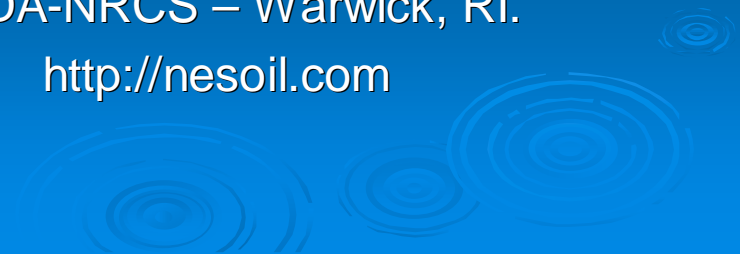


# Geology and New England Landscapes

Jim Turenne, CPSS  
USDA-NRCS – Warwick, RI.  
<http://nesoil.com>



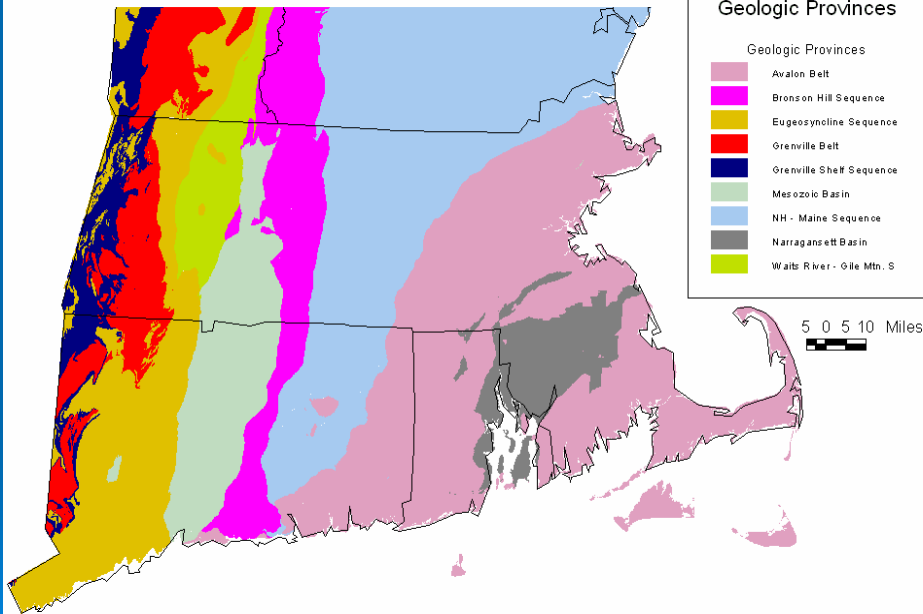
# Why Geology?

- Provides the “big picture” of site conditions.
- Major part of soil formation (parent material and landscape/relief factors).
- Important for understanding hydrologic settings and conditions.
- Wetlands occur only on certain parts of the landscape!

# Earth Layers

- Soil - USDA - formation, classification, interpretations.
- Surficial Geology - USGS - Soft regolith above bedrock.
- Bedrock Geology - USGS - Type of rocks, formation,





# Soil Formation: Parent Material

Geologic Material Soil Formed From.

- Types of minerals.
- Reaction (pH) of soil.
- Soil Color.
- Interpretations.
- Physical properties.

Types of PM: Glacial, Volcanic, Organic, Loess, Colluvium, Alluvium, etc.

