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Soil: descriptions, water levels, and data access

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The basics of soil descriptions

- Horizons
- Texture
- Coarse Fragments
- Color
- Structure
- Consistence
- Redoximorphic features

https://www.nrcs.usda.gov/sites/default/files/2022-09/field-book.pdf

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Form 11:

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
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Additional Notes:

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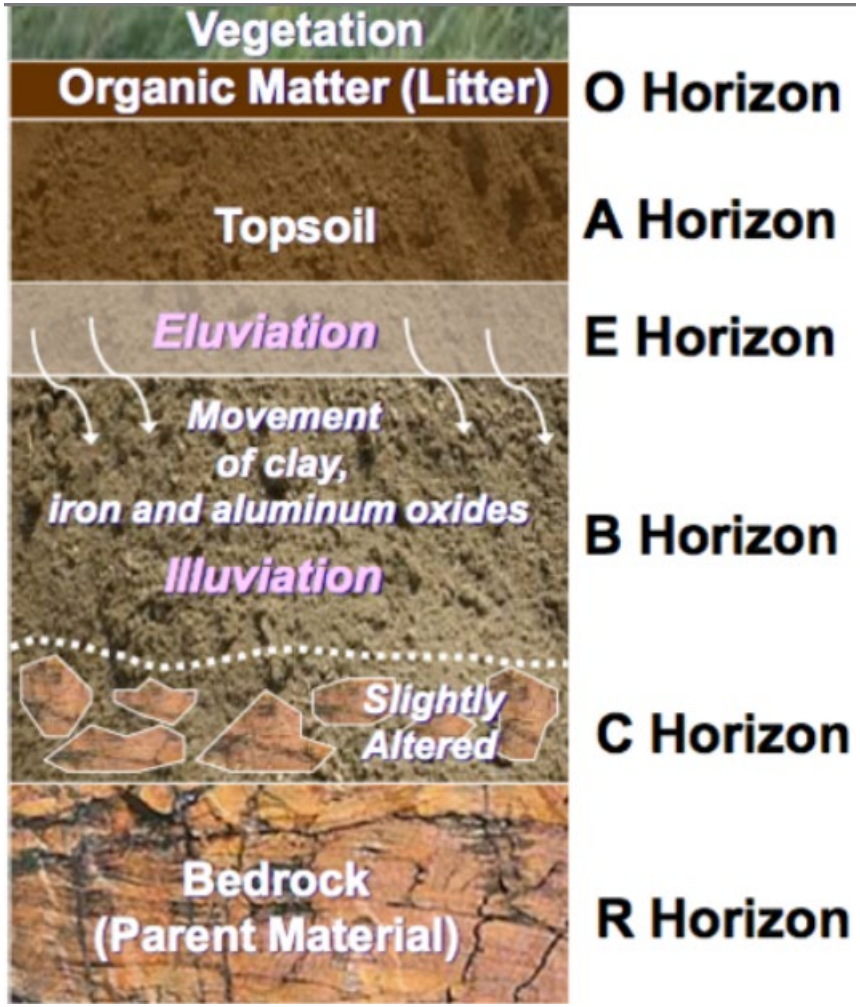
Major Horizon Designations



A Horizon

B Horizon

C Horizon

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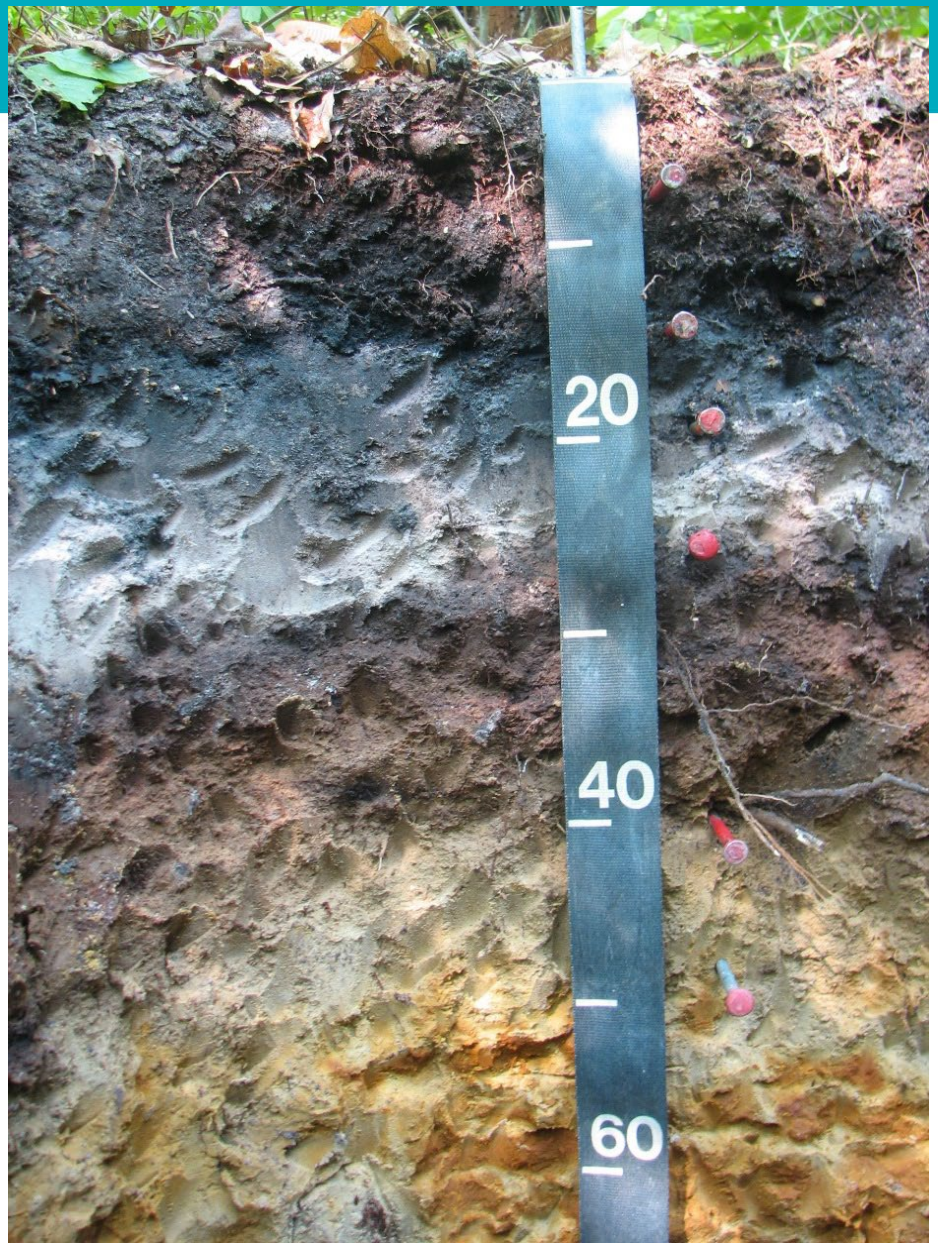
O Horizon

E Horizon

B Horizon

B Horizon

C Horizon



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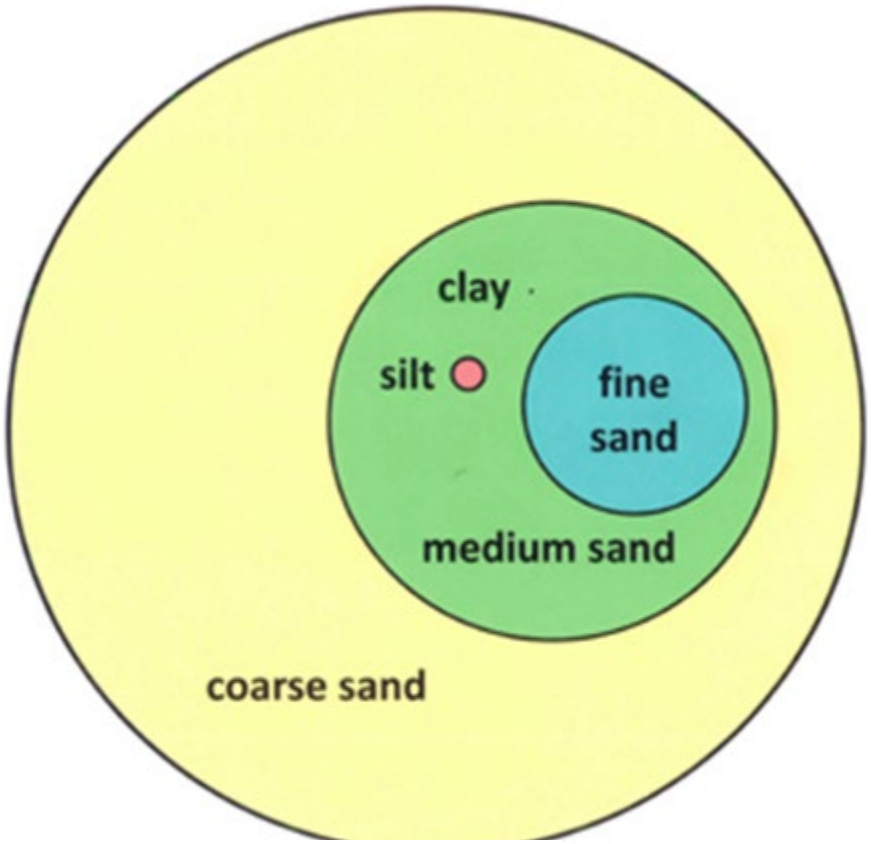
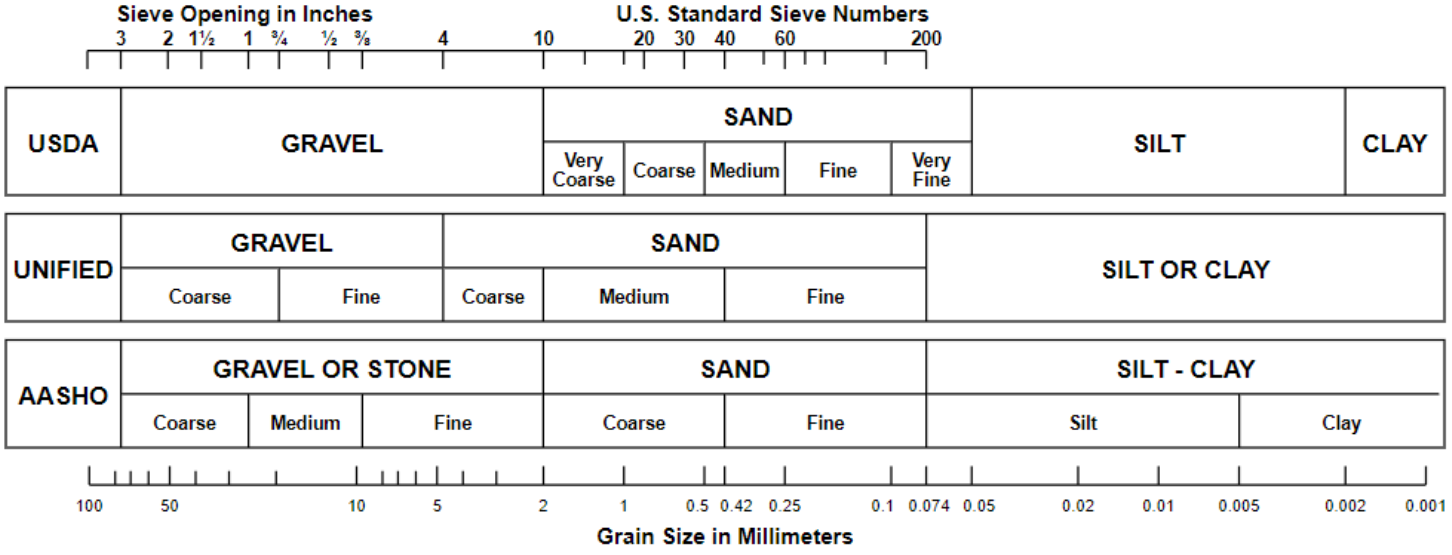
Soil Texture

The proportion of

- Sand (0.05-2.0 mm)
- Silt (0.002-0.05 mm)
- Clay (<0.002 mm)

Anything larger is gravel, stones, boulders





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Clay size particles

- <0.002 mm
- When wet – very smooth, sticky, forms a strong ribbon
- When dry – extremely firm and requires strong pressure to crush
- Dirties pores of one's hands
- Particles stay suspended in water for long periods of time

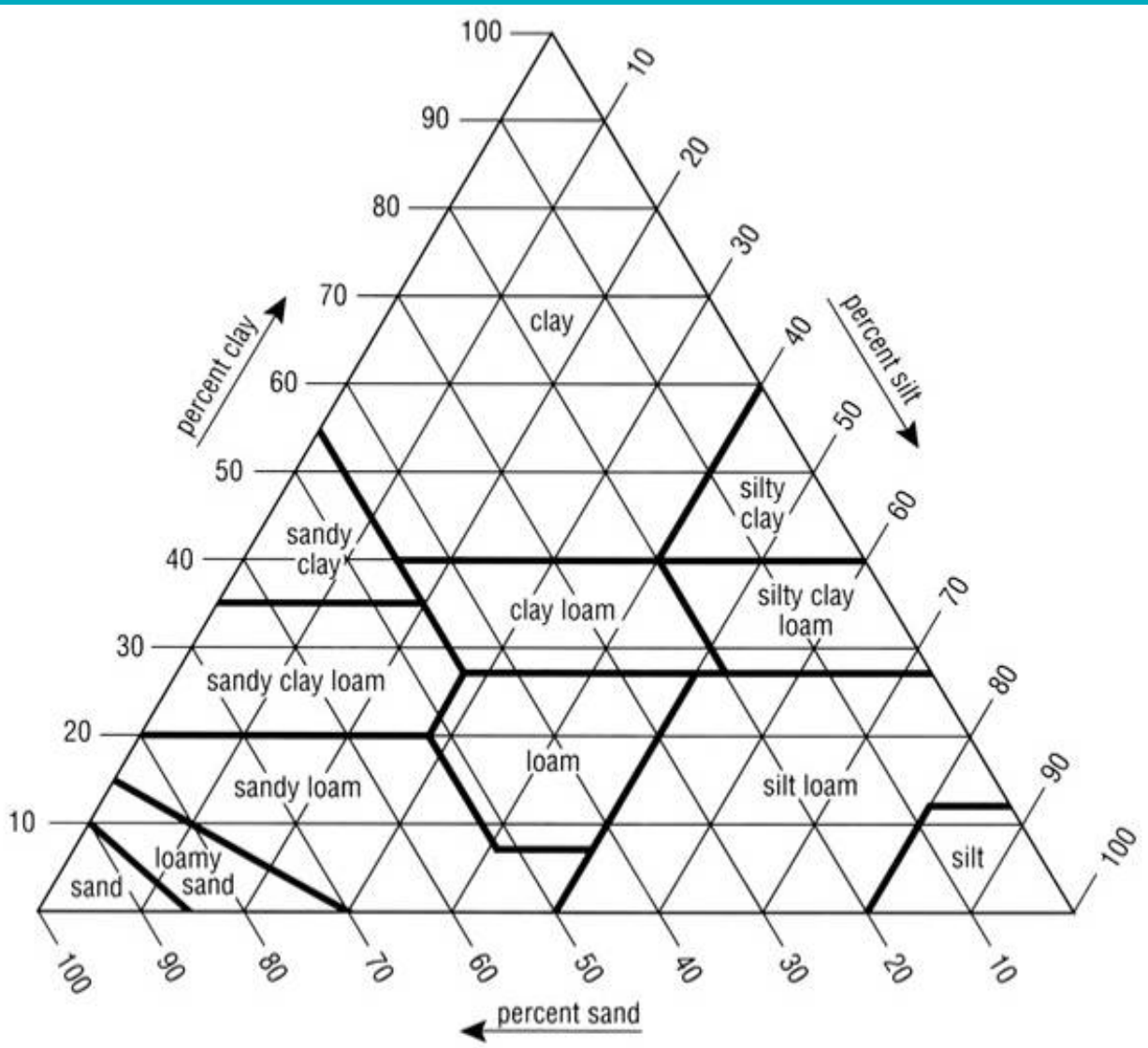
Silt size particles

- 0.002 to 0.05 mm
- Very smooth, non gritty feel like flour or talcum powder
- When wet – slightly to non sticky, forms a weak ribbon
- When dry – crushes with moderate pressure
- Dirties pores of one's hands
- Particle will suspend in water when mixed

Sand size particles

- 0.05 to 2 mm
- Largest size class and is further divided into subcategories.
  - Very coarse sand (1 to 2 mm)
  - Coarse sand (0.5 to 1 mm)
  - Medium sand (0.25 to 0.5 mm)
  - Fine Sand (0.1 to 0.25 mm)
  - Very fine sand (0.05 to 0.1 mm)
- Composed mainly of weathered grains of quartz.
  - Sand is gritty to the touch.
  - Sand grains will not stick to each other.
- Non sticky
- Hands can be wiped clean
- Particles do not suspend in water

