SEASONAL HIGH WATER TABLE INDICATORS NON-HYDRIC

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OBJECTIVES

- Define terms necessary to identify seasonal high water table indicators
- Define and describe soil redoximorphic indicators for the non-hydric soil grouping

NOTE

Additional information on certain slides will be found in the “NOTES” section and will only be visible in the “normal” view in PowerPoint

Soil Textures and Redox Features

- Sandy Soil- any soil with a texture of Loamy Fine Sand (LFS) or more coarse
- Loamy/Clayey Soil- means any soil with a texture of Loamy Very Fine Sand (LVFS) or finer

Sandy Textured Soils

- Very coarse sand (VCOS)
- Coarse sand (COS)
- Sand (S)
- Fine sand (FS)
- Very fine sand (VFS)
- Loamy coarse sand (LCOS)
- Loamy sand (LS)
- Loamy fine sand (LFS)

Loamy/Clayey Textured Soils

- *Loamy very fine sand (LVFS)* [yes, this counts as a loamy/clayey soil for SHWT indicators]
- Coarse sandy loam (COSL)
- Sandy loam (SL)
- Fine sandy loam (FSL)
- Very fine sandy loam (VFSL)
- Loam (L)

Loamy/Clayey Textured Soils

- Silt loam (SIL)
- Silt (SI)
- Sandy clay loam (SCL)
- Clay loam (CL)
- Silty clay loam (SICL)
- Sandy clay (SC)
- Silty clay (SICL)

Seasonal High Water Tables

- Seasonal High Water Table (Seasonal High Saturation in USDA NRCS terms) is the highest level to a zone of saturation in the soil in most years. Normally persists for several weeks and normally occurs during the time of the year when the most rain falls (June-September in FL)

Seasonal High Water Tables

- A water table that is seasonally high for <30 days is NOT indicated in the Soil and Water Features Table in USDA NRCS Soil Surveys

Apparent/Perched Water Table

- Apparent: a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil
- Perched: Water standing above an unsaturated zone. In some places, an upper, or perched, water table is separated from a lower one by a dry zone

Proper SHWT Indicator Use

There is a correct way….

Redoximorphic Reactions

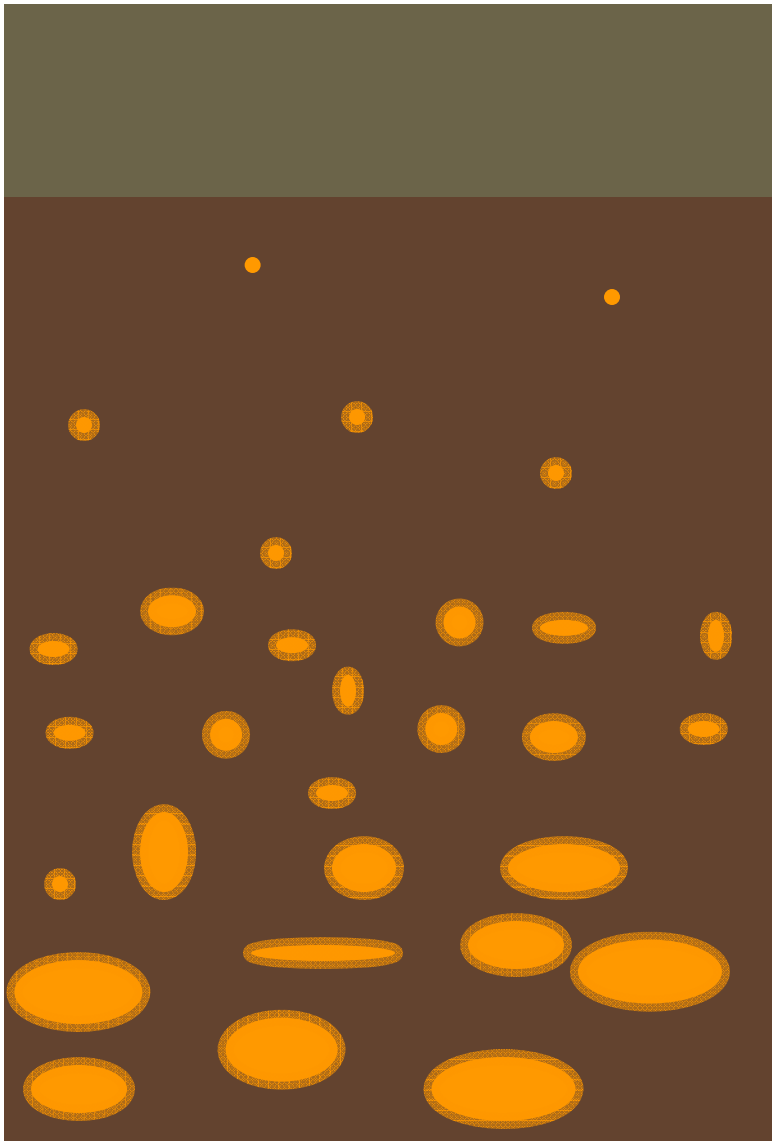
- Also known as REDOX, which is an Oxidation/Reduction reaction.
- This is a process in which one or more substances are changed into others
- Change in color could be due to presence of water which creates the redox reaction

Redoximorphic (Redox) Features

- Caused by presence of specific minerals and their reaction to water over a specific minimum time frame
- Used to predict SHWT
- Requires certain colors, amounts, and contrast when compared with surrounding soils

Redoximorphic (Redox) Features

- Redox *Concentrations*: areas of apparent accumulation (*more color*) of Fe-Mn (Iron-Manganese) oxides, resulting in splotches of higher chroma
- Redox *Depletions*: removal of Fe or Mn from the soil resulting in a removal of color, leaving grayer soils



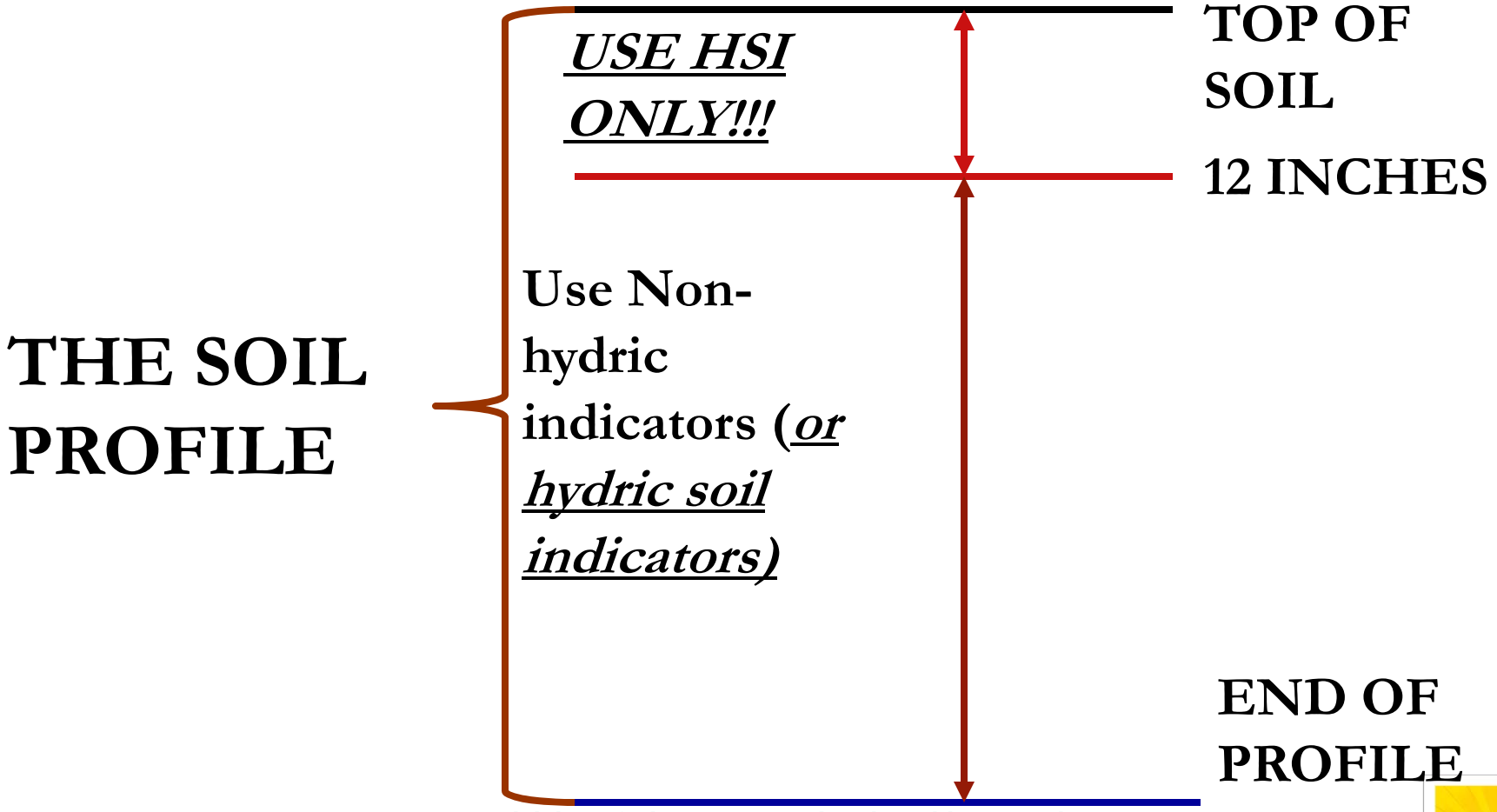
Typical of High Chroma Redox

NOTE DIFFUSE BOUNDARIES OF REDOX CONCENTRATIONS

Non-hydric Soil Indicator Usage

- The non-hydric indicators are used beginning at 12” below natural grade
- From top of natural grade to 12” the hydric soil indicators are used
- The hydric soil indicators will be discussed in the next presentation

Which SHWT Indicators to Use?



Non-Hydric Soil Indicators

- Different in sandy soils than in loamy/clayey (finer textured) soils
- Must be used beginning at 12” below natural soil surface, cannot be used within 12” of natural soil surface
- If some part of natural soil has been removed must take that into account

Volume of Redoximorphic Features

The quantity (*volume*) of the redoximorphic features in the soil sample is important for the determination of the estimated seasonal high water tables

Non-hydric soils

- Redoximorphic features must be at least COMMON, but can also be MANY
- They *CANNOT* be FEW
- Need to know the required volume that redox features must occupy to count as "common" or "many"

Quantity of Redoximorphic Features

- Few -- less than 2% (<2%)
- Common -- 2 to 20% (2-20%)
- Many -- more than 20% (>20%)

Mottle Boundaries

- Sharp -having a color gradation not discernable to the naked eye
- Clear -color grades over <2 mm
- Diffuse -color grades over ≥2 mm

Redox Features in Sandy
Non-hydric soils

- Mottles must meet following to be a Redoximorphic (redox) feature:
- Hue: 2.5YR through 10YR
- Value: ≥5
- Chroma: ≥6
- Must be at least common (2%) or many (>20%) in volume
- And….

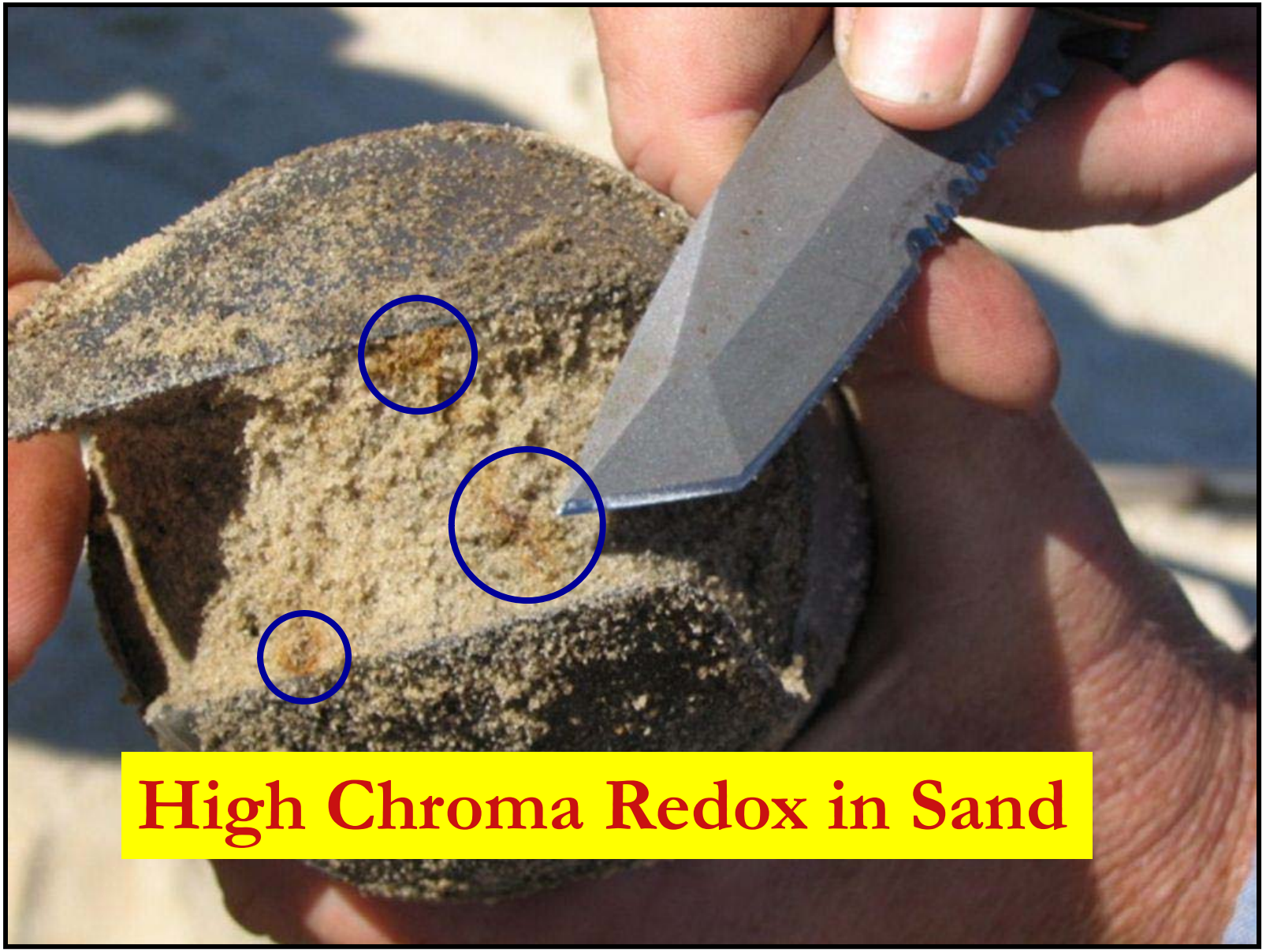
Redox Features in Sandy
Non-hydric soils

- Must have diffuse boundaries and have distinct/prominent contrast with matrix
- Matrix chroma ≥3 ; any value

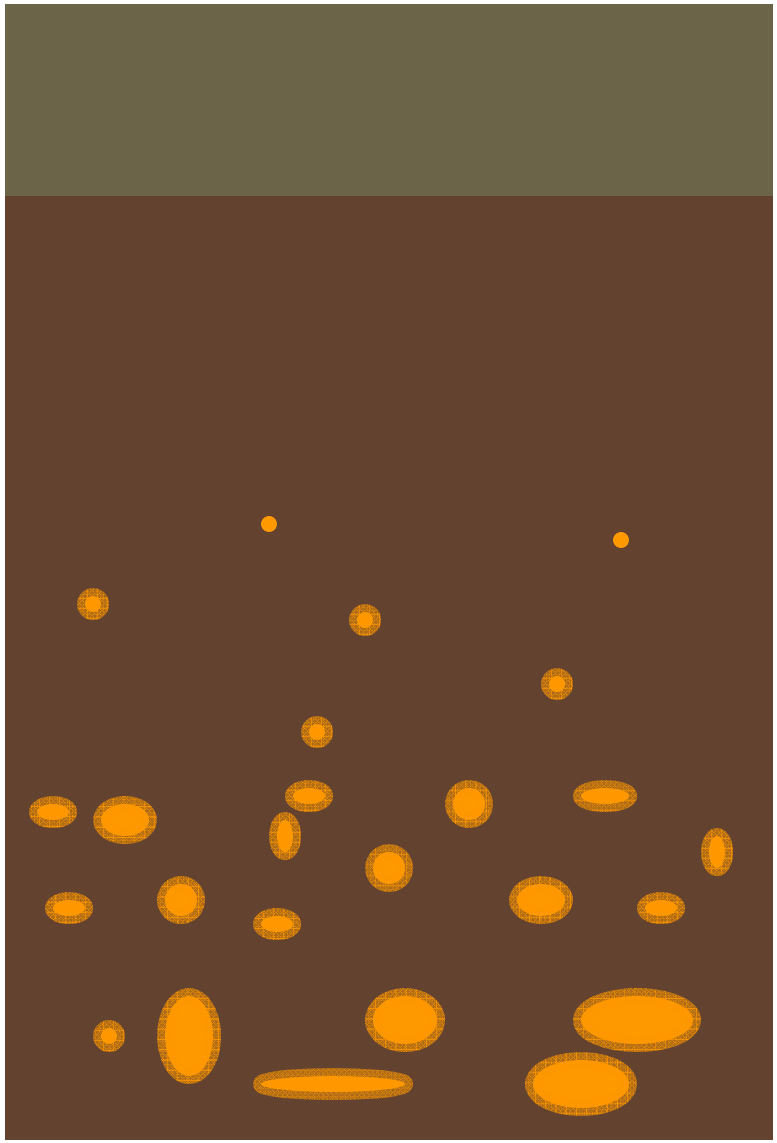
NODULES AND CONCRETIONS:

- Nodules are cemented or hardened plinthite
- Concretions are similar except for the presence of visible, concentric layers around a point or line
- Both have sharp boundaries and except as specifically noted for specific HSI, do not count as a redoximorphic feature

High Chroma Redox in Sand


High Chroma Redox in Sand

Redox concentrations with diffuse boundaries



TYPICAL OF HIGH CHROMA REDOX

NOTE DIFFUSE BOUNDARIES OF REDOX CONCENTRATIONS

Redox Features in Loamy/Clayey, Non-hydric soils

- Hue: ANY (non-gley hues)
- Value: ≥5
- Chroma: ≤2 from 12” to 1 meter (39.37”)
- Chroma: ≤3 deeper than one meter
- *Can be diffuse mottles or be the matrix color*

Low chroma in SCL

Low chroma in SCL

Low Chroma in SCL

Low Chroma MATRIX in SCL

- The depth at which these low chroma colors are encountered is the estimated depth of the SHWT
- Exception to use of this color pattern as an indicator: where low chroma colors directly underlie a dark topsoil layer, the SHWT is at, near, or above the soil surface (this could be a hydric soil indicator)

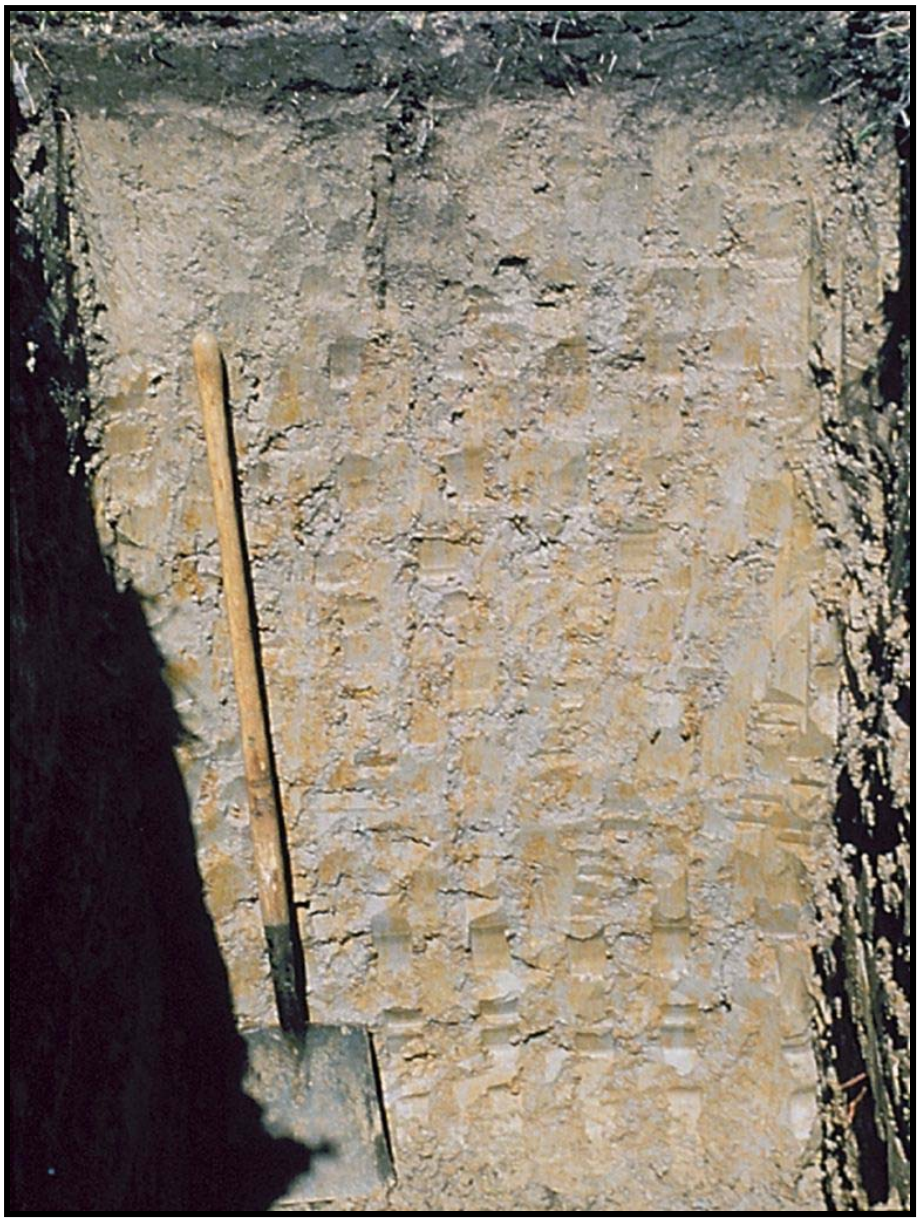
- Contemporary redox concentrations have diffuse boundaries
- Relict redox concentrations may have sharp boundaries

Gley Charts- SHWT Indicators for ALL soil textures

- Hue: ANY on the Gley Charts
- Value: ≥4
- Chroma: ANY (Gley chromas all ≤2)
- Can be matrix color (commonly is)
- NOTE: These types of colors found in very wet mineral soils

Well drained (oxidized) soil

Red color is oxidized iron (in abundance)

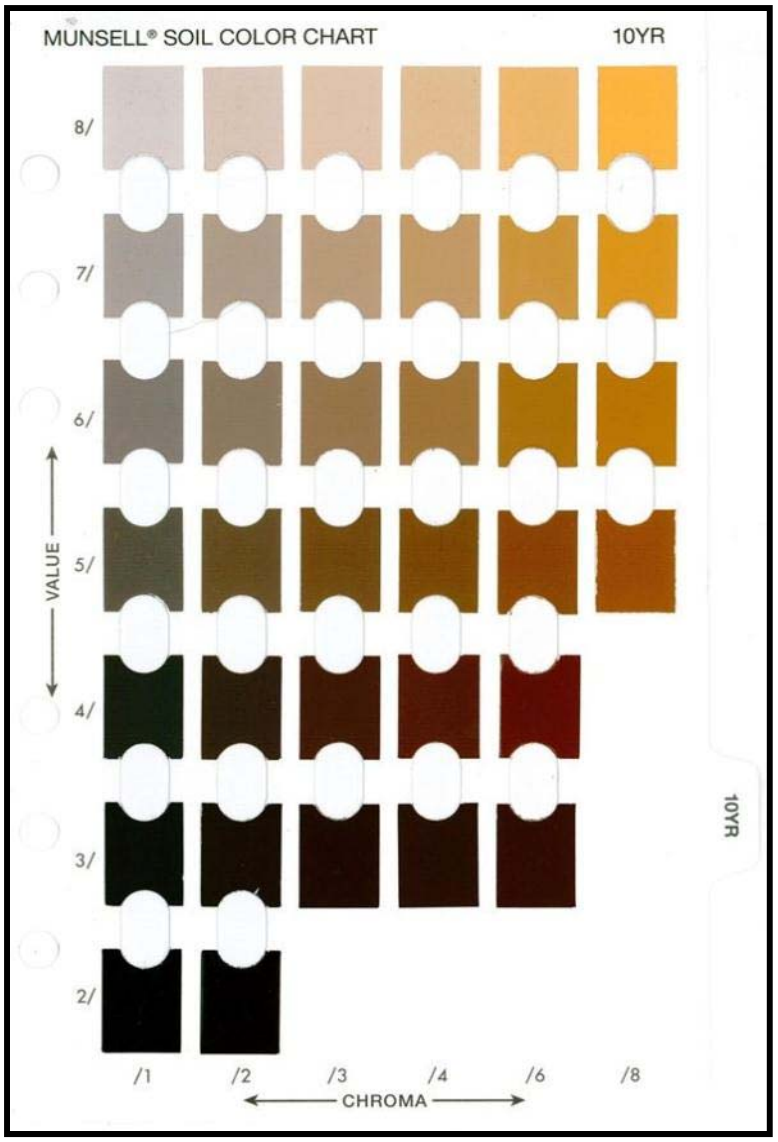


Poorly Drained (Reduced) Soil

The gray is reduced iron, which is where iron has been removed.

Less Iron ⟷ More Iron

Less OM ↕ More OM



Contemporary vs. Relict Features

- Contemporary - Soil morphological features that reflect *current* hydrologic conditions of saturation and anaerobiosis. These *are* used to determine SHWT
- Relict - Soil morphological features that reflect *past* hydrologic conditions of saturation and anaerobiosis. These *are not* used to determine SHWT

Relict (not useