SOIL SCIENCE 101

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CT Envirothon Training, 2014
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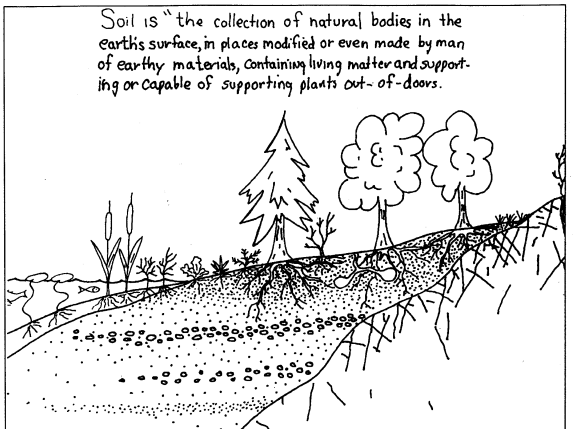
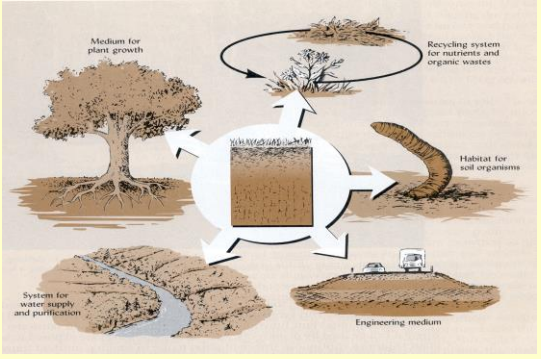


FIVE CRUCIAL ECOLOGICAL ROLES OF SOILS



From: The Nature and Properties of Soils, 11th edition, N.C. Brady and R.R. Weil, Prentice Hall, NJ, 1996

FUNCTIONS OF SOIL

- Regulate water flow
- Filter potential pollutants
- Sustains plant life
- **Sustains animal life**
- Cycles and stores nutrients – N, C, P
- Waste disposal – sludge applications or home septic systems
- Building materials – brick, adobe
- Recreational activities – sports, camping, gardening

SOIL FORMATION

- CLIMATE
- BIOTIC ACTIVITIES
- PARENT MATERIAL
- TOPOGRAPHY
- TIME

Each soil has unique layers, called horizons, which can be distinguished by their physical and chemical characteristics. These characteristics are either inherited from the geologic materials from which they were derived or acquired as a result of various physical and chemical processes that acted upon the parent materials. Soils never reach a static state; they are constantly changing!

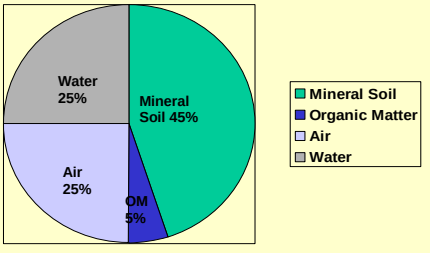
CONNECTICUT SOILS

- **IN GENERAL, SOILS HERE ARE STONY, ACIDIC, SANDY LOAMS**
- **RESULT OF GLACIATION**
- **AREAS OF LAKEBED SEDIMENTS AND ALLUVIAL SOILS**
- **AREAS OF SHALLOW TO BEDROCK SOILS**

Map Showing New England's Major Glacial Lakes

A Guide to New England's Landscape - Neil Jorgensen

SOIL COMPOSITION



SOIL PHYSICAL PROPERTIES

- **TEXTURE** - Refers to the relative proportion of sand, silt and clay.
- **STRUCTURE** - Overall arrangement or aggregation of soil particles.
- **COLOR –** Used to locate water table

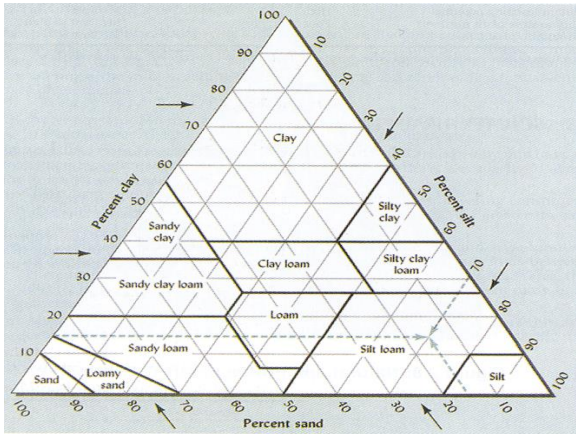
SOIL SEPARATES

SOIL PARTICLES ARE CLASSIFIED BY SIZE INTO GROUPS CALLED SOIL SEPARATES:

SAND = .05 to 2.0 mm

SILT = .002 to .05 mm

CLAY = < .002 mm

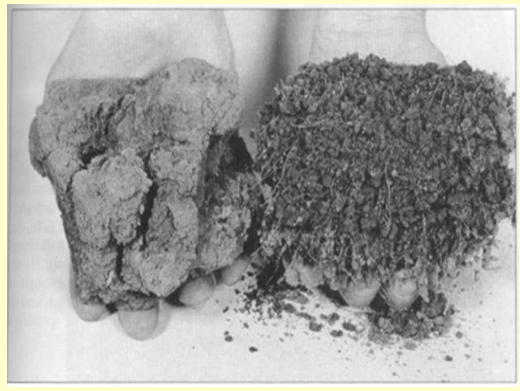


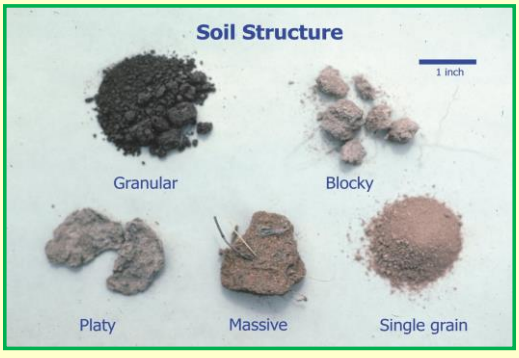
TEXTURAL CLASSES MOST CONNECTICUT SOILS

CLASS	%SAND	%SILT	%CLAY
LOAM	40	40	20
SANDY LOAM	60	30	10
SILT LOAM	30	55	15
LOAMY SAND	83	12	5

SOIL PROPERTY INFORMATION CONVEYED BY TEXTURE

- WATER-HOLDING CAPACITY
- PERMEABILITY
- POROSITY
- NUTRIENT-HOLDING CAPACITY
- ROOT/SHOVEL PENETRATION

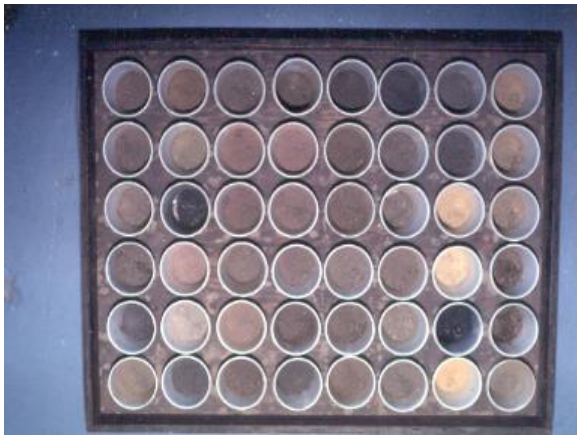




From: fvtchort.wikispaces.com

SOIL STRUCTURE AFFECTED BY:

- CULTIVATION
- MOISTURE LEVEL
- FREEZING/THAWING
- ROOT GROWTH
- SOIL ORGANISMS
- FOOT OR VEHICLE TRAFFIC



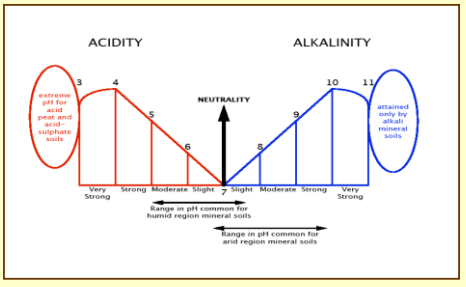
SOIL COLORS

- Dark soil usually = high organic matter
- Red/yellow = iron oxides = rust (hematite & goethite)
- Color change from red to gray due to reduction to Fe 2+ by microbes in saturated soils (mottles or redox) – indicates how high water table is in wettest season.

SOIL CHEMICAL PROPERTIES

- SOIL pH - MEASUREMENT OF THE ACIDITY OR ALKALINITY OF THE SOIL
- CATION EXCHANGE CAPACITY - MEASUREMENT OF THE SOIL'S ABILITY TO RETAIN AND SUPPLY NUTRIENTS

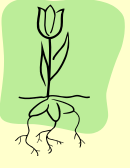
THE pH SCALE



Graphic by R. Zito, MG 2010

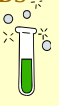
SOIL pH AFFECTS:

- NUTRIENT AVAILABILITY
- ELEMENT TOXICITY
- FATE OF SOIL POLLUTANTS
- MICROBIAL ACTIVITY
- ROOT GROWTH
- AGGREGATE STABILITY



WHY CONNECTICUT'S SOILS ARE ACIDIC

- PARENT MATERIAL IS LOW IN BASE CATIONS (Schist, Gneiss, Granite, etc.)
- OXYGEN (Respiration) AND WATER PRODUCES CARBONIC ACID
- ORGANIC MATTER DECOMPOSITION PRODUCES ORGANIC ACIDS
- ACID RAIN

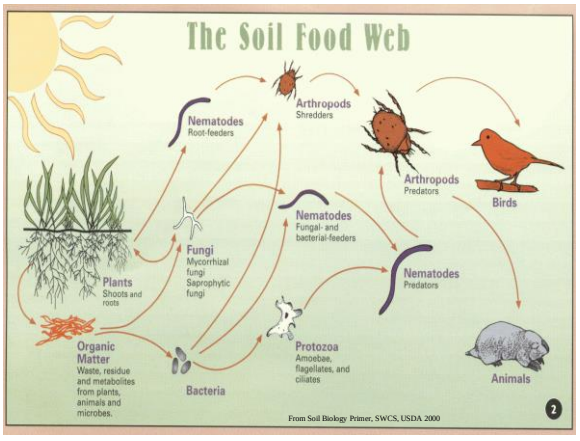


BIOLOGICAL CHARACTISTICS OF SOILS

- MAY BE A TON OF MICROORGANISMS IN AN ACRE OF TOPSOIL
- OBTAIN THEIR ENERGY AND FOOD BY BREAKING DOWN ORGANIC MATERIALS
- MICROSCOPIC PLANTS AND ANIMALS, ROOTS, INSECTS, WORMS, MOLES, ETC.
- THROUGH DECAY, HUMUS IS FORMED – Hail Humus!!!

ORGANIC MATTER

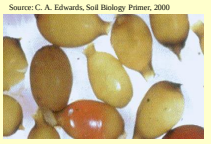
- INCREASES NUTRIENT-HOLDING CAPACITY
- INCREASES WATER-HOLDING CAPACITY
- IMPROVES STRUCTURE AND DRAINAGE
- SOURCE OF PLANT NUTRIENTS
- SUPPLIES ENERGY AND FOOD TO SOIL ORGANISMS
- INFLUENCES SOIL COLOR



EARTHWORMS

- Usually sign of healthy soil
- Major decomposers
- Can ingest, grind, digest and excrete as much as 15 tons soil/acre/year!
- More than 7000 species
- Lumbricus family most important in agriculture
- May be 50 to 500 /sq. yard
- Dramatically alter soil structure, water movement, nutrient dynamics and plant growth

Source: C. A. Edwards, Soil Biology Primer, 2000



Net Effect on Vegetation

No earthworms, Camels Hump, VT

Forest invaded by *Amynthas agrestis* Shelburne

From PPT by Dr. Josef Gorres, UVM

http://2.bp.blogspot.com/_27y_ETmoUBU/SYSqdKwPHI/AAAAAAAAAA/jc/o6l-1GUZZR/s400/deer-vermont.jpg

AMYNTHAS AGRESTIS

Photo by J. Preston


THAT'S
ALL
FOLKS!