Texture = Relative proportion of sand, silt, and clay sized particles by weight



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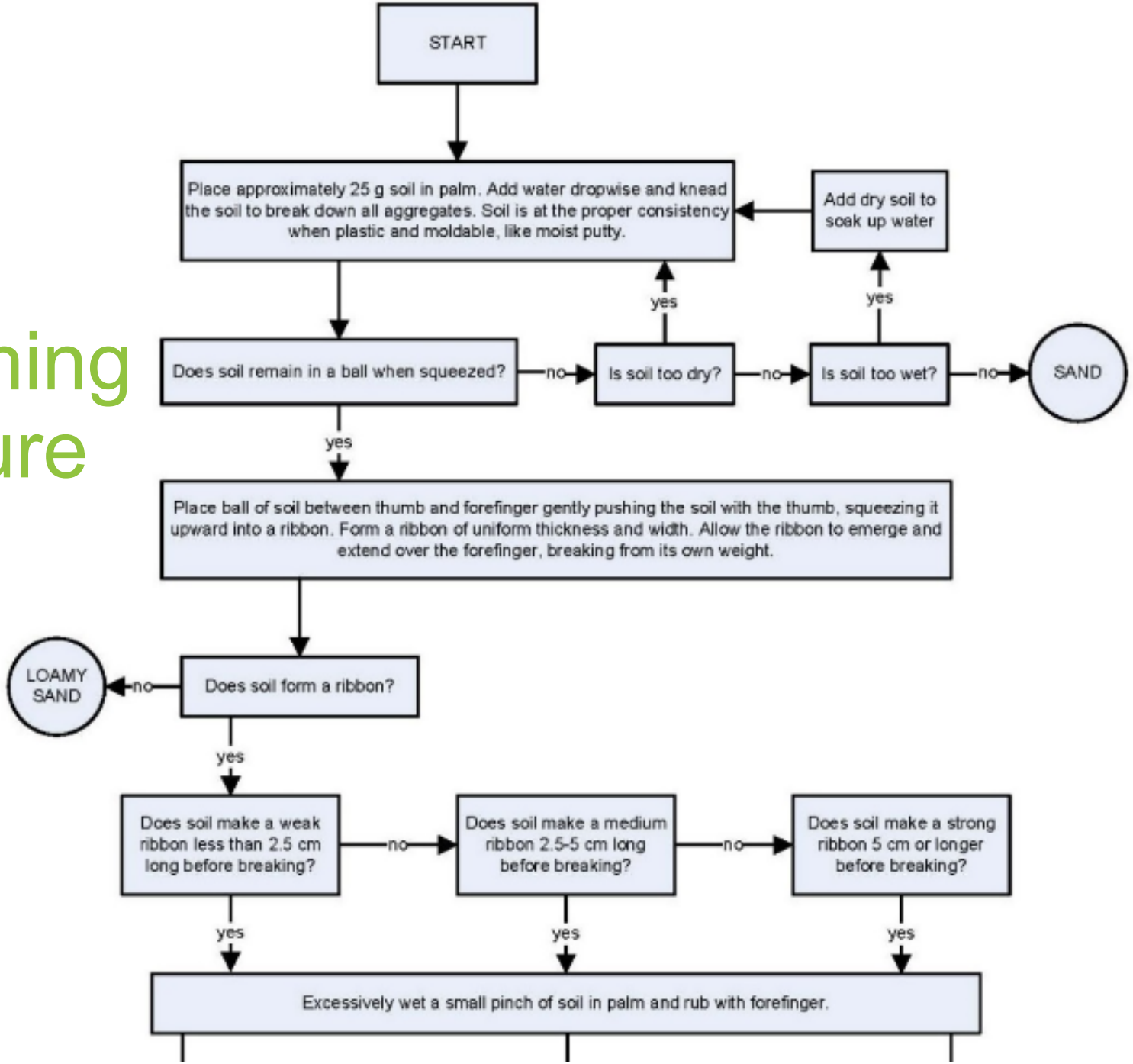
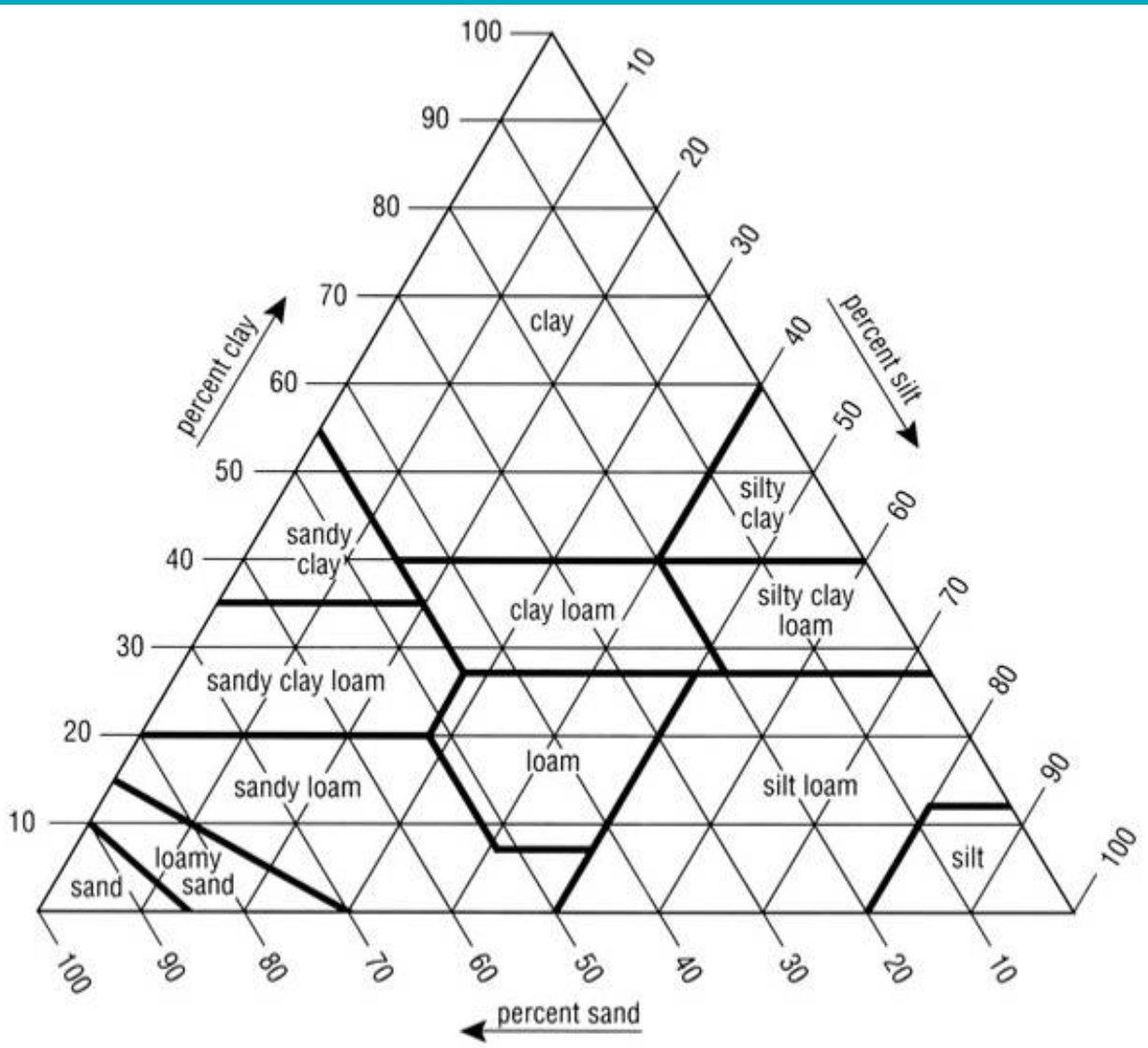
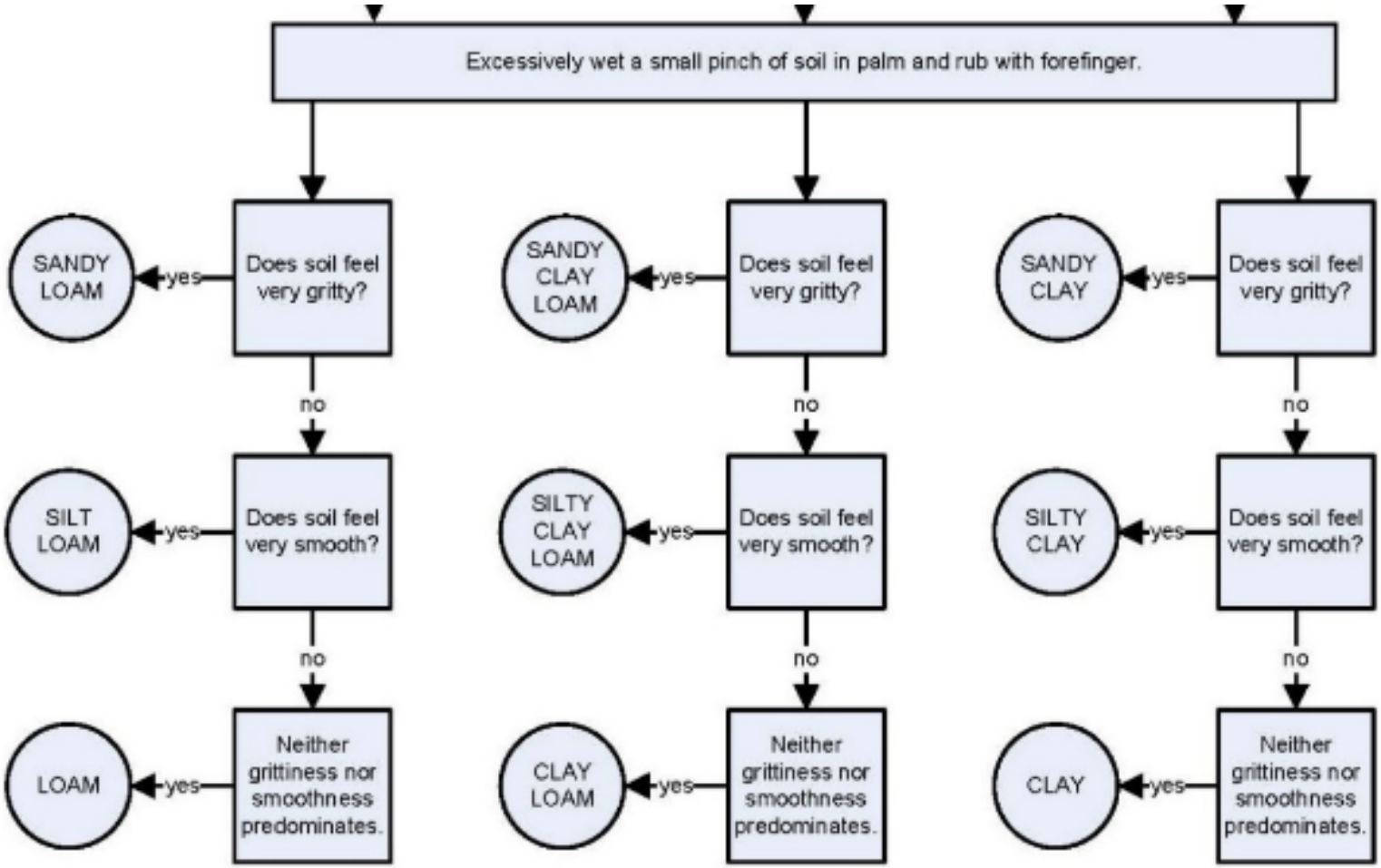
Determining soil texture by feel



Texture = Relative proportion of sand, silt, and clay sized particles by weight



Determining soil texture by feel



Organic Soil Material vs. Mineral Soil Material

- Mineral, mucky modified (A, B, C horizon)
- Organic (O horizon) – 20 to 30 percent organic matter by weight (12 to 18 percent organic carbon)
- Kinds of Organic Material:
  - Fibric: non to slightly decomposed organic matter, >2/3 fiber content
  - Hemic: partially decomposed organic matter, 1/3 to 2/3 fiber content
  - Sapric: well decomposed organic matter, <1/3 fiber content

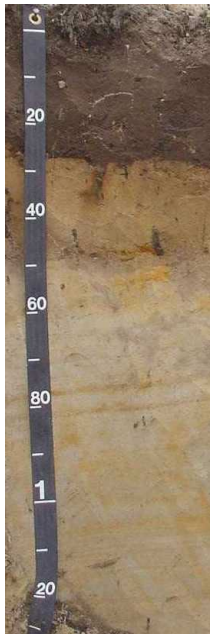
Coarse fragments

Gravel	2.0 mm to 3 inches
Cobbles	3 inches to 10 inches
Stones	10 inches to 2 feet
Boulders	Greater than 2 feet

Estimated by volume

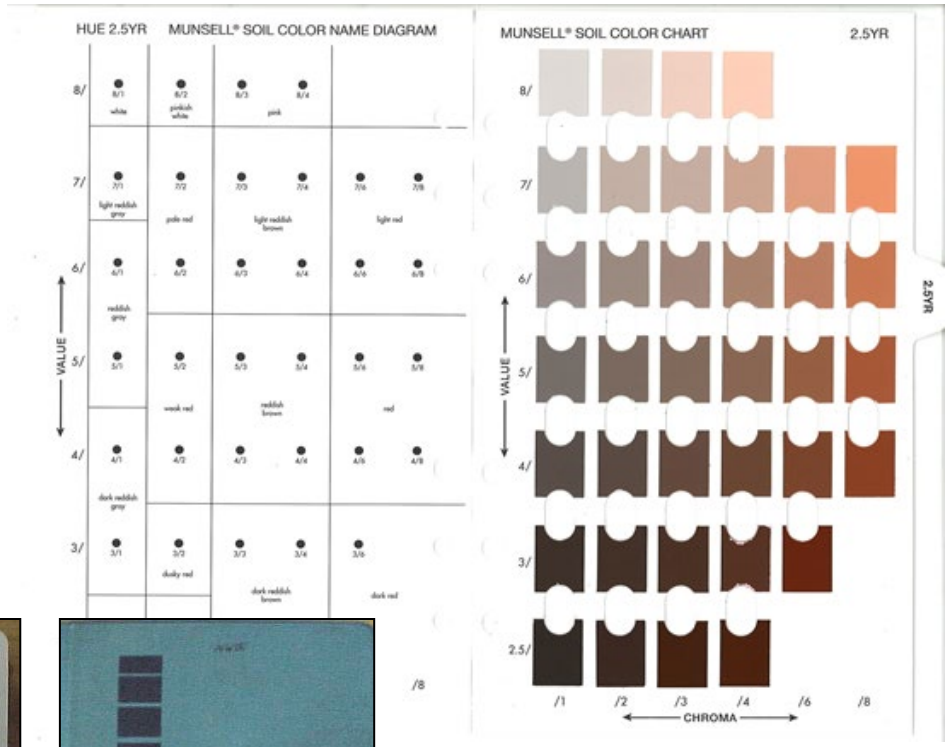
Soil Color

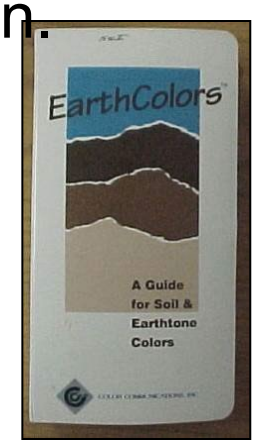
- Organic matter: Brown or black
- Iron: Yellow, orange, and red
- Manganese: purplish black
- Parent material mineralogy: varies

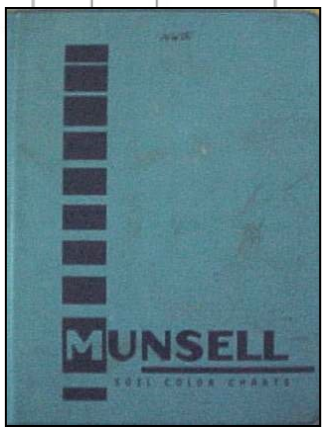




Munsell® or Earth Colors®

- The Munsell notation system is a system for recording color.
  - Earth Colors and Munsell books use the same color notation.







