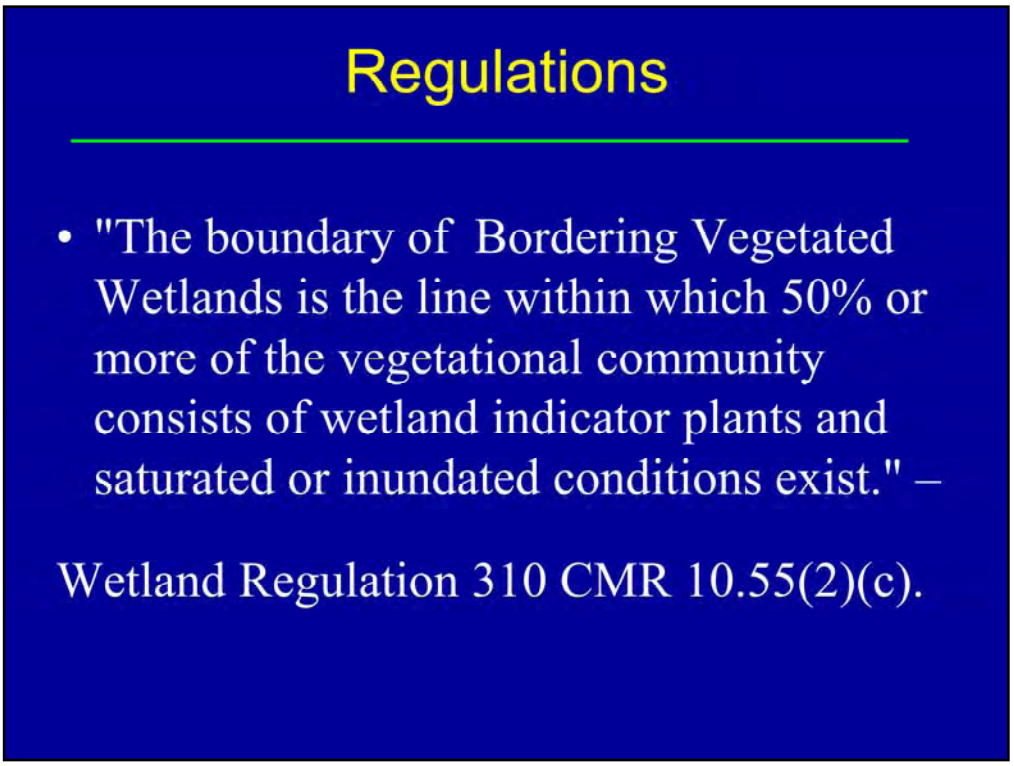
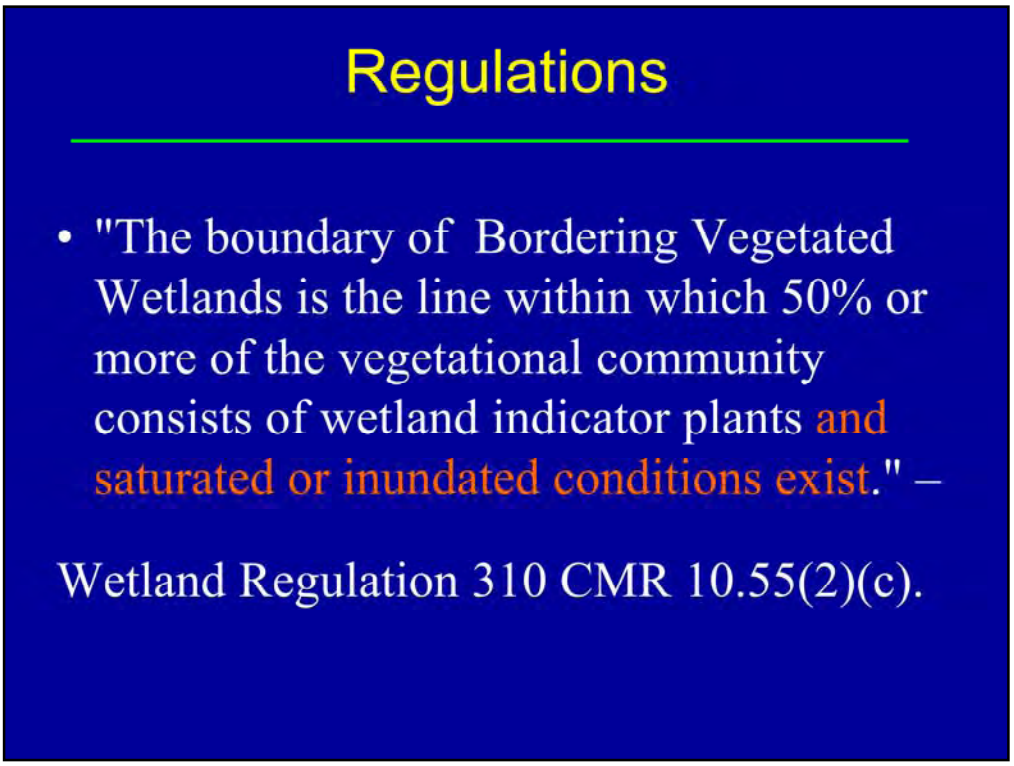
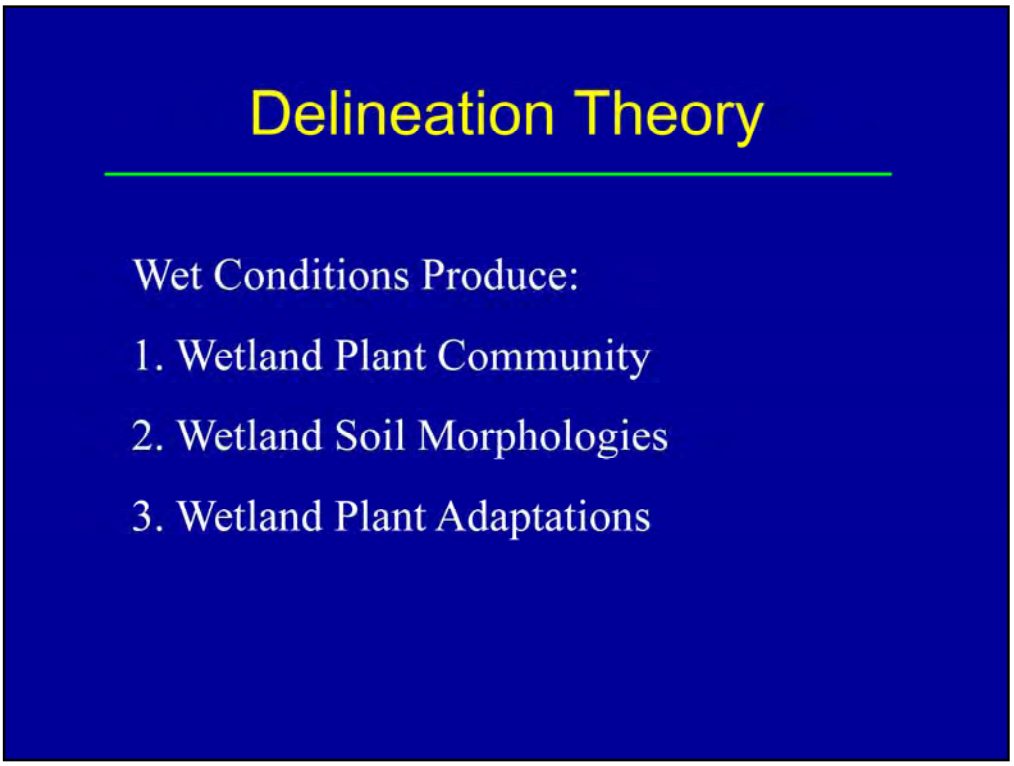
This workshop is a cooperative venture between the Buzzards Bay National Estuary Program and the Massachusetts Association of Conservation Commissions. The BBNEP and MACC have been cooperating, coordinating and conducting wetland delineation workshops since 1992.



The delineation of wetlands is done in a regulatory context. The applicable regulation, 310 CMR 10.55(2)(c) together with **Wetlands Program Policy BVW**: Bordering Vegetated Wetland Delineation Criteria and Methodology, Issued: March 1, 1995, and the delineation manual "Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act" provided clear guidance as to the proper way to delineate wetlands in Massachusetts.



This workshop will focus on the use of soil morphology to determine if saturated of inundated conditions exist using the DEP delineation manual.

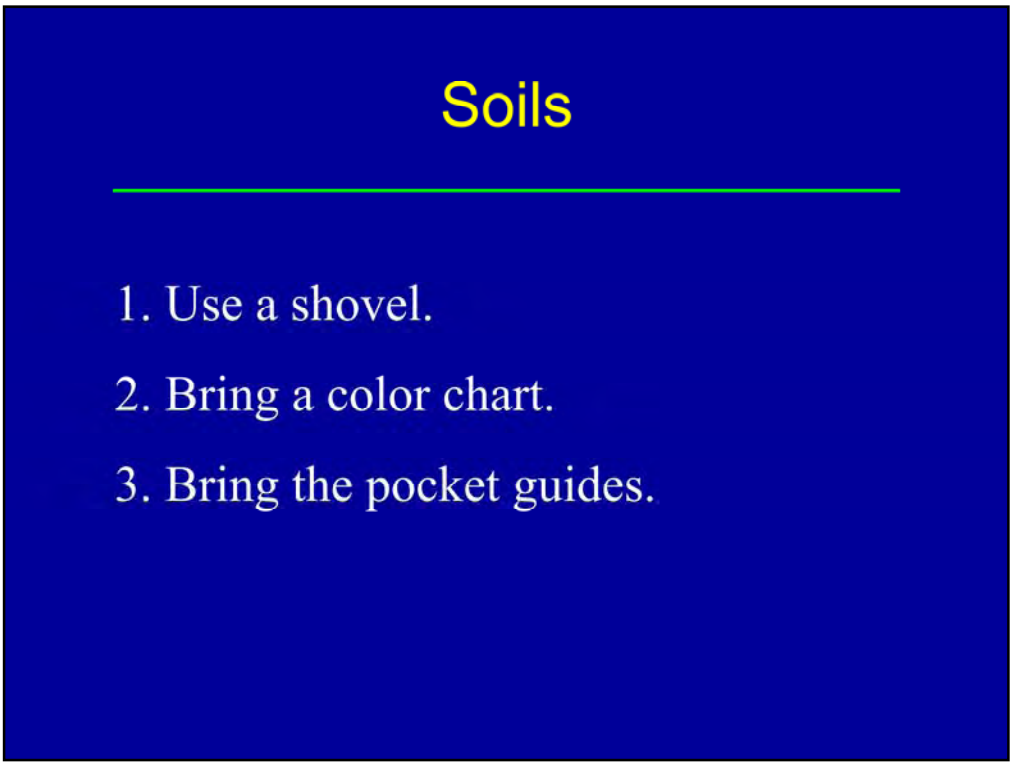


Wetlands have water at or near the surface for a sufficient time to produce anaerobic conditions in the upper part of the soil. The anaerobic condition is not noticeable directly in the field but it does produce changes in the soil morphology and plant community that can be observed. The plant community observations and soil morphologies are used to delineate wetland regardless of season.

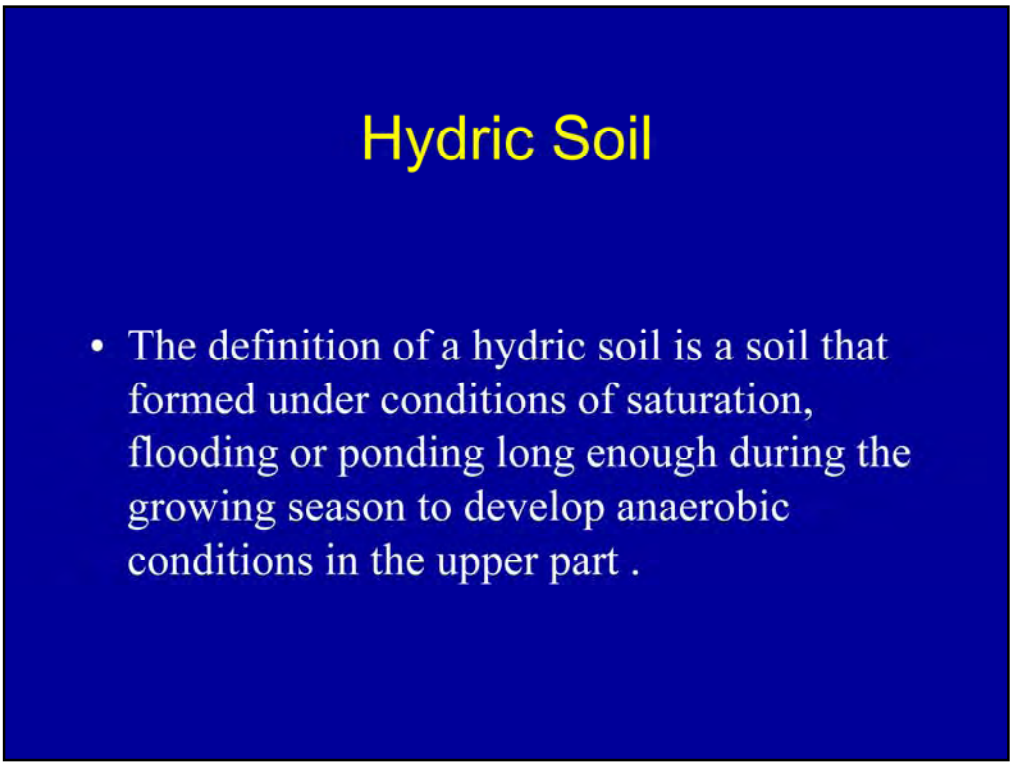
The plant community is determined by species composition and wetland plant indicator status. Confirmation of hydrology is largely done by the use of soil morphology.

The confirmation of Hydrology through the use of soils will be the focus of this workshop.

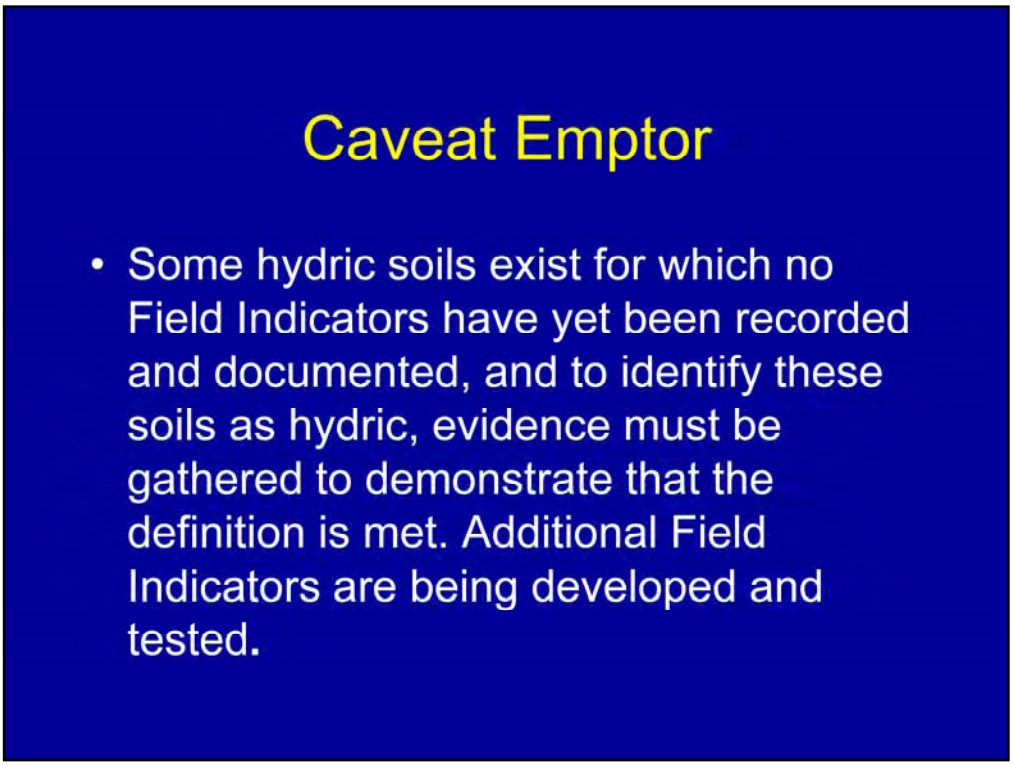
Under normal circumstances (wiggle room intended) the presence of hydric soils are required for an area to be considered a wetland.



If you are checking someone's wetland flagging show enough respect to take a shovel to dig some holes. Augers are fine to confirm what you find along a flag line, but for subtle changes (what you would expect in a transitional area) you need to dig a real hole. A complete list of tools to bring to the site is included on page 40 of the DEP delineation manual. The only additions the BBNEP staff make would be golf tees, bug spray, a cell phone, and of course the Buzzards Bay NEP pocket guides.



This is what you are looking for when you delineate a wetland. Remember that when you are making decisions, you are looking at the vegetation and soils to determine if the water table comes within 12 inches of the surface.



When using the DEP manual, keep in mind that the soils you encounter may be more varied that the list on pages 29-31. If something doesn't make sense, consult an expert. Sometimes even the soil experts are confounded, and look at the vegetation. If you are looking into a soil hole and get confused, take your head out of the hole to look around, it may help. BBPNEPand MACC offer an advanced class that look atther more complicated soil morphologies.

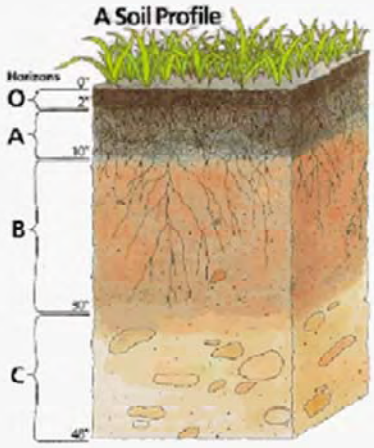
Soil samples from Carver. Wettest from right to left. These are disturbed, sandy spodosols. Notice the redoximorphic features in all samples. This should make a lot more sense at the end of the show. Also note this was the last known sighting of the small trowel.

Photo credit: John Rockwell

Soil Horizons

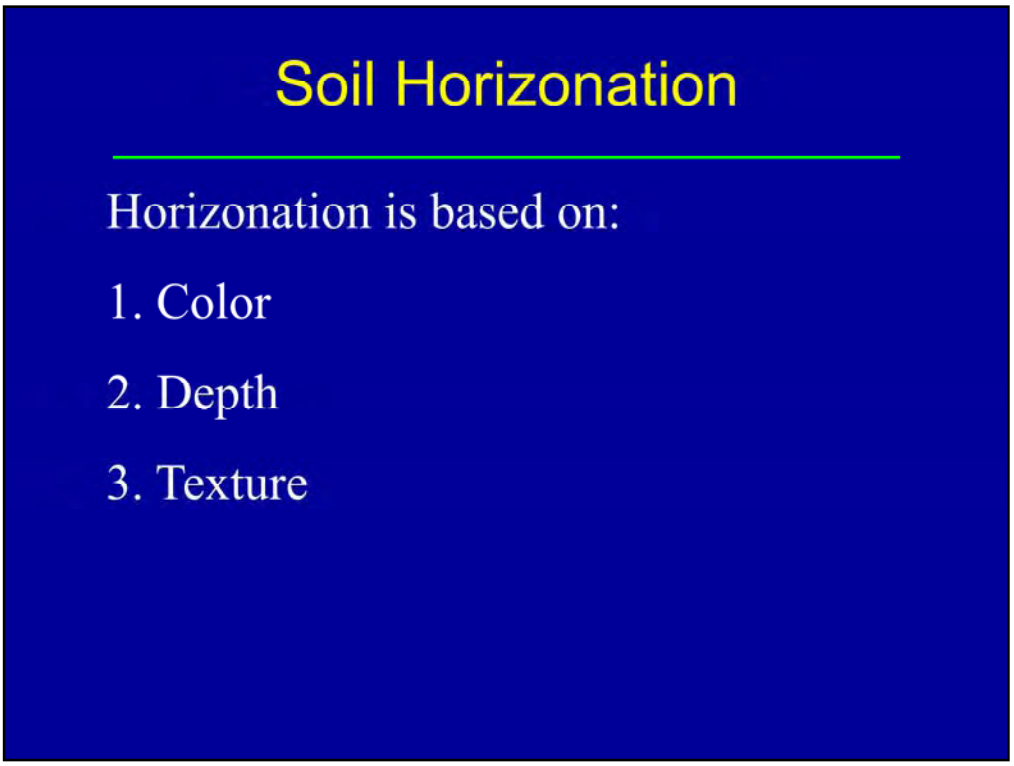
A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil forming processes.

Used to classify the soil and make interpretations.

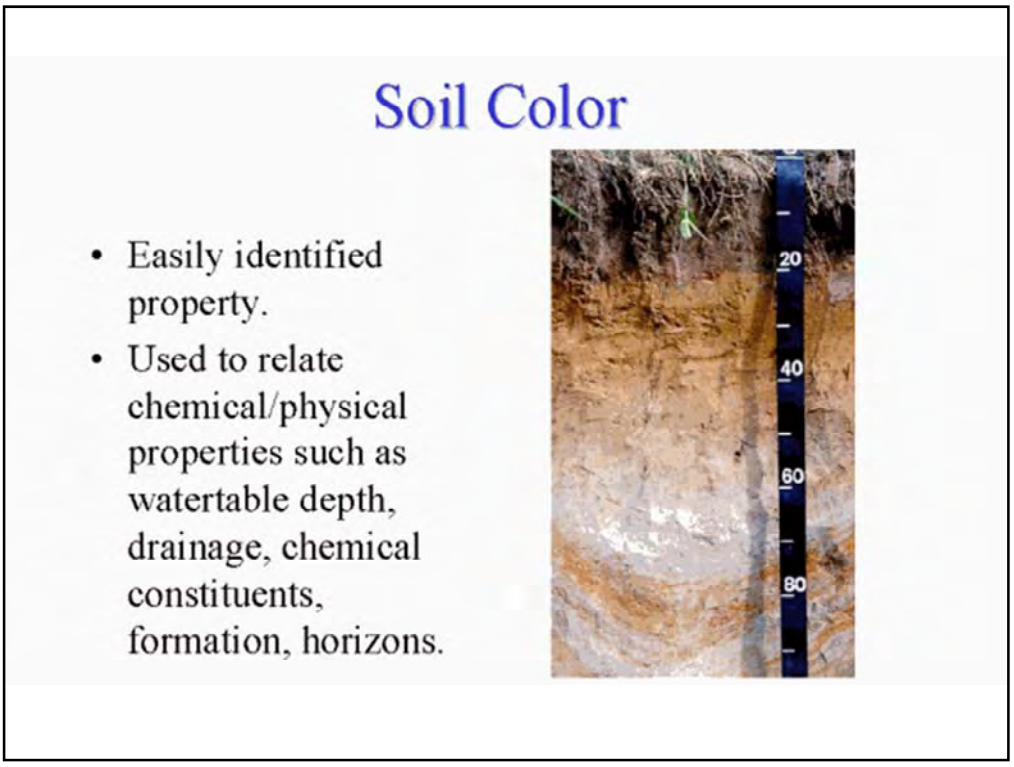


There is no set number of horizons a soil profile can have can have. Horizons are split or differentiated by changes of color, texture, roots, structure, rock fragments, redoximorphic features, or for any reason the describer decides. Always remember the definition of each master horizon before deciding what to call the horizon.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

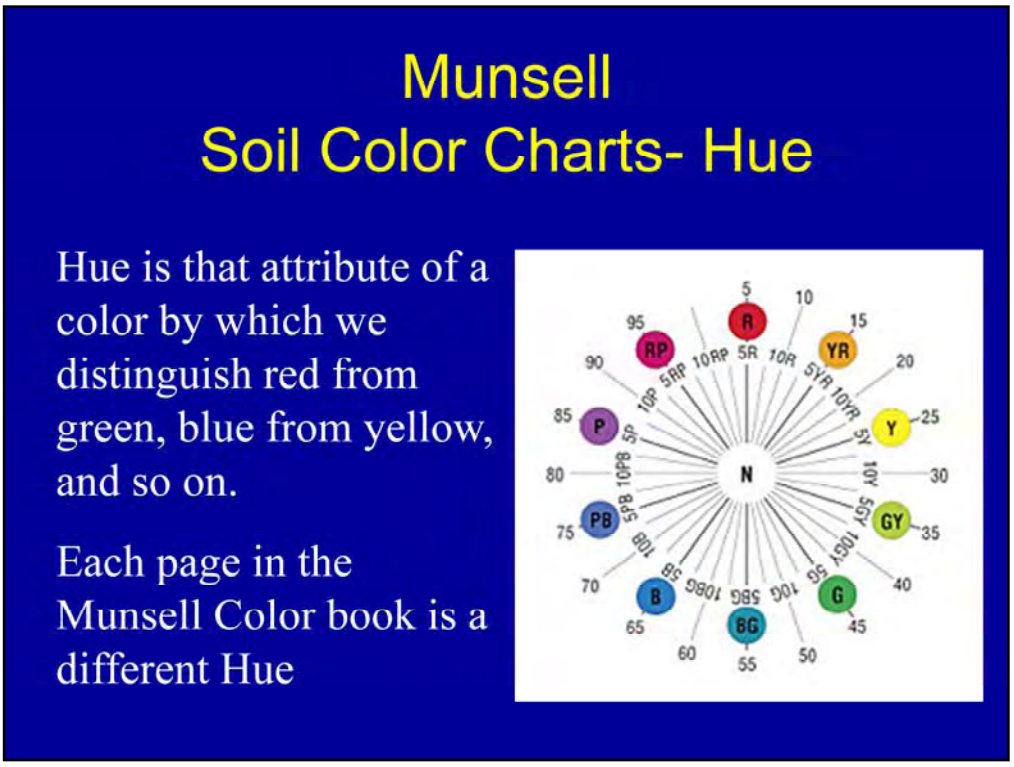


For color use the Munsell color charts, for depth use a tape measure, for texture use the “Buzzards Bay Pocket Guide to Describing and Documenting Soil Conditions”



Soil color is the most obvious and easily determined soil characteristic. Although it has little known direct influence on the functioning of the soil, color is one of the most easily determined soil properties and other more important soil characteristics can be inferred from soil color.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



In 1905, Albert Henry Munsell developed this color wheel as a way to standardize colors for art restoration purposes. The soil colors are only a small segment of the color wheel.

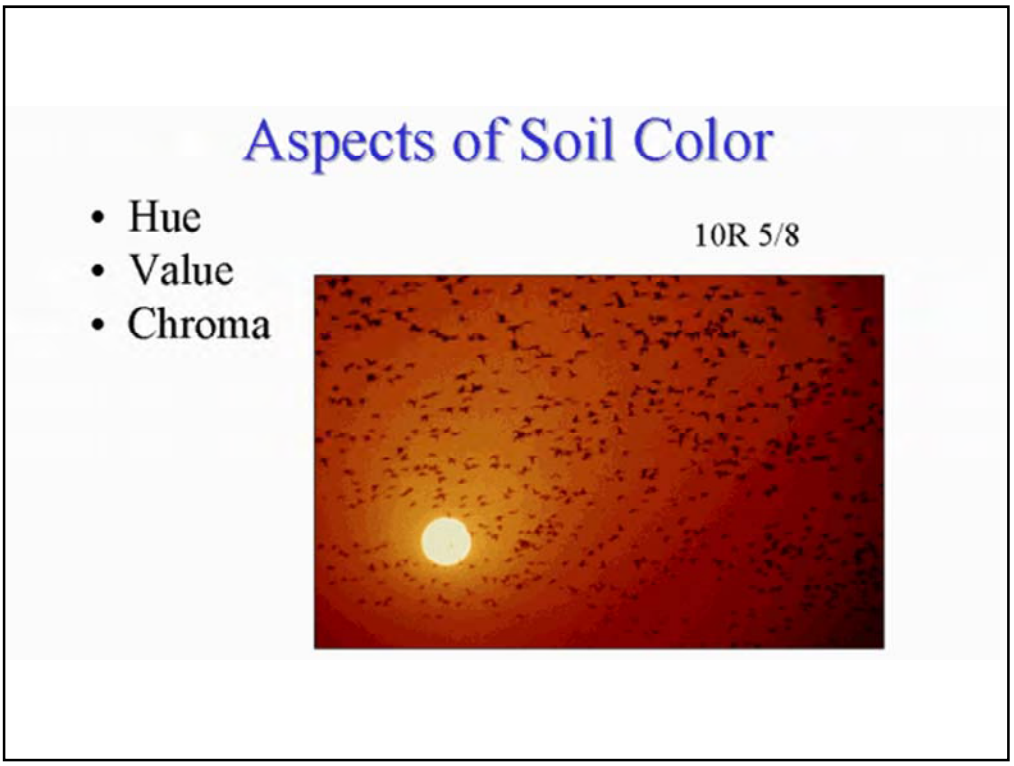
Photo Credit: Munsell Color Services, A Division of GretagMacbeth

Soil Color

- The munsell color book is used to document color in a standard notation.
- **Hue:** Dominant spectral color.
- **Value:** The degree of light/dark of a color in relation to a neutral gray scale.
- **Chroma:** Strength of hue.

This is the 10YR page from the Munsell book. It is a good place to start as it is the most commonly used page in New England.

Slide composed by: Jim Turenne
Email: jimjet@cox.net
Home Page: http://nesoil.com



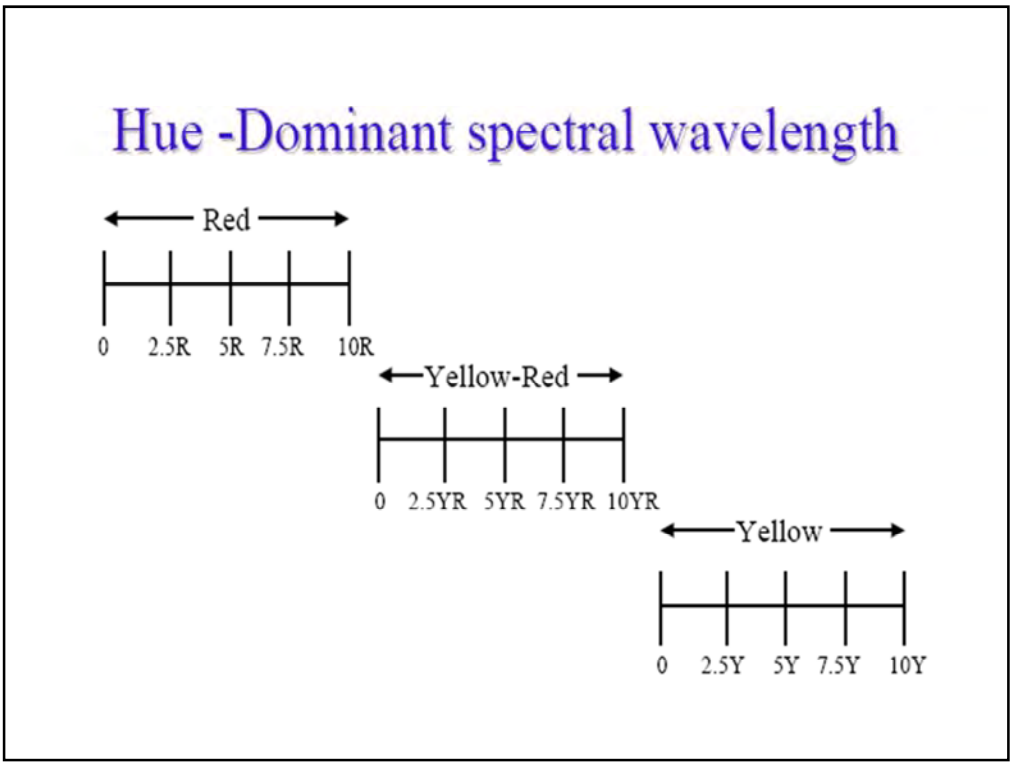
Color of soils is mainly due to (1) organic matter content and (2) presence and chemical form of Fe and Mn.

•1. Both of these properties are important in the identification of hydric soils.

•2. Common names for colors (e.g., light red, grayish brown) mean different things to different people. Soil scientists describe color using Munsell Soil Color Charts (www.munsell.com).

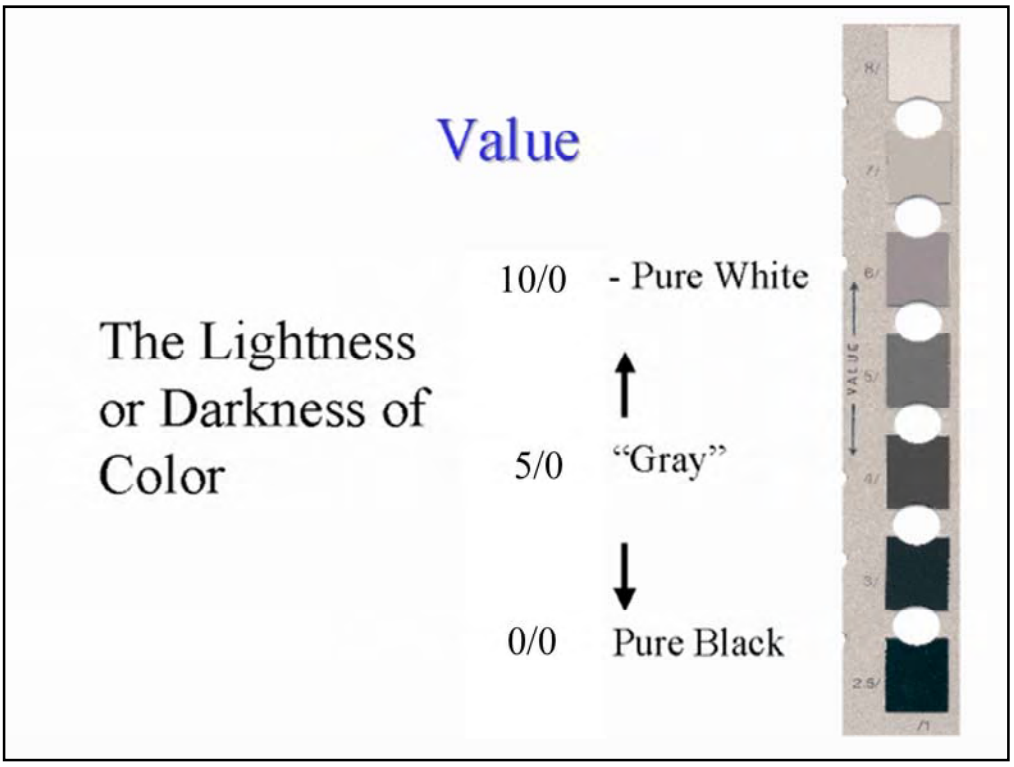
•The Munsell color system embodies three aspects of color -- hue, value, and chroma.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



Hue refers to the dominant spectral wavelength of light (red, ye4llow, green, blue, etc.) The symbol for hue is the letter abbreviation of the color preceded by a number from 0 to 10 . With the YR (yellow red) range, the hue becomes more yellow and less red as the number increases. The notation for hue in the Munsell Color Book is located at the top right corners of the color chart page.

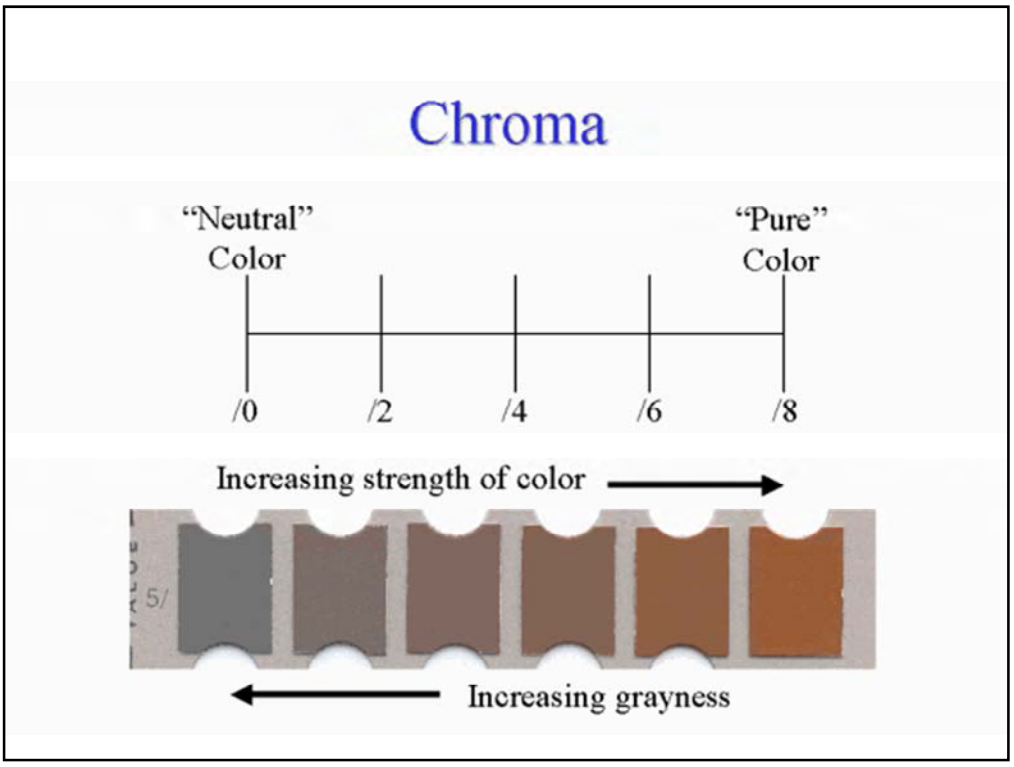
Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



•*Value* refers to the amount of light reflected from the chip. On a neutral gray scale, a value of 10 indicates pure white, and value of 0 indicates pure black.

•Value runs north-south (Vertical) on the Munsell page. All chips in a row have equal value.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



•*Chroma* refers to the relative purity or strength of the spectral color. Chroma runs from 0 (neutral gray) to 8 (highest strength of color found in soils).

•Chroma increases to the right across the Munsell page. All chips in a column have equal chroma.

•Zero-chroma chips have no color, they are neutral gray. Often they are simply given a hue designation N (neutral).

Author: Jim Turenne
Email: jimturrene@gmail.com
Home Page: http://nesoil.com

Munsell® or Earth Colors ®

- The Munsell notation system is a system for recording color.
- The Earth Colors and Munsell books use the same colors.
  - Differences are from personal interpretation of color, fading of pages over time, smudging of chips with use, and quality control from the factories.

Earth Colors is no longer available. The alternative to the Munsell Book now available is the Globe Soil Color Book.

Slide composed by: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

Reading Soil Colors

- Optimum conditions
  - Natural light
  - Clear, sunny day
  - Midday
  - Light at right angles
  - Soil moist
  - NO sunglasses!

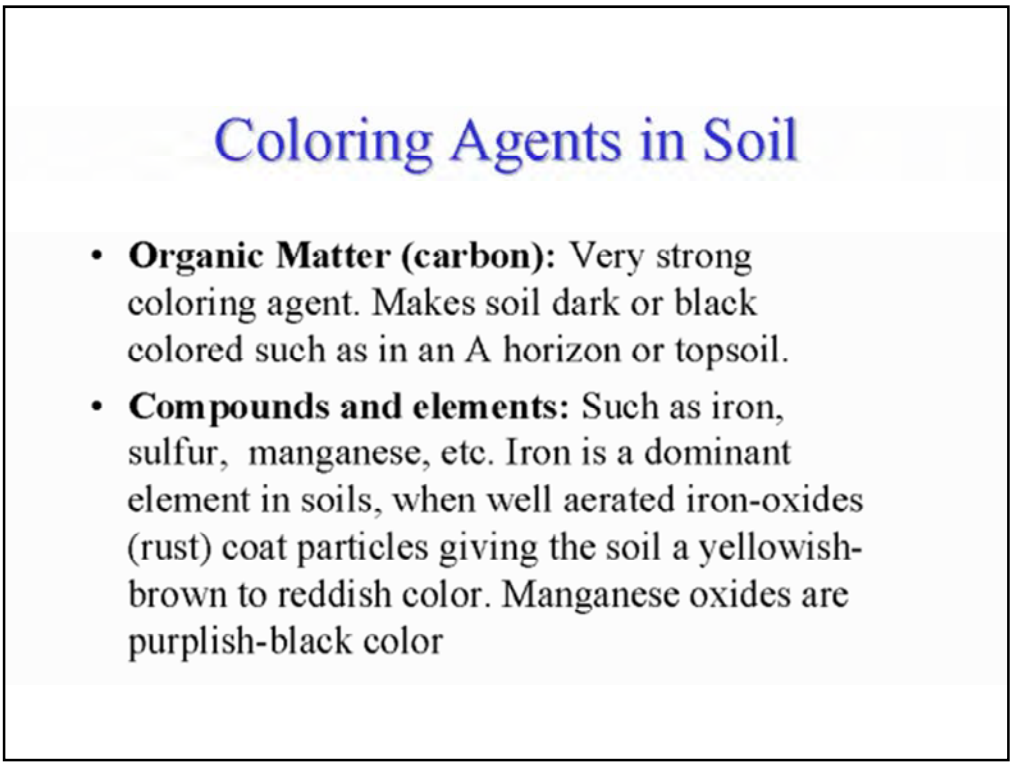
•If the lighting is poor and it is a critical color decision, collect a sample and look at it the next day under natural light. Get another person's opinion. Do not close the sample in an airtight bag, as color may change. In some soils (i.e., reduced matrix), colors may change upon exposure to air.

•Moist soil colors are critical. All hydric indicators and color guidelines refer to moist colors. If the soil is dry use a squirt bottle to moisten it.

•No sunglasses. (added by jr)

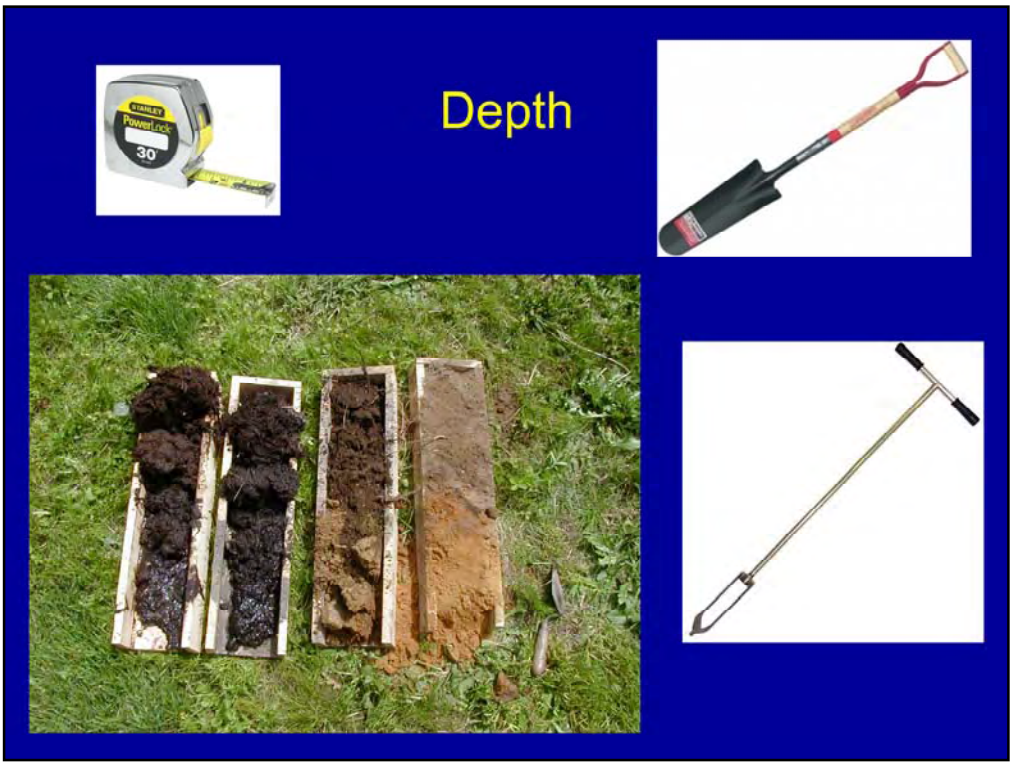
•Never, ever put the soil on the color chip as shown on the slide! (added by jr)

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

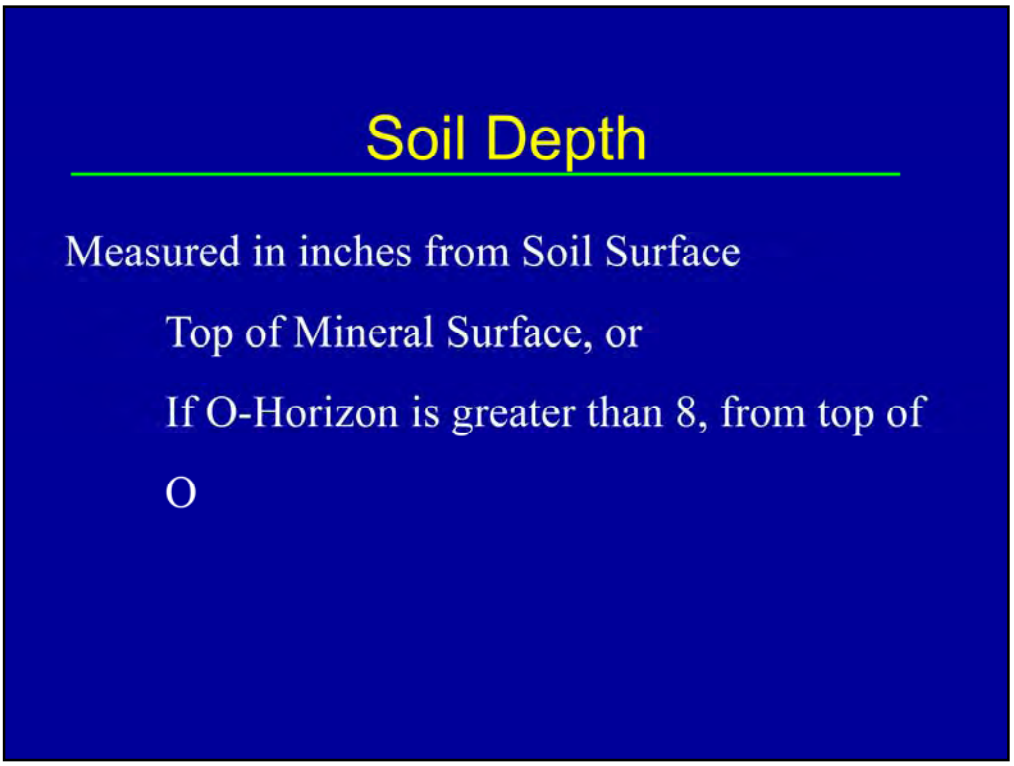


In general; black colors indicate organic matter (carbon), reddish-yellowish brown colors indicate iron oxides and well-drained conditions, blotchy color patterns are caused by saturation and reduction by a water table.

Author: Jim Turenne
Email: jimjet@cox.net
Home Page: http://nesoil.com

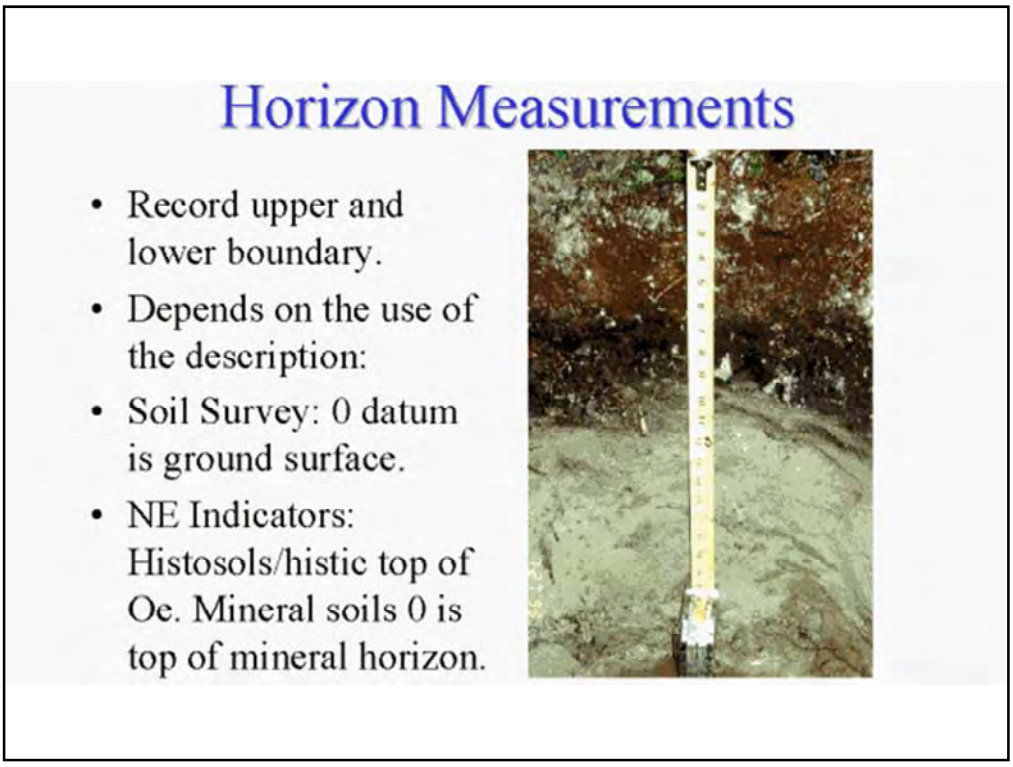


Soil depth is easily measured with any tape measure. Broken folding carpenter rulers are easy to get and very handy. Also useful is a 30’ tape which can double measuring sampling areas.



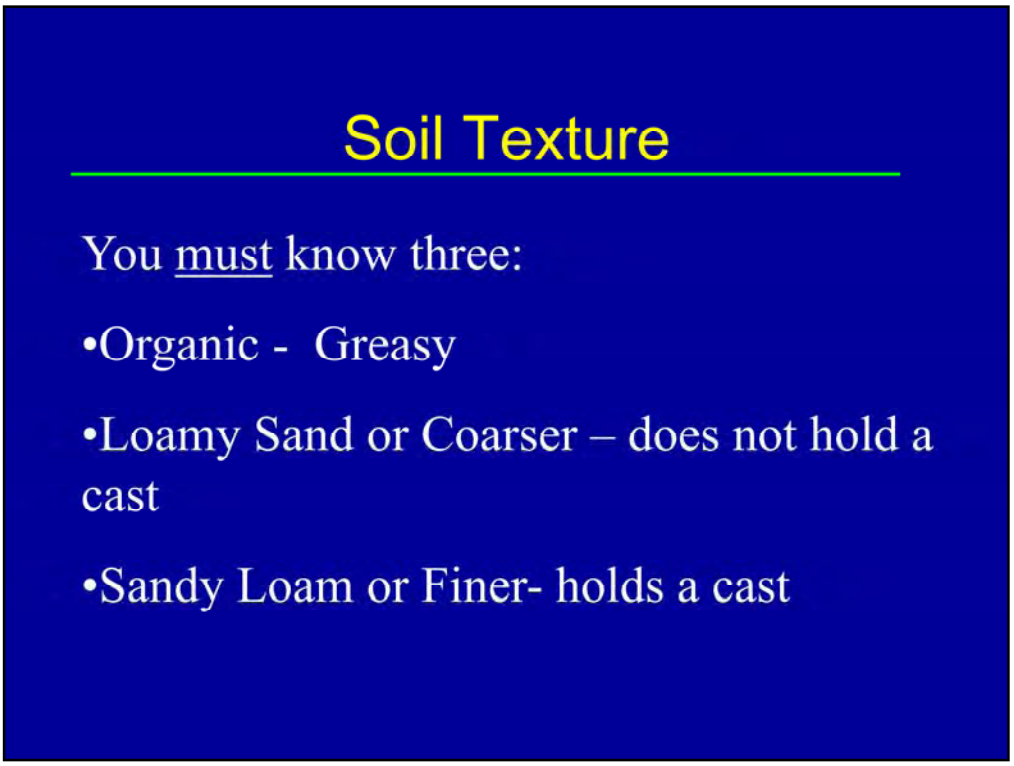
Check out the field test for organic soil, as opposed to a dark A, in the "Buzzards Bay Pocket Guide to Describing and Documenting Soil Conditions."

Sometimes you will run into a mucky mineral soil where the organic layer and mineral layer have been mixed by agricultural activity. The mucky mineral soil is a mineral soil, not organic.

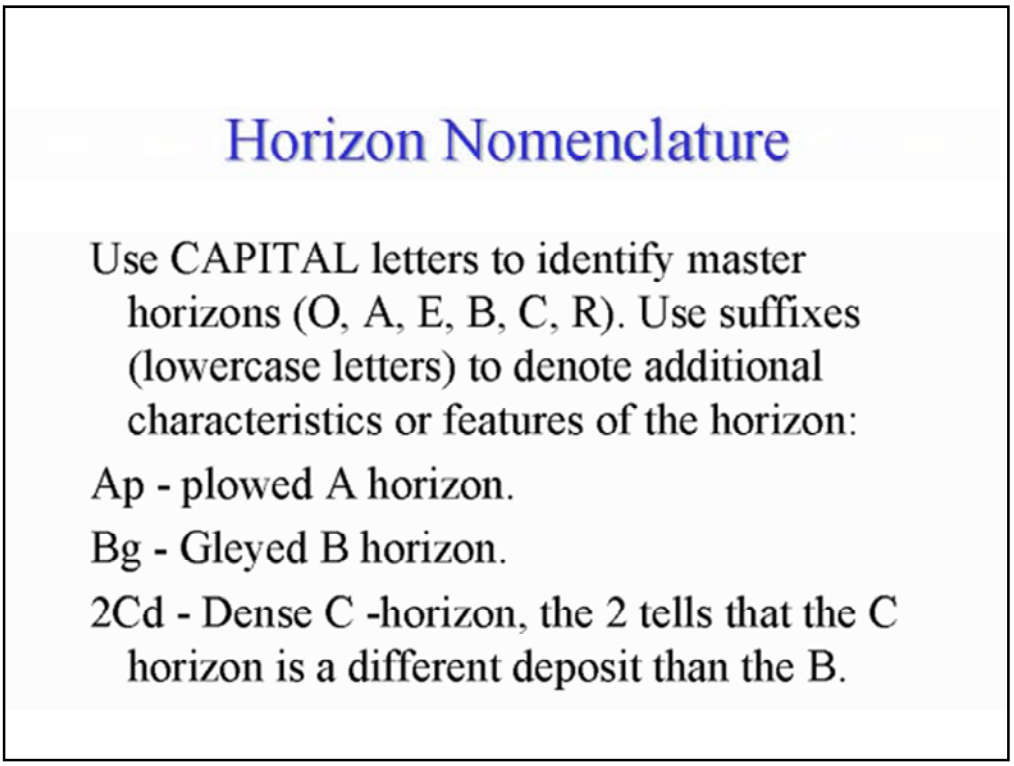


Recent leaf litter which has not been compacted by snow or water is not counted as the surface (0 depth) datum for measurement. Blow or swipe the recent leaf litter away, record it as leaf litter on the description form.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

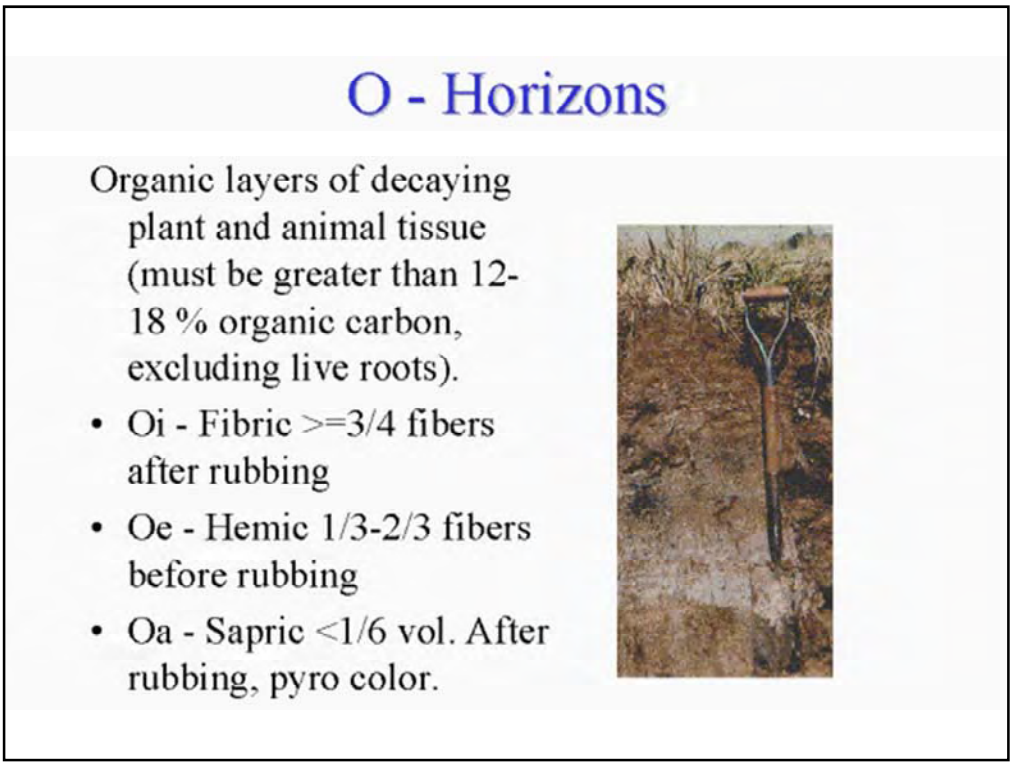


Always carry the “Buzzards Bay Pocket Guide to Describing and Documenting Soil Conditions” in your back pocket until this is memorized.



When describing a pedon, examine the pit completely, decide where horizon breaks are (use something to mark breaks like a large nail or golf tee), describe each horizon (color, texture, structure, etc.), then decide the proper master horizon and suffix.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



O horizons: are soil layers with a high percentage of organic matter. Typically within a woodland area there are three distinct organic layers: one of leaves, pine needles and twigs (Oi); underlain by a partially decomposed layer (Oe); and then a very dark layer of well decomposed humus (Oa).

Field criteria:

•Greater than 20-30% organic matter (less if high clay content).

•Dark or dark-reddish brown, nearly black, color - colors can be misleading and should only be used when other field criteria are observed.