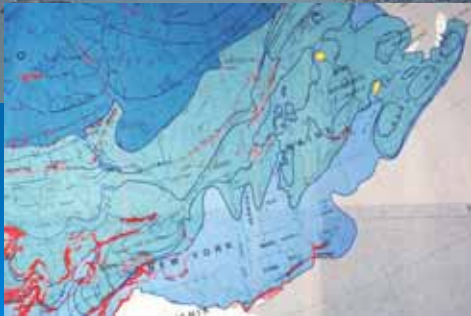


# New England Parent Materials

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



# Pleistocene Ice Age



Extent of Last Advance



Ice Left MA around 14,500 YBP

# 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.

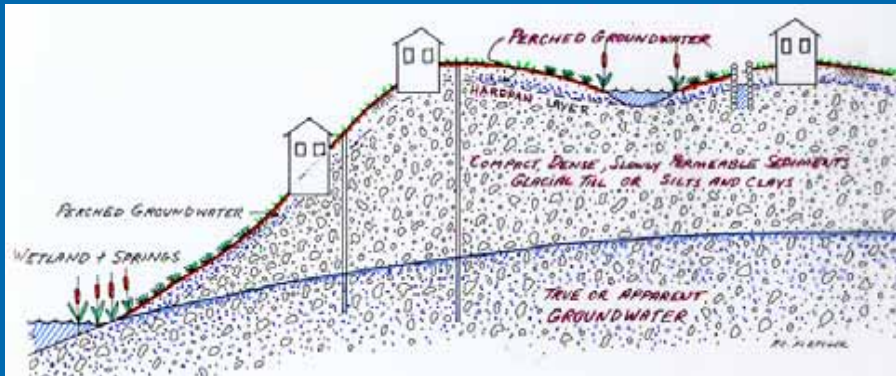


# Till Properties

- Major Types: Basal and Ablation.
- Landforms: Drumlins, moraines, Uplands, Bedrock Controlled Areas, Ice contact.
- Basal till has a dense restrictive layer which impedes downward water movement (perches water).
- Large sub-angular stones and boulders.

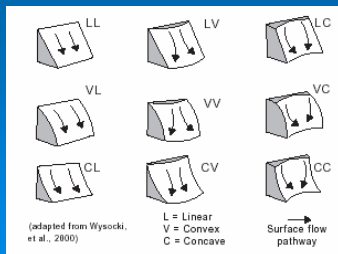


# Hydrology in Tills



- Vertical water movement is restricted due to restrictive layer causing perched water tables.
- Wetlands can occur on high elevations and on slopes.
- Landform drives hydrology!

# Landscape Position!



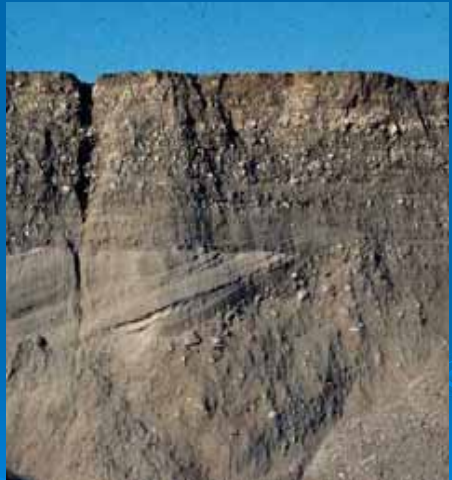
# Glacial Fluvial (outwash)



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

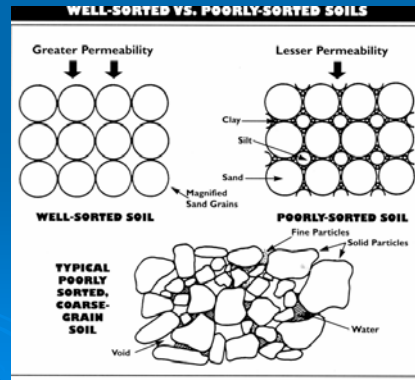
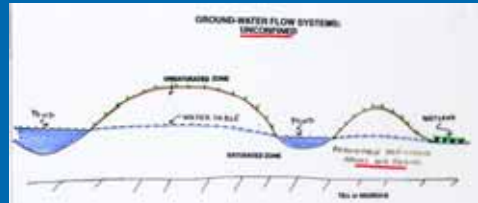
# Outwash Properties

- Dominantly sand and gravel sized particles.
- Stratified layers.
- Generally lacking large coarse fragments (larger than cobbles).
- Few limitations for most uses.



# Outwash Hydrology Concerns

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



# Glacial Lacustrine & Marine

- Fine textured sediments deposited in glacial lakes which have now drained or filled or sediments deposited in marine environments that have been uplifted due to isostatic rebound.
- Slowly permeable layers of silt and clayey material – perched water tables.
- Hitchcock, Taunton, Concord, Sudbury, N Shore areas.

# Other Geologic Deposits



# Glacial Landforms



# Post Glacial Deposits

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

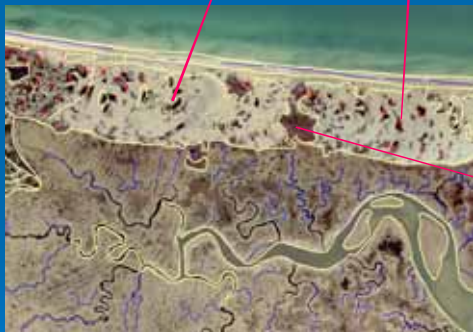
Most upland soils in NE have a thin 18-36 inch eolian cap. Deposited rapidly after ice left.



