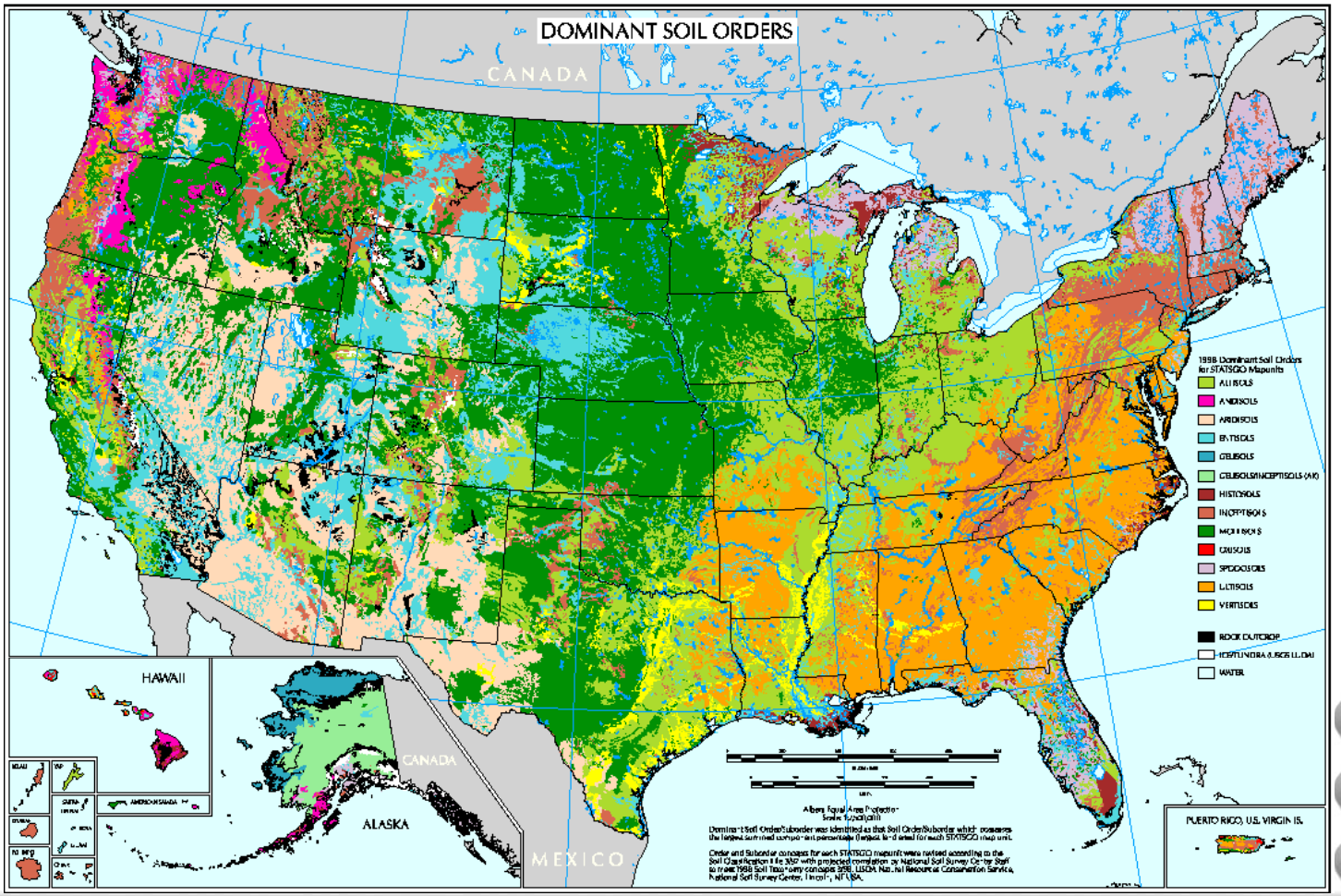
Order

(Entisol)

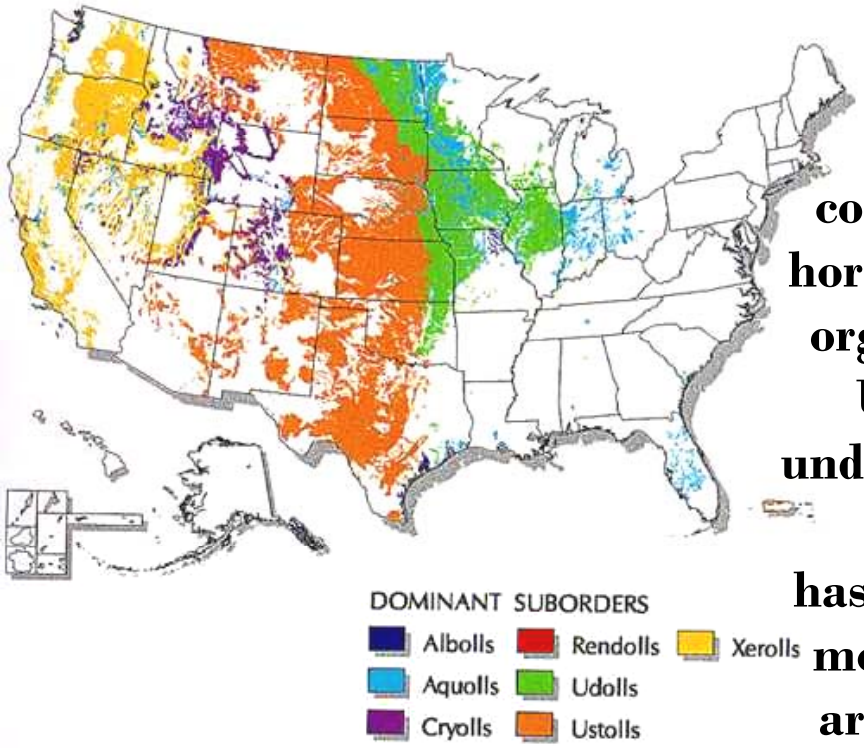
12 Soil Orders

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

- Entisol
- Inceptisol
- Andisols
- Spodosols
- Mollisols
- Alfisols
- Ultisols
- Oxisols
- Aridisols
- Vertisols
- Histosols
- Gelisols

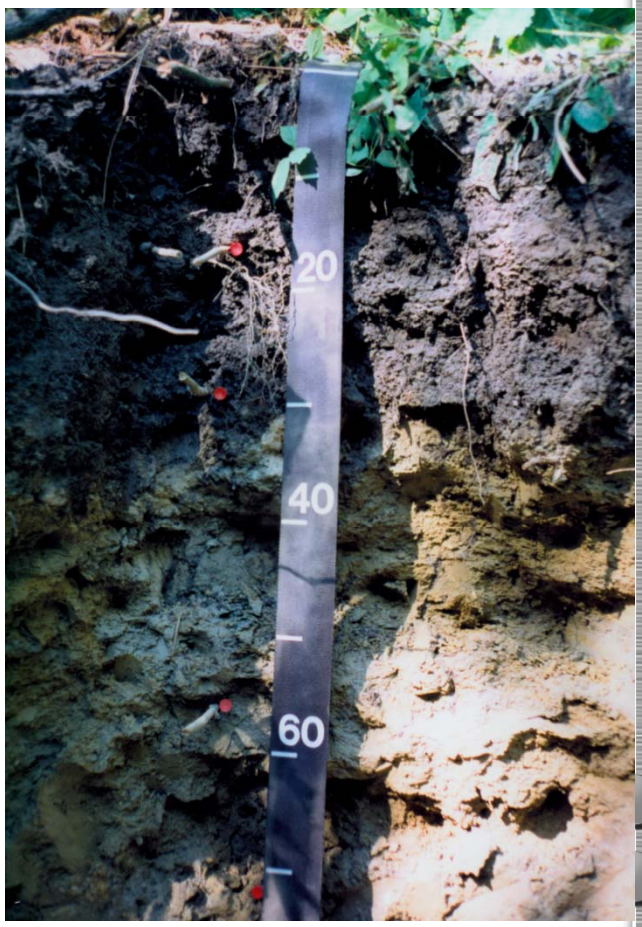


Mollisols

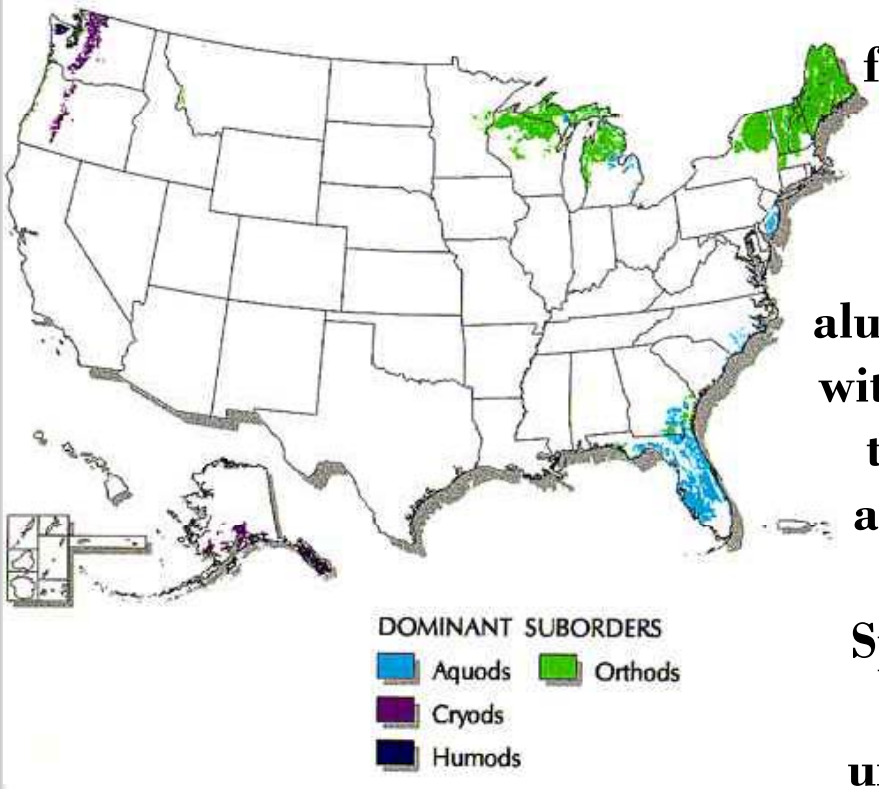


Orders that occur in Connecticut

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



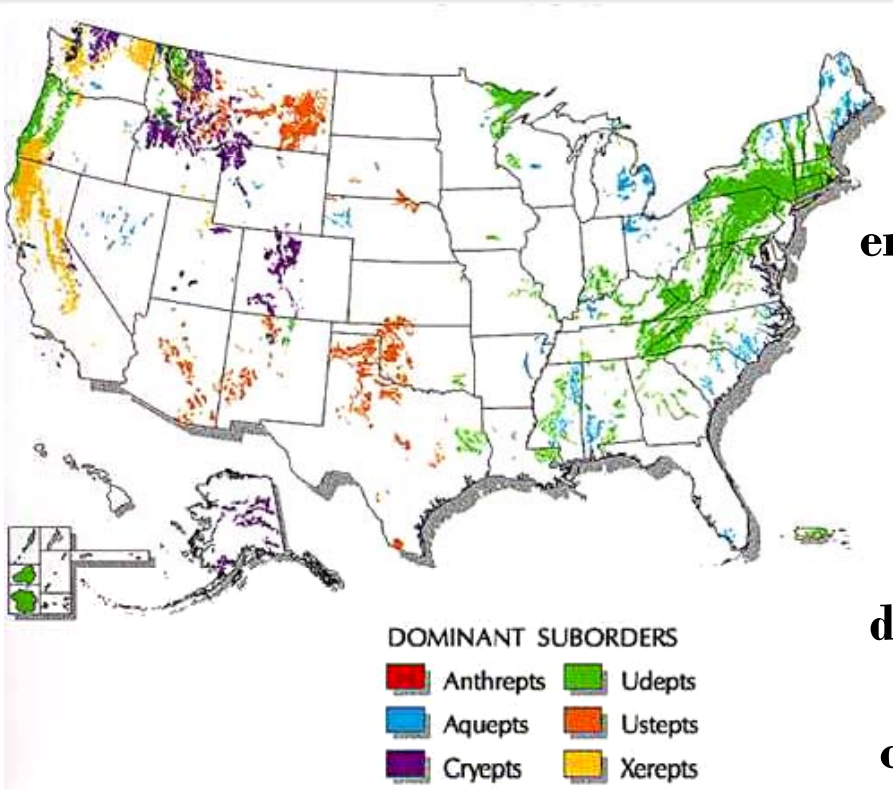
Spodosols



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 Connecticut. 4% of the world's ice-free land surface.

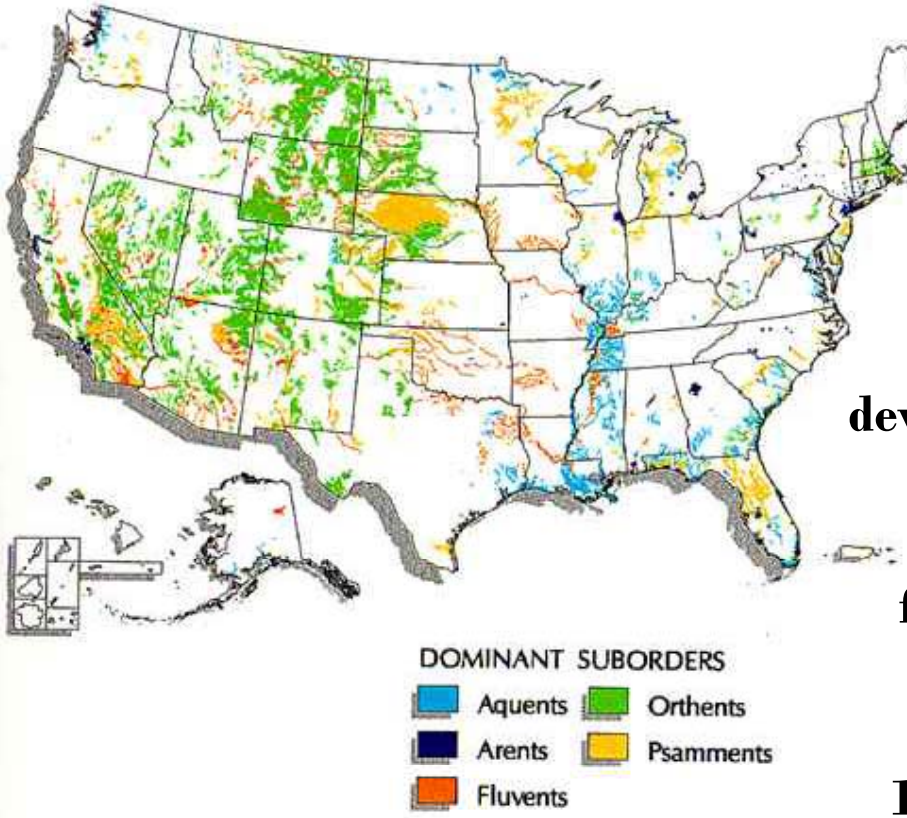
Inceptisols



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 Connecticut. 17% of the world's ice-free land surface.

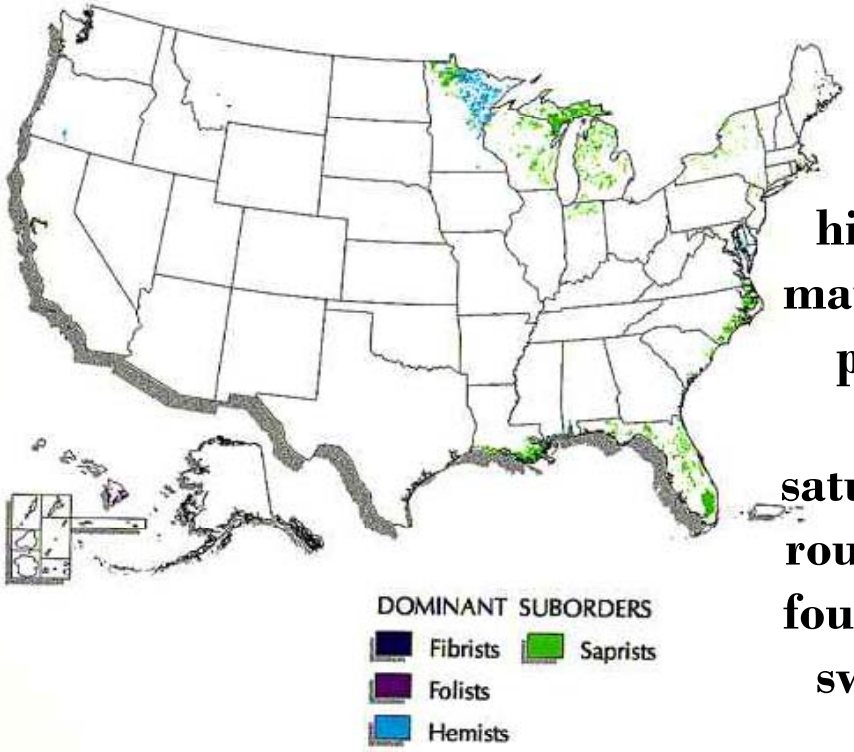
Entisols



Orders that occur in Connecticut

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.

Histosols



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.

Orders that occur in Connecticut

Aquic Conditions

Identifying the aquic moisture regime requires that soils

1) **are saturated**

2) **are reduced**

3) **have redoximorphic features**

- ***redox concentrations***
- ***redox depletions***

Soil Saturation

When soils are saturated, soils 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*

Aquic Conditions and Soil Drainage Class

- National criteria are required to meet aquic classifications in soil taxonomy
- Drainage classes are locally assigned classifications based on conditions and applications
- 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.

Organic Soils

Organic soil material has greater 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)

Questions?