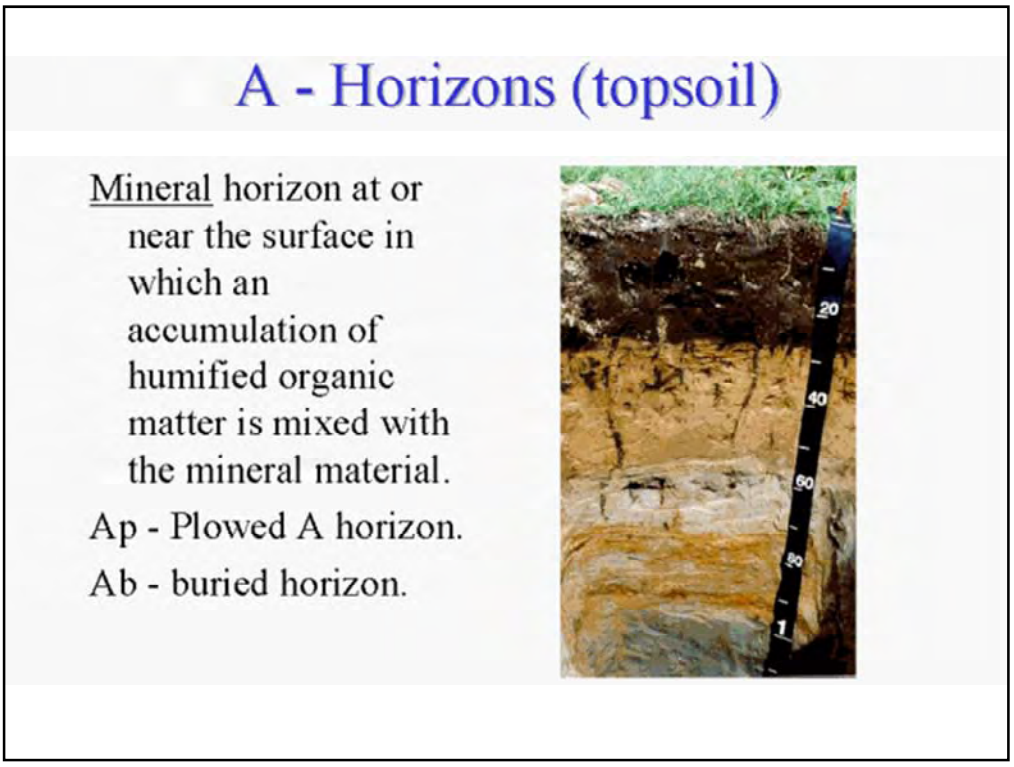
•Low strength, greasy feel, light weight when dry, may have a high fiber content.

•Typically a very dark surface horizon. When observed buried beneath a mineral horizon, this may signify a disturbed site where the original soil was buried by fill material.

From Soil Taxonomy:

O horizons or layers: *Layers dominated by organic material*. *Some are saturated with water for long periods*, *or were once saturated but are now artificially drained*; *others have never been saturated*.

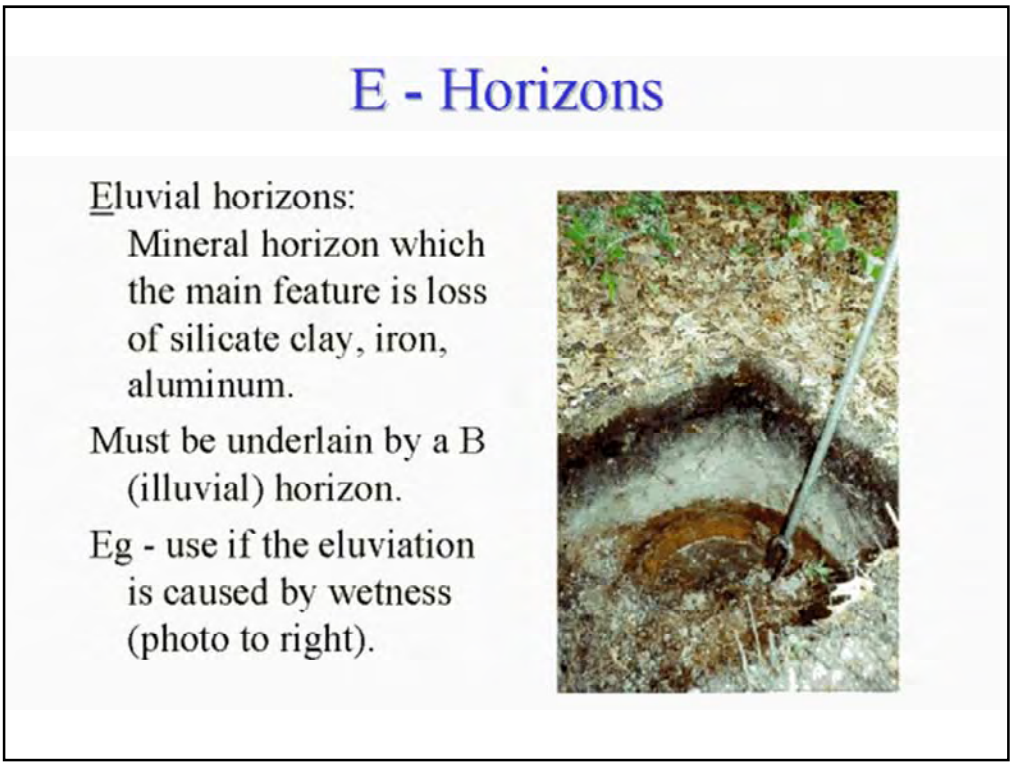
Some O layers consist of undecomposed or partially decomposed litter (such as leaves, needles, twigs, moss, and lichens) that has been deposited on the surface; they may be on top of either mineral or organic soils. Other O layers consist of organic material that was deposited under saturated conditions and has decomposed to varying stages. The mineral fraction of such material constitutes only a small percentage of its volume and generally



The first requirement for all master horizons other than O horizons is that they are composed mostly of mineral material. It is very important to be able to differentiate organic from mineral material. Dark color of the A horizon is due to the mixing of humus with mineral. If the A is more than 2-3 inches thick, it has probably been plowed, look for an abrupt boundary such as the photo above. Some soil profiles in wooded areas have an A horizon that formed over an old Ap (most of the Northeast was farmed in the past).

From Soil Taxonomy:
A horizons: *Mineral horizons which have formed at the surface or below an O horizon*; *they exhibit obliteration of all or much of the original rock structure and show one or both of the following*: (1) *an accumulation of humified organic matter intimately mixed with the mineral fraction and not dominated by properties characteristic of E or B horizons (defined below)*, *or* (2) *properties resulting from cultivation*, *pasturing*, *or similar kinds of disturbance*.

If a surface horizon has properties of both A and E horizons but the feature emphasized is an accumulation of humified organic matter, it is designated an A horizon. In some places, as in warm arid climates, the undisturbed surface horizon is less dark than the adjacent underlying horizon and contains only small amounts of organic matter; it has a morphology distinct from the C layer, although the mineral fraction is unaltered or only slightly altered by weathering. Such a horizon is designated A because it is at the surface; however, recent alluvial or eolian deposits that retain fine stratification are not considered to be A horizons unless cultivated.



E horizon: is a mineral horizon in the upper part of the soil. Typically present only in forested areas it underlies an O or A horizon. It is a light colored, leached horizon.

Field criteria:

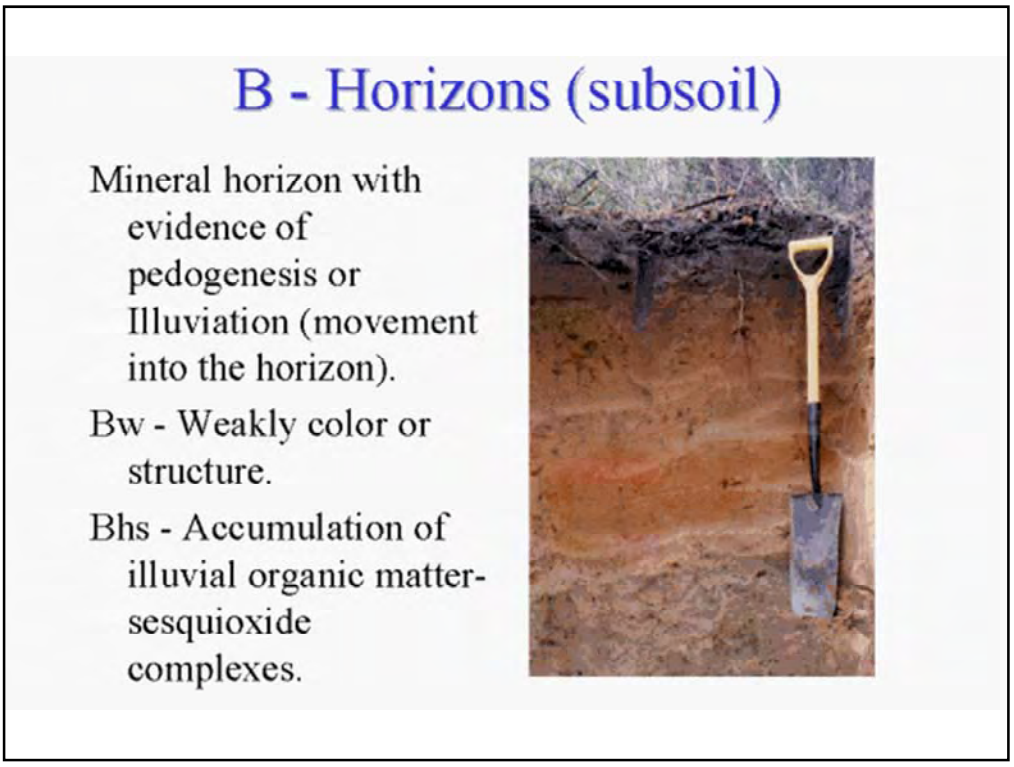
•Commonly near the surface, underlying an O or A horizon and above a B horizon.

•Generally lighter in color than either the overlying organic and/or A horizons and the underlying B horizon (E horizons MUST have a B horizon below).

•Formation (in New England soils): Upland soils - weak organic acids strip iron coating from the sand grains and material is leached down into the subsoil. The light color of the E horizon is due to the natural color of the dominant quartz sand grains. Wet-Sandy soils - Tend to have rapidly fluctuating water tables. When the water is at or near the surface, iron is reduced and becomes soluble. When the water drops the iron precipitates out into the underlying B-horizon (organic material is often moved into the B horizon).

Hydric Soil Concerns: E horizons (and Spodisols in general) may cause problems for hydric soil determination, the gray color of the E can be mis-interpreted for a gleyed horizon. E horizons can occur in upland soils as well as hydric soils. Always look below the E for signs of wetness and see if the wetness morphology connects to the surface. If the E horizon formed by saturation and reduction by a water table, call it an Eg horizon to differentiate it from an upland E.

From Soil Taxonomy:



B horizons: are commonly referred to as the subsoil. They are a zone of accumulation where rain water percolating through the soil has leached material from above and it has precipitated within the B horizons or the material may have weathered in place. Well drained soils typically have the brightest color development within the B horizons.

Field criteria:

•Subsurface horizon formed below an O, A and/or E horizon and above the C layer.

•In well drained soils, the B horizon is typically a yellowish brown to strong brown color and is commonly referred to as the subsoil.

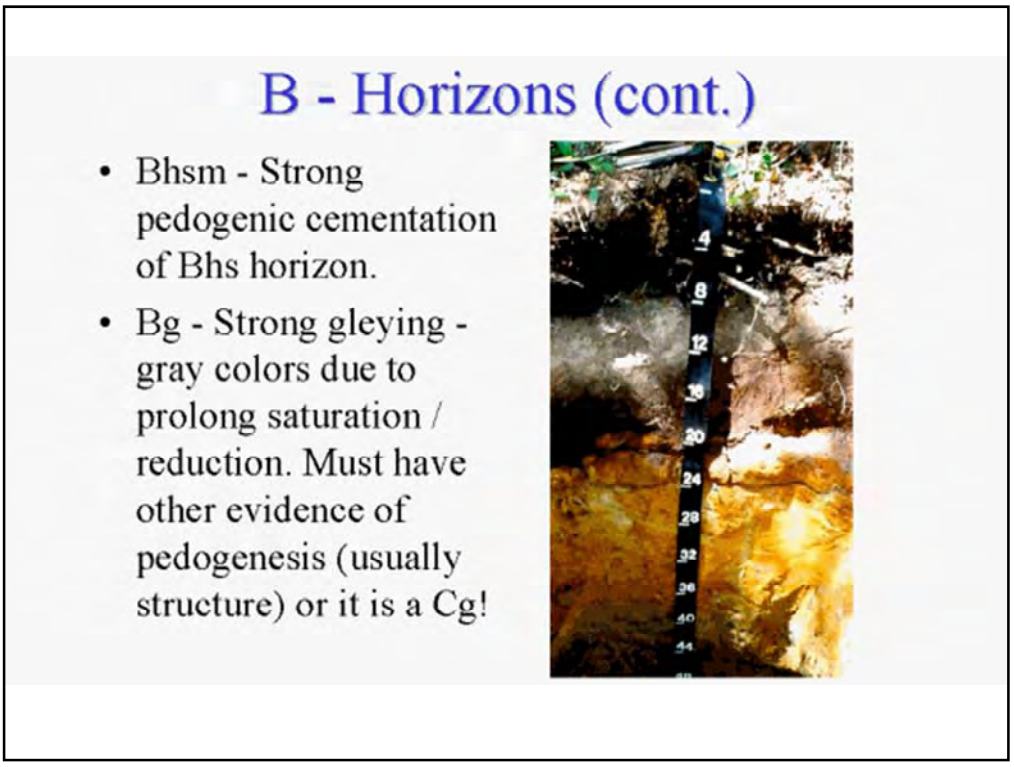
•B - horizons have material (usually iron but also humus, clay, carbonates, etc.) which has moved into it (Illuviation) they also have structure development in some pedons.

•Within New England, B horizons typically extend to a depth of 2 to 3 feet below the surface.

•The A and B horizons together are called the soil solum.

From Soil Taxonomy:
B horizons: *Horizons which have formed below an A*, *E*, *or O horizon*; *they are dominated by the obliteration of all or much of the original rock structure and show one or more of the following*:

(1) *Illuvial concentration of silicate clay*, *iron*, *aluminum*, *humus*, *carbonates*, *gypsum*, *or silica*, *alone or in combination*; (2) *Evidence of removal of carbonates*;



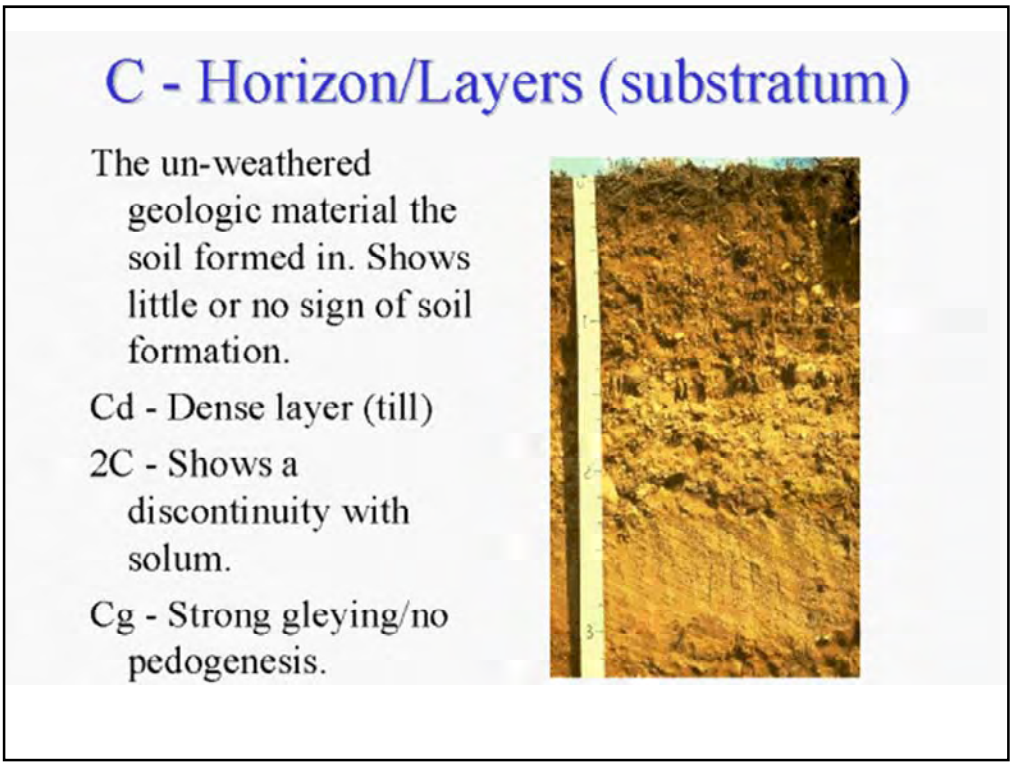
From Soil Taxonomy:
Suffix Symbols
Lower-case letters are used as suffixes to designate specific kinds of master horizons and layers. The term *accumulation* is used in many of the definitions of such horizons to indicate that these horizons must contain more of the material in question than is presumed to have been present in the parent material. The suffix symbols and their meanings are as follows:

a -*Highly decomposed organic material* -This symbol is used with O to indicate the most highly decomposed organic materials, which have a rubbed fiber content of less than 17 percent of the volume.

b -*Buried genetic horizon* -This symbol is used in mineral soils to indicate identifiable buried horizons with major genetic features that were developed before burial. Genetic horizons may or may not have formed in the overlying material, which may be either like or unlike the assumed parent material of the buried soil. This symbol is not used in organic soils or to separate an organic from a mineral layer.

c -*Concretions or nodules* -This symbol indicates a significant accumulation of concretions or nodules. Cementation is required, but the cementing agent is not specified, except that it cannot be silica. This symbol is not used if the concretions or nodules consist of dolomite or calcite or more soluble salts, but it is used if the nodules or concretions are enriched with minerals that contain iron, aluminum, manganese, or titanium.

d -*Physical root restriction* -This symbol indicates root-restricting layers in naturally occurring or man-made unconsolidated sediments or materials, such as dense basal till, plow pans, and other mechanically compacted zones.



C-horizons are glacial or post-glacial material in the Northeast.

•C layers: are commonly referred to as the substratum. These are layers, excluding bedrock, that are little affected by soil forming processes and have changed very little if any since the time they were deposited. C - horizons can have redoximorphic features within them.

Field criteria:

•Little affected by soil forming processes.

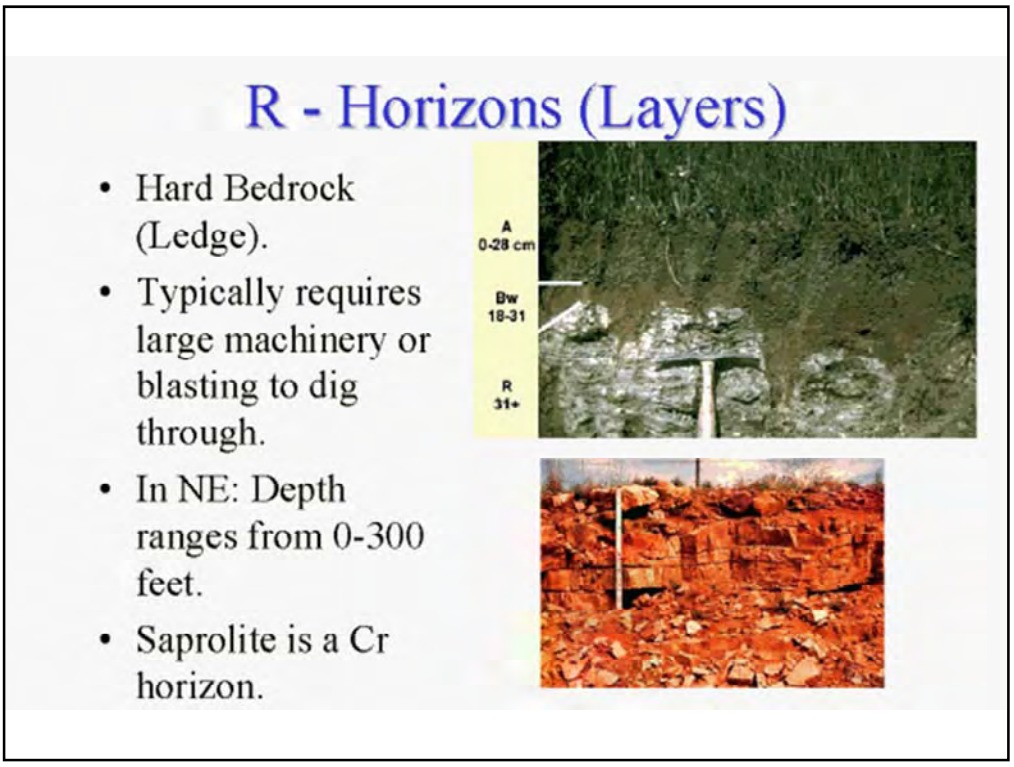
•Lack color development, color is that of the unweathered geologic material.

•Geologic layering or strata is often present.

•Most soil in the Northeast have a “cap” or mantle of eolian material over the geologic C horizon, the 2C designation is used for soils with an eolian cap.

From Soil Taxonomy:
C horizons or layers: *Horizons or layers*, *excluding hard bedrock*, *that are little affected by pedogenic processes and lack the properties of O*, *A*, *E*, *or B horizons*. *Most are mineral layers*. *The material of C layers may be either like or unlike the material from which the solum has presumably formed*. *The C horizon may have been modified*, *even if there is no evidence of pedogenesis*.

Included as C layers are sediment, saprolite, unconsolidated bedrock, and other geologic materials which are commonly noncemented and characterized by low or moderate excavation difficulty. Some soils form in material that is already highly weathered, and if such material does not meet the requirements for A, E, or B horizons, it is designated C. Changes not considered pedogenic are those not related to overlying horizons. Layers



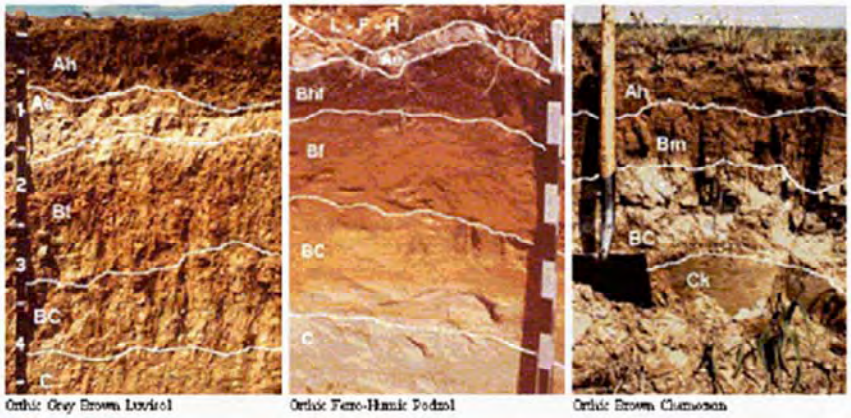
From Soil Taxonomy:

R layers: *Hard Bedrock*

Granite, basalt, quartzite, and indurated limestone or sandstone are examples of bedrock designated R. R layers are cemented, and excavation difficulty exceeds high. The R layer is sufficiently coherent when moist to make hand-digging with a spade impractical, although it may be chipped or scraped. Some R layers can be ripped with heavy power equipment. The bedrock may contain cracks, but these are generally too few and too small to allow roots to penetrate. The cracks may be coated or filled with clay or other material.

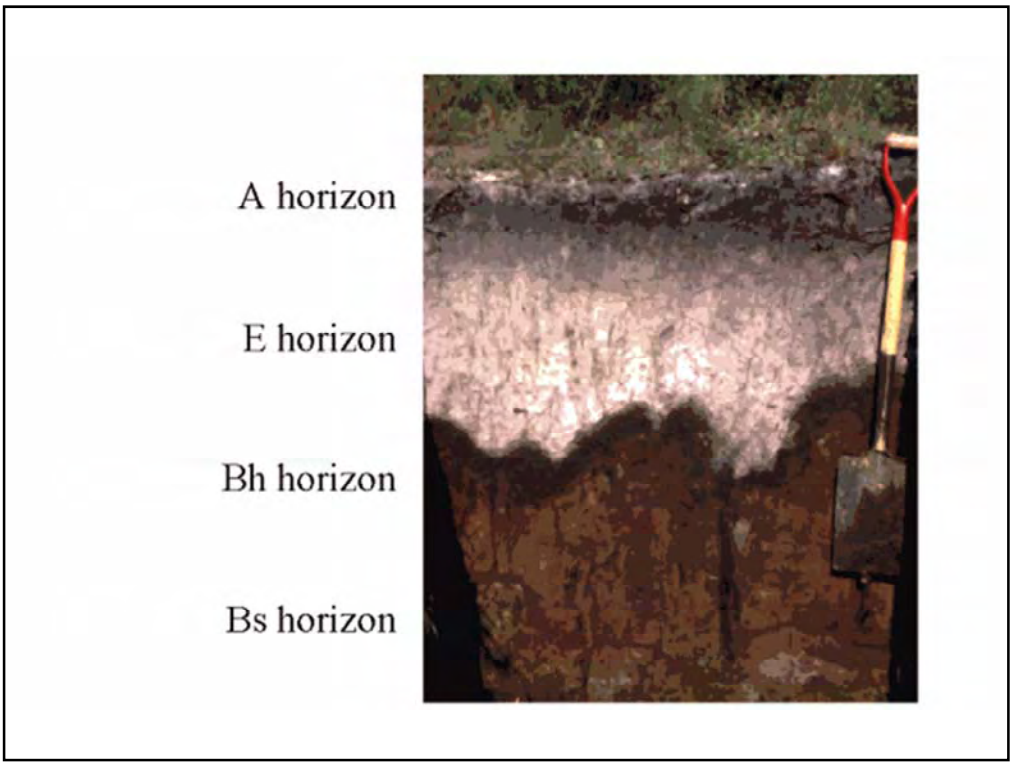
Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

Describing Soil Profiles



Orthic Gray Brown Luvisol | Orthic Ferro-Humic Podzol | Orthic Brown Chernozem

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



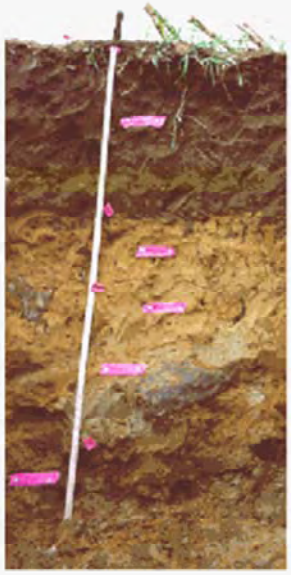
For example, Leon series (Sandy, siliceous, thermic Aeric Alaquods), borderline hydric.

E Horizons can have “grey” colors (high value, low chroma) in upland environments.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

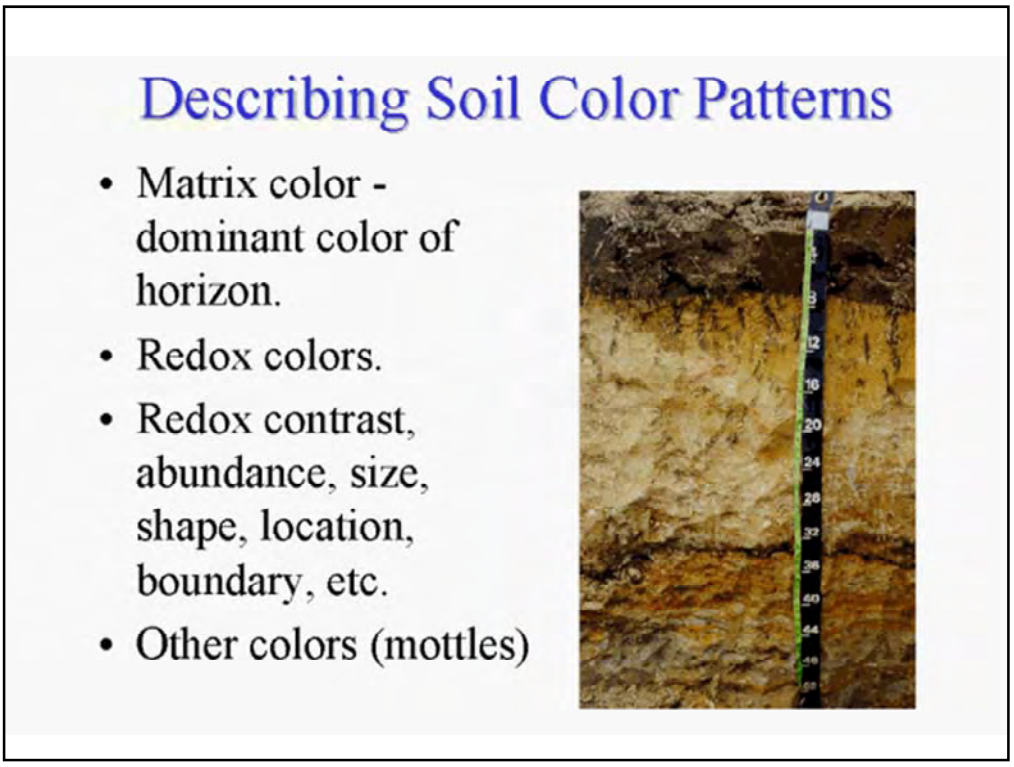
Describing Soil Profiles

- Locate horizon breaks, determine horizonation (learn definitions).
- No set number of horizons in a pedon.
- For each horizon document depth, color, texture, redox, structure, consistency, rocks, etc.
- Note variability.



Also note horizon boundary - abrupt, clear, gradual and topography - smooth, wavy, irregular, broken.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com



Each soil horizon/layer (including organic horizons) must have the color recorded. Some horizons have more than one matrix color (not redox features) such as transitional or combination horizons (A/B, BC). In this case estimate the percentages of each color. Note the soil color location (ped face, ped interior, etc.) and other patterns. Organic horizons are often described fresh out of the pit, then a rubbed color or color after exposure to air.