# Costal Dunes

Hydric Soil

Wet Spot  
Symbol



Barnstable Soil Survey



Hooksan Soil

# Post Glacial

- **Alluvium** - sediments deposited in modern-day floodplains.
- Problem soil areas due to young age (little soil formation), natural buried horizons.
- Usually only on large rivers and streams.



# Post Glacial

- **Organic** - material deposited by dead organisms.
- Over 8 inches of organic material at surface = hydric soil.
- Swamps, bogs, fens, marshes.



# Post Glacial Deposits

- **Anthro-transported material** (Cut and Fill) - recent sediments deposited or removed by human activity.
- Lot of areas in the NE have been altered by humans.
- Difficult morphology.
- Atypical situations (87 manual).

Redox

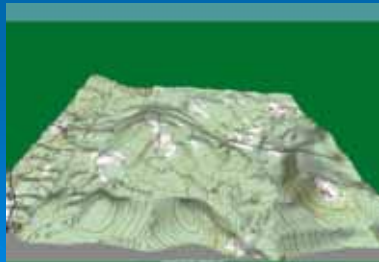
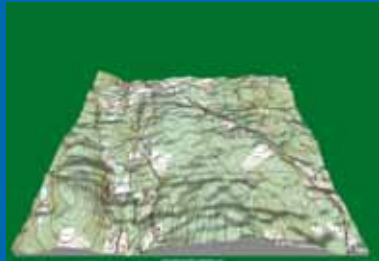
Fill

Organic



# New England Landscapes

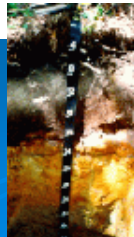
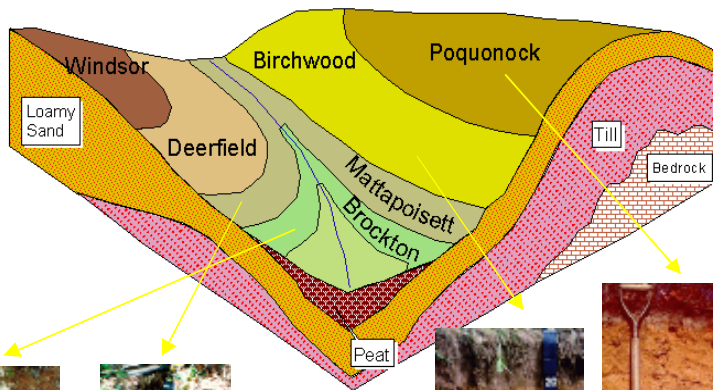
**Drumlins** – A smooth, elongated, oval-shaped hill typically composed of dense (lodgement) till. Most are oriented NW to SE – direction of ice flow.



# Typical Drumlin Soil Catena

## Soil/Geology

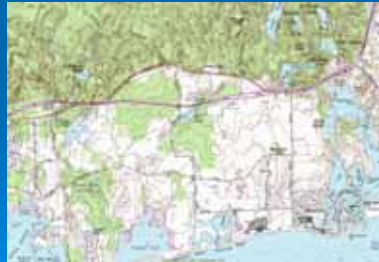
- Bedrock
- Birchwood
- Brockton
- Deerfield
- Mattapoissett
- Poquonock
- Solum
- Swansea
- Till
- Windsor
- peat



# New England Landscapes

**Outwash Plains** – Level to undulating areas composed of stratified sand and gravel.

**End Moraines** (outwash heads) – Hummocky to steep areas with bouldery surfaces composed of loose sandy till and ice-contact outwash.



# Fluvial Landscapes

**E** = Esker

**P** = OW Plain

**B** = Bog

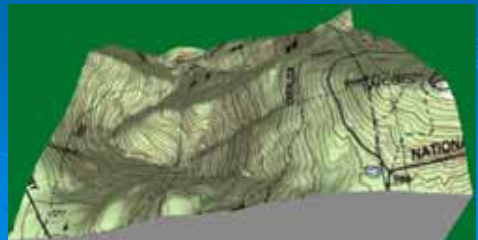
**K** = Kame

**H** = Head of  
outwash



# Bedrock Controlled Landforms

- BCL areas usually show as irregular contour lines on topo.
- Sometimes its difficult to tell if BCL or fluvial – use soil survey.
- Wetlands can occur in areas where the underlying rock is not fractured.



End



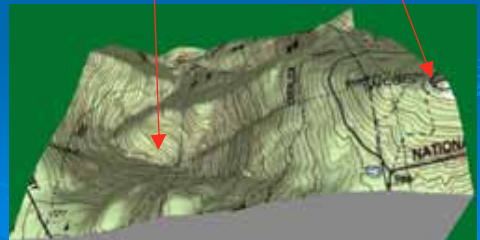
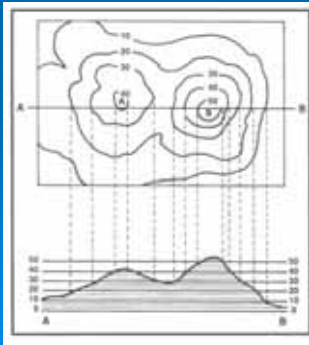
# Reading Topographic Maps

Contour lines – shows areas of equal elevation.

Also shows drainage, cultural features, water, etc.

Convex slope

Concave slope





# Major SNE Geologic Events

ERA	PERIOD	EPOCH million years ago	IMPORTANT GEOLOGIC EVENTS IN MASSACHUSETTS	
CENOZOIC	QUATERNARY	Pleistocene	Wisconsinan ice age begins 80,000 years ago and covers Massachusetts between 25,000 and 10,000 years ago. Marine sediments deposited during Sangamon interglacial stage. Remnant 68 of Illinoian ice sheet deposited 140,000 years ago.	
		1.6 Pliocene	Deposition of glauconitic sands, coarse sands, and gravel.	
	24 Miocene			
	30 Oligocene			
	50 Eocene			
	TERTIARY	65 Paleocene	Intrusive rhyolite in northeastern Massachusetts. Deposition of variegated clays, silts, and lignite coal at Gay Head. Marine sediments of coastal plain deposited far inland.	
145				
MESOZOIC	CRETACEOUS	145	Rift column initiates opening of Atlantic Ocean and formation of Pangaea. Rift basins open in the Connecticut Valley region. Basalt flows and dikes, including Medford dike.	
	JURASSIC	208	Deposition of fossiliferous redbeds. Chocomaus leave tracks.	
	TRIASSIC	245	Deposition of coarse clastic sediments.	
	PERMIAN	285	Final assembly of Pangaeaian supercontinent during the Alleghanian orogeny, 275 to 260 million years ago.	
	PENNSYLVANIAN MISSISSIPPIAN	320	Narragansett Basin and other coal basins form in Avalon terrane.	
360		Rapid uplift of Nashoba terrane. Continued sedimentation.		
PALEOZOIC	DEVONIAN	417	Acadian mountain building event—Merrimack, Nashoba, and Avalon microcontinents collide with Laurentia and its associated volcanic island chains. Collision produces extensive plutonism and dome uplift. Rift plutonism and volcanism in Avalon terrane. Rift plutonism and volcanism in Avalon terrane. Initial stage of Acadian mountain building event.	
	SILURIAN	443	Sedimentary rocks deposited unconformably on Bronson Hill volcanic belt of Laurentia. Edge of Avalon terrane sinks beneath Nashoba terrane in subduction zone, generating more Burlington mylonite.	
	ORDOVICIAN	495	Volcanic and plutonic activity begins in Ordovician time continues to build Nashoba and Merrimack terranes. Shelburne Falls and possibly Bronson Hill volcanic island chains, which formed along margin of Laurentia, collide with continent in the Taconic mountain building event. Rifts open in Avalon and produce alkaline plutonic activity.	
	CAMBRIAN	545	Final assembly continental shelf sediment—Stockbridge marble and Cheshire quartzite—deposited on Laurentian margin. Thrust-bearing sediments deposited on margins of Avalon.	
	PRECAMBRIAN	PROTEROZOIC EON	2,500	Avalon and associated microcontinents separate from Gondwana 500 million years ago. Boston 60 basin forms in Avalon about 570 million years ago. Major faulting and shearing along margin of Gondwana forms the Burlington mylonite. Magma from the Avalon volcanic chain intruded the mylonite, forming the DeWitt and Milford granites. Rodinia supercontinent completely assembled by 750 million years ago, then breaks up, giving rise to Gondwana supercontinent.
		ARCHEAN EON	2,500	Grenvillian mountain building event affects Grenville gneisses on eastern margin of Laurentia, 1.2 to 1.1 billion years ago.

Geologic time scale. —Geologic times from Paleo, 1983; Tucker and McKeown, 1995; Bowring and others, 1993

Pleistocene glaciations.

Sedimentation/erosion.

Connecticut mesozoic basin.

Narragansett Basin forms.

Acadian & Avalonian orogeny.

Basement rocks formed

Grenvillian Orogeny