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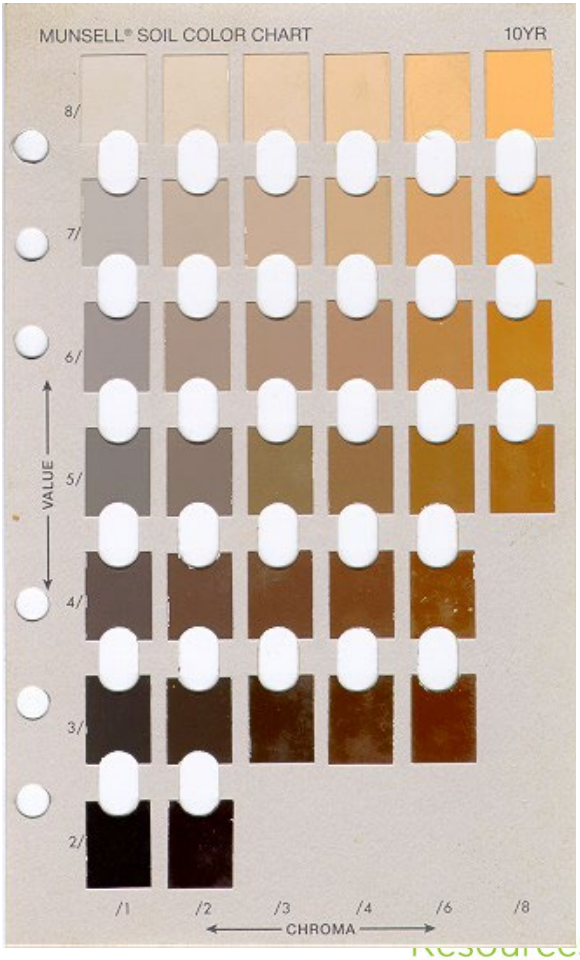
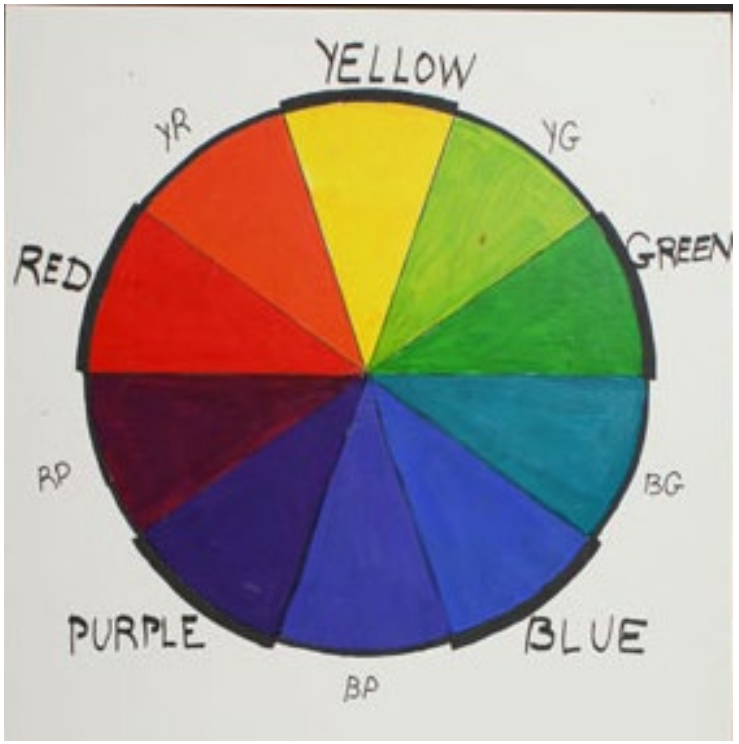
Soil Color

- Munsell system uses three elements of color:
  - Hue
  - Value
  - Chroma



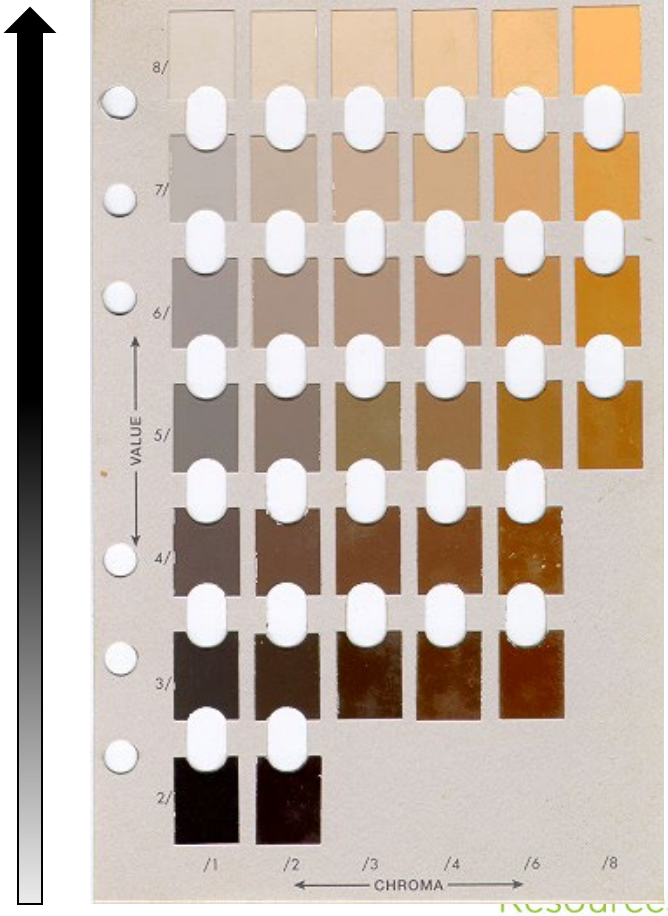
Hue

- The dominant color
  - R (Red)
  - Y (Yellow)
  - YR (Yellow-Red)



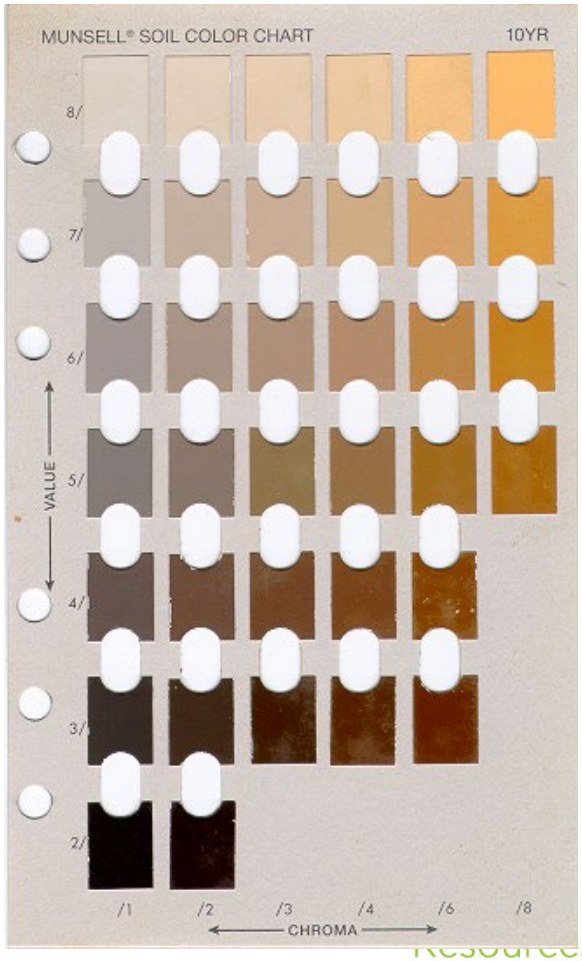
Value

- How light or dark is the color
  - High value = white
  - Low value = black



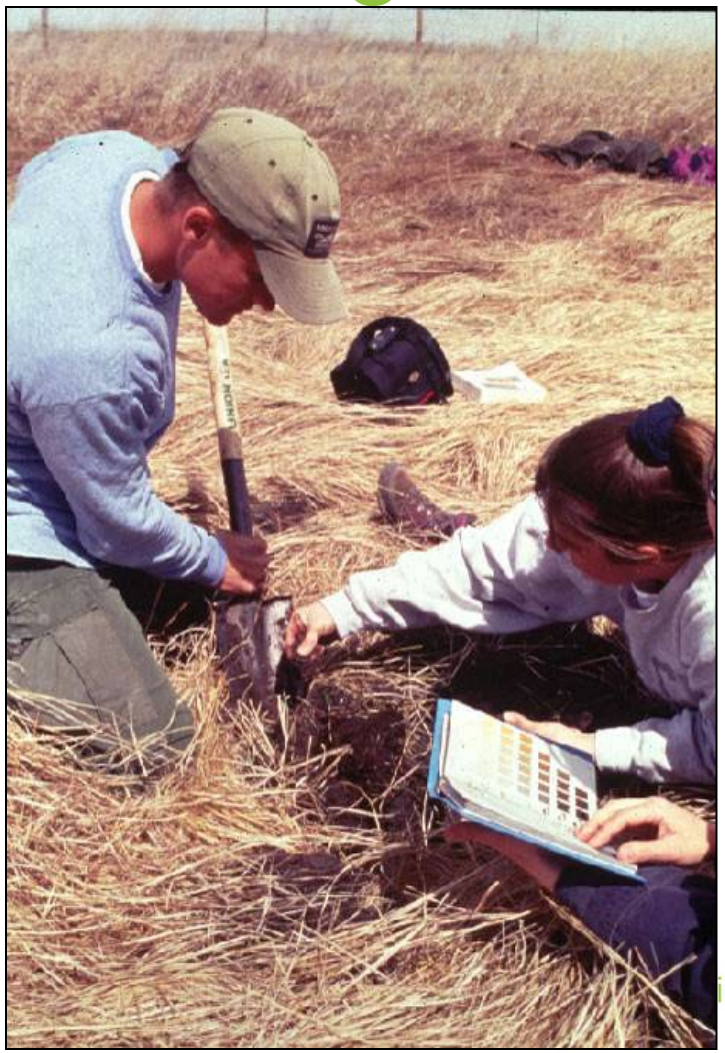
Chroma

- The strength or saturation of color
  - Low chroma: lack of saturation
  - High chroma: more saturation



Optimum conditions for reading soil colors:

- Soil moisture:
  - Moist
- Light:
  - In the sunlight
  - No artificial light
  - No sunglasses
- Soil surface:
  - broken face
- If dry, moisten to record color
- If wet, allow to dry to moist state
- Record color immediately after sampling.
  - Ferrous iron can oxidize rapidly after exposure to oxygen and can create colors of higher chroma.



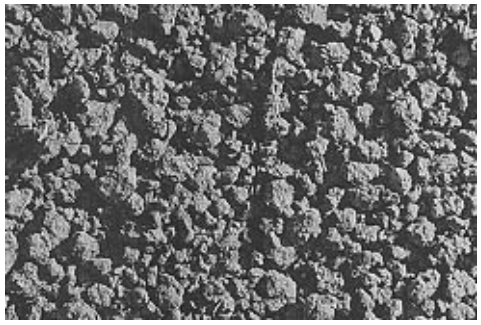
Describing Soil Color

- Matrix (predominant) color for each layer.
- Multiple soil colors can be redoximorphic features.

Structure

- Cohesion of particles into larger units = PEDS

Granular



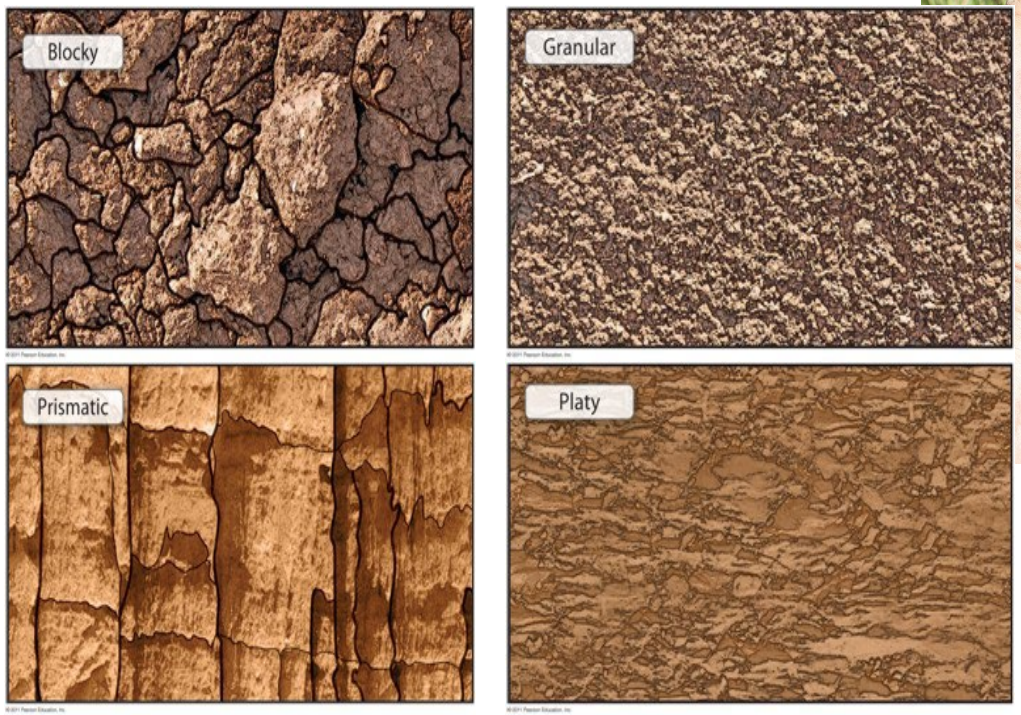
Blocky

Single-Grain

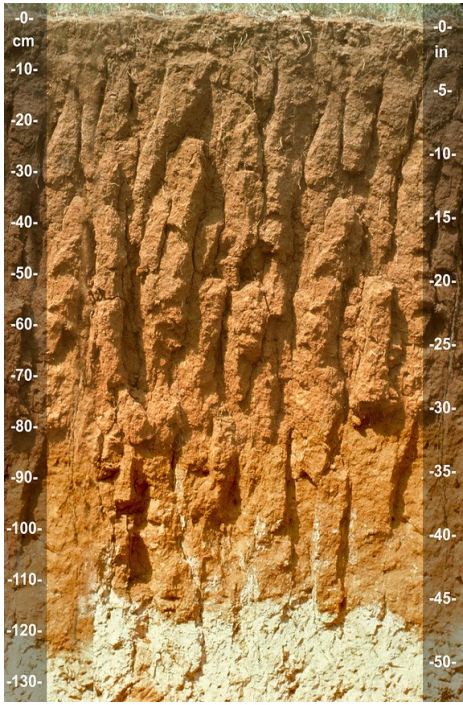
USDA-NRCS Davis, CA

Structure

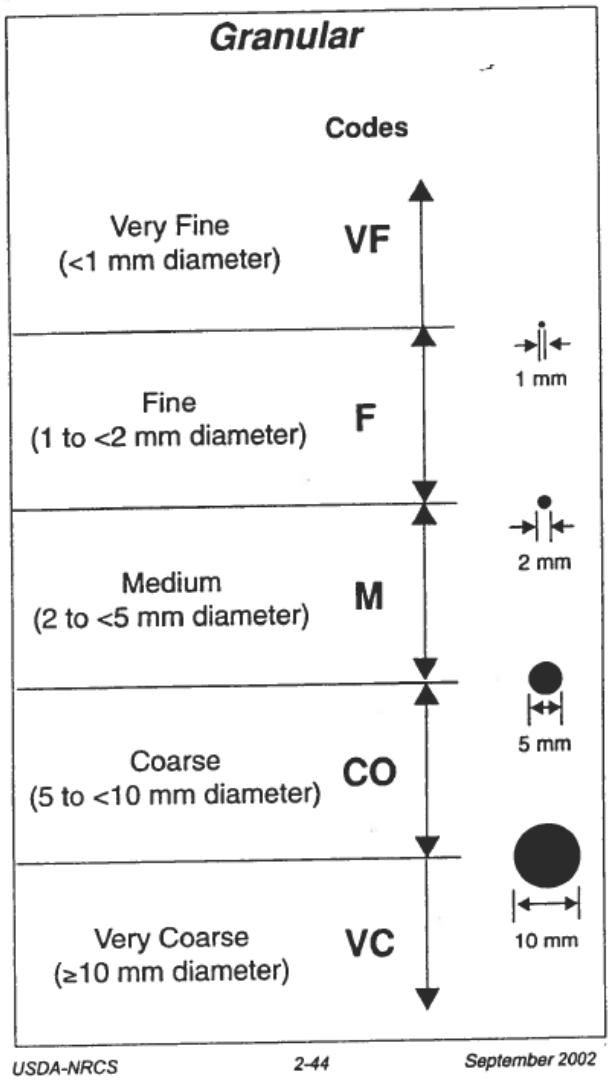
Granular, blocky, platy, prismatic

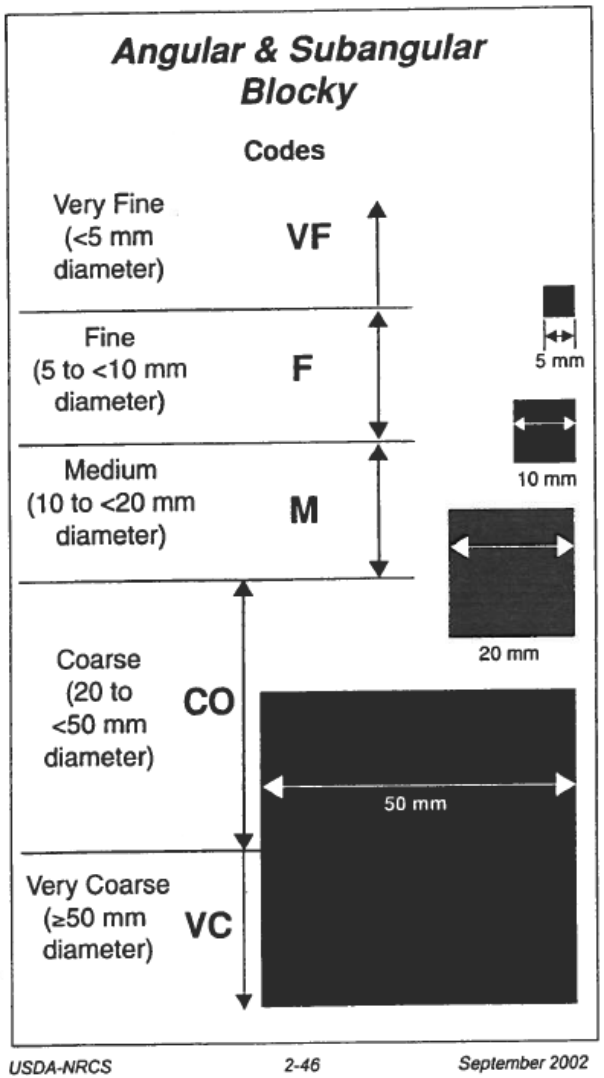


Pearson Education, Inc 2011

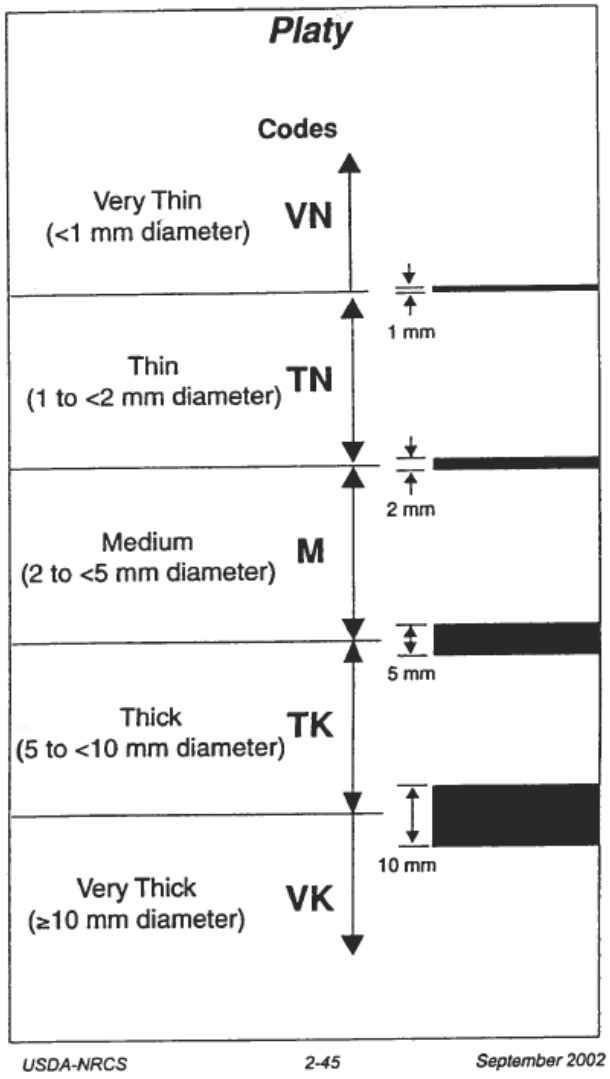


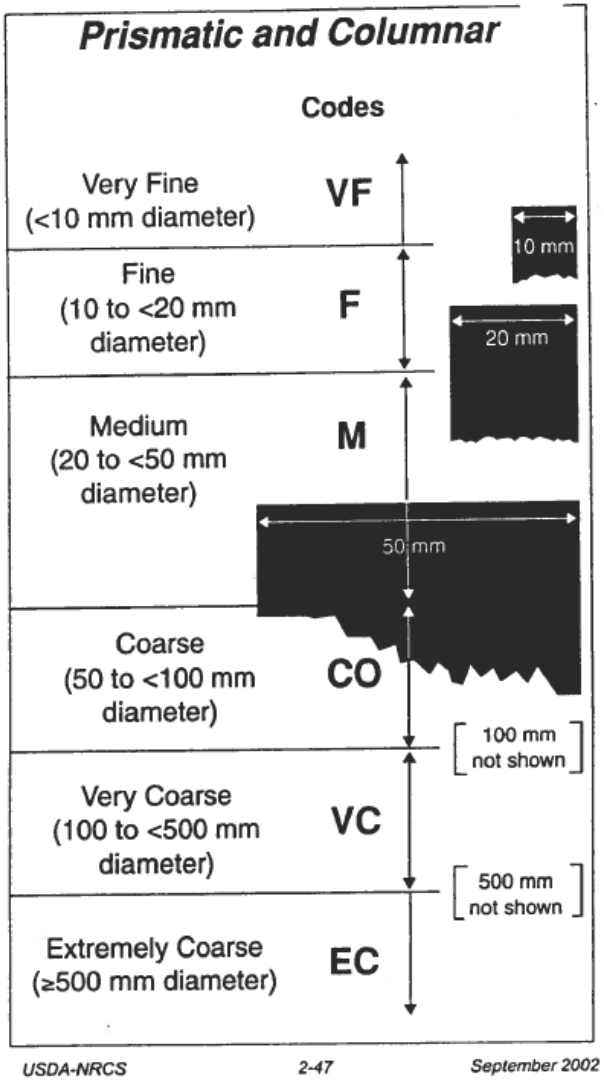
Photos courtesy of John Kelley





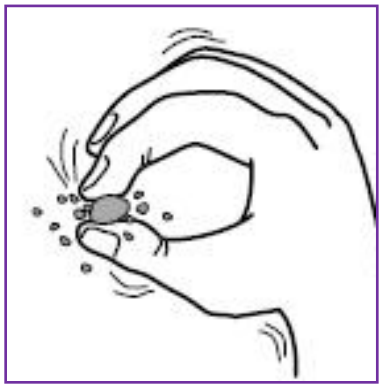
Source: Field Book for Describing and Sampling Soils, Version 2.0



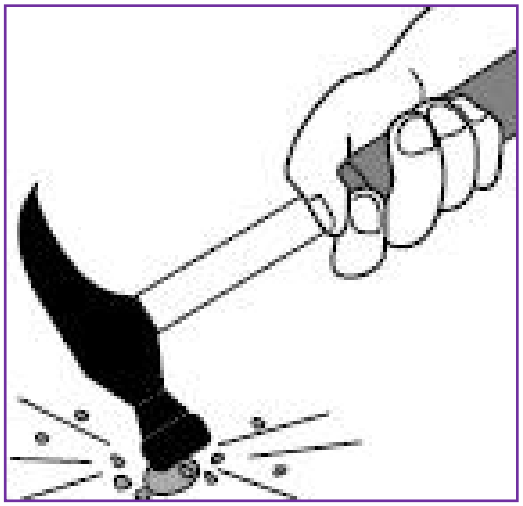


Source: Field Book for Describing and Sampling Soils, Version 2.0

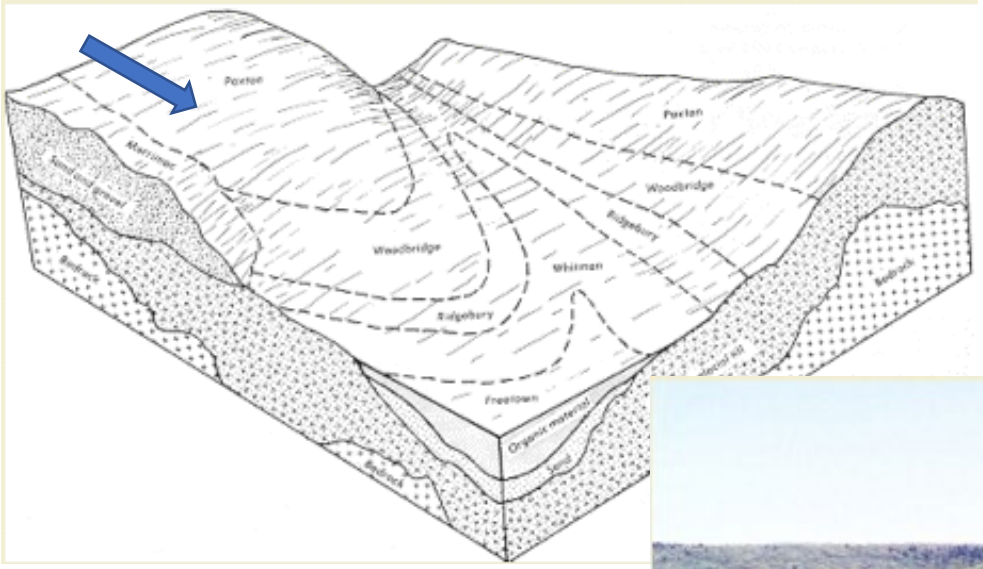
Consistence



Cohesiveness, adhesiveness, bulk density
resistance to force

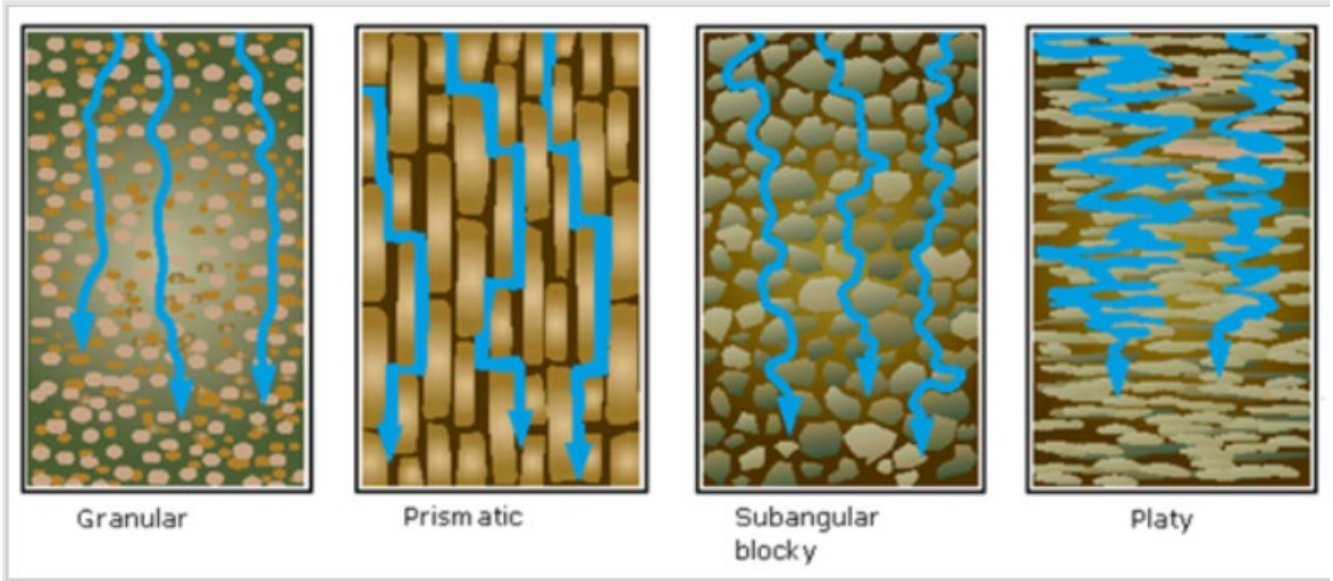


Loose- intact specimen not obtainable
Very Friable – very slight force between fingers
Friable – slight force between fingers
Firm – moderate force between fingers
Very Firm – strong force between fingers
Extremely Firm – moderate force between hands
Slightly Rigid – foot pressure by full body weight


Paxton
Woodbridge
Ridgebury
Whitman
Freetown
Organic material
Bedrock

What influences water movement?

- Gravity
  - Texture
  - Structure
  - Slope
  - Impermeable layers
- Capillary action
  - Texture
  - Structure



Water movement through different soil structure shapes. Developed by USDA-NRCS.

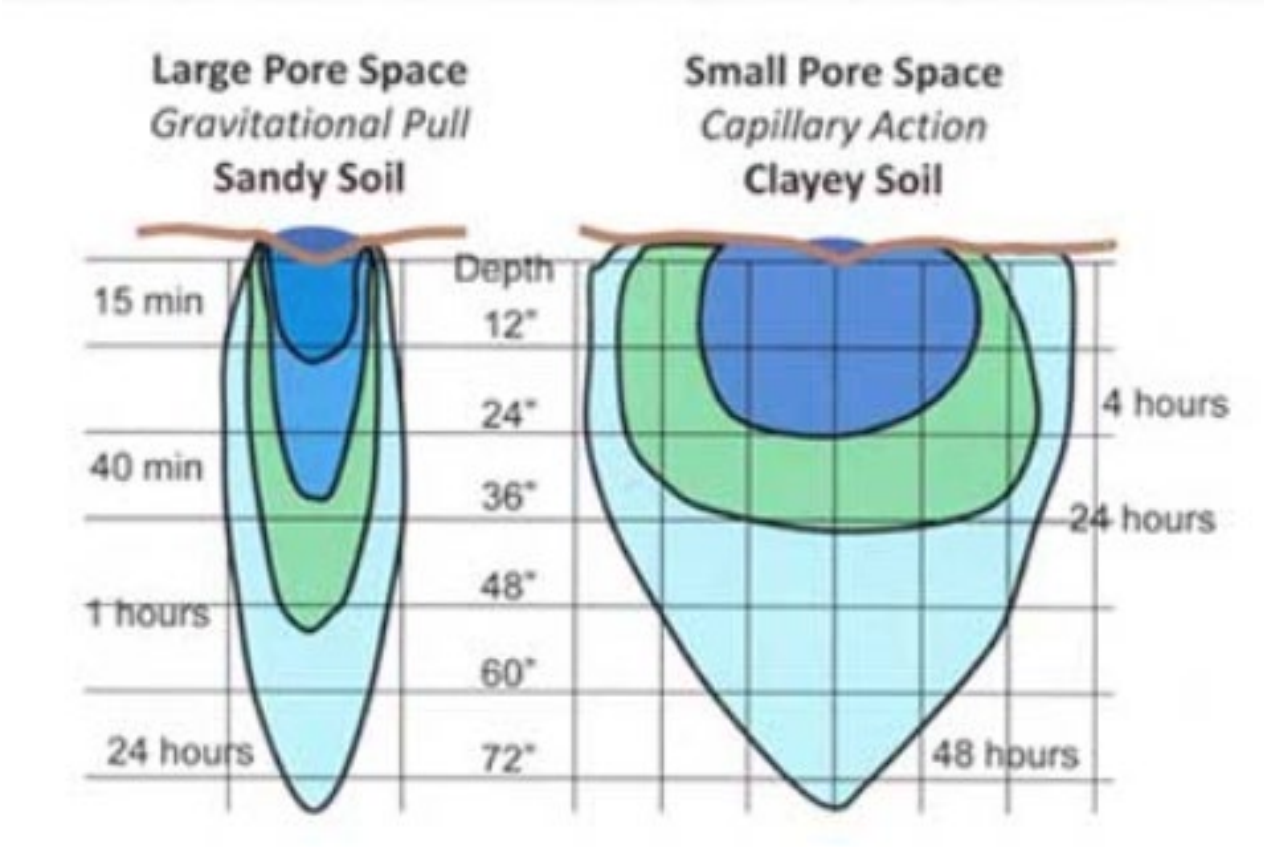
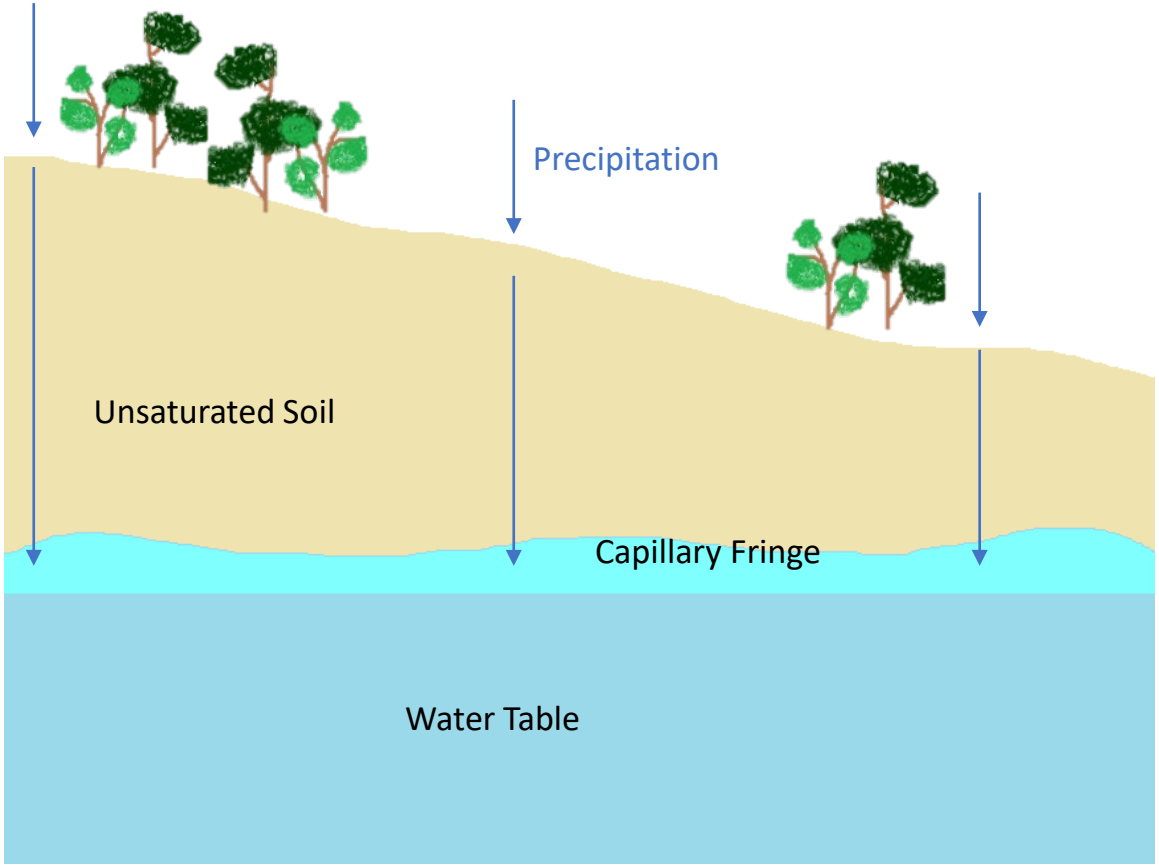
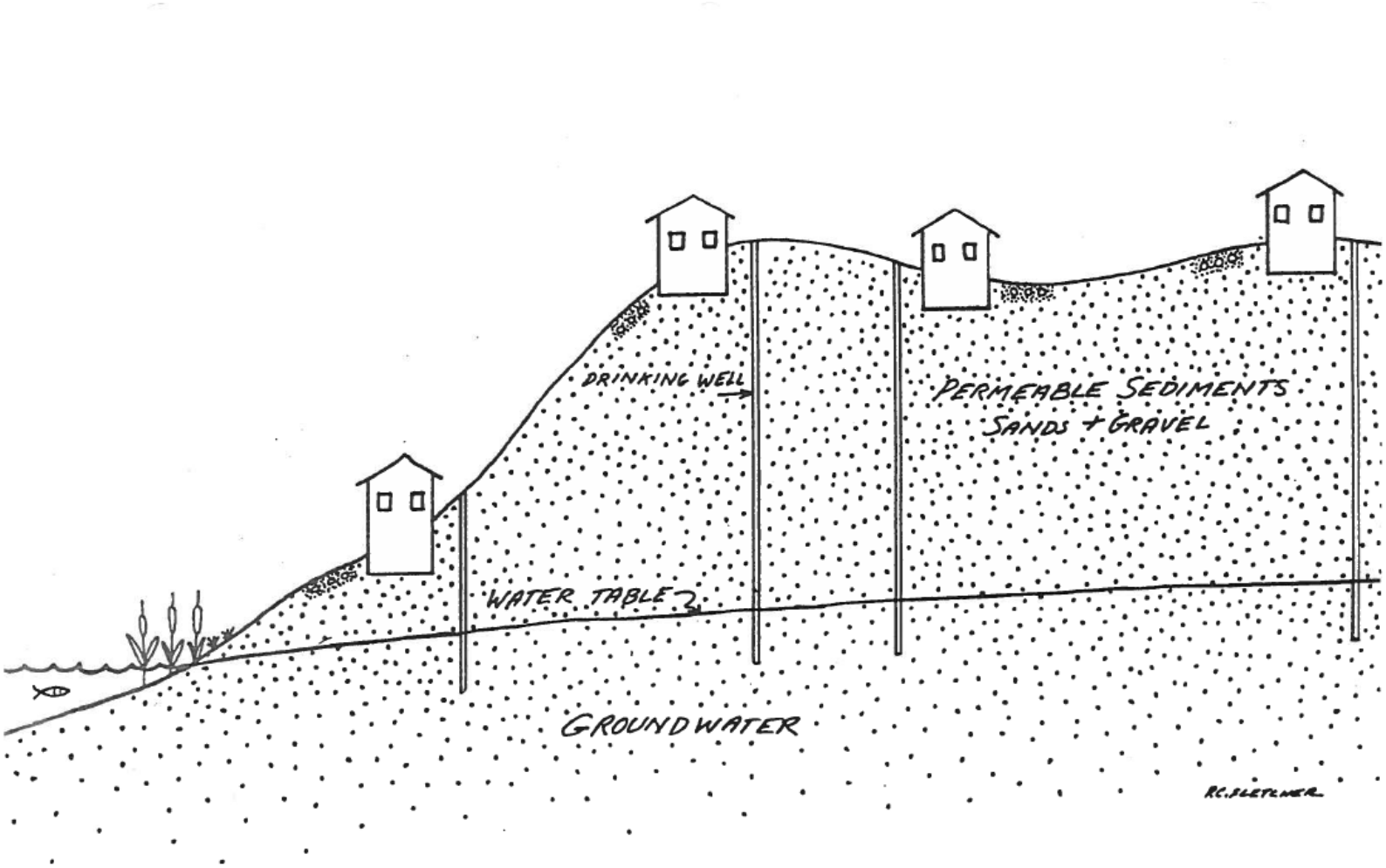


Figure 1: Comparison of water movement in sandy versus clayey soils. Water moves more quickly through sandy soils due to larger pore spaces and the force of gravity. In finer textured soils, water moves more slowly and is drawn through by capillary action. Figure: Colorado State Extension

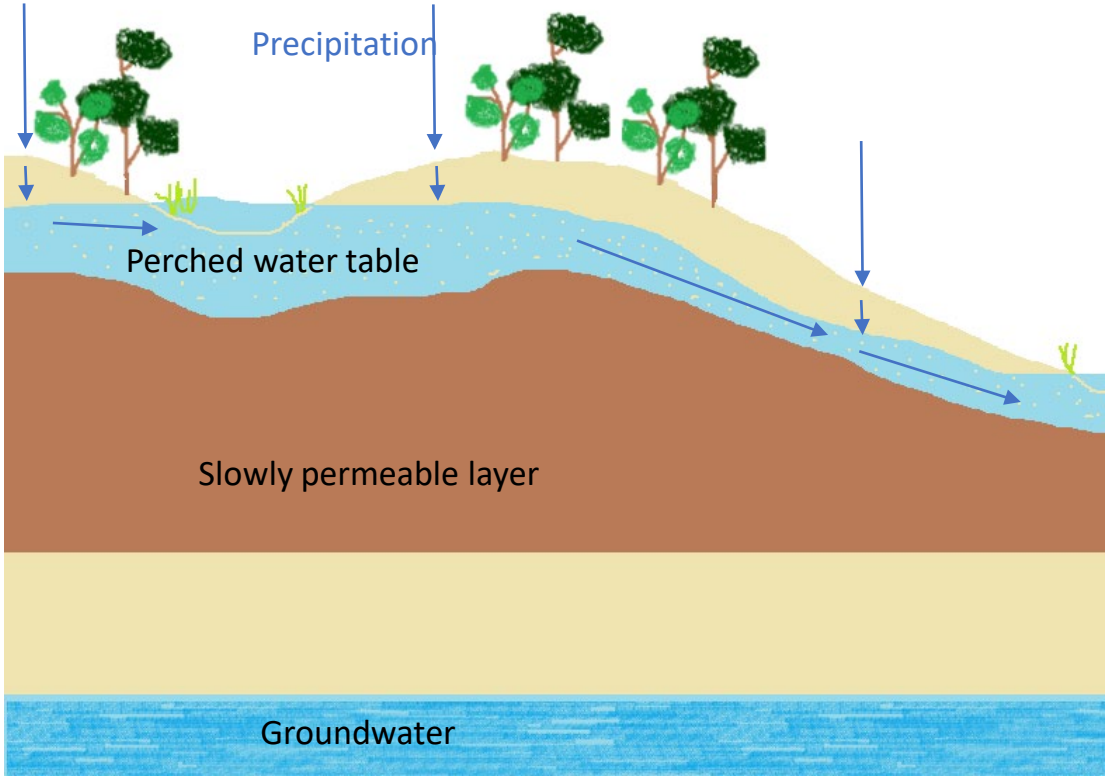
Soils no limiting layer – outwash/glaciofluvial

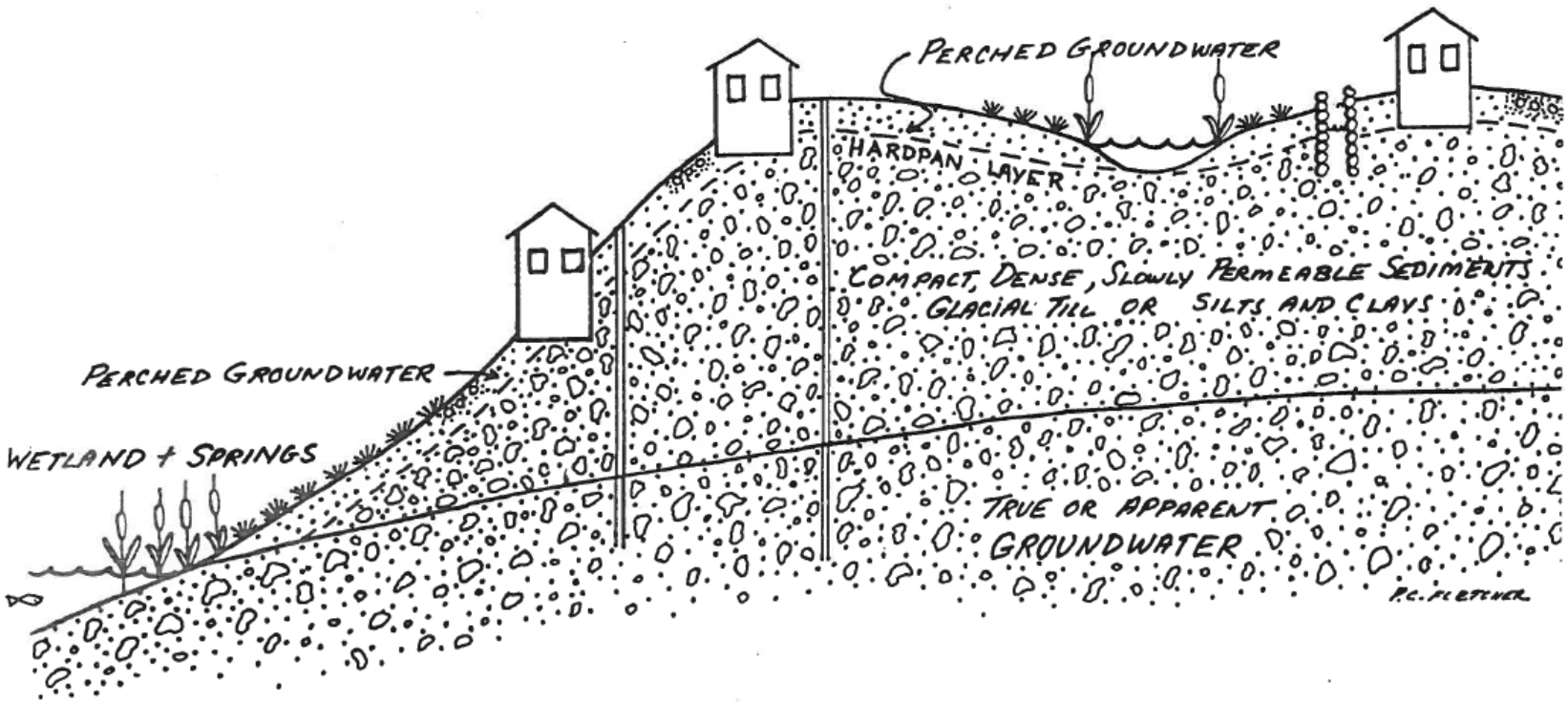


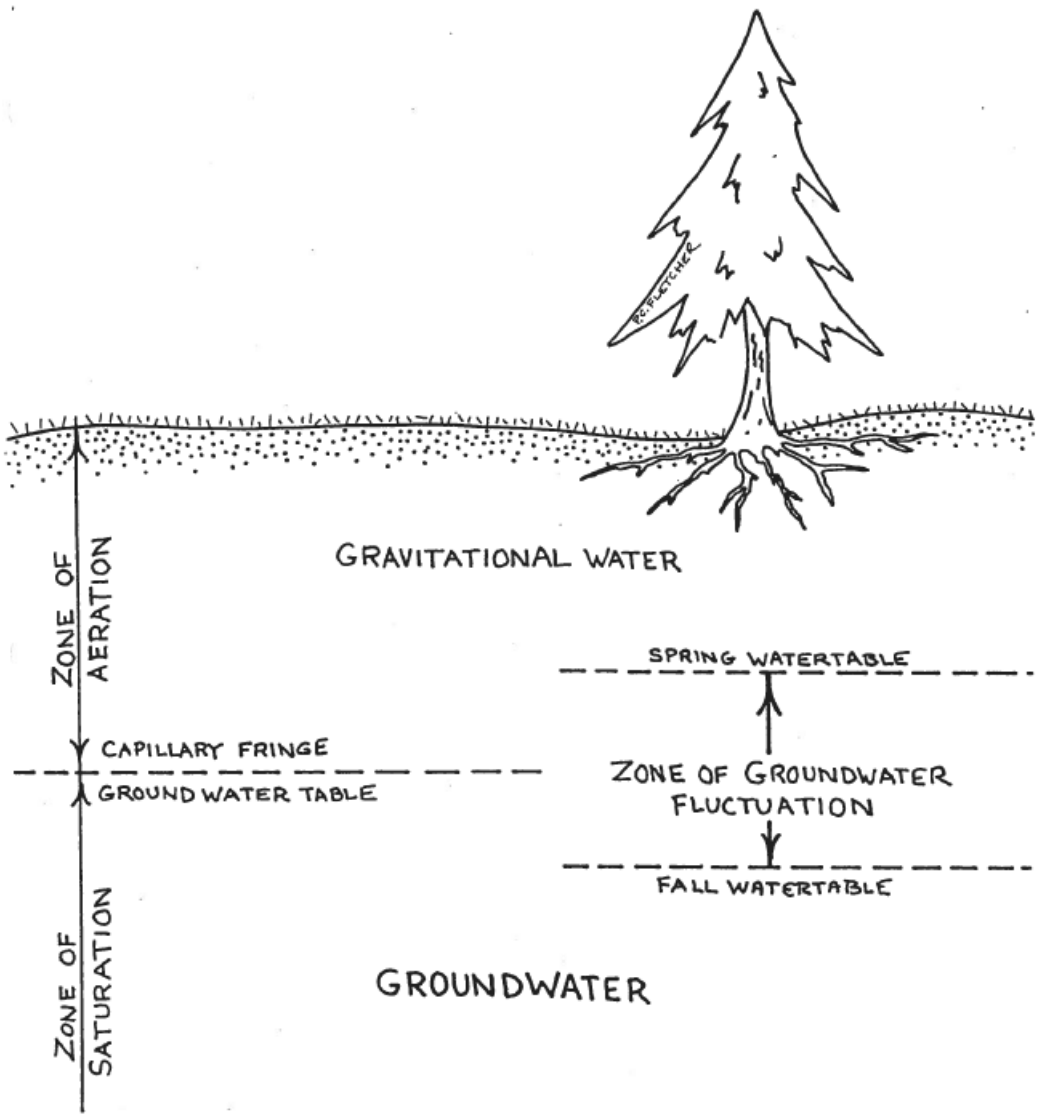
Soils no limiting layer – outwash/glaciofluvial



Soils with a limiting layer – dense till/ impermeable bedrock

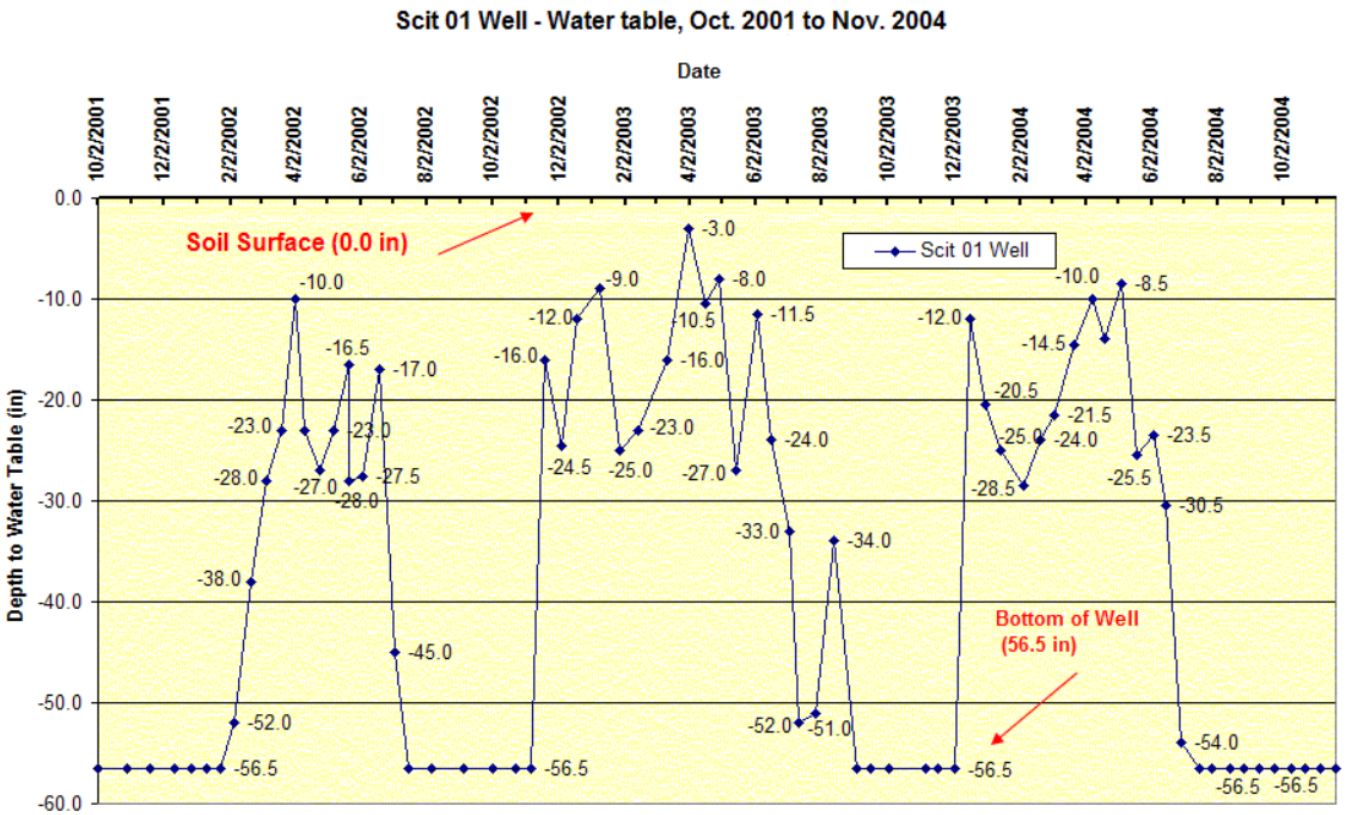


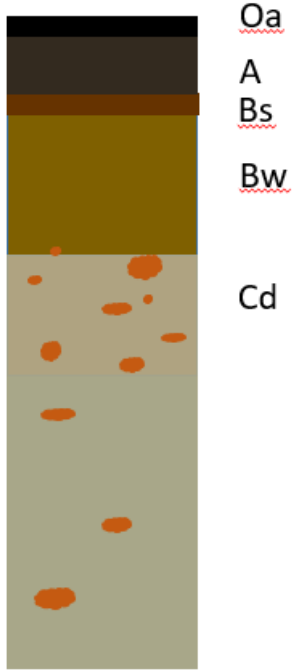

PERCHED GROUNDWATER
HARDPAN LAYER
COMPACT, DENSE, SLOWLY PERMEABLE SEDIMENTS
GLACIAL TILL OR SILTS AND CLAYS
PERCHED GROUNDWATER
WETLAND + SPRINGS
TRUE OR APPARENT
GROUNDWATER
P.C. FLETCHER


P.C. FLETCHER
GRAVITATIONAL WATER
ZONE OF AERATION
SPRING WATERTABLE
CAPILLARY FRINGE
GROUND WATER TABLE
ZONE OF GROUNDWATER FLUCTUATION
FALL WATERTABLE
ZONE OF SATURATION
GROUNDWATER

PC Fletcher

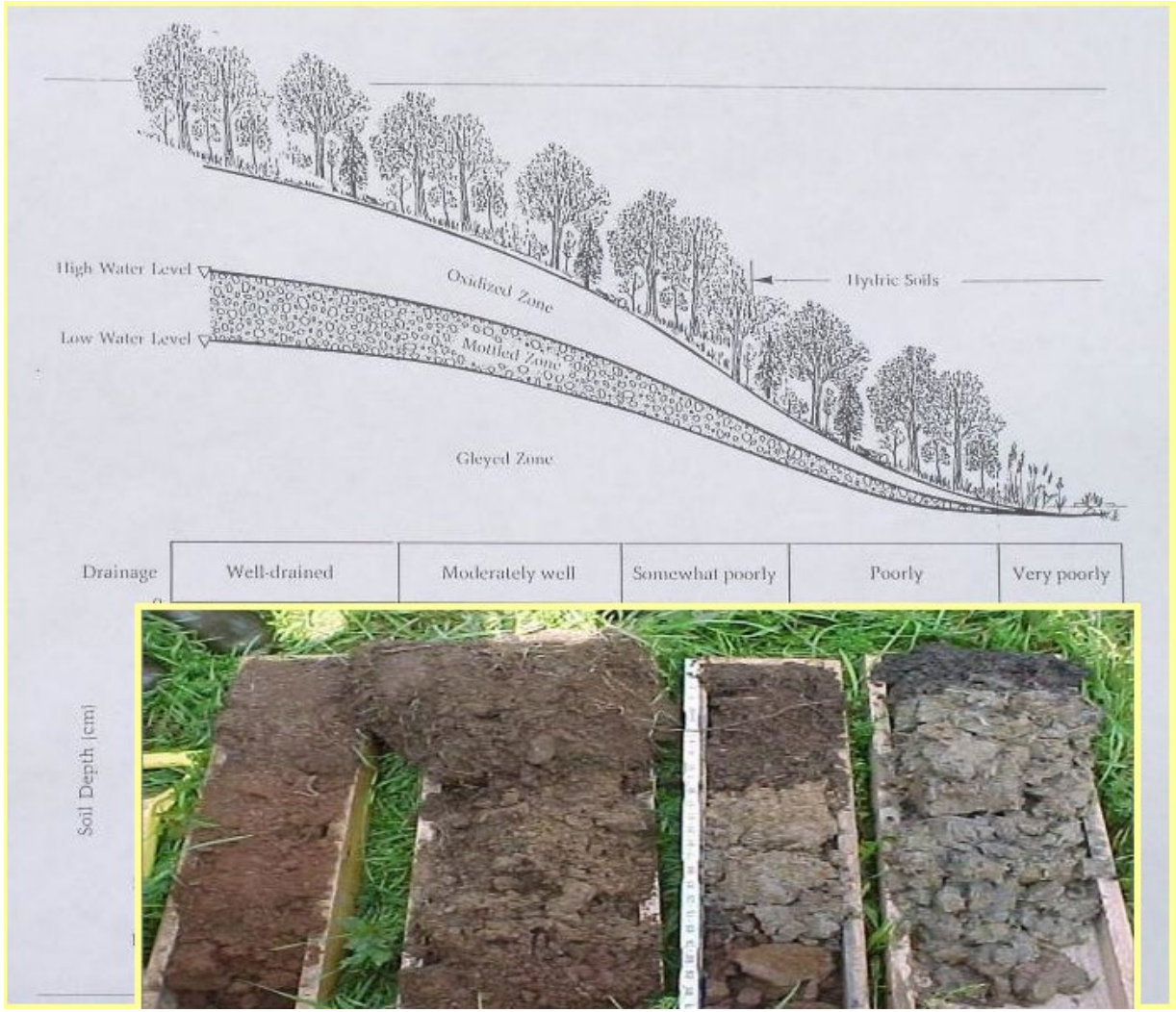
Water table fluctuations





Soil Drainage Class

(water table depth)



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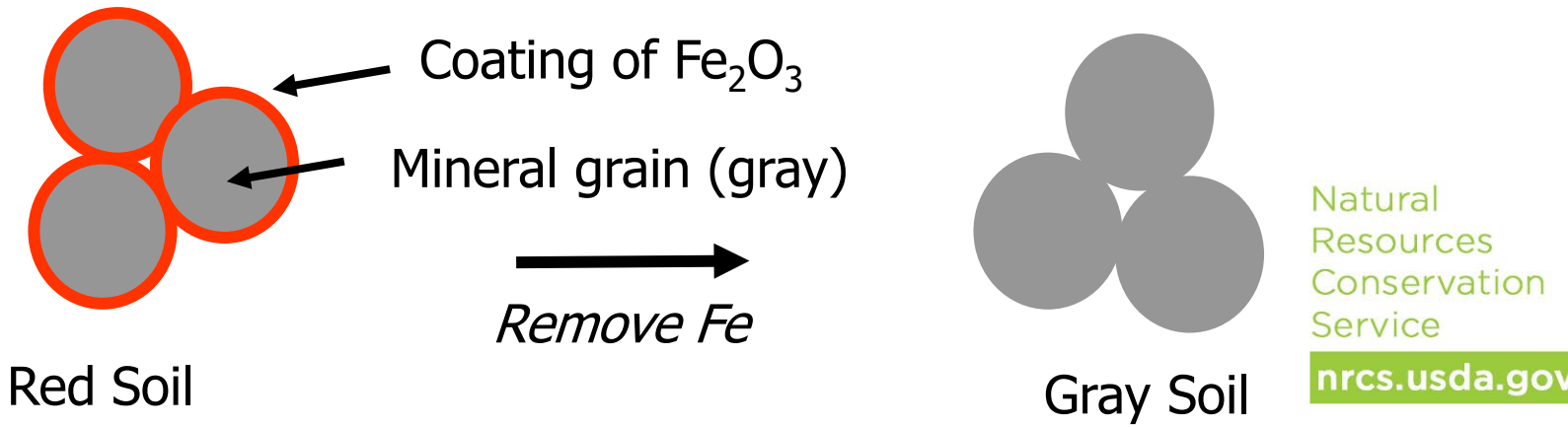
Redoximorphic Features

Features formed by the processes of reduction, translocation, and/or oxidation of Iron (Fe) and Manganese (Mn) oxides

Oxidation/Reduction and Soil Color

- In subsoil horizons, Fe and Mn oxides give soils their characteristic brown, red, and yellow colors.
- When saturated and reduced, Fe and Mn are mobile and can be stripped from soil particles.
- This leaves the characteristic mineral grain color, usually a neutral gray.



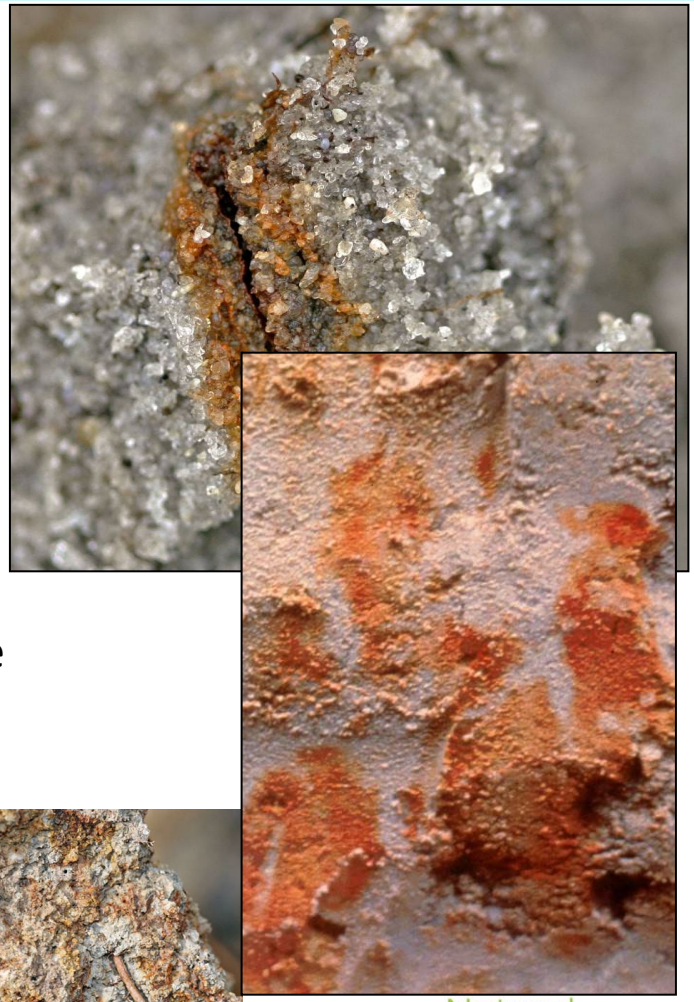
How Redox Features Form

Conditions needed:

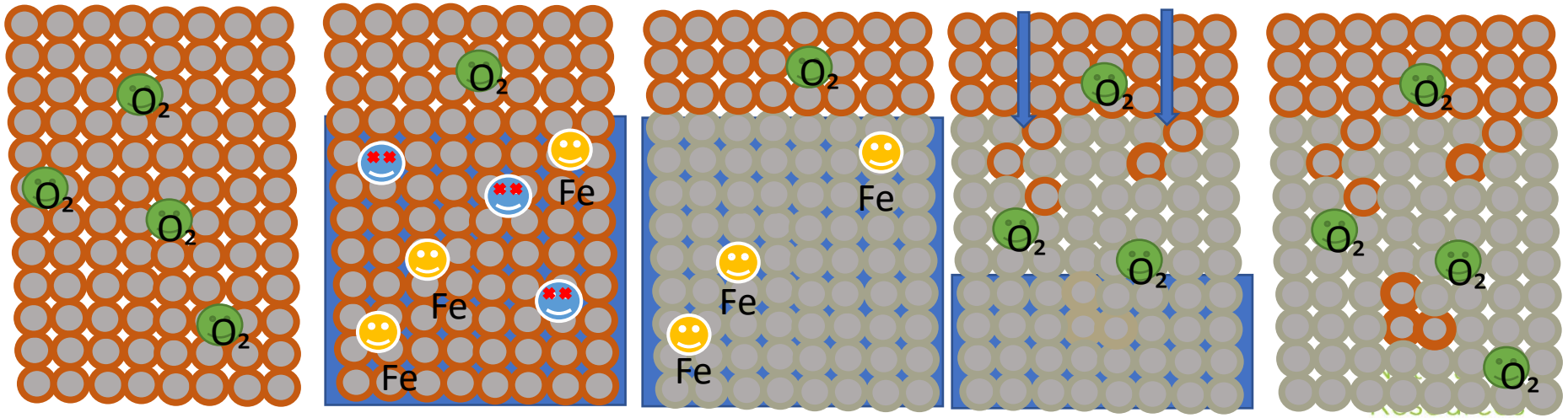
- Fluctuating water table
- Temp above biological zero
- Organic matter
- Microorganisms
- Anaerobic conditions
- Iron minerals in the soil

How Redox Features Form

Oxygen	O_2	→	H_2O
Nitrogen	NO_3-	→	$N_2\uparrow$; NH_4^+
Manganese	Mn^{+4}	→	Mn^{+2}
Iron	Fe^{+3}	→	Fe^{+2}
Sulfur	SO_4^{-2}	→	H_2S (Hydrogen sulfide gas)
Carbon	CO_2	→	CH_4 (Methane)



Water table rises and soil becomes saturated	Aerobic microorganisms in soil consume the free O_2 (1-2 days)	Electrons produced by microorganisms (respiration) reduce elements	Ferrous (reduced) iron is clear and more mobile than Ferric (oxidized) iron. It may move with the groundwater	Water table drops, O_2 is reintroduced, Iron oxidizes (1-2 years to see features with the naked eye)
	Anaerobic microorganisms begin to consume organic matter	It takes about 10 days in a lab under ideal conditions for the iron to become reduced. Can take years to see a gray matrix.		~30 days of flooding needed to produce a visible concentration



Redox Concentrations

Bodies of apparent accumulation of Fe/Mn oxides

- Masses
- Pore linings
  - on ped faces
  - in root channels
- Nodules and concretions

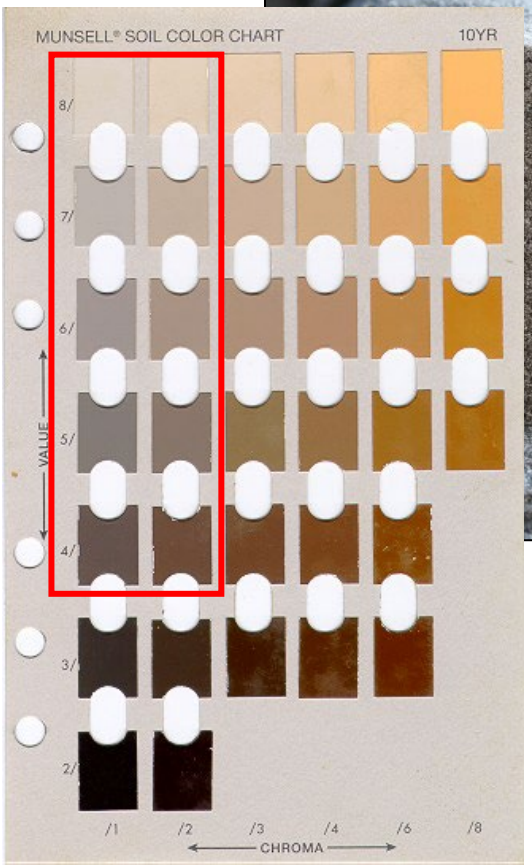
Redox concentrations

- Masses
- Pore linings
- Root channels
- Iron (red) and Manganese (black)

Redox Depletions

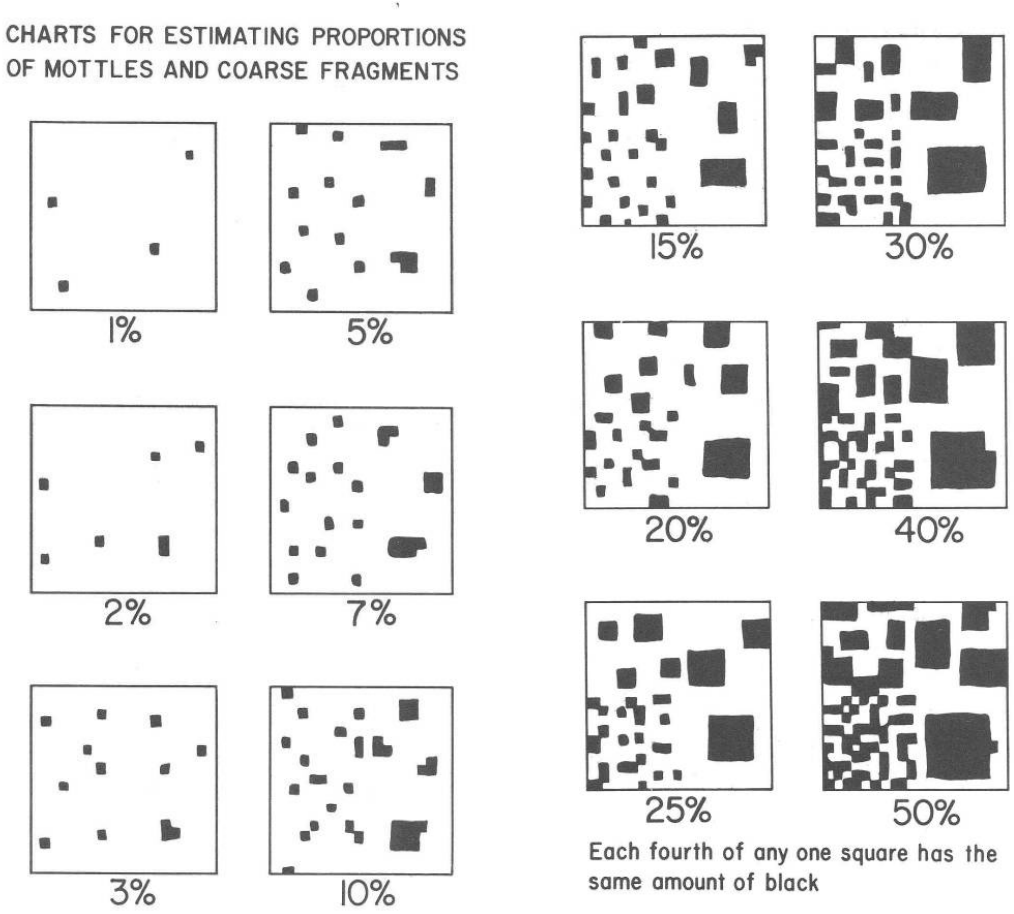
Bodies of low chroma where Fe/Mn oxides have been stripped out

- Generally value ≥4
- Chroma ≤2
- Formerly called
  "gray mottles"



Abundance of Features

- Few: <2%
- Common: 2 to <20%
- Many: >20%

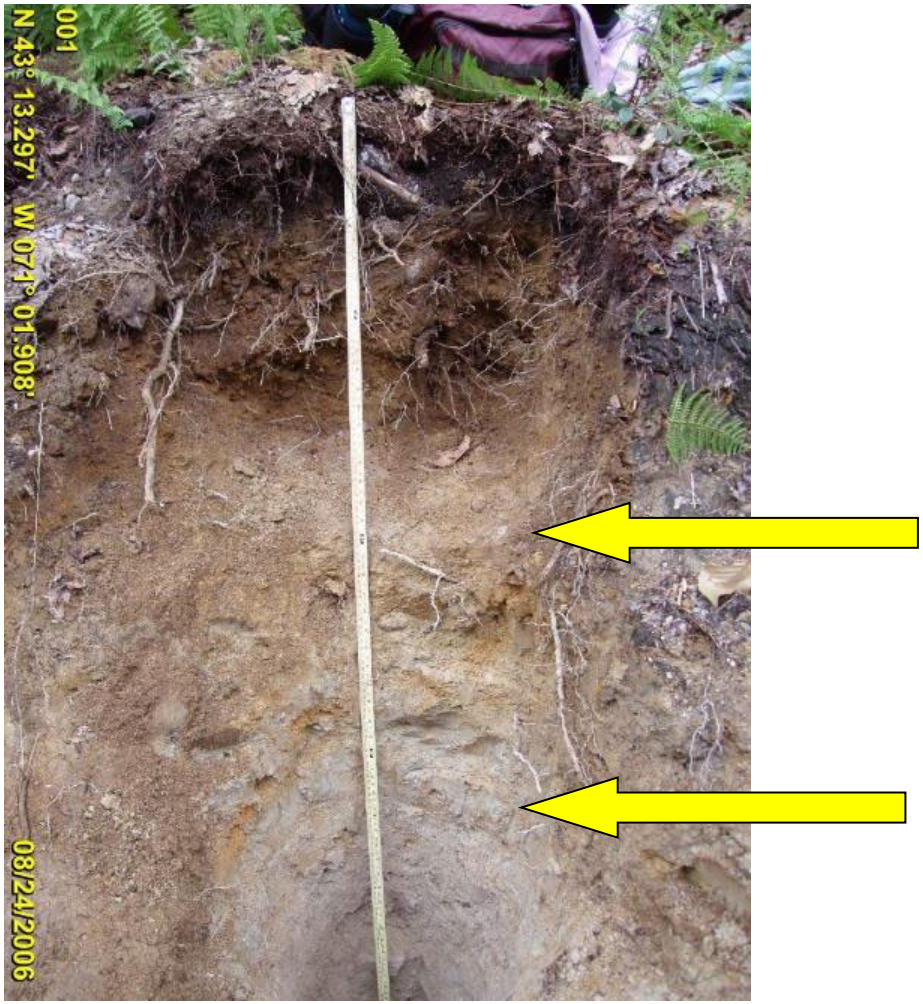


Supplemental Materials

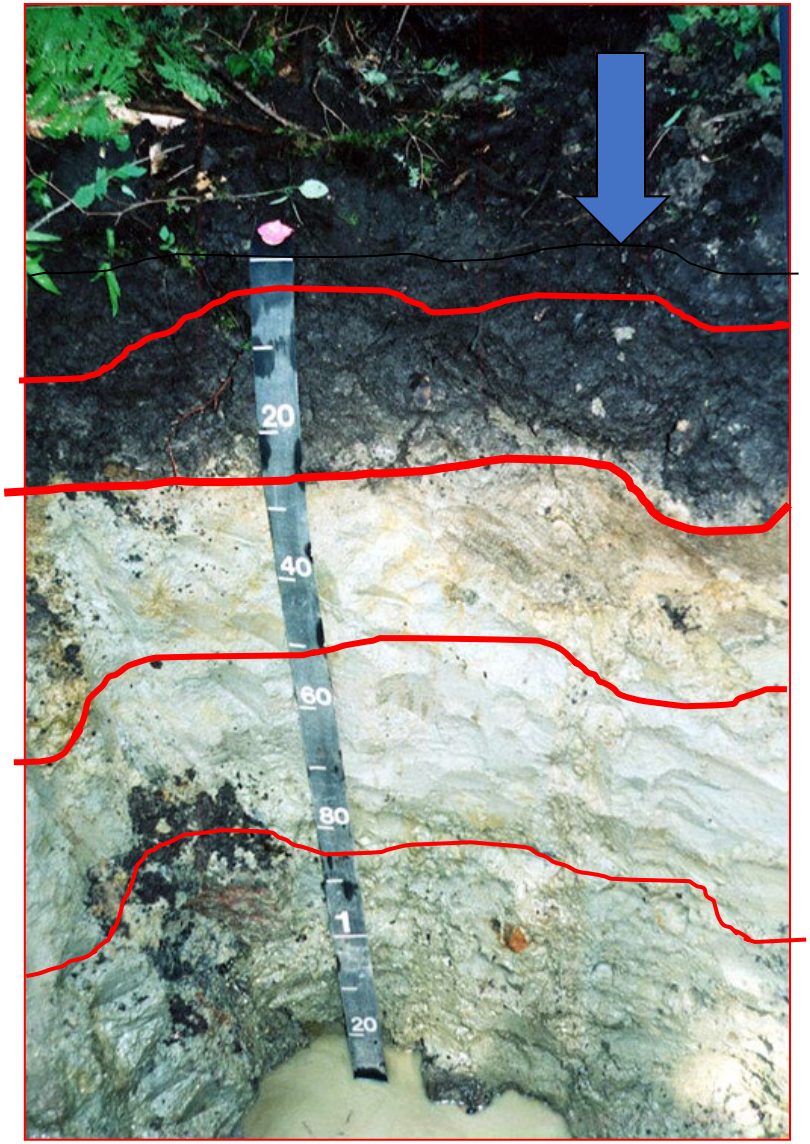
Can you see the redox?

Where is the water table in the spring?

Top of the water table is at 24” making it a moderately well drained soil



Describing Soils



Layer 1: Oa Muck surface

Layer 2: A horizon, MK L, 10YR 2/1, with Roots

Layer 3: Bg1 horizon, VFSL, 5Y 5/2 with Redox, No Roots

Layer 4: BCg horizon, FSL, 5Y 5/2, No Roots

Layer 5: 2Cg horizon, GR COS, 5Y 4/2, No Roots

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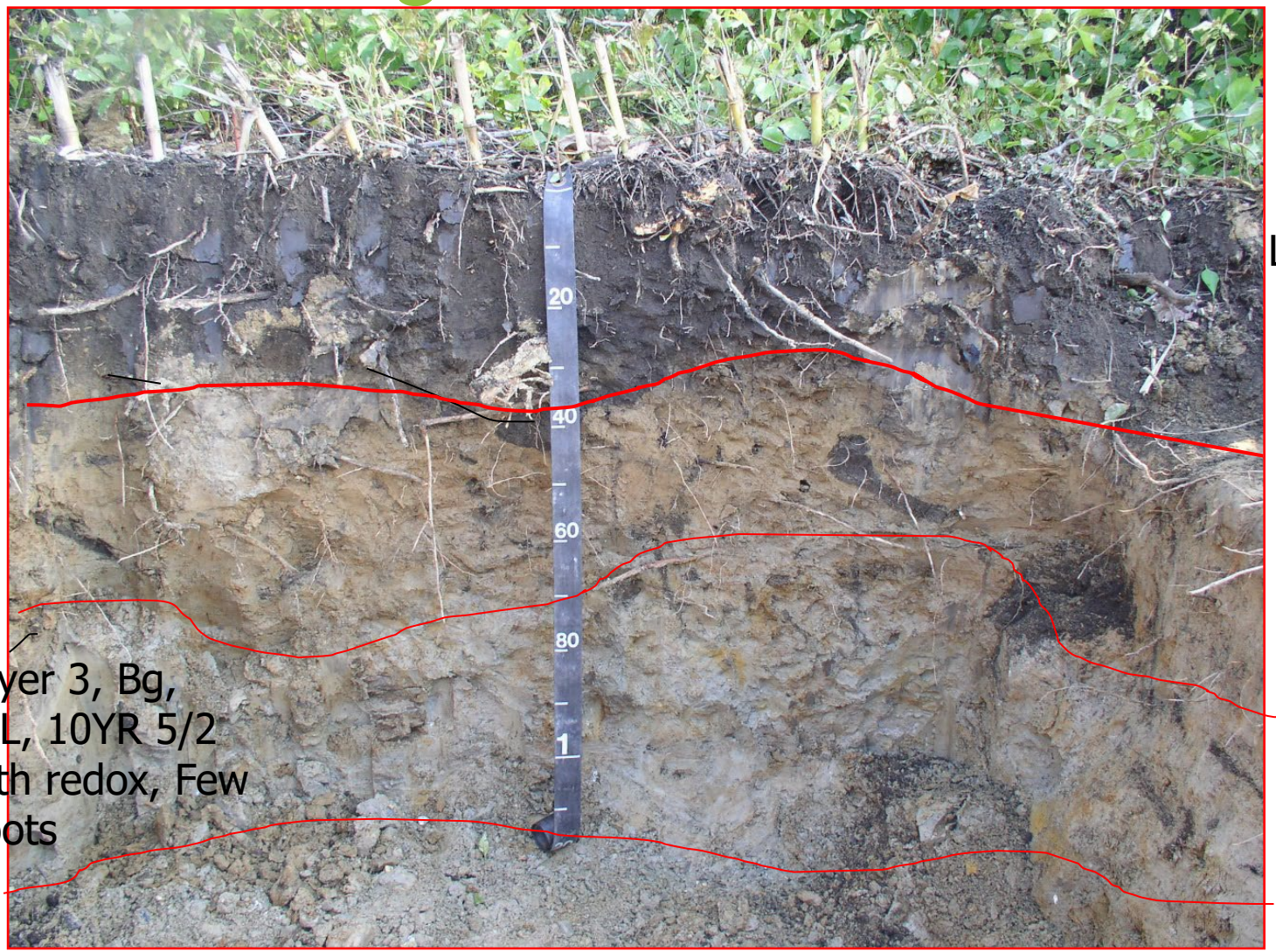
Describing soils



Layer 1, Ap, FSL, 10YR 2/2, Many Roots

Layer 2, Bw, FSL, 10 YR 4/3, with redox, Common roots

Layer 3, Bg, FSL, 10YR 5/2 with redox, Few Roots

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https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

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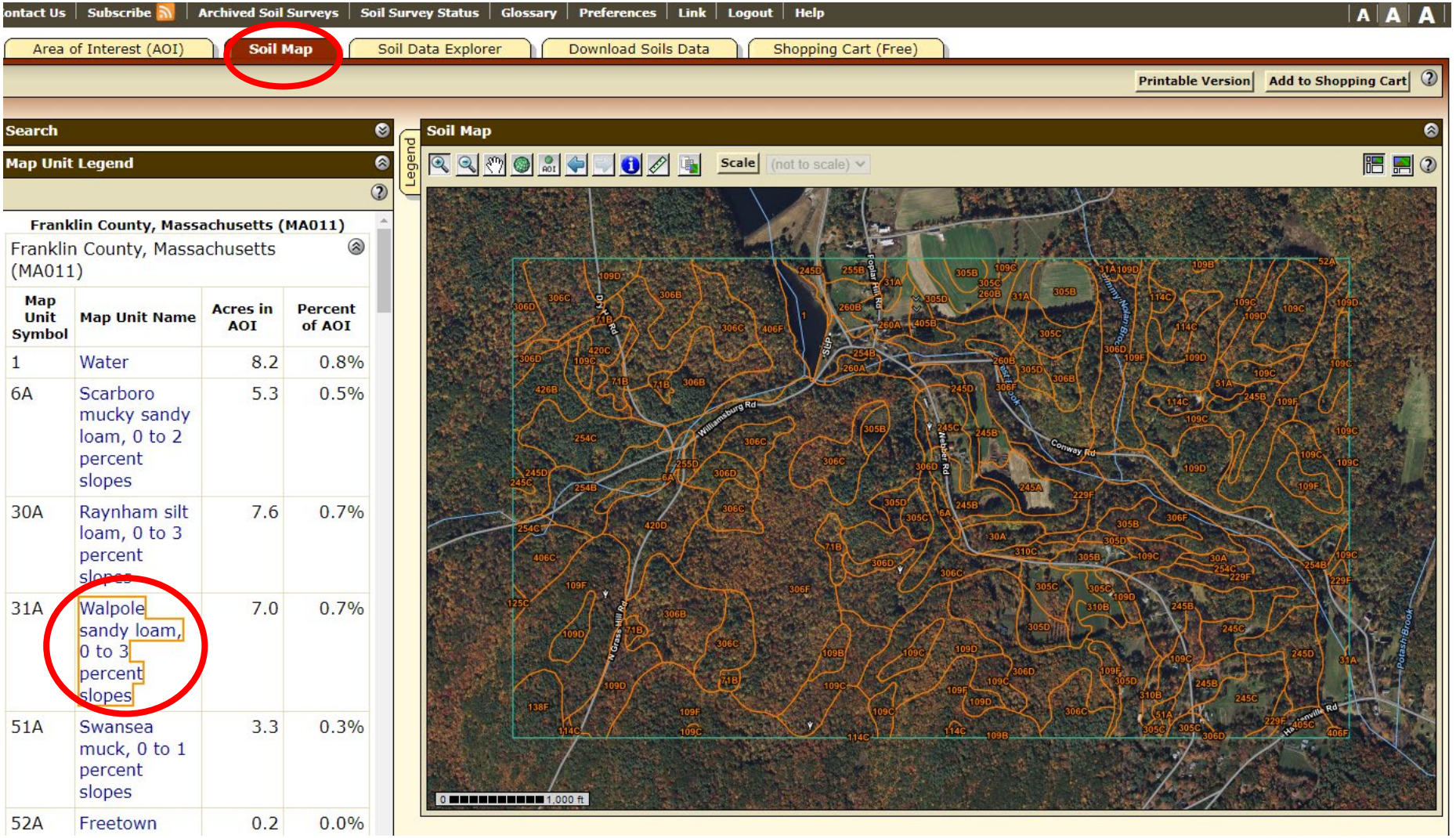

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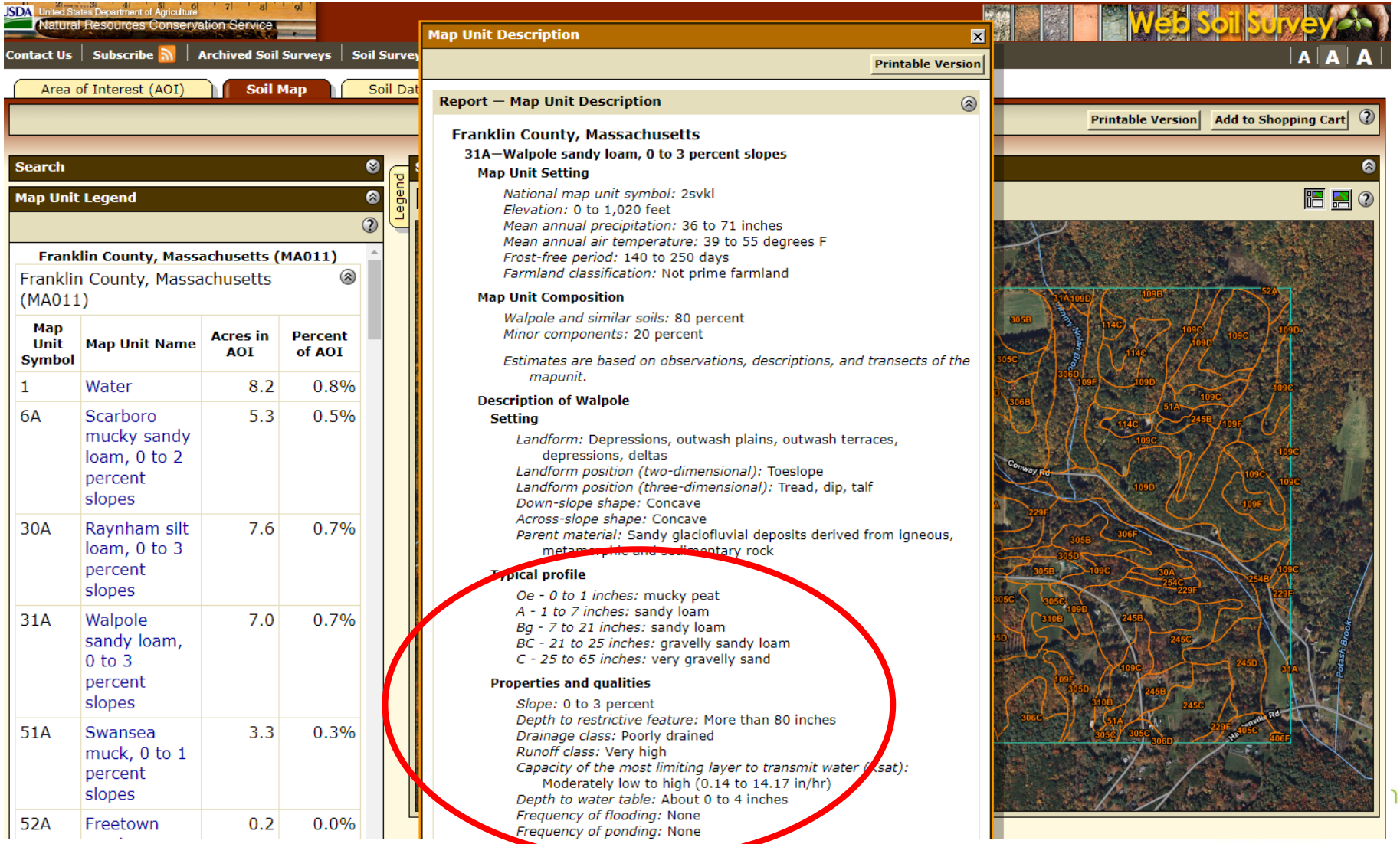

https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

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Sign up for E-mail updates on the Official Soil Series Descriptions (OSDs)

DIRECTIONS

The following entry field may be used to retrieve an Official Soil Series Description and/or a Series Extent Map. If you enter a series name that is found in the database, the Official Soil Series Description will be displayed with a link to the Series Extent Map at the end. If you enter a series name that is not found, the best-matched series names will be displayed with links to the Official Soil Series Description and Series Extent Map. You may also retrieve a list of soil series names that match a partial name you enter using wildcard characters with links to the Official Soil Series Description and Series Extent Map.
Click **here** to see the possible wildcard characters.

Enter the Official Soil Series Description name you would like to view or a partial name with wildcard characters. Capitalization does not matter.

walpole

Submit Clear Form

REPORT

Series	Classification	OSD Link	Series Extent Map Link
WALPOLE	SANDY, MIXED, MESIC AERIC ENDOAQUEPTS	View WALPOLE Description	View WALPOLE Extent Map

https://soilseries.sc.egov.usda.gov/osdname.aspx

LOCATION WALPOLE CT+MA NH NY RI VT

Established Series
Rev. MFF-SMF
05/2014

WALPOLE SERIES

The Walpole Series consists of very deep, poorly drained sandy soils formed in outwash and stratified drift. They are nearly level to gently sloping soils in low-lying positions on terraces and plains. Slope ranges from 0 to 8 percent. Saturated hydraulic conductivity is moderately high or high in the surface layer and subsoil, and high or very high in the substratum. Mean annual temperature is about 48 degrees F., and mean annual precipitation is about 43 inches.

TAXONOMIC CLASS: Sandy, mixed, mesic Aeric Endoaquepts

TYPICAL PEDON: Walpole sandy loam - forested, 2 percent slope. (Colors are for moist soil.)

Oe--0 to 3 cm (0 to 1 in); black (10YR 2/1) moderately decomposed forest plant material. (0 to 7 cm thick)

A--3 to 18 cm (1 to 7 in); very dark brown (10YR 2/2) sandy loam; weak medium granular structure; very friable; many fine and medium roots; 8 percent gravel; very strongly acid; clear smooth boundary. (8 to 33 cm thick)

Bg--18 to 53 cm (7 to 21 in); dark grayish brown (2.5Y 4/2) sandy loam; massive; friable; common fine and few medium roots in the upper part of the horizon and few fine roots in the lower part; 10 percent gravel; common medium prominent strong brown (7.5YR 5/6) and common medium prominent yellowish brown (10YR 5/4) and yellowish brown (10YR 5/6) masses of iron accumulation and common medium distinct light brownish gray (10YR 6/2) iron depletions; strongly acid; gradual smooth boundary.

BC--53 to 63 cm (21 to 25 in); light olive brown (2.5Y 5/4) gravelly sandy loam; massive; friable; 20 percent gravel; common medium prominent yellowish brown (10YR 5/6) masses of iron accumulation and light brownish gray (10YR 6/2) and dark grayish brown (2.5Y 4/2) iron depletions; strongly acid; clear smooth boundary. (Combined thickness of the Bg and BC horizons is 36 to 61 cm.)

C1--63 to 104 cm (25 to 41 in); light yellowish brown (2.5Y 6/4) very gravelly loamy sand; single grain; very friable; 30 percent gravel and 5 percent cobbles; common medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) masses of iron accumulation; strongly acid; gradual smooth boundary. (25 to 102 cm thick)

C2--104 to 165 cm (41 to 65 in); light brownish gray (10YR 6/2) very gravelly sand, few brown (10YR 5/3) streaks; single grain; loose; 35 percent gravel and 5 percent cobbles; moderately acid.

TYPE LOCATION: Windham County, Connecticut; town of Killingly, 400 feet north along North Shore Drive from the intersection with Connecticut Route 101, 500 feet east of North Shore Drive; USGS Danielson topographic quadrangle; latitude 41 degrees 50 minutes 58 seconds N. and longitude 71 degrees 54 minutes 28 seconds W., NAD 27

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to sand or loamy sand substratum layers range from 46 to 71 cm. Rock fragments range from 0 to 25 percent by volume in the solum and from 0 to 50 percent in individual layers of the substratum. Typically, 70 percent or more of the rock fragments are rounded gravel. Reaction ranges from very strongly acid to neutral throughout.

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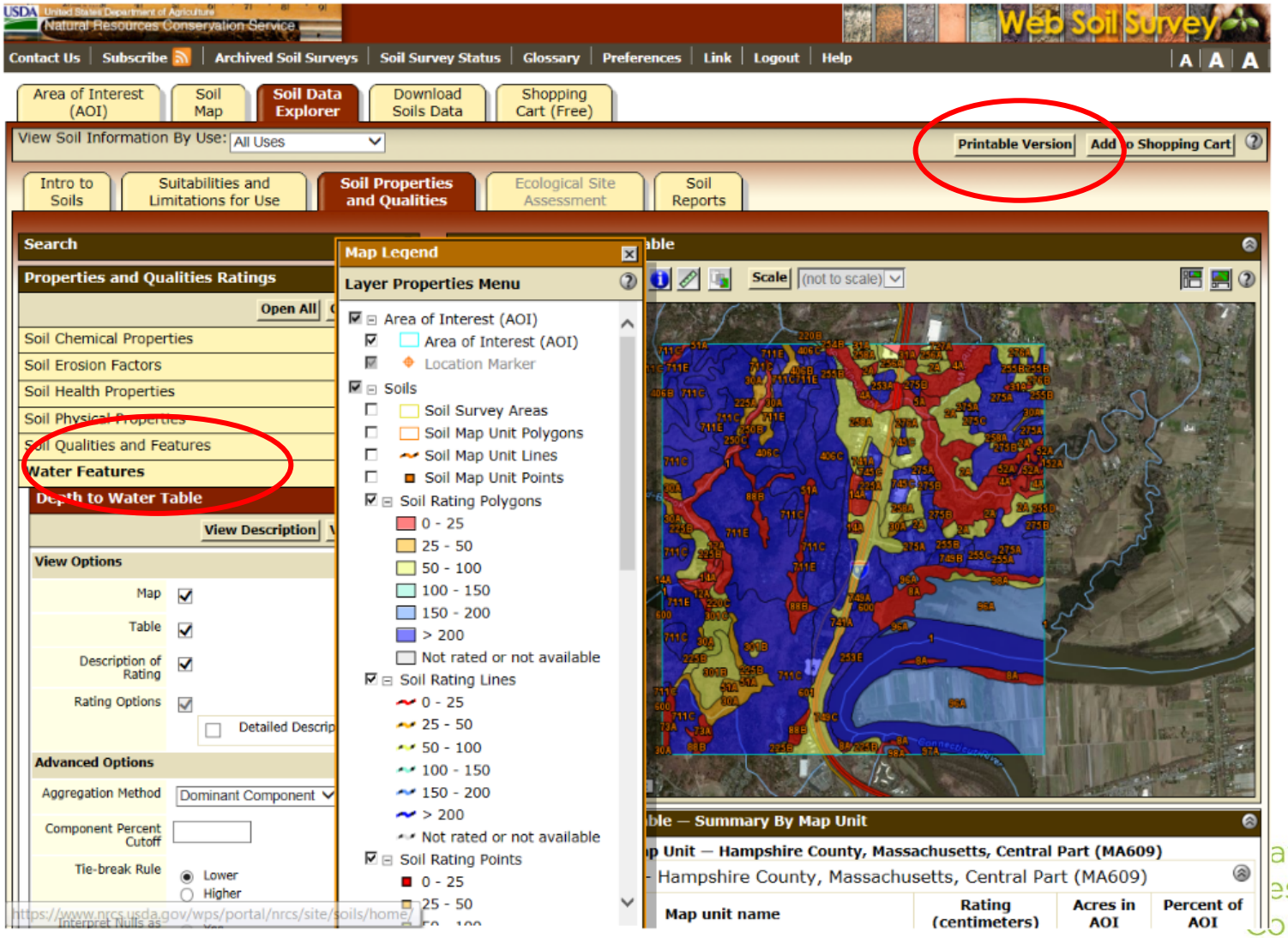

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SoilWeb

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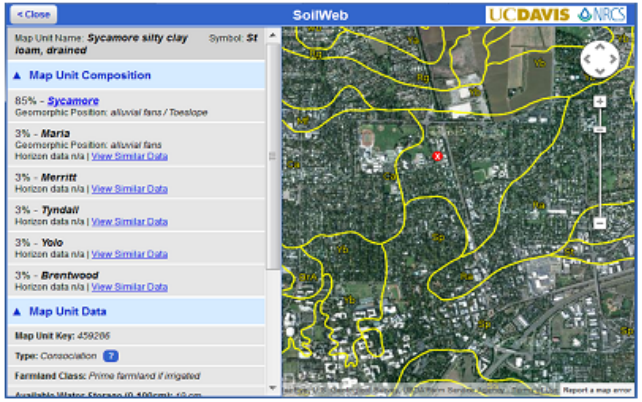
SoilWeb Apps

Our online soil survey can be used to access USDA-NCSS detailed soil survey data (SSURGO) for most of the United States. Please choose an interface to SoilWeb:

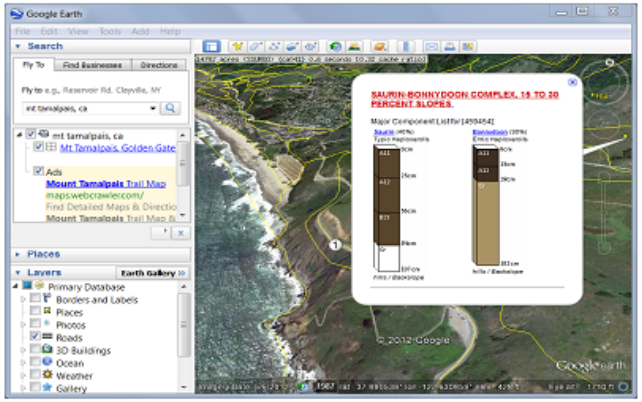
SoilWeb

Explore soil survey areas using an interactive Google map. View detailed information about map units and their components. This app runs in your web browser and is compatible with desktop computers, tablets, and smartphones.



SoilWeb Earth

Soil survey data are delivered dynamically in a KML file, allowing you to view mapped areas in a 3-D display. You must have Google Earth or some other means of viewing KML files installed on your desktop computer, tablet, or smartphone.



https://casoilresource.lawr.ucdavis.edu/gmap/
https://casoilresource.lawr.ucdavis.edu/soilweb-apps/

Natural Resources Conservation Service

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SoilWeb for the iPhone

View More by This Developer

By CA Soil Resource Lab

Open iTunes to buy and download apps.

Description

GPS based, real-time access to USDA-NRCS soil survey data, formatted for the iPhone. This application retrieves graphical summaries of soil types associated with the iPhone's current geographic location, based on a user defined horizontal precision. Sketches of soil profiles are linked to their official soil series description (OSD) page. Soil series names are linked to their associated page within the CA Soil Resource Lab's online soil survey, SoilWeb [1]. An up-to-date map of were data is available for queries can be found here [http://casoilresource.lawr.ucdavis.edu/soil_web/national_status_map.php].

References:

1. http://dx.doi.org/10.1016/j.cageo.2008.10.016

- iPhone and Android app
- Links to phone GPS
- Brings up major component of map unit at your location
- Links to Series and selected interpretations