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

Redoximorphic Features

After the matrix color is determined, record the color patterns of the redox features if present.

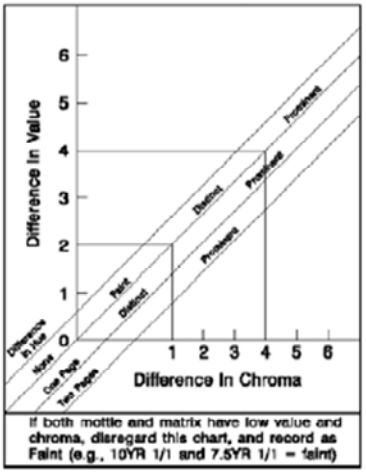
- Can be very complex.
- Describe color, size, contrast, shape, location.

For a complete description on describing redox features refer to the "Buzzards Bay Pocket Guide to Describing and Documenting Soil Conditions."

Slide composed by: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

Contrast of Redox

- Contrast refers to the degree of visual distinction between associated colors
  - Faint -- evident only on close examination.
  - Distinct -- readily seen.
  - Prominent -- contrast strongly.



•Contrast of mottles is important. Contrast can be obtained from color charts, just make sure to describe the colors.

•For hydric soil determinations, mottles should be either distinct of prominent. Faint mottles don't mean much to experienced soil scientists.

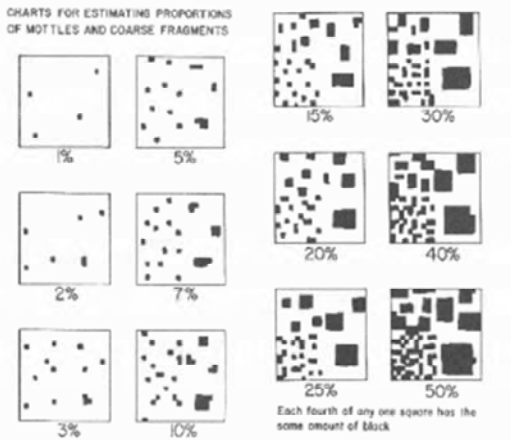
•IMPORTANT NOTE: on Soil Contrast (May 2002):
http://soils.usda.gov/technical/technotes/note2.html

Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

Abundance and Size of Redox

- Few - less than 2%
- Common - 2 to 20%
- Many more than 20%

- Fine - < 5 mm
- Medium - 5 to 15 mm
- Coarse > 15 mm



•Abundance is also important. Less than 2% is pretty shaky; usually if you can find features without really hunting they will be at least 2%.

•Size doesn't matter. The small amount of research done on this subject indicates that contrast and abundance are important and that size of features is not related to time of saturation / reduction.

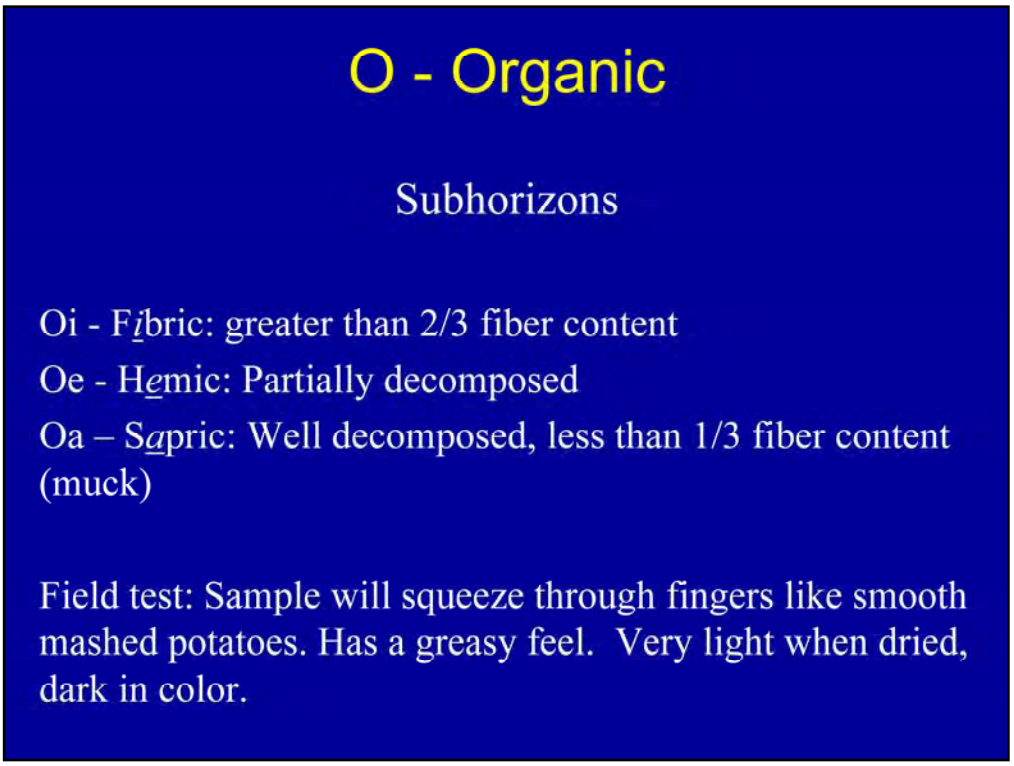
Author: Jim Turenne
Email: jimturenne@gmail.com
Home Page: http://nesoil.com

To check to see if you have learned anything yet , which of these indicates hydric soils? (Dry to wet from right to left)

Hint: the two on the left may be wet.

There’s that pesky trowel again.

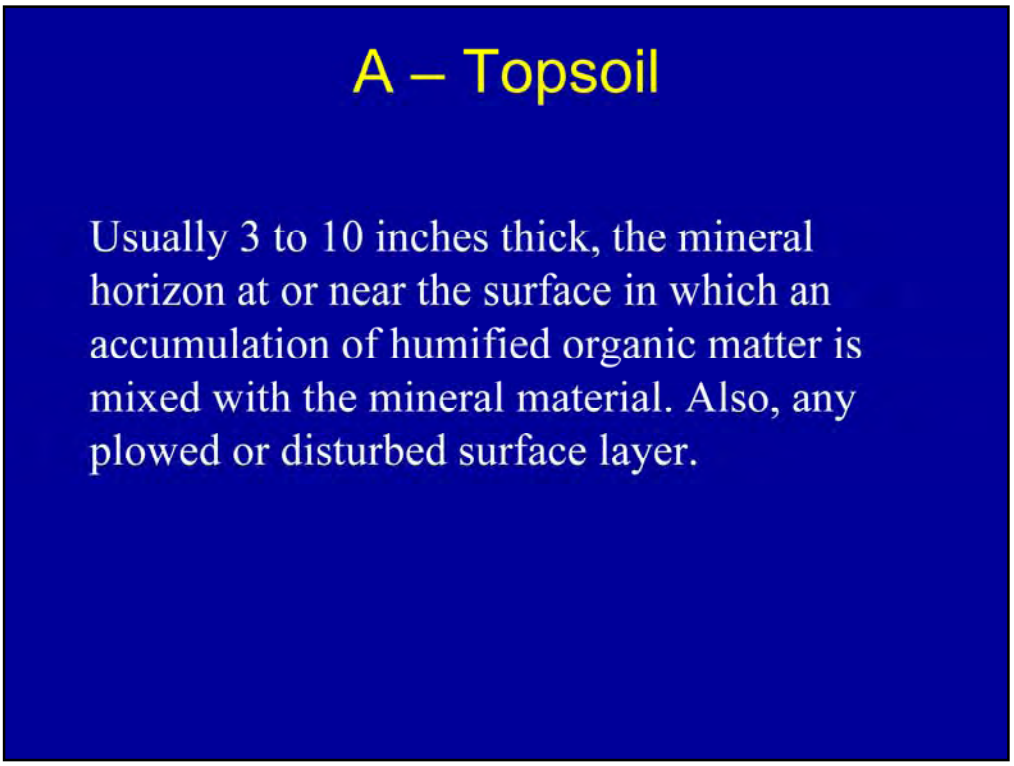
Photo Credit: John Rockwell



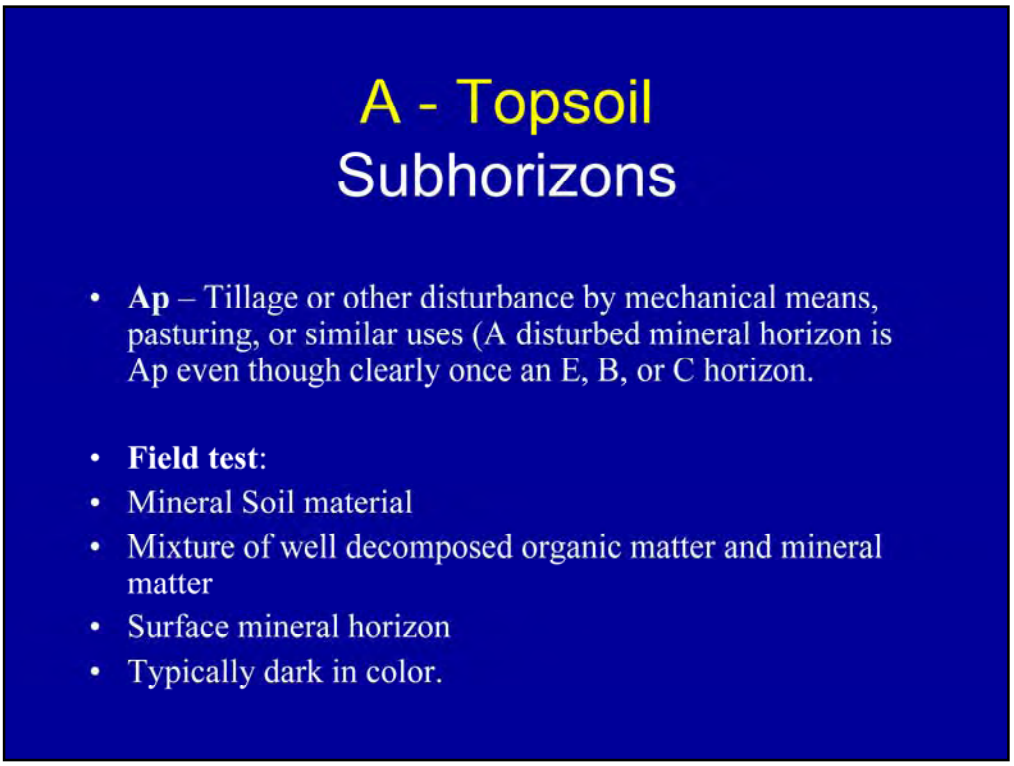
Let’s repeat what we have learned, with some local examples.

Freetown soil series. This sample has over 51” of organic material. Using the BBNEP Pocket Guide to Delineating Wetlands, what hydric soil criteria is met?

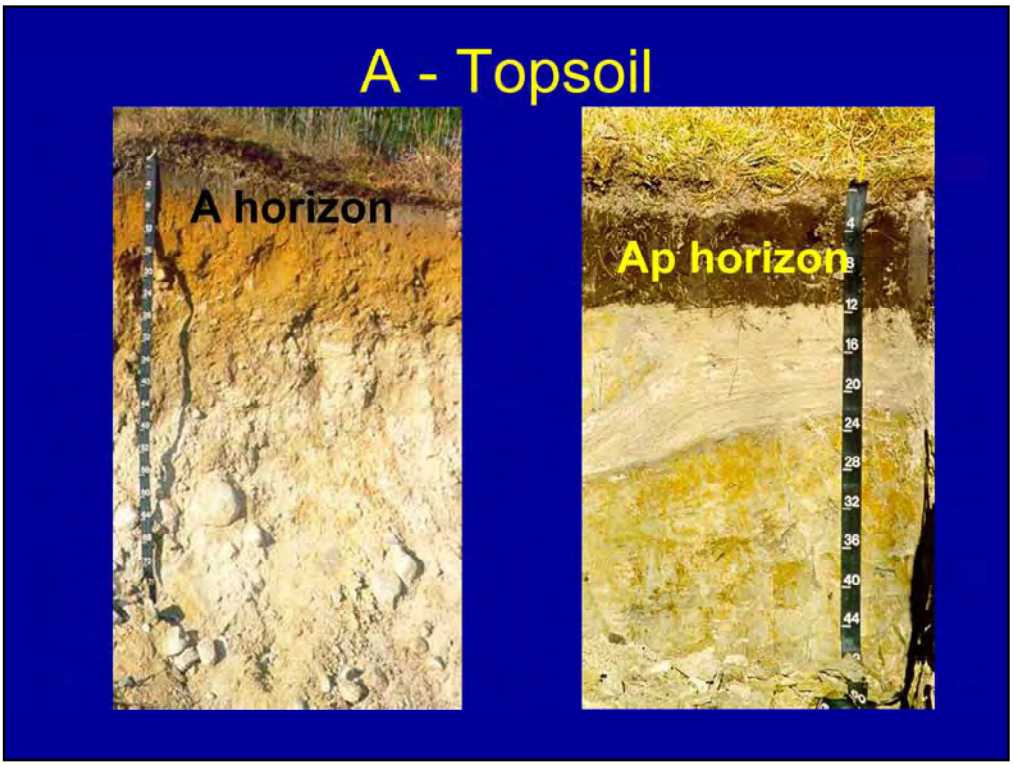
Photo Credit: Jim Turenne



The A horizon may be dark, but it is a mineral horizon, as opposed to an organic horizon. A horizons are color is dominated by the presence of organic material.



Any A over 3 inches thick is probably an Ap. Over 12 inches thick it might be an area where farm animals came through a wetland to water. Over 20” thick its not likely that the horizon was naturally formed.



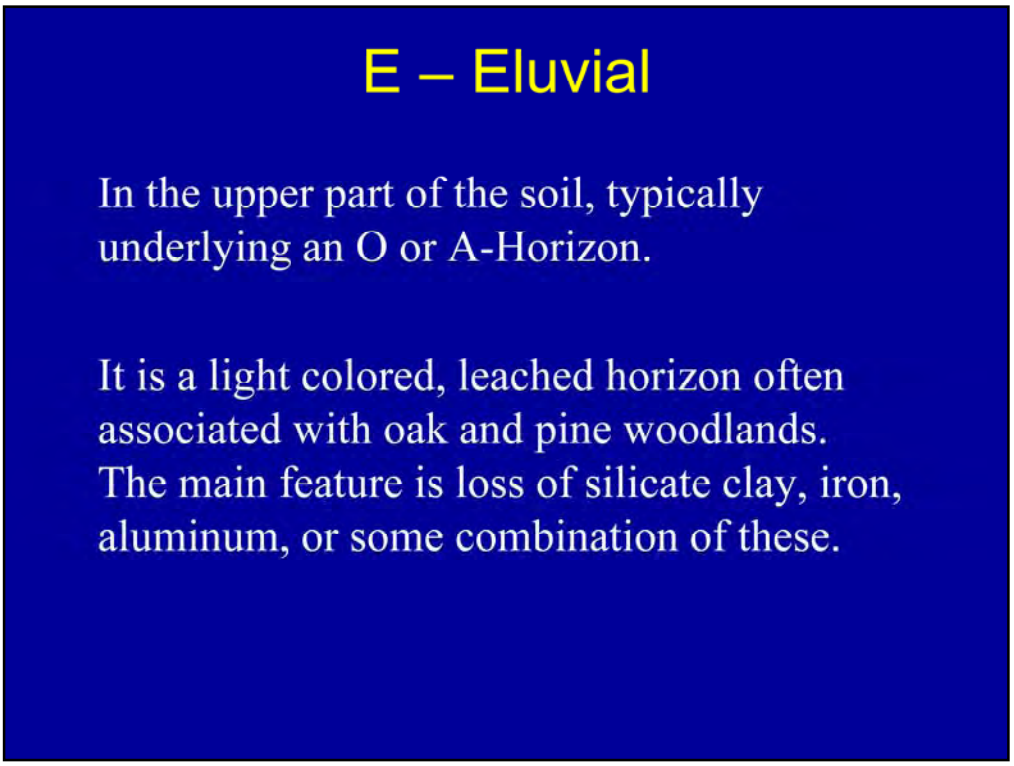
This is a good example of an A (left) verses an Ap (right) Notice the thickness as well as the abrupt change in the horizons.

Gloucester Series on Left : description at http://nesoil.com/muds/pedons/2344001.htm

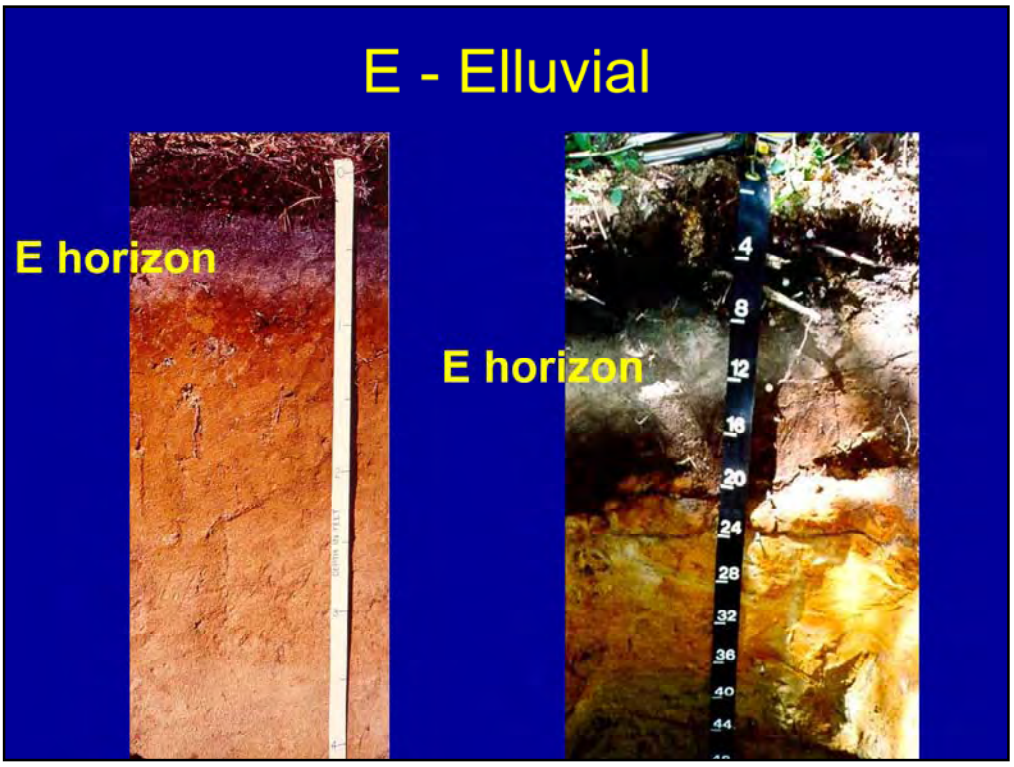
Enosberg Series On Right:

0-12 in - Ap horizon, loamy sand.
12-23 in - C1 horizon, gray sand.
24-32 in - 2C1, mottled (redox concentrations and depletions) silt loam.
32-48 in - 2Cg, silt loam.

Photo Credits: Jim Turenne



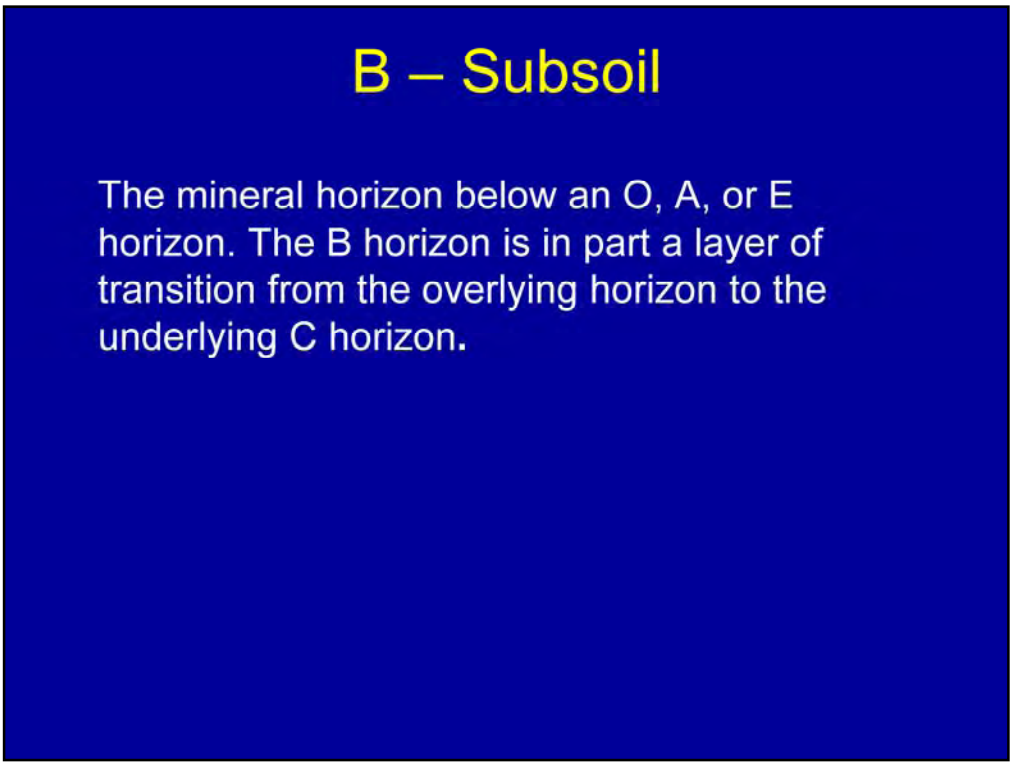
Also note that this soil exists where there was once white oak and pines.



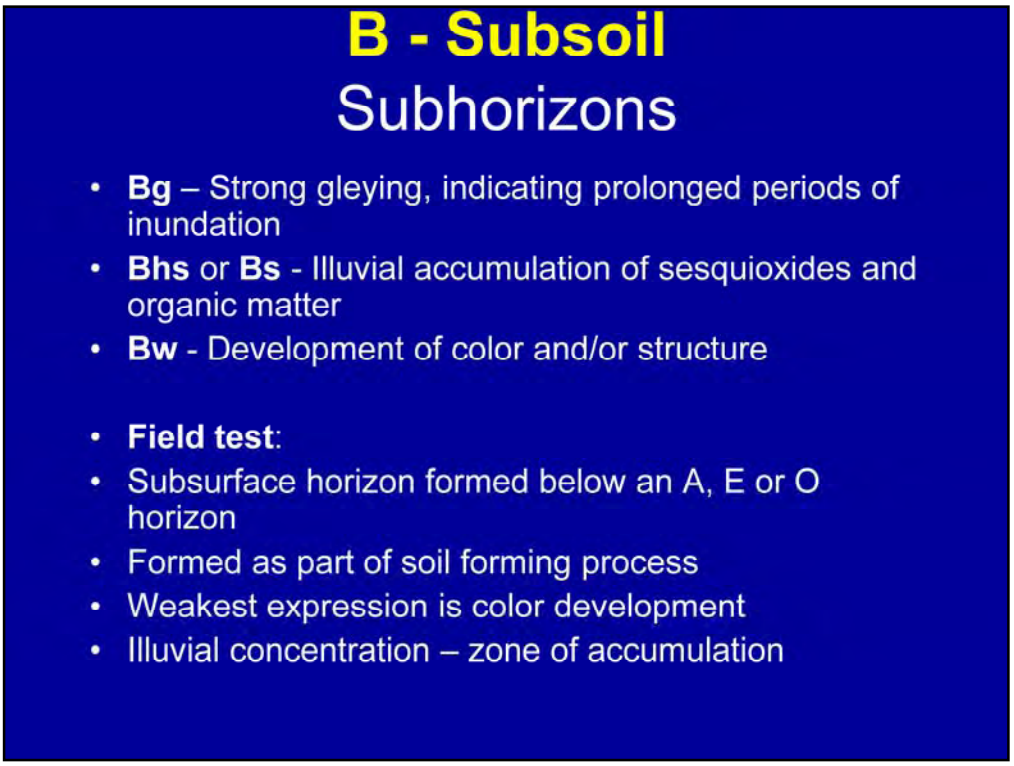
An upland E on the left, Carver Series, and wetland E (Eg) on the right, Mattapoisett Series.

Carver Series Photo by nesoil.com

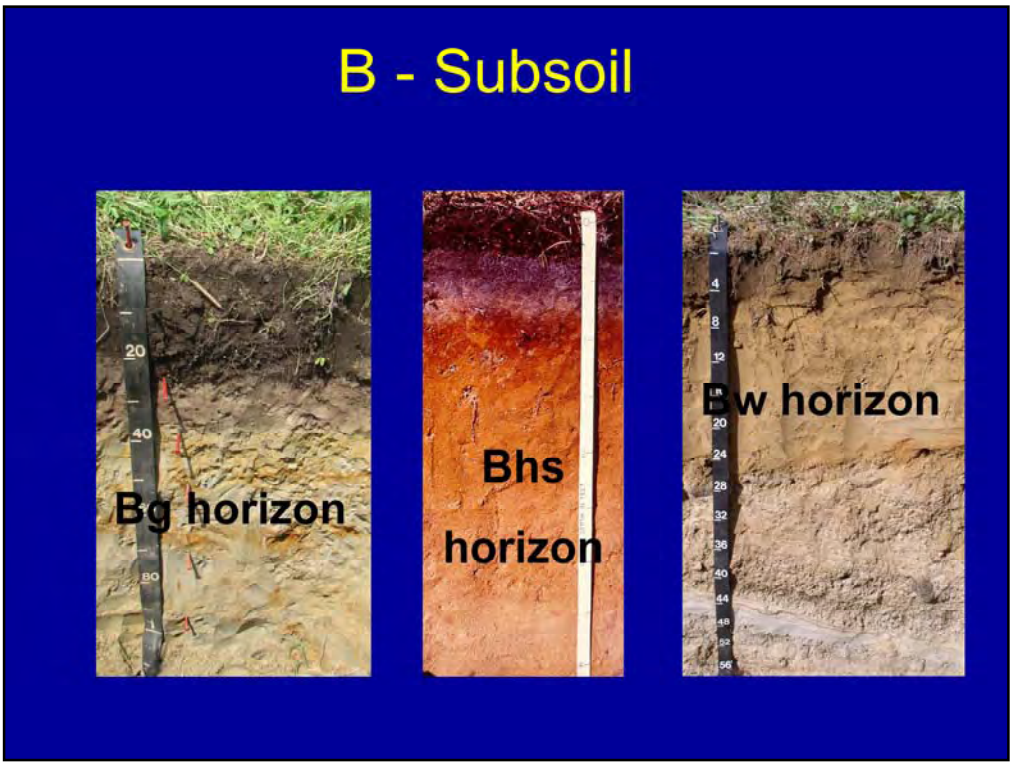
Mattapoisett Photo by Lea Ann Pytlik



The B is received some minerals leaching down from above to form, or has developed, some structure.

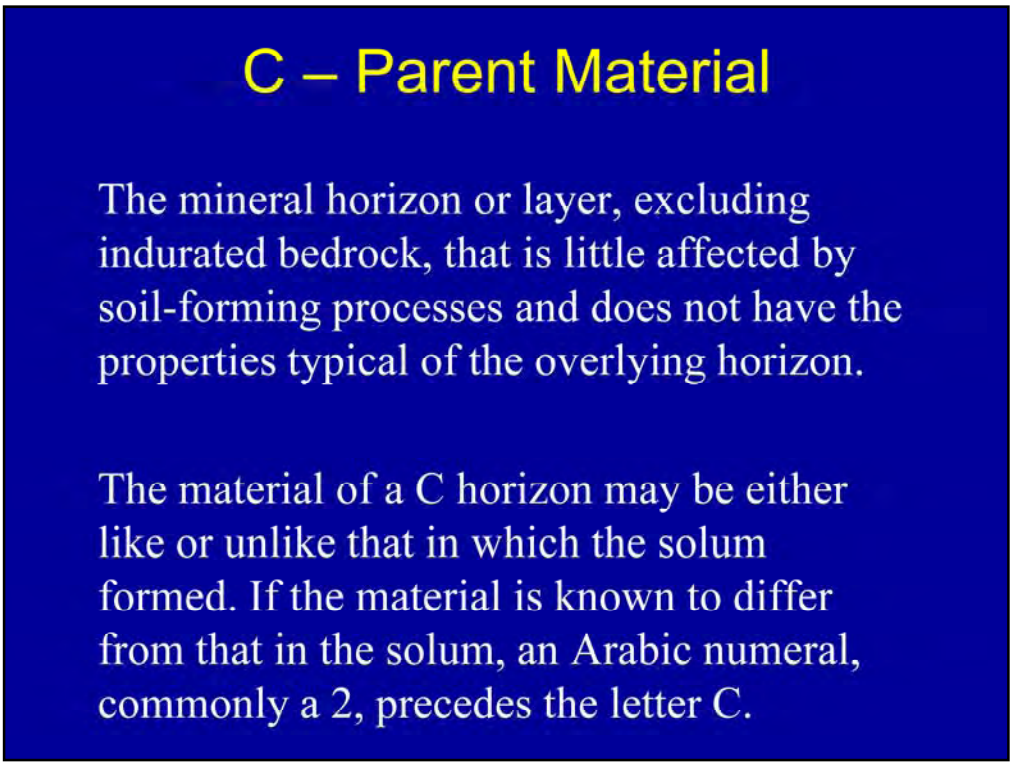


A complete list of sub-horizons is in the *Notes* section of Slide 18.

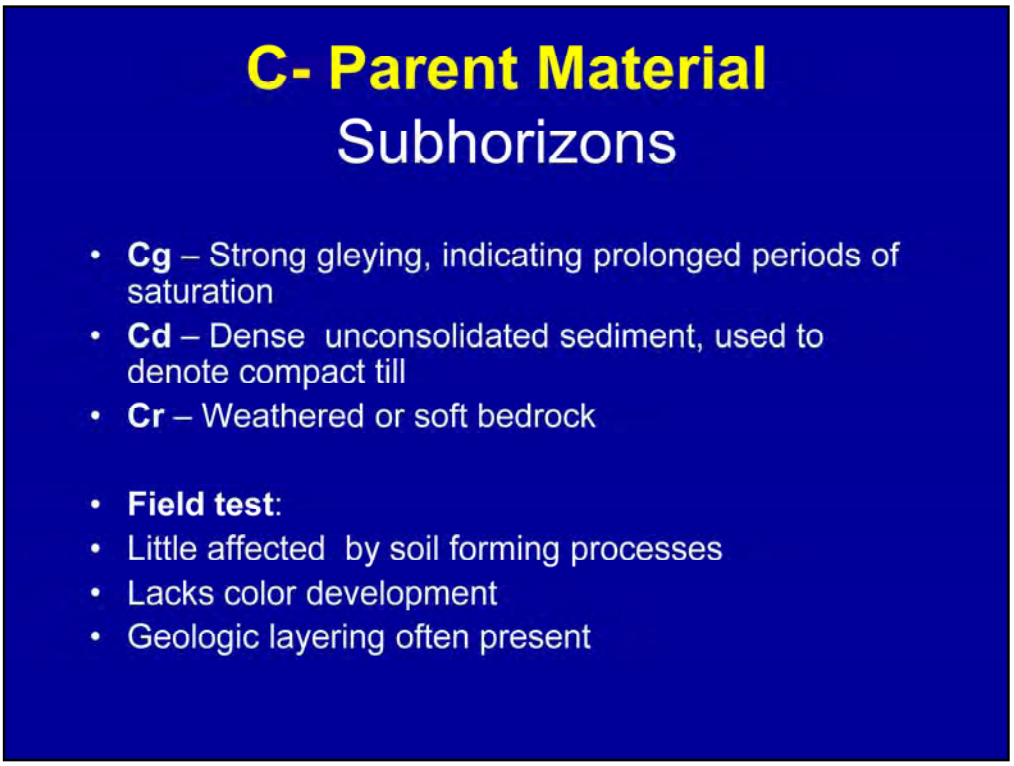


Examples (from left to right) of a gleyed, spodic, and weathered B.

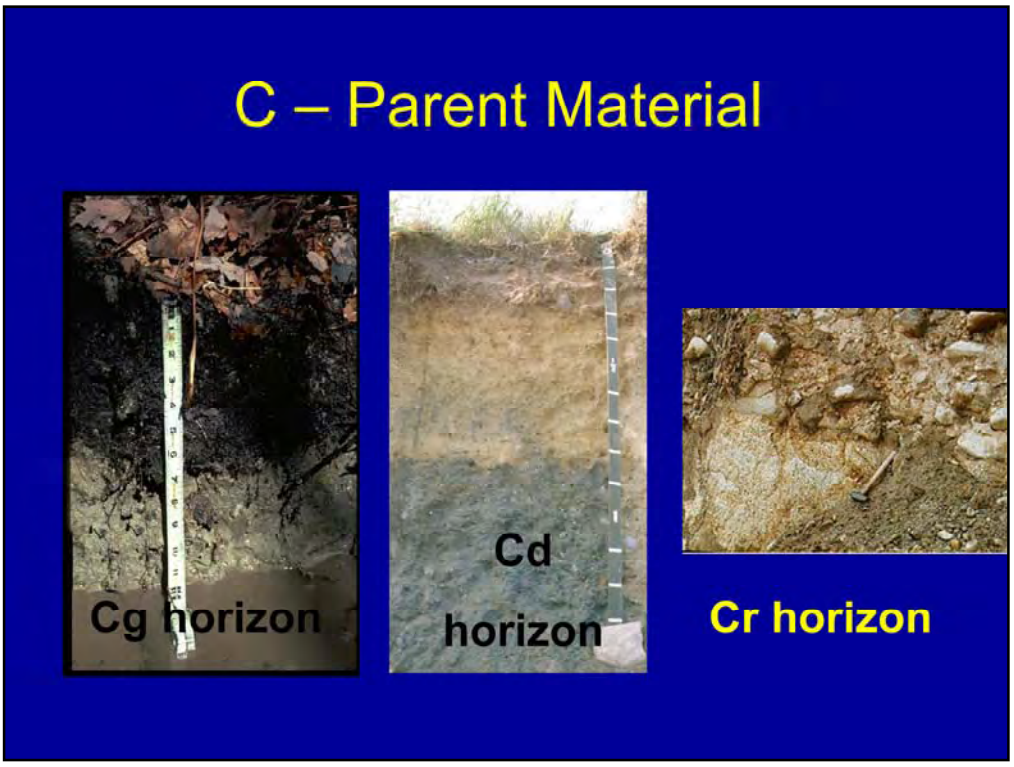
From left to right: Birdsall Photo by Peter Fletcher, Carver photo at nesoil.com, Enfield photo by Jim Turenne



This is material that has not changed since it was deposited by the ice sheet (or ice sheet retreat).

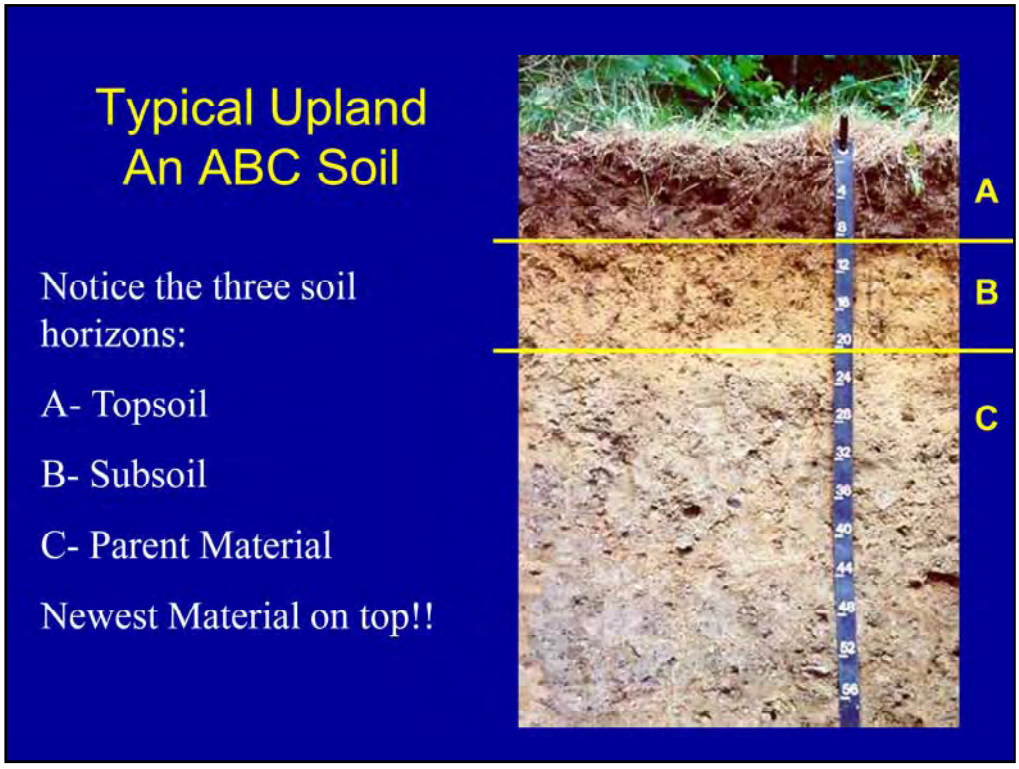


A complete list of sub-horizons is in the *Notes* section of Slide 18.



Examples (from left to right) of gleyed, dense fragipan, and rocky C layers

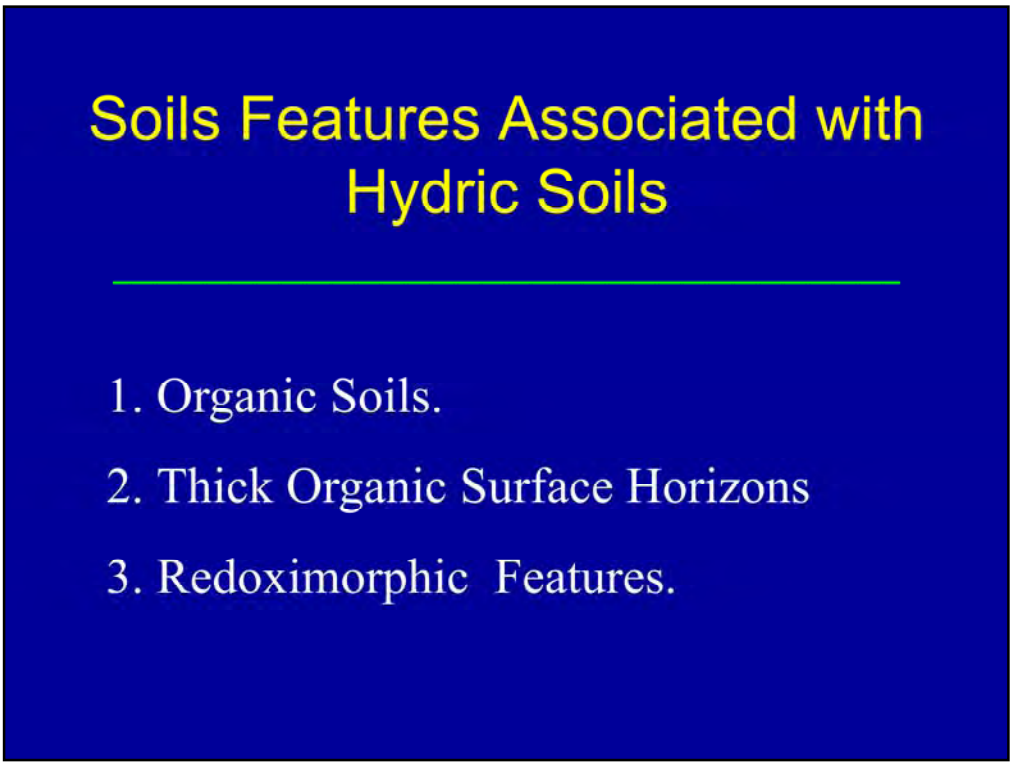
Photos from Left to right: Birdsall photo by Peter Fletcher, Poquonock photo courtesy of Mark Stolt,



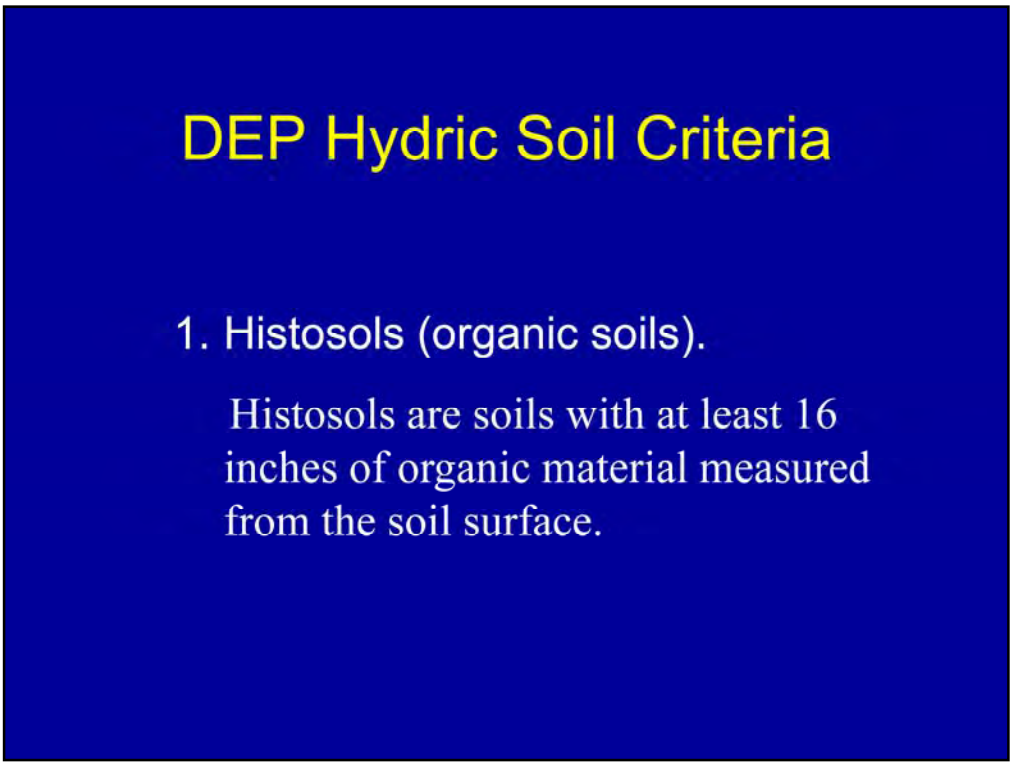
This is the most basic soil profile.

There also seems to be an C2 starting at around 40-44”

Photo Credit: nesoil.com


Soils Features Associated with Hydric Soils
1. Organic Soils.
2. Thick Organic Surface Horizons
3. Redoximorphic Features.

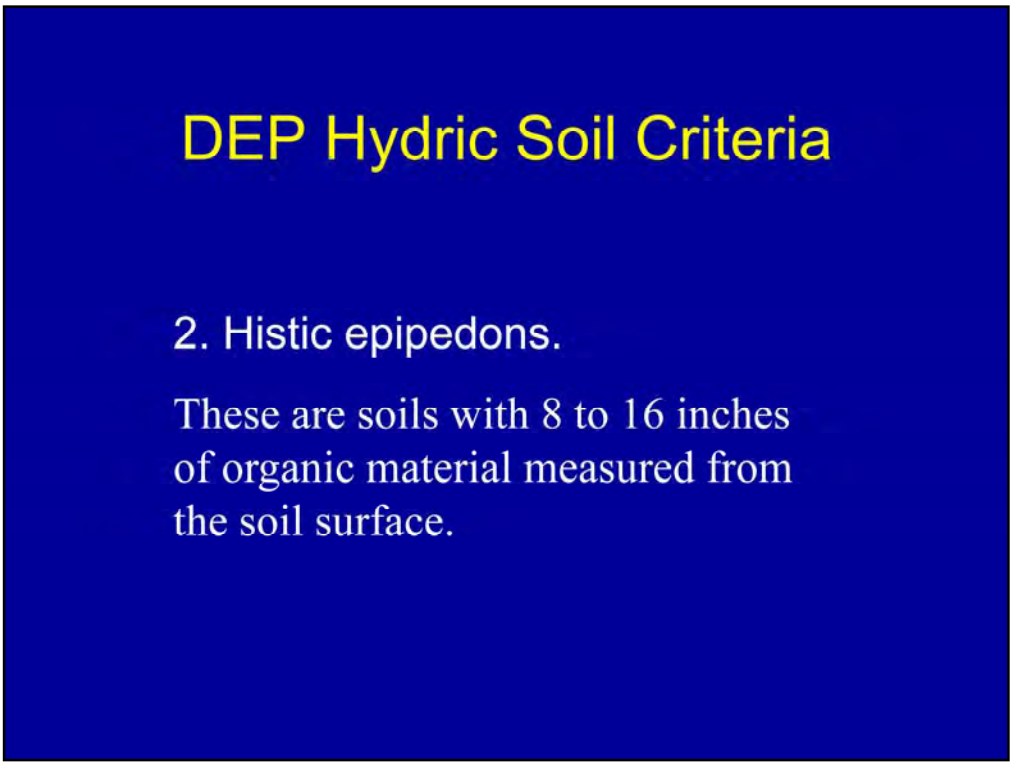
Memorize!



Let's run through the DEP Hydric Soil criteria. You don't have to remember this. It's on page 29 of the DEP manual and on page 21 of the BBNEP Pocket Guide

If you are wondering if this soil is hydric you might want to check your nerves to your feet. You are standing in water – and slowly sinking.

Photo Credit: Jim Turenne

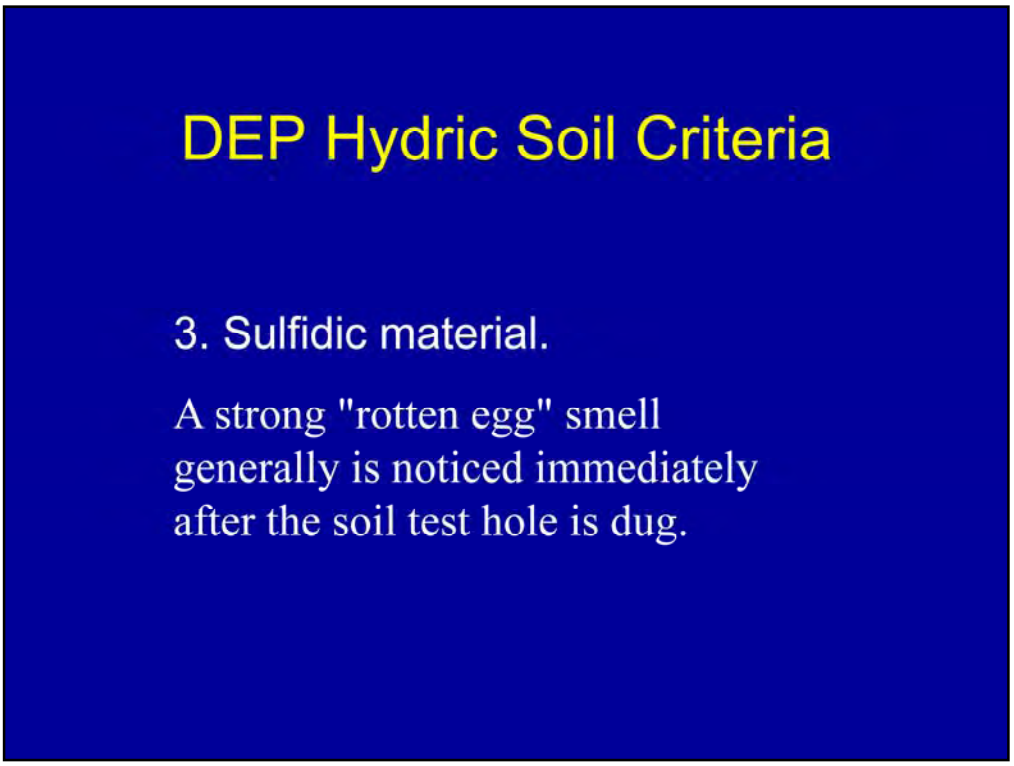


Not to get too fancy but…. Histic means organic, and epipedons means soil surface layer.

Photo also includes red masses and redox depletions.

Notice the sensitive fern (A once-cut fern using the ID system in A Field Guide to the Ferns.)

Photo Credit: Field Indicators of Hydric Soils in the United States v. 6



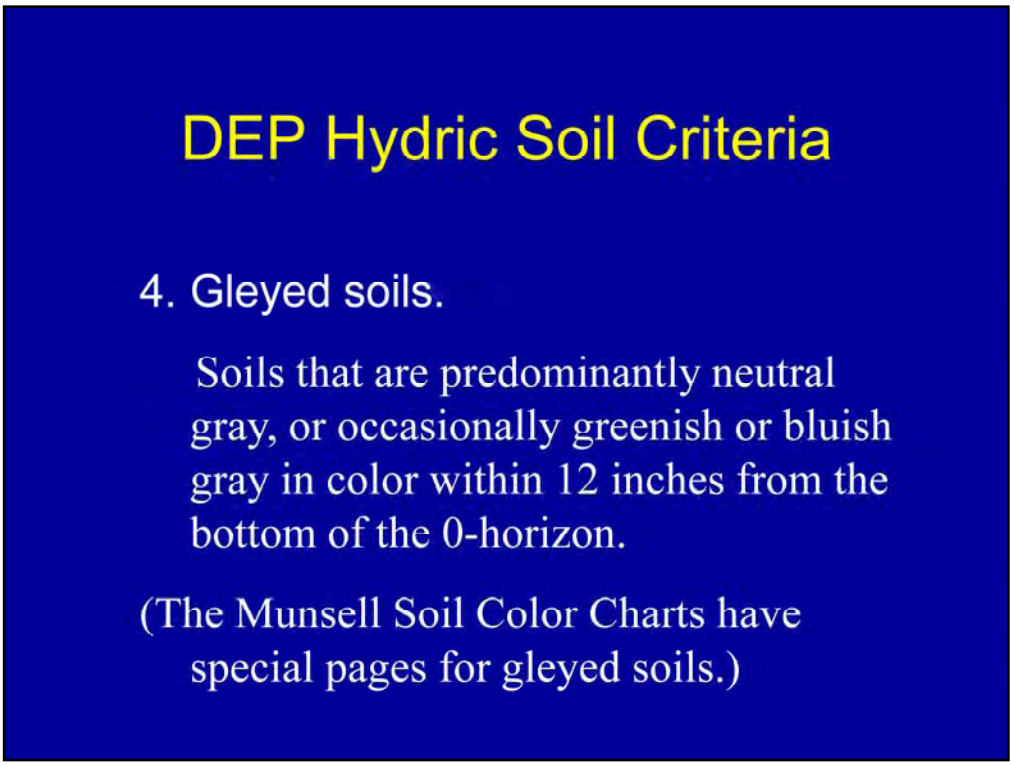
At this point the reduction is so great, if you don't know you are in a wetland, get on the Recreation Committee. BTW you're in a salt marsh.

Sulfihemist from a tidal marsh in Massachusetts.

Sulfuric material is the black soil material aligned with wooden part of spade handle.

These are the only soils that commonly have a sulfidic odor. The sulfidic odor does occur in freshwater wetlands but it is not as common.

Slide from NRCS, Wetland Science Institute, Power Point Presentation "Field Indicators of Hydric Soils" available at http://www.maenvirothon.org/hydric%20soils.ppt



These soils are very wet and usually are not found at the wetland edge.

Any soil scientists in the audience realize that gleyed matrix is not the same as the Soil Survey Manual criteria for putting a g on a horizon (like Bg isn't necessarily gleyed). You might want to point this out to others also that the g horizon designation in soil survey reports just generally means high value, low chroma due to wetness and it has been inconsistently applied over the years.

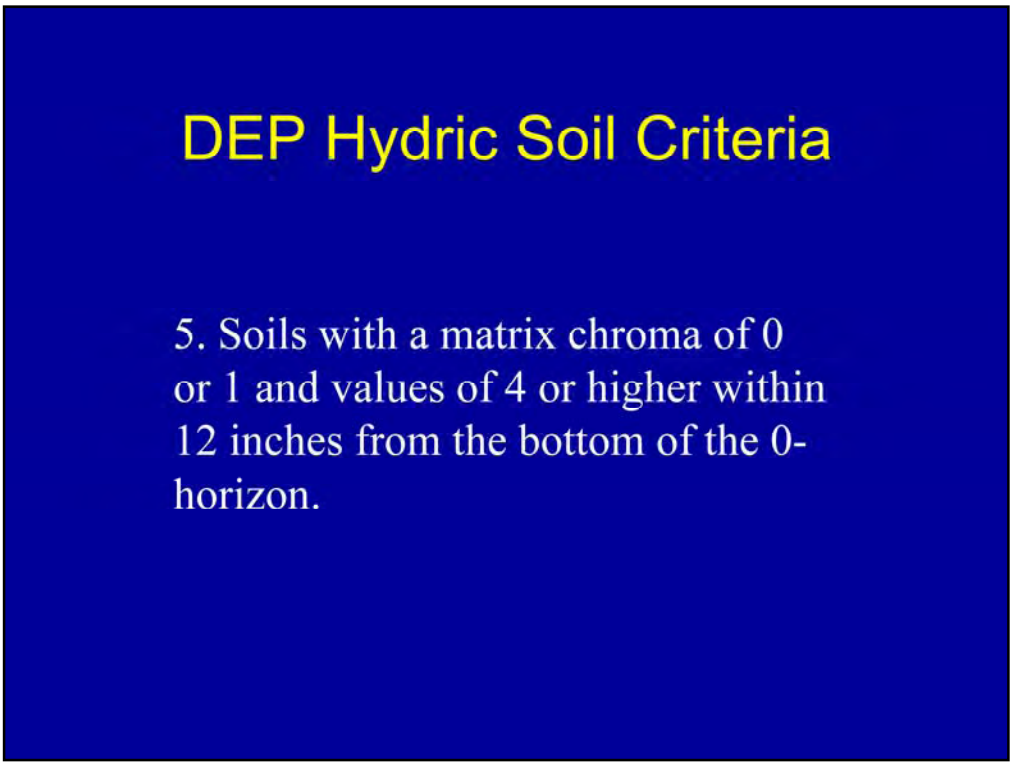
Also, reduced matrix (one that changes color upon exposure to air as per Vepraskas) fits this. It is a rare phenomena but maybe worth mentioning.

Slide from NRCS, Wetland Science Institute, Power Point Presentation "Field Indicators of Hydric Soils" available at http://www.maenvirothon.org/hydric%20soils.ppt

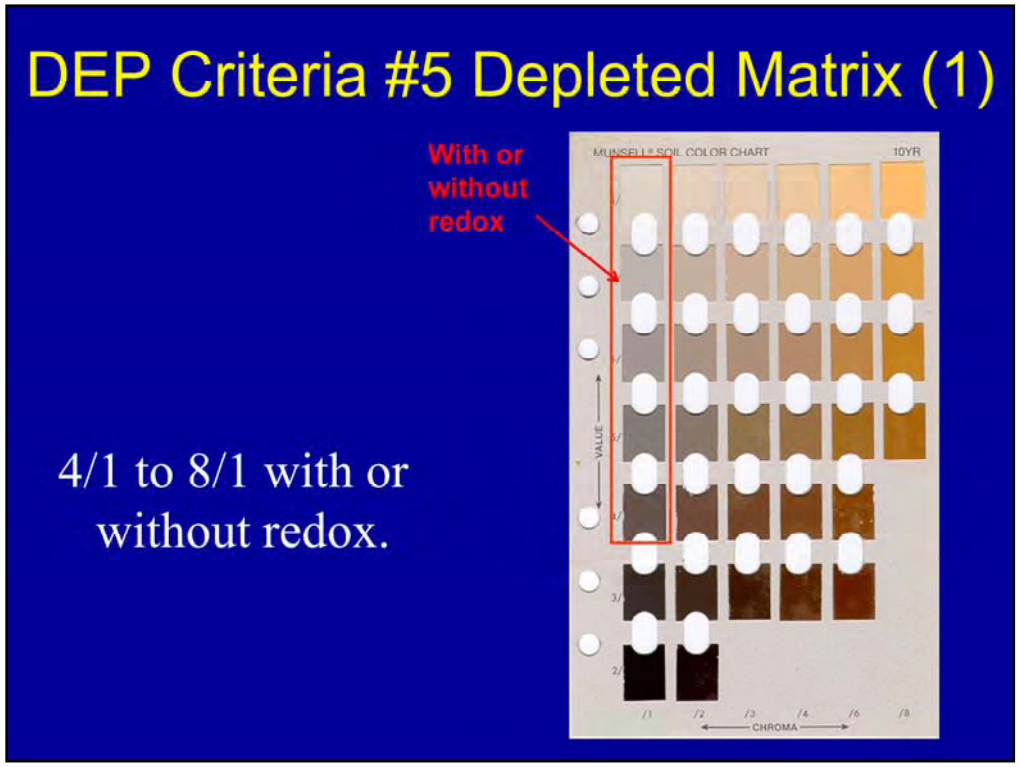
This photo shows a redox depletion (5BG 6/0 munsell color) along a dead root channel (visible in the center) with redox concentrations (10YR 5/6) around the depletion

Photo and description from: nesoil.com

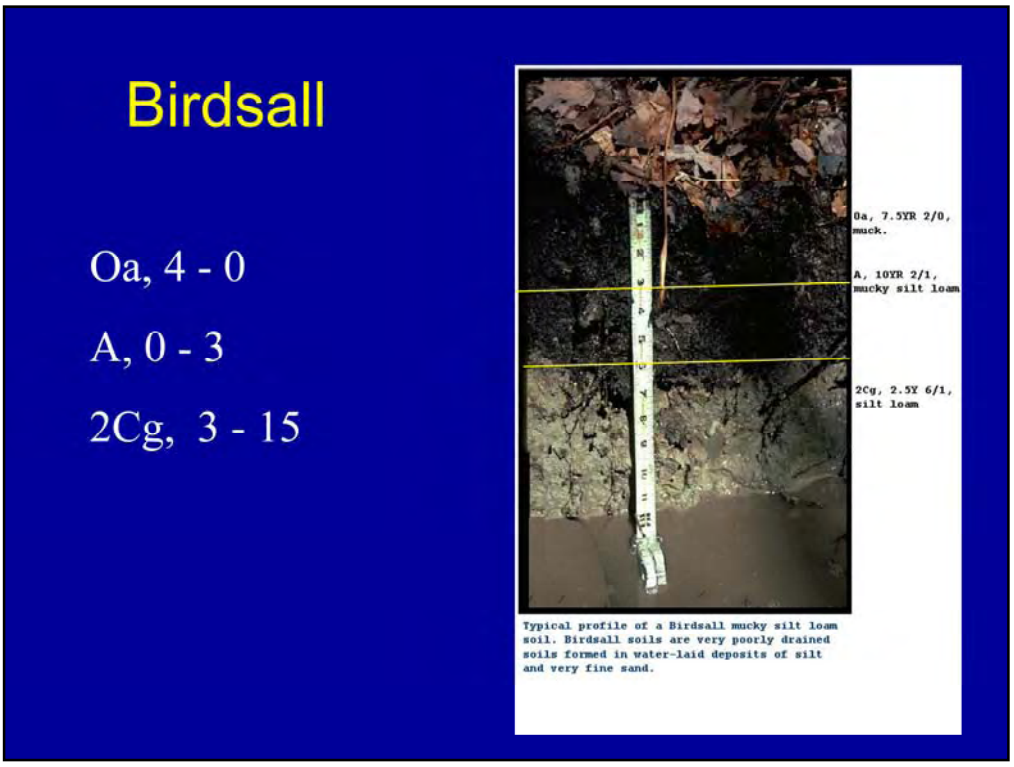
For hydric soil determinations, a gleyed matrix has the hues and chroma identified in this illustration with a value of 4 or more. [Due to inaccurate color reproduction, do not use this page to determine soil colors in the field.]



This morphology is referred to as a depleted matrix. It differs slightly from the ACOE hydric soil criteria.



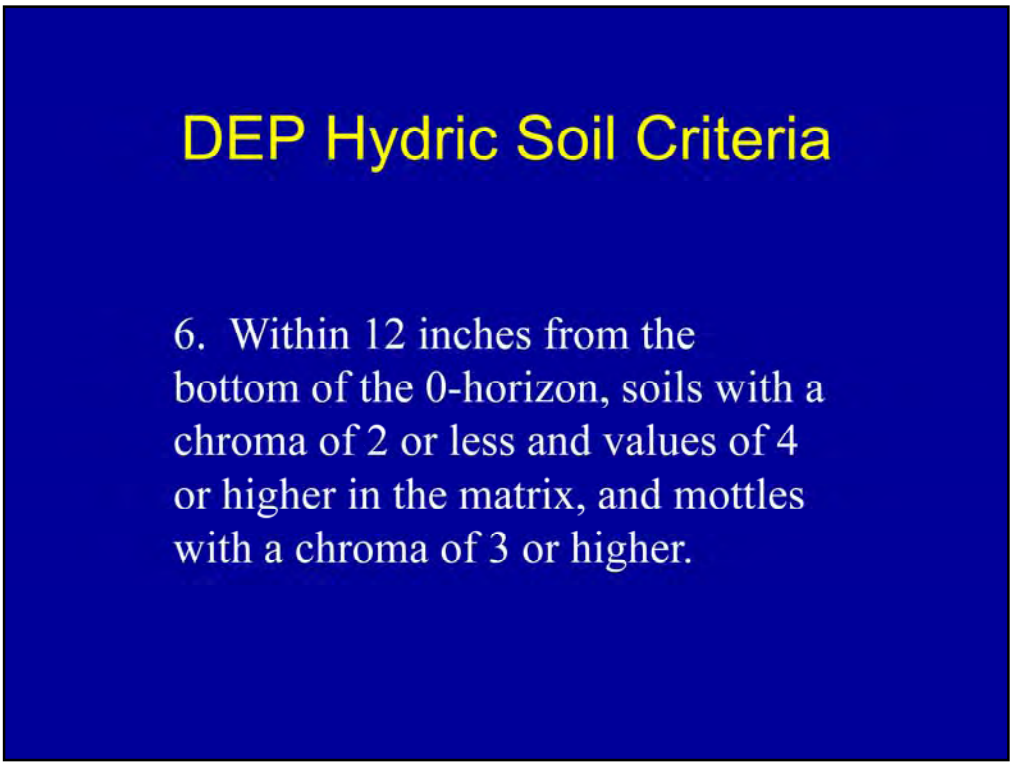
See DEP Manual page 29 and page 21 of the BBNEP Pocket Guide to Delineating Wetlands.



The fine print:

Oa, 7.5YR 2/0 muck
A 10YR 2/1 mucky silt loam
2Cg, 2.5Y 6/1 silt loam

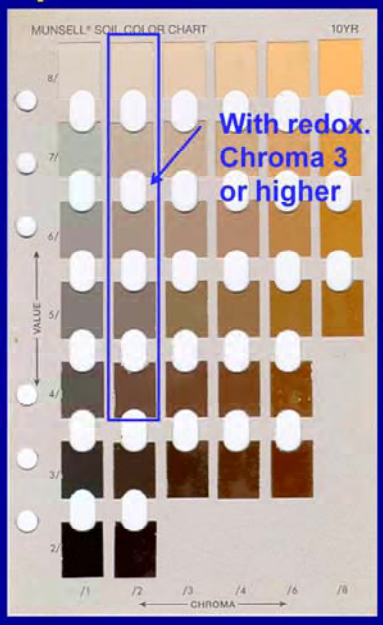
Photo Credit: Peter Fletcher



This morphology is also referred to as a depleted matrix. It differs slightly from the ACOE hydric soil criteria.

DEP Criteria #6 Depleted Matrix

4/2, to 8/2 with redox.
chroma 3 or higher

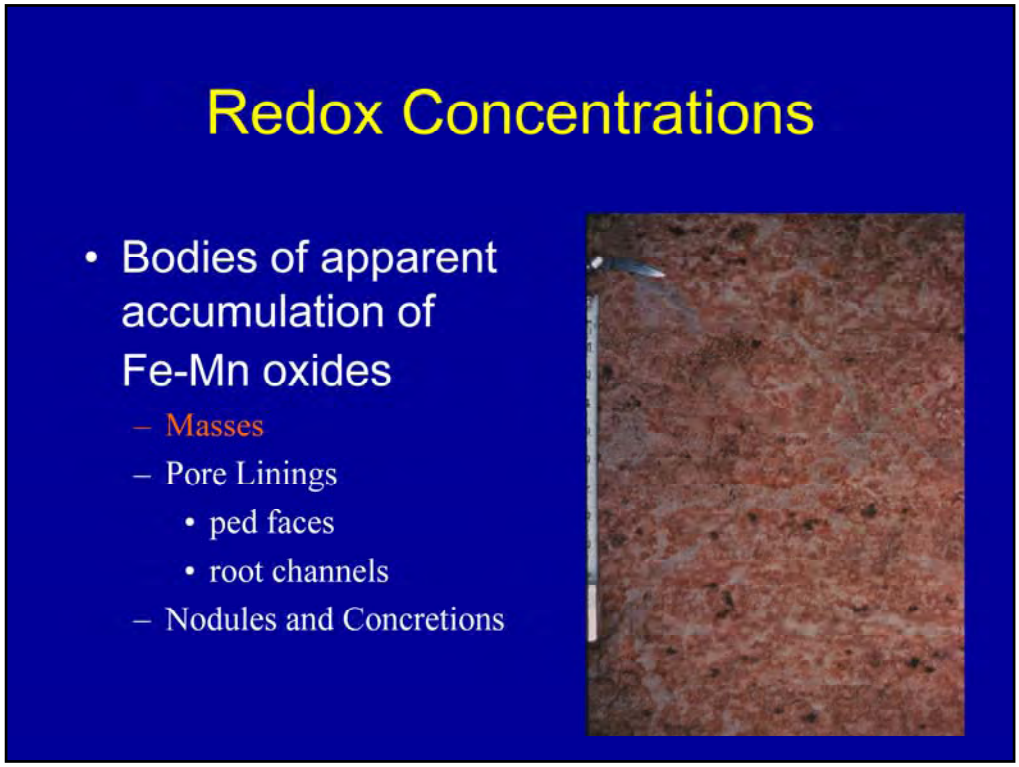


See DEP Manual page 29.

DEP Criteria #6 Depleted Matrix

"mottles with a chroma of 3 or higher" aka "*redox concentrations*"

Photo from: NRCS, Wetland Science Institute, Power Point Presentation "Field Indicators of Hydric Soils" available at http://www.maenvirothon.org/hydric%20soils.ppt



Soft bodies:

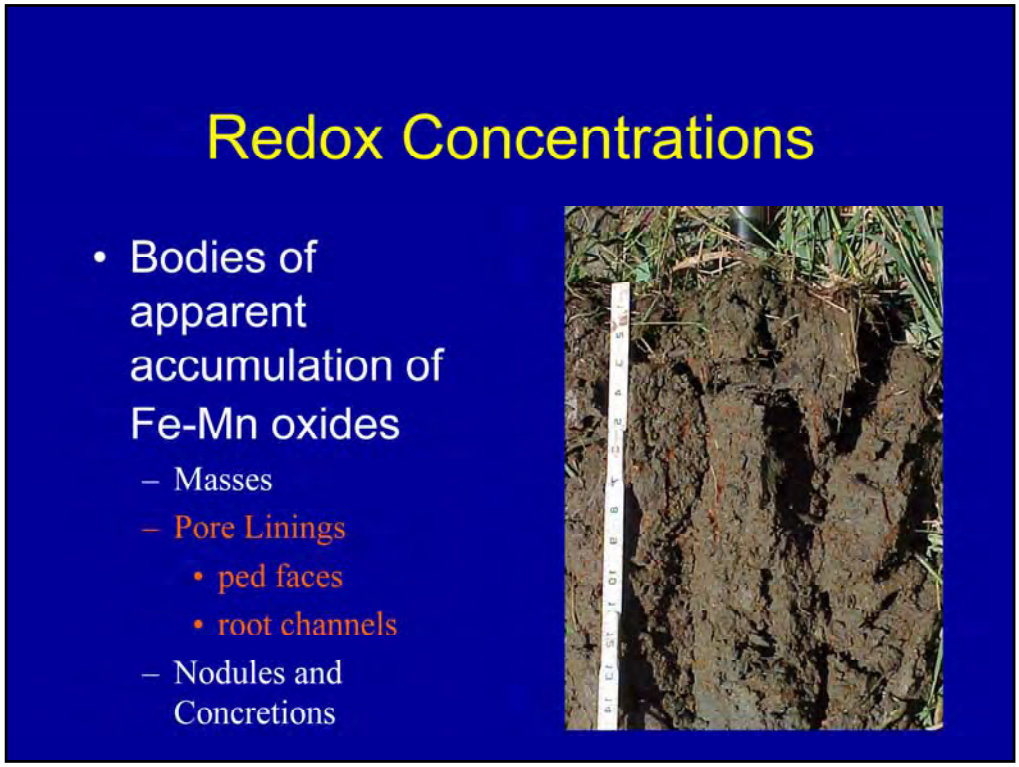
frequently in the soil matrix

variable shape

can usually be removed from the soil “intact”

Photo from: NRCS, Wetland Science Institute, Power Point Presentation “Field Indicators of Hydric Soils” available at http://www.maenvirothon.org/hydric%20soils.ppt

Darker colored masses are dominated by Mn.

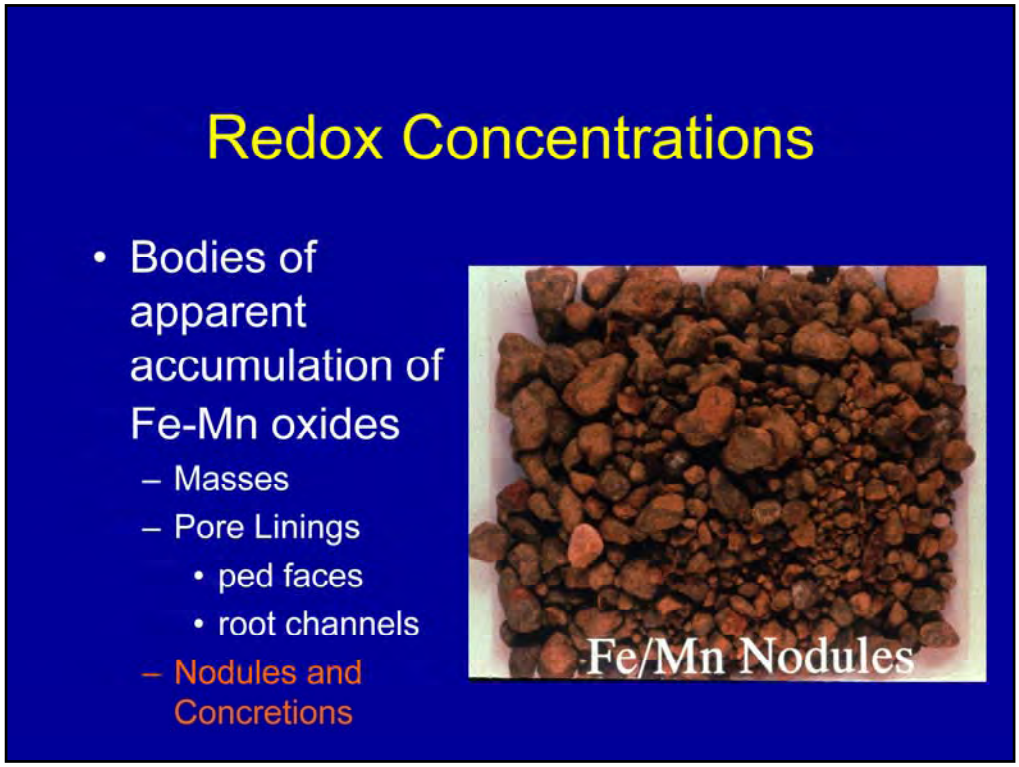


Redox concentrations, most often (in upper horizons) they occur as pore linings in root channels and pore linings on ped faces.

Note the difference in soil terminology vs. hydrology indicators. Soil scientists say redox concentrations as pore linings in root channels, NOT the same as oxidized rhizospheres which require living roots. In fact, the rhizosphere is on / immediately adjacent to root and the roots should have an iron “plaque” on them in order to be used as a hydrology indicator.

Picture is redox concentrations occurring as pore linings on ped faces and in root channels.

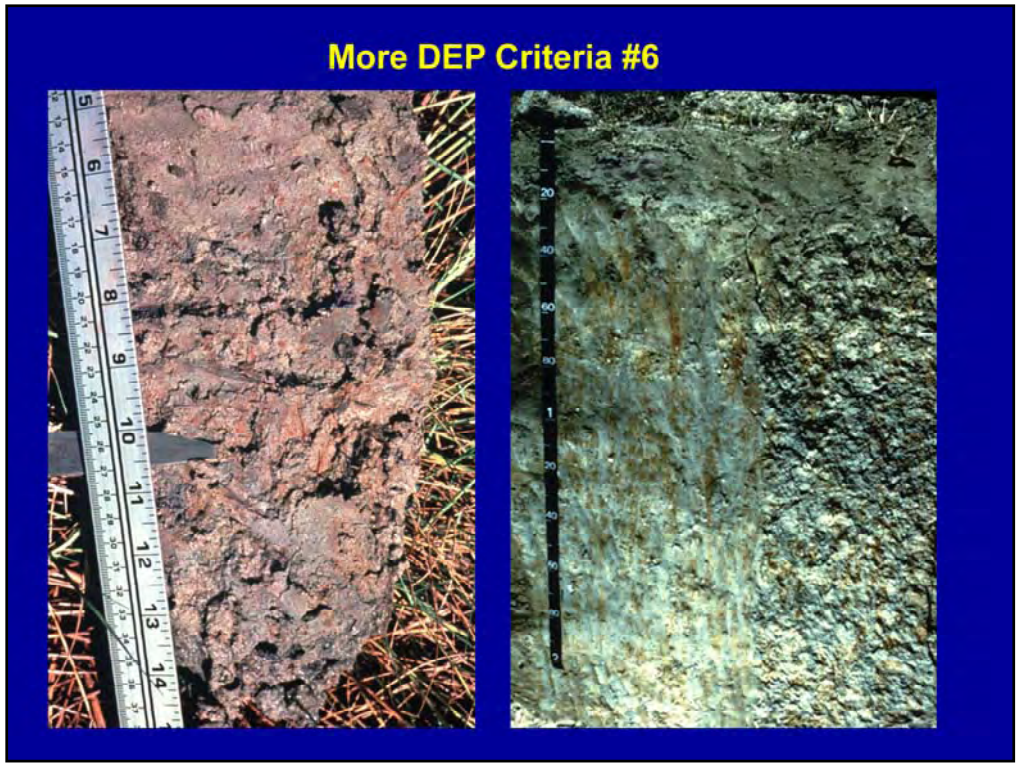
Photo from: NRCS, Wetland Science Institute, Power Point Presentation “Field Indicators of Hydric Soils” available at http://www.maenvirothon.org/hydric%20soils.ppt



Screened Fe nodules from a soil in Texas. In Texas these features are sometimes used on “gravel” roads. These are most likely relict.

Contemporary concretions / nodules should have “halos”, diffuse boundaries, or be irregular in shape.

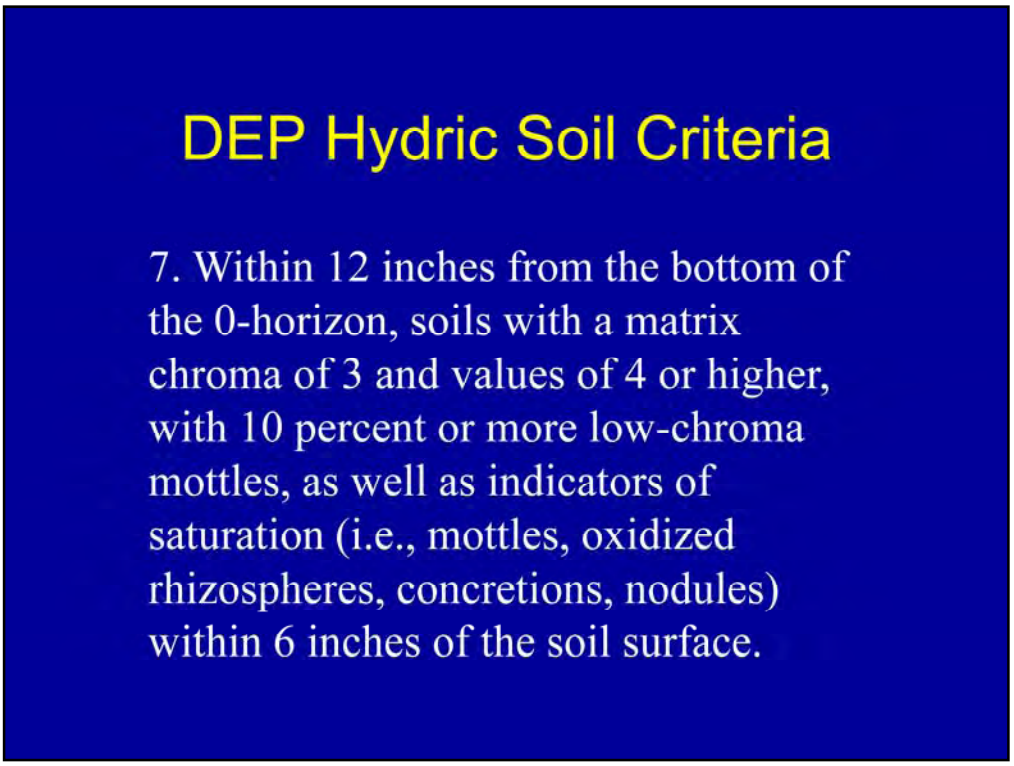
Photo from: NRCS, Wetland Science Institute, Power Point Presentation “Field Indicators of Hydric Soils” available at http://www.maenvirothon.org/hydric%20soils.ppt



Examples of DEP Criteria #6 in loamy soils. The soil on the right is “Grady”, a southeastern hydric soil. Other soil is unknown.

On some projectors the left slide may appear to be pinkish, it actually is gray with red orange redox accumulations.

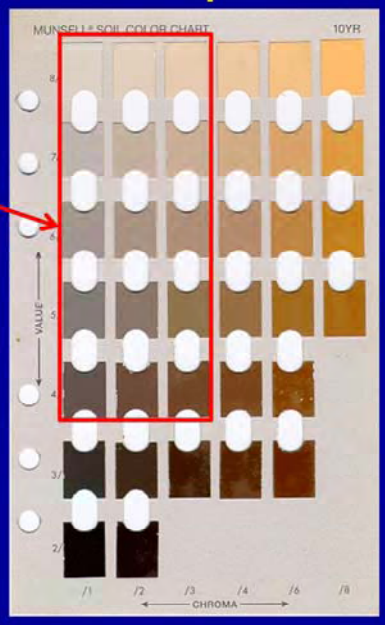
Photos from: NRCS, Wetland Science Institute, Power Point Presentation “Field Indicators of Hydric Soils” available at http://www.maenvirothon.org/hydric%20soils.ppt



This criteria is referred to as redox depletions.

DEP Criteria #7 Redox Depletions

With 10% or more low chroma mottles and other redox. within 6 inches of the surface



See DEP Manual page 29.

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

- generally value ≥ 4
- chroma ≤ 2
- formerly called "gray mottles"

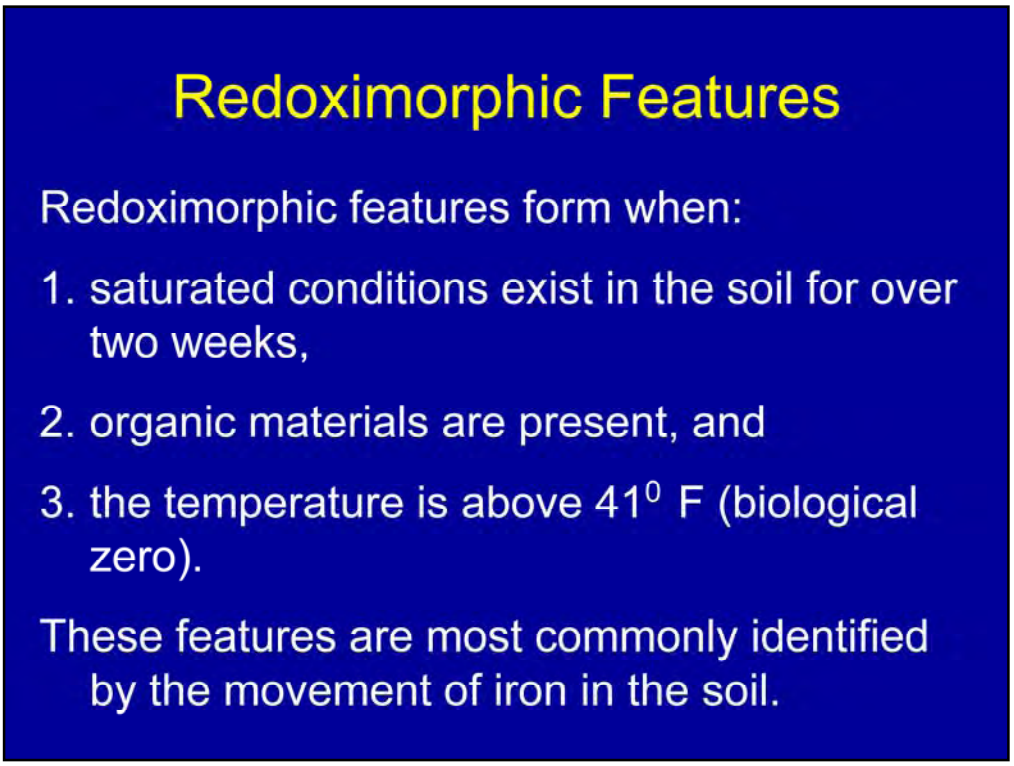
Picture shows redox depletions along root channels. Redox depletions are most common along root channels because this is where the organic material is available to energize the microbial reduction process.

Photo from: "Redoximorphic Features" presentation developed by Michael Whited, NRCS - Wetland Science Inst. August, 2000
http://www.maenvirothon.org/hydric%20soils.ppt

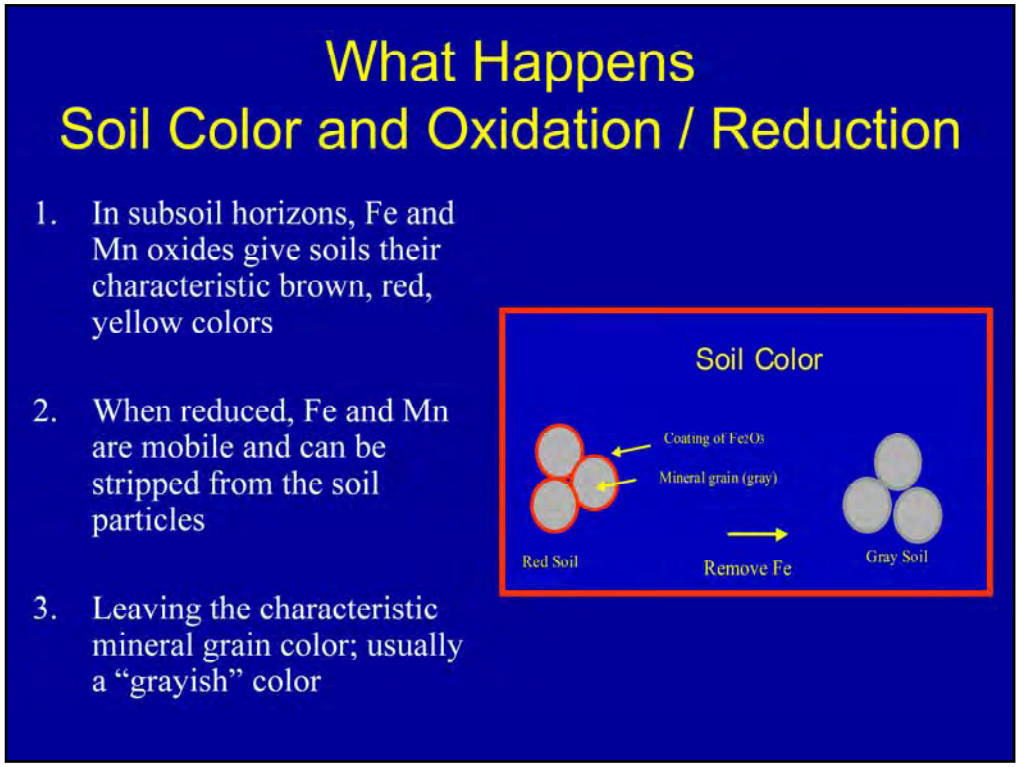
DEP Criteria #7 Redox Depletions

- Also needs indicators of saturation (i.e., mottles, oxidized rhizospheres, concretions, nodules) within 6 inches of the soil surface

Photo Credit: Keith Johnson, Mountain State Biosurveys, LLC

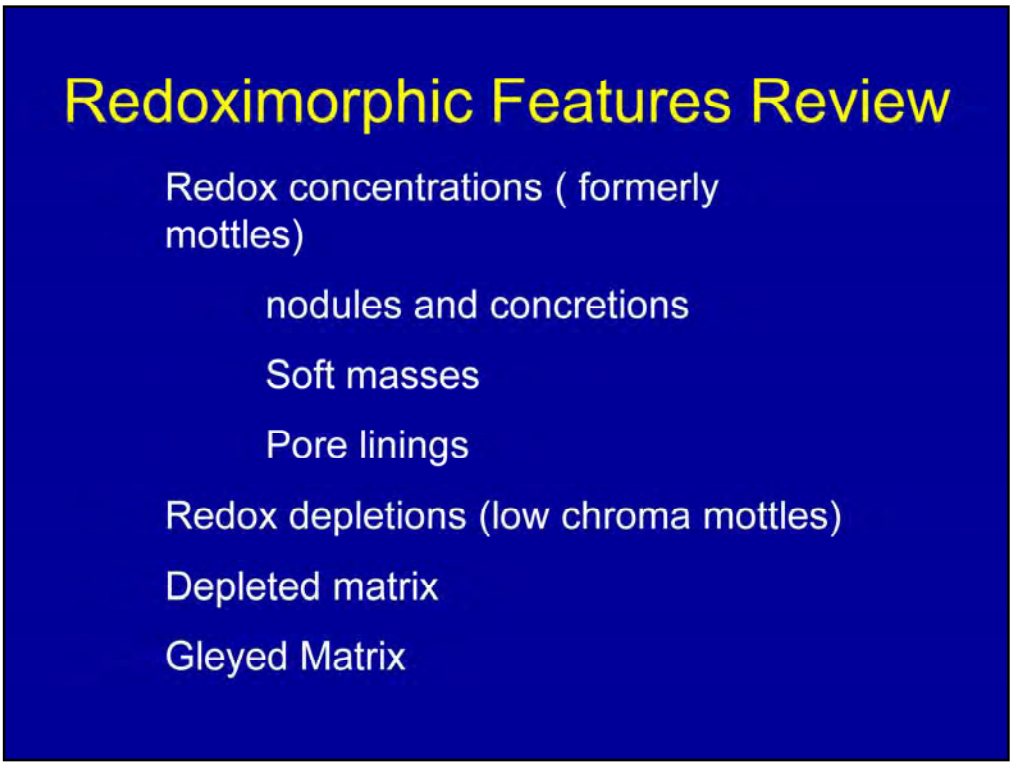


This is handy to remember because at some point you have to think about the fact that the water table must be within a foot of the surface. If you have a foot and a half deep low spot nearby, you should be seeing water stained leaves in that low spot.



The most common coloring agent in NE soils is iron. Most mineral soil grains are dominantly silica, so they are generally "colorless", i.e. gray or whitish, unless they are coated by OM or Fe.

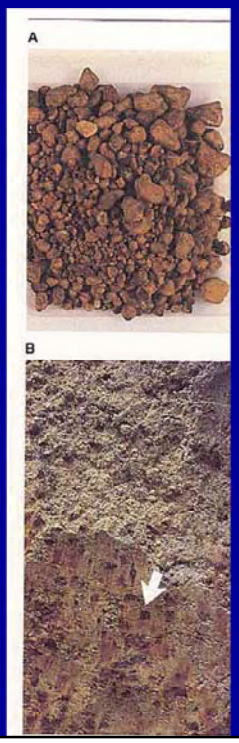
Slide from: "Redoximorphic Features" presentation developed by Michael Whited, NRCS - Wetland Science Inst. August, 2000
http://www.maenvirothon.org/hydric%20soils.ppt



Lets run through these again.

Redoximorphic Features
Redox Concentrations

Nodules and Concretions



These are hard, you can smash them but the stay together pretty well. A good sign of wet conditions.

Photo Credit: Keith Johnson, Mountain State Biosurveys, LLC

Redoximorphic Features
Redox Concentrations

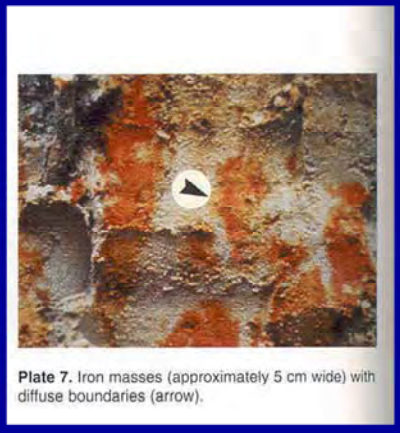
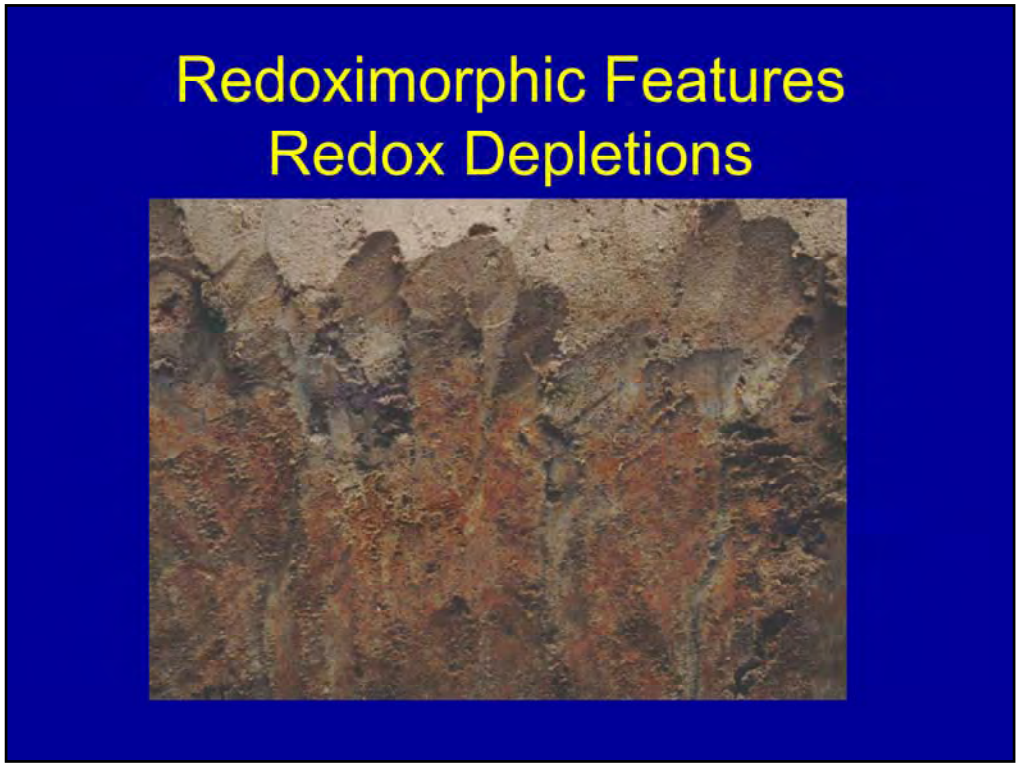


Plate 7. Iron masses (approximately 5 cm wide) with diffuse boundaries (arrow).

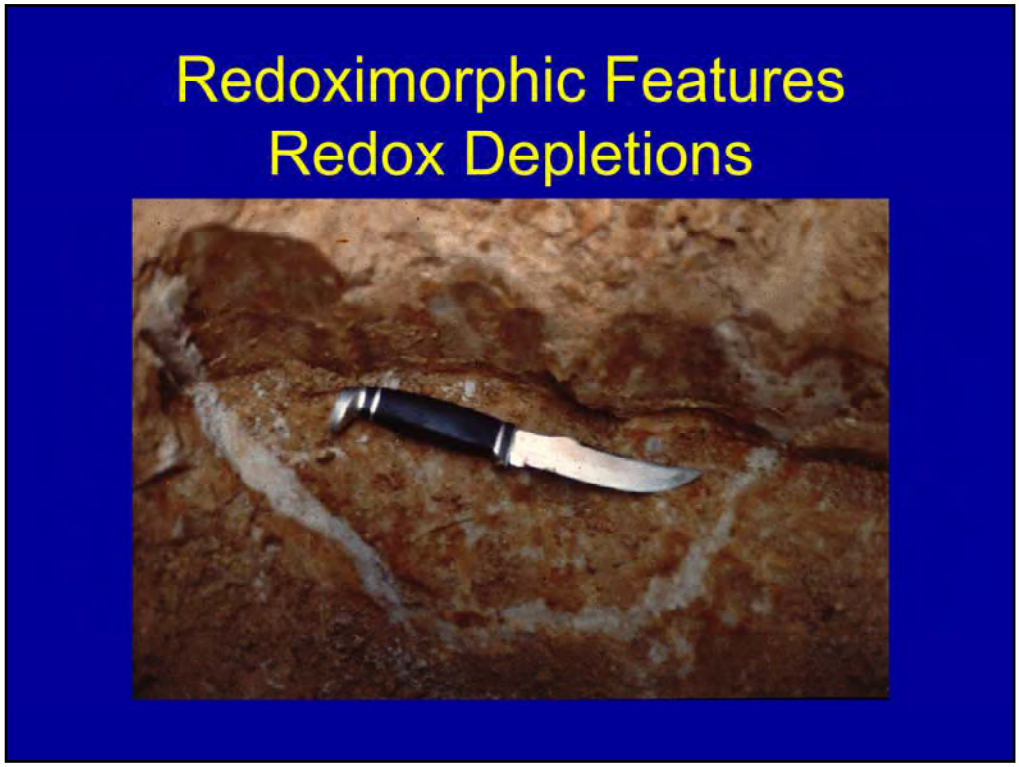
Soft masses

We used to call these “mottles.”



Redox depletions along root channels in an episaturated (perched water table) soil. The upper part of the profile is depleted. Water perches on the clay layer and as it trickles down through root channels into subsoil reduction occurs along root channels.

Photo by Warren Lynn - NRCS.



Redox depletion along ped face in subsoil. This is common morphology in subsoils with fragipans.

Picture is looking down at a horizontal cross-section.

Slide from: “Redoximorphic Features” presentation developed by Michael Whited, NRCS - Wetland Science Inst. August, 2000
http://www.maenvirothon.org/hydric%20soils.ppt

Redox depletion along ped face in subsoil. This is common morphology in subsoils with fragipans.

Picture is looking down at a horizontal cross-section.

Slide from: “Redoximorphic Features” presentation developed by Michael Whited, NRCS - Wetland Science Inst. August, 2000
http://www.maenvirothon.org/hydric%20soils.ppt

Redoximorphic Features
Depleted Matrix

- Dominant color of the soil is "gray"
- Commonly used to identify hydric soils
  - Discussed more in hydric indicators section

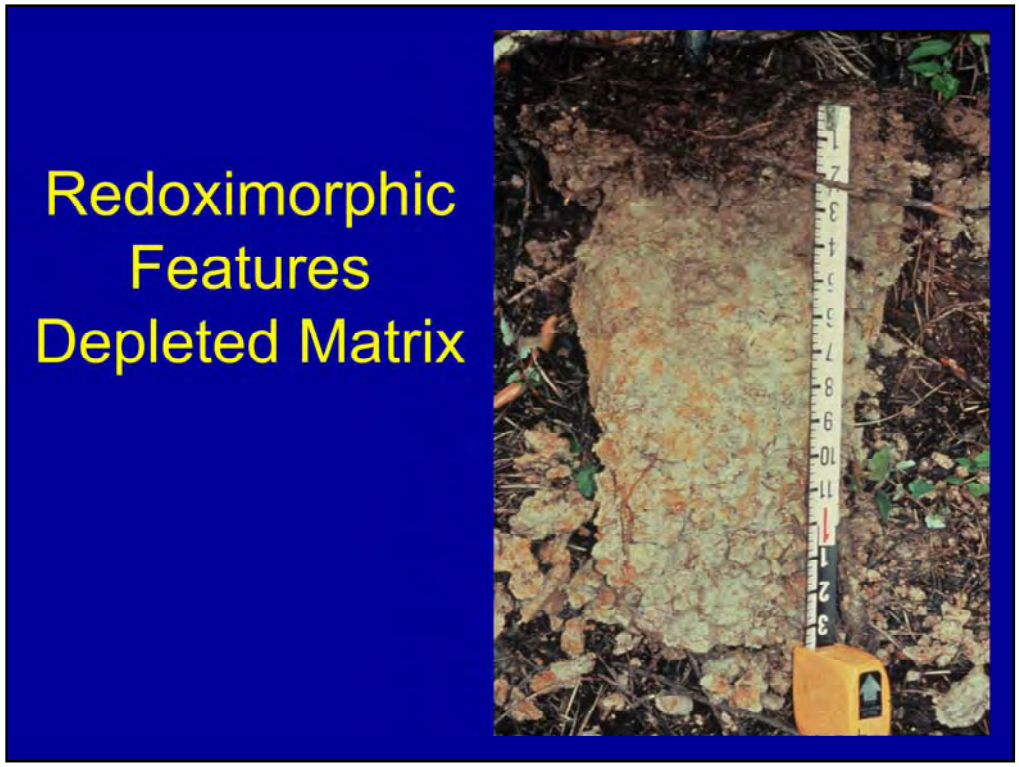
Depleted matrix in a Fragiaquept. This profile may be close, but (I believe) the dominant color is "gray." Might be used as an opportunity to ask the class what they perceive as the dominant color.

Slide from: "Redoximorphic Features" presentation developed by Michael Whited, NRCS - Wetland Science Inst. August, 2000
http://www.maenvirothon.org/hydric%20soils.ppt

Enosberg Series:

0-12 in - Ap horizon, loamy sand.
12-23 in - C1 horizon, gray sand.
24-32 in - 2C1, mottled (redox concentrations and depletions) silt loam.
32-48 in - 2Cg, silt loam.

Photo Credits: Jim Turenne



More depleted matrix

Photo Credit: Photo from: NRCS, Wetland Science Institute, Power Point Presentation “Field Indicators of Hydric Soils” available at http://www.maenvirothon.org/hydric%20soils.ppt

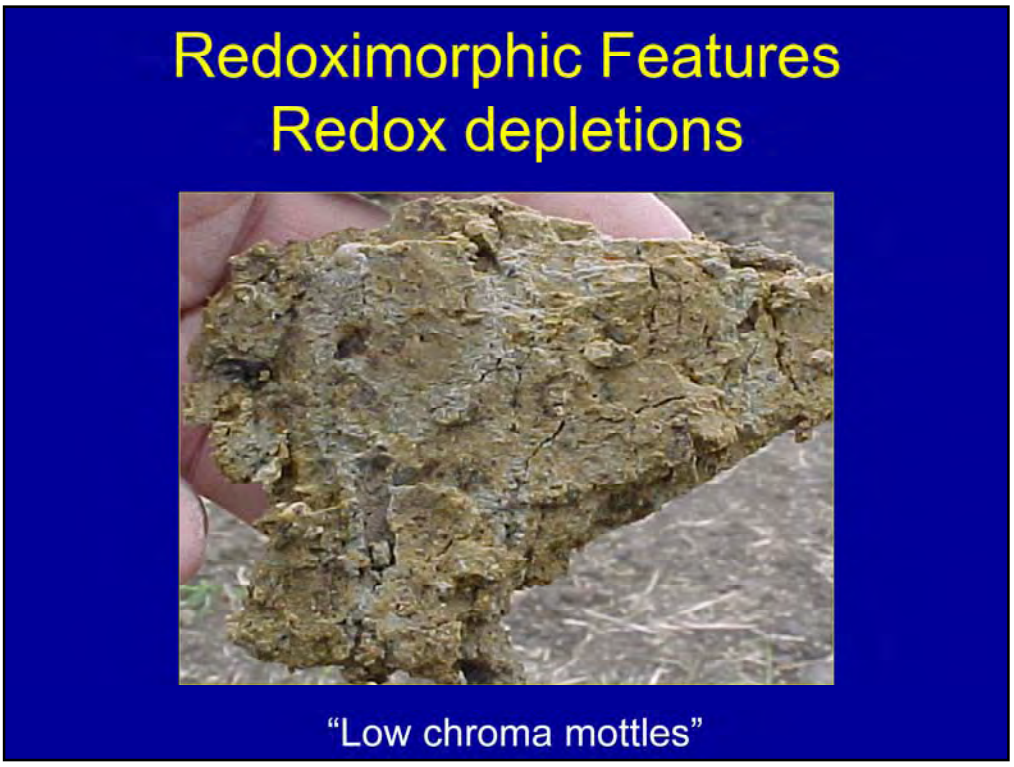


Photo from: "Redoximorphic Features" presentation developed by Michael Whited, NRCS - Wetland Science Inst. August, 2000
http://www.maenvirothon.org/hydric%20soils.ppt

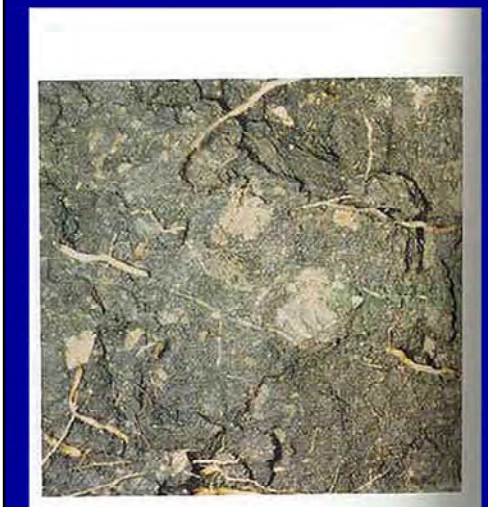
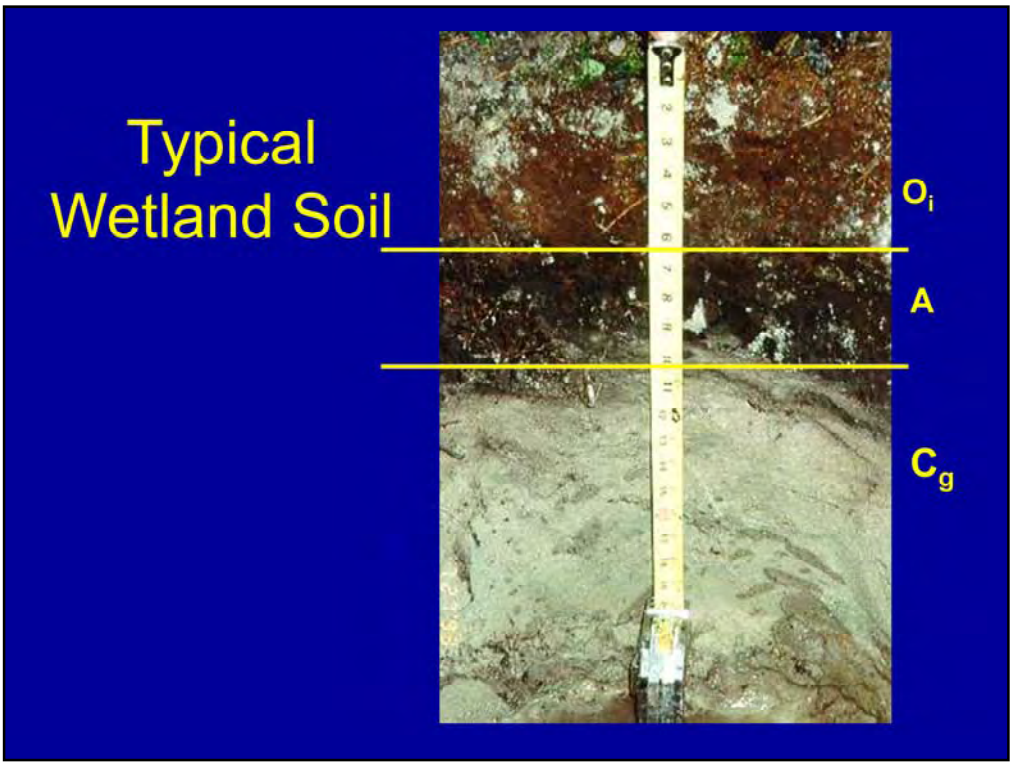


Plate 13. Iron depletions (gray spots) in matrix of A horizon. Largest depletions are approximately 20 mm wide.

Redoximorphic Features Redox depletions

More “low chroma mottles”

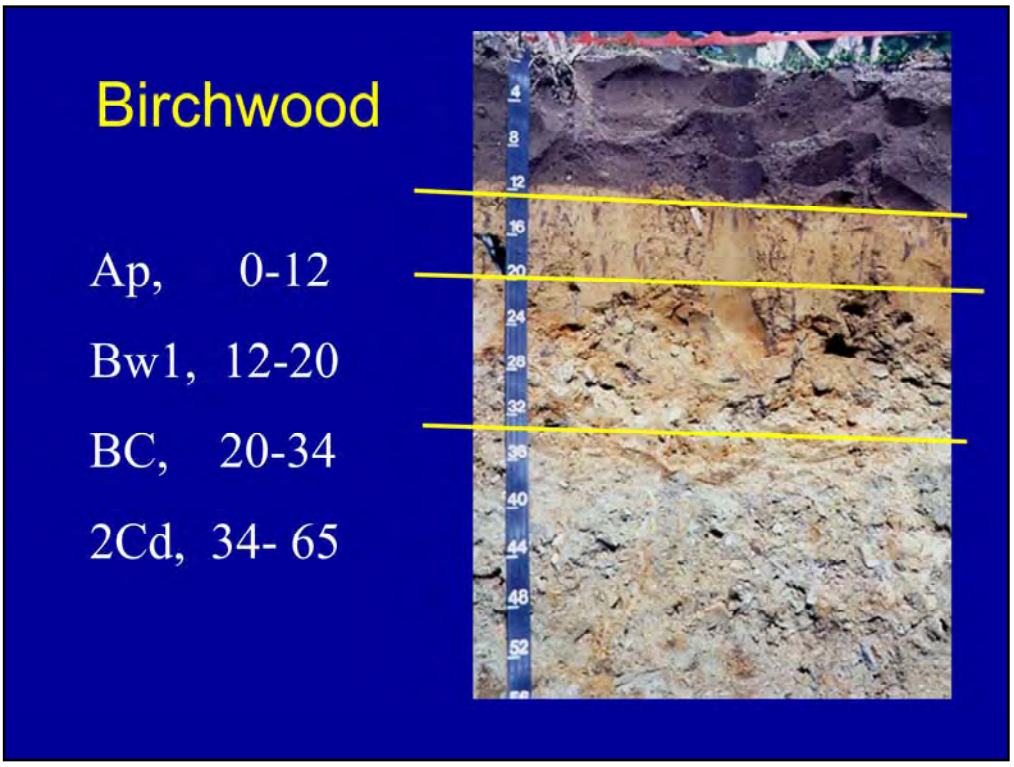
If you know the source of this slide, please contact john.rockwell@state.ma.us



What DEP criteria are met to determine this is a Hydric Soil?

DEP criteria #5, “

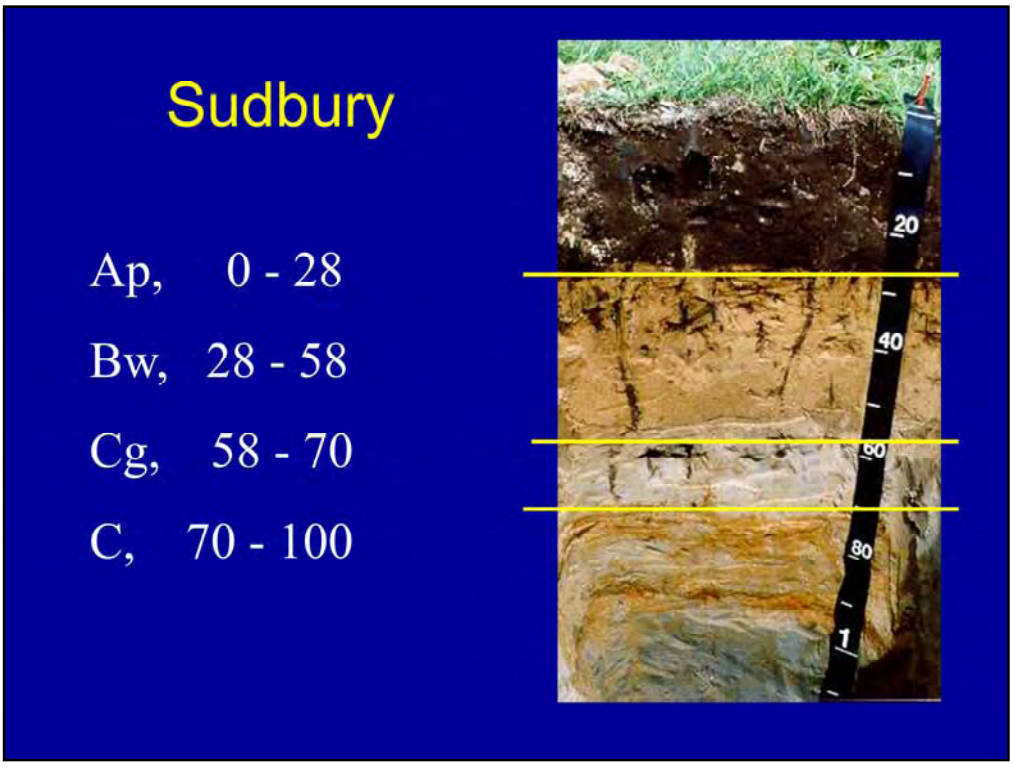
Photo Credit: Jim Turenne



Using the DEP Hydric soil criteria; is this a hydric soil?

No, the redoximorphic features don't start until 20 inches. Too deep for a hydric soil.

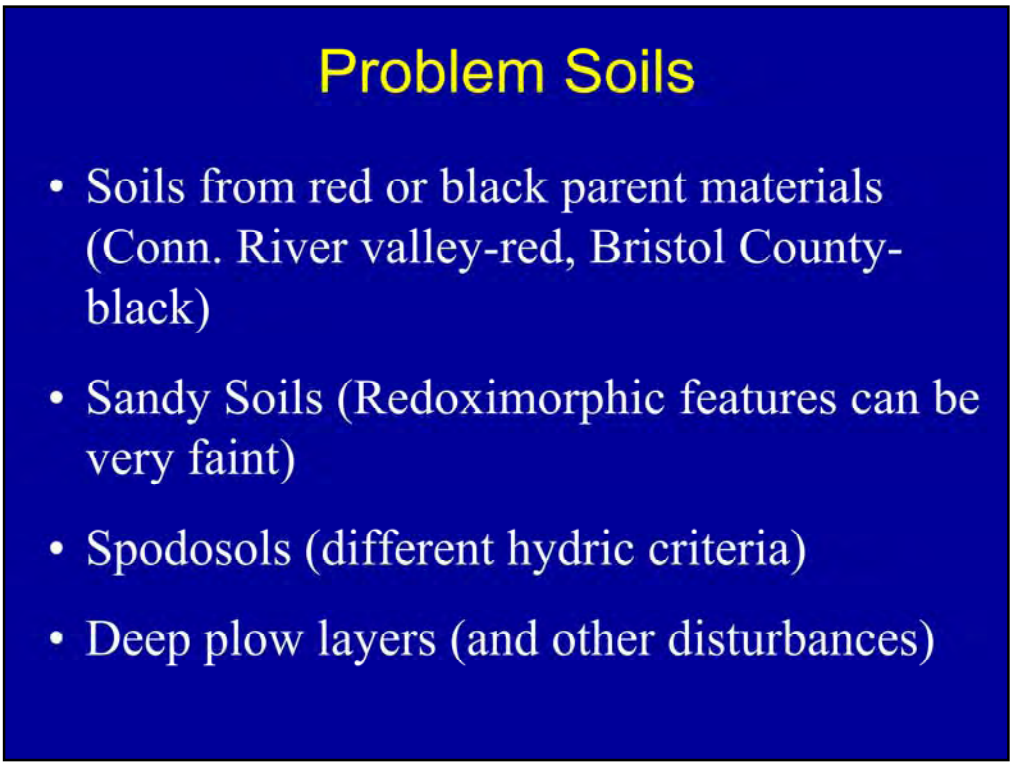
Photo Credit: Rob Tunstead.



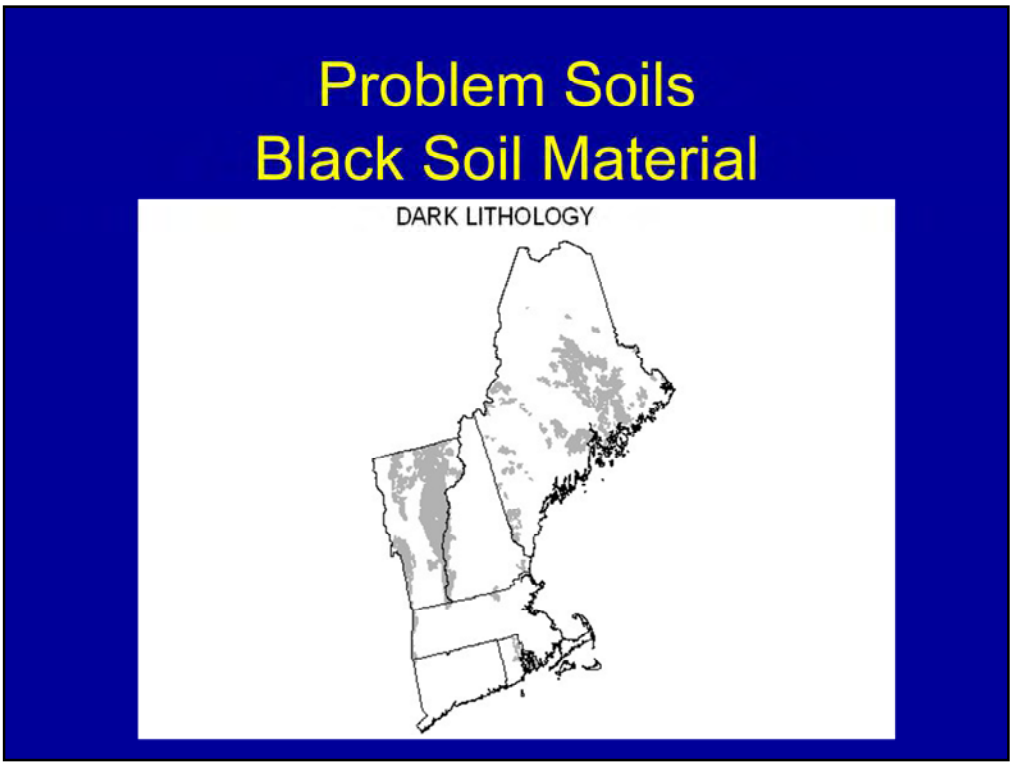
Using the DEP Hydric soil criteria; is this a hydric soil?

No, the redoximorphic features don't start until 58 cm (22.5 inches). Too deep for a hydric soil.

Photo Credit: Jim Turenne



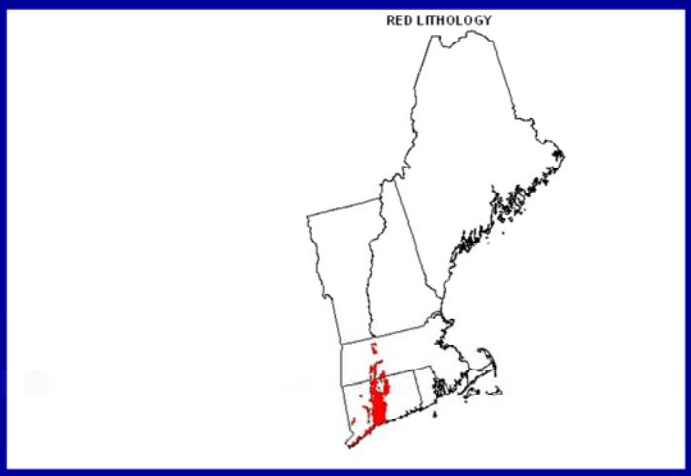
Don’t fret if you can’t figure these out, call an expert!



Limited applicability to Massachusetts, some around Providence.

These maps were prepared by Al Averill and Darlene Monds of the NRCS Massachusetts office.

Problem Soils
Red Soil Material

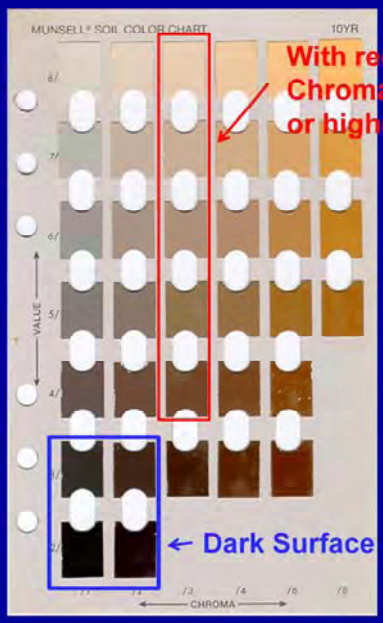


Limited to some areas of the Connecticut River Valley.

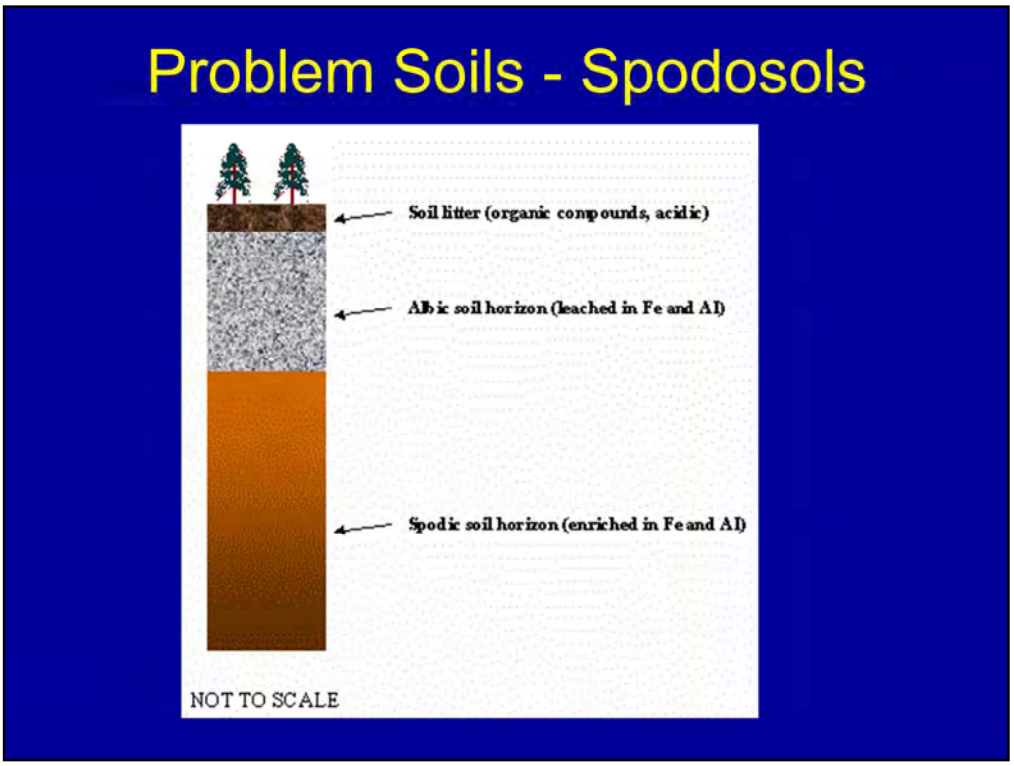
These maps were prepared by Al Averill and Darlene Monds of the NRCS Massachusetts office.

DEP Sandy Soils

- a) high organic content in the surface layer (typically darker colors with values less than 3 and chroma of 2 or less) with mottles or other indicators of saturation directly below;
- b) organic streaking (now referred to as stripping) directly below the A-horizon; or
- c) matrix chroma of 3 (from the Munsell Soil Color Charts) in the top 12 inches of soil measured from the bottom of the 0-horizon, with distinct or prominent mottling.

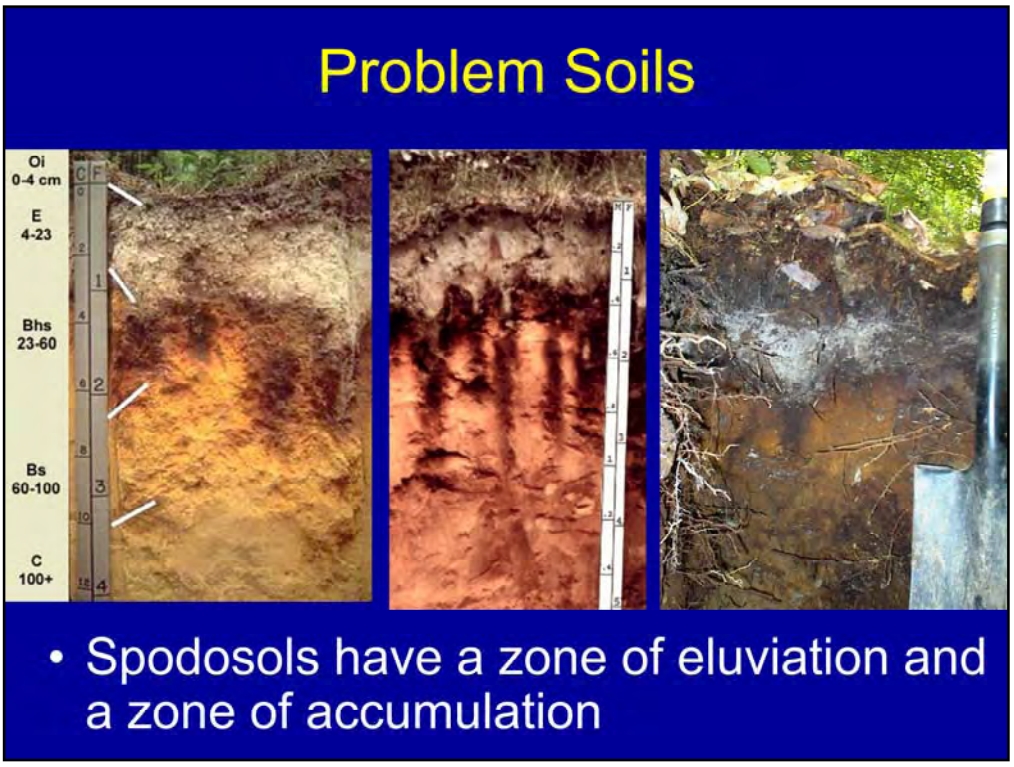


See DEP Manual page 30.



Conceptually, spodosols are rather simple. Minerals and organic substances leach out of the albic horizon, though a process of eluviation, and accumulate in the spodic horizon.

Graphic Credit: Dr Walt McNab, Lawrence Livermore National Laboratory, Livermore, California, U.S.A. *from, Lecture 3: Spodosol Soil Profile Formation: Leaching of Base Metals from Shallow Soils and Organo-Metallic Complexation http://www.cmdlet.com/demos/msrt-course/Lecture_C_3.html*



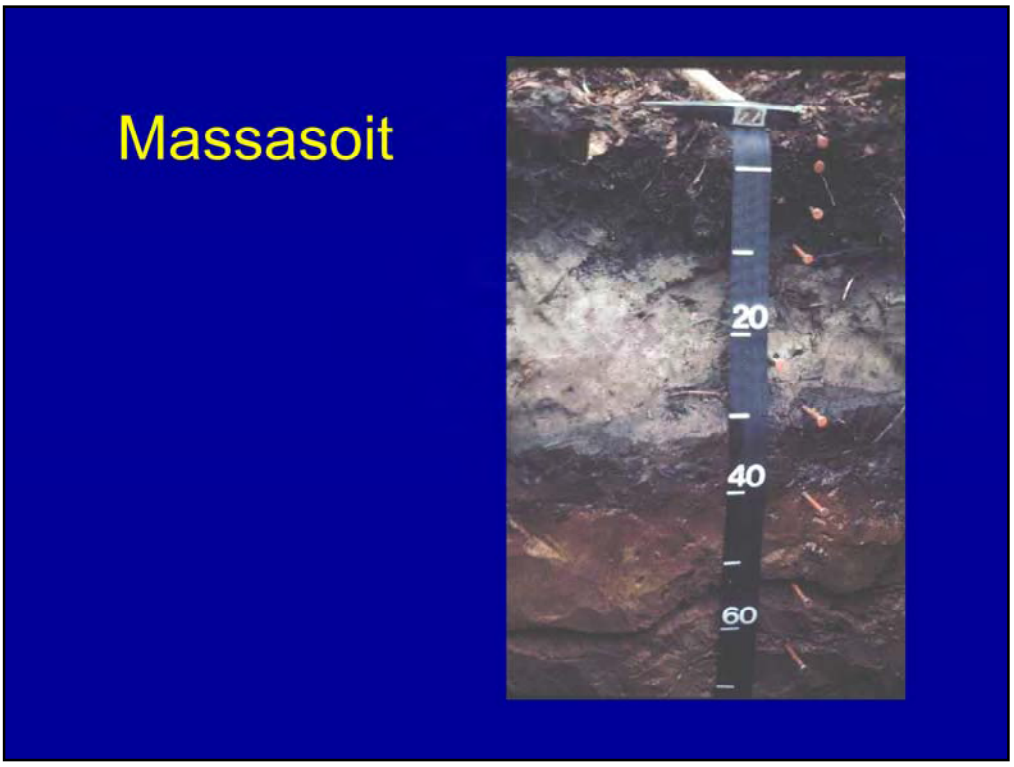
You will see these throughout the Buzzards Bay watershed.

Photo Credits:

Left: University of Idaho website: http://soils.ag.uidaho.edu/soilorders/

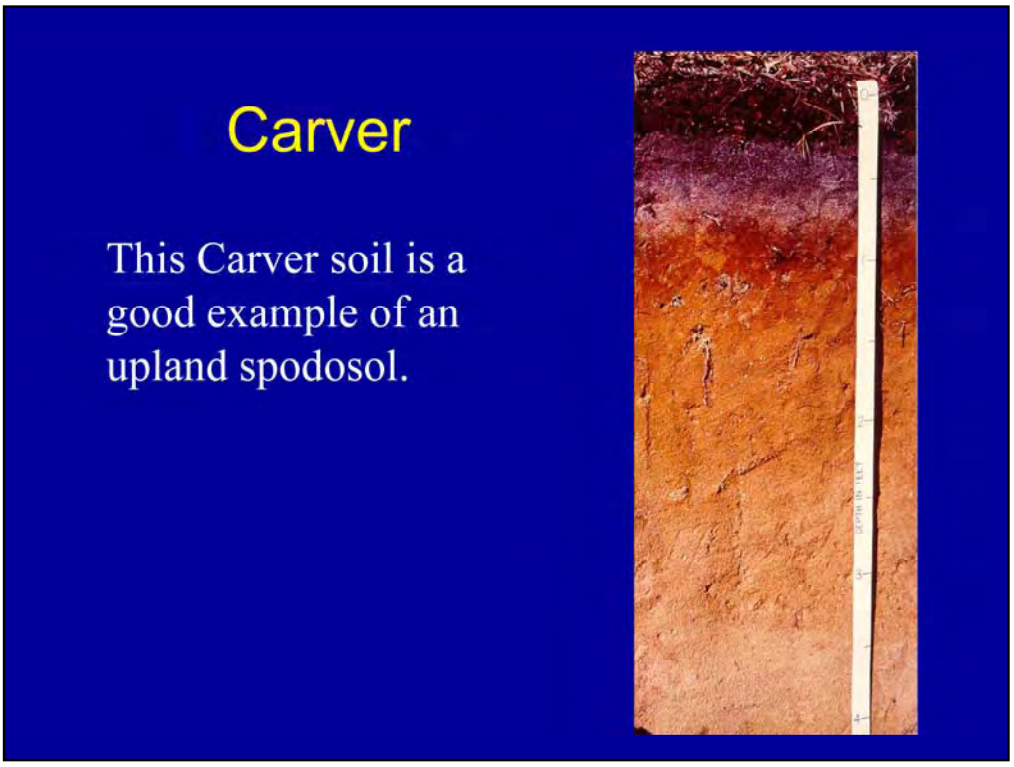
Center: NRCS, http://urbanext.illinois.edu/soil/orders/spodosol.jpg

Right: Hubbard Brook Ecosystem Study, http://www.hubbardbrook.org/image_library/view.php?id=312



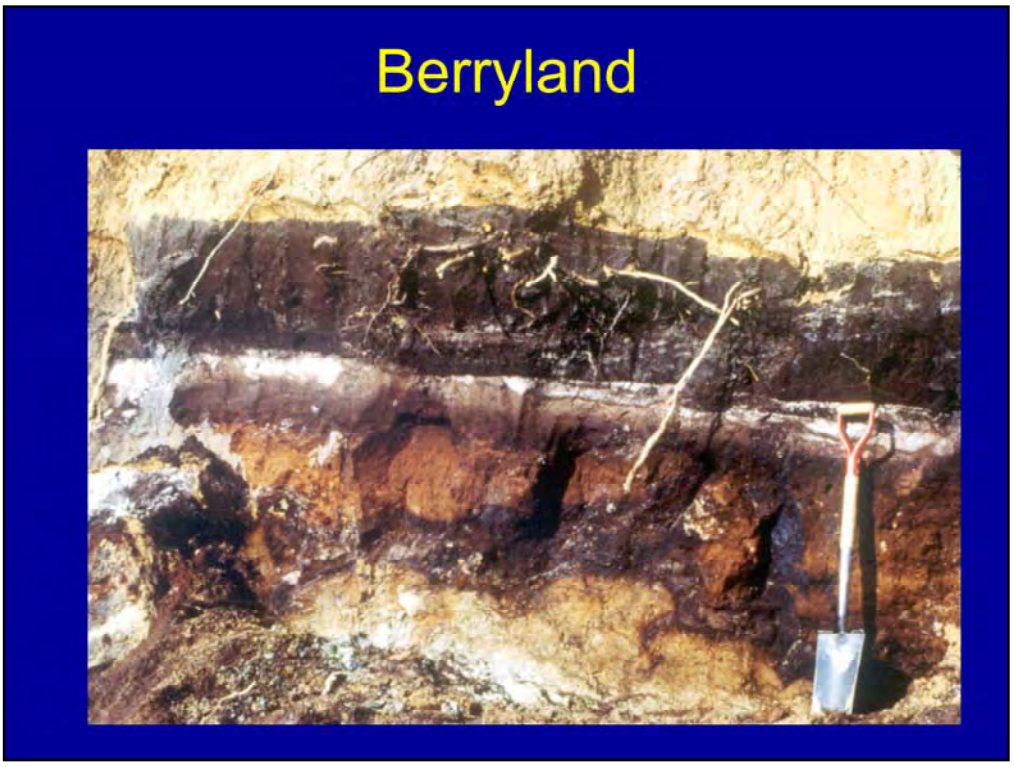
Using the DEP Hydric soil criteria; is this a hydric soil?

Yes, this soil has 3 of the criteria listed below.



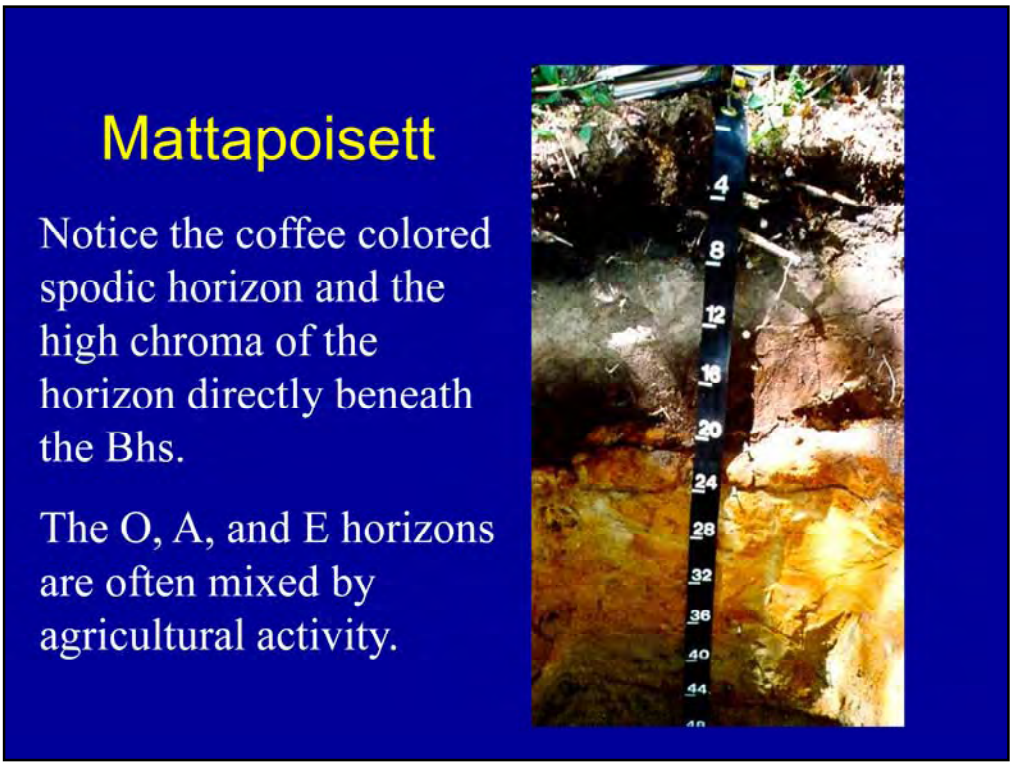
Note the lack of redox features at any depth.

Photo Credit: http://nesoil.com/images/carver.jpg



Using the DEP Hydric soil criteria; is this a hydric soil?

Yes, this soil has 3 of the criteria listed below.



Using the DEP Hydric soil criteria; is this a hydric soil?

Yes, this soil has 4of the criteria listed below.

This is a problem (plowed) problem (sandy) problem soils (spodosol). Note the reddish horizon below the Ap horizon. The E horizon has been mixed into the A horizon by agricultural activity. Call in the experts!

Photo Credit; John Rockwell

First, notice the E horizon and the underlying Bhs horizon. That tips you off that this is a spodosol, or as DEP says, “evergreen forest soil”

It looks like (without checking for texture):

0” – 3” HTM

3” – 8” A

8” – 11” Eg

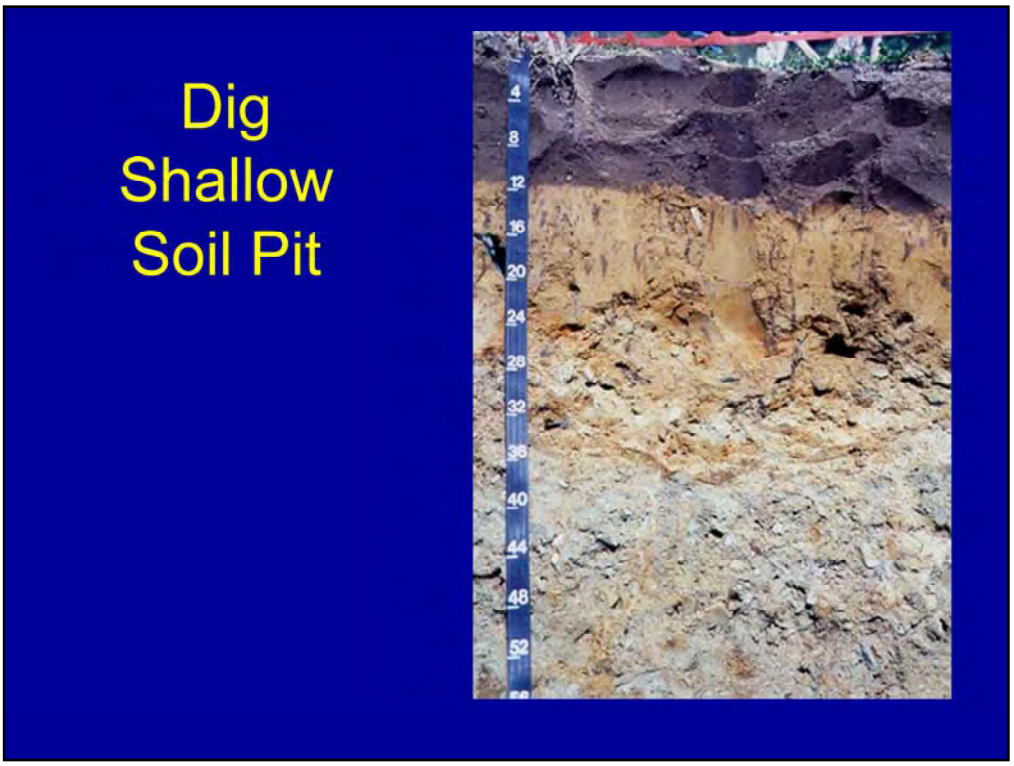
11” – 14” Bhs

14”17” Bs

(A good rule of thumb for spodosol is that if the Bhs is the color of coffee grounds and at least two inches think, its hydric.)

Second, the top layer is not organic material, or an A. Therefore, its not naturally occurring , but fill (aka, HMT, for Human Transported material) , and you may have an enforcement situation.

Photo Credit: John Rockwell



Using the DEP Hydric soil criteria; is this a hydric soil?

No, redox features don't start until 20-24 inches

This profile has the following morphology:

0-12 inches, Ap horizon -loamy sand.

12-20 inches, Bw1 horizon -loamy sand.

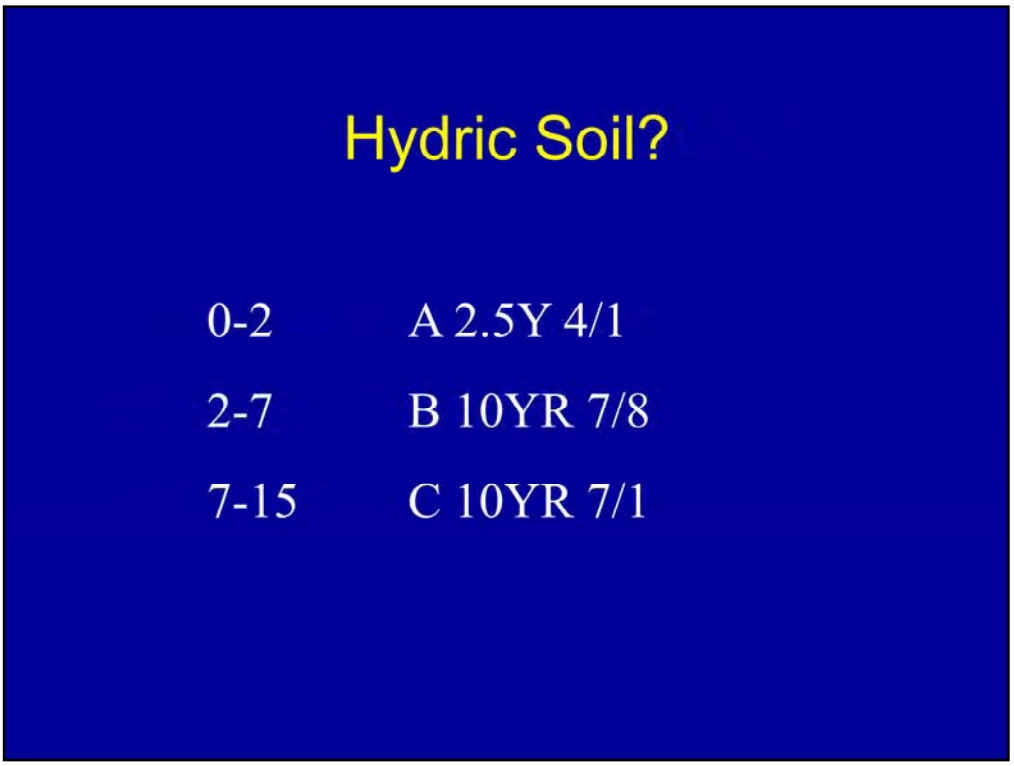
20-34 inches, BC horizon -gravelly loamy sand with many redoximorphic features

34-65 inches, 2Cd -gravelly fine sandy loam, very firm basal till, many redoximorphic features.

Photo by: Rob Tunstead

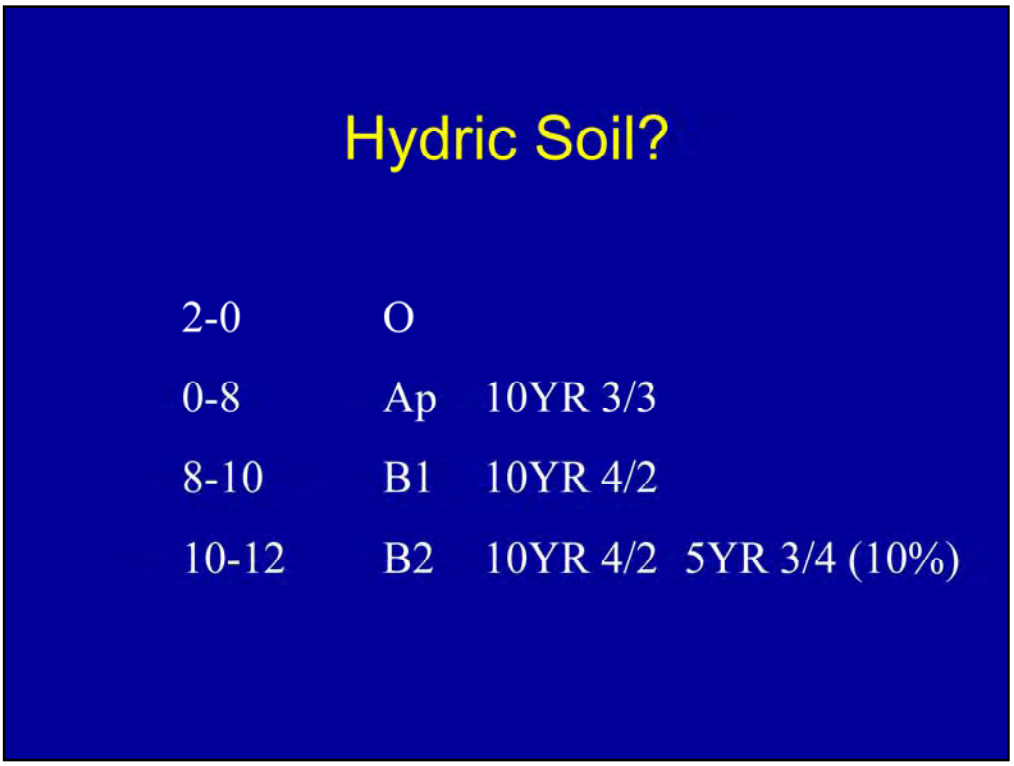
After the class you still won't be able to determine this one, get an expert.

Photo from Field Indicators for Identifying Hydric Soils in New England V3.0 by Jim Turenne,



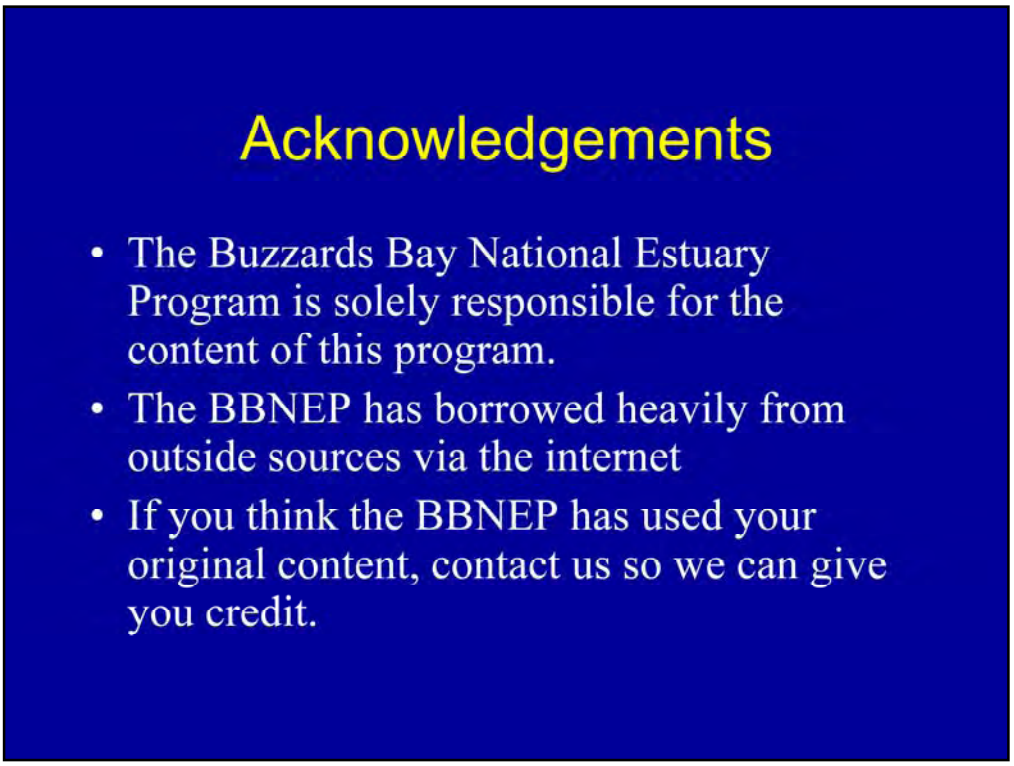
Using the DEP Hydric soil criteria; is this a hydric soil?

Yes. This soil profile meets DEP Hydric Soil Criteria #5. Within 12 inches of the soil surface (at 7 to 15 inches) is a layer with a value of 7, chroma 1, which meets the “



Using the DEP Hydric soil criteria; is this a hydric soil?

Yes. This soil profile meets DEP Hydric Soil Criteria #6. Within 12 inches of the soil surface (at 10 to 12 inches) is a layer with a value of 4, chroma 2, with redox concentrations that have a chroma of 4, which meets the “



Buzzards Bay National Estuary Program
John Rockwell
Wetland Specialist
2870 Cranberry Highway
East Wareham, MA 02538
#508-291-3625 x14
mailto: john.rockwell@state.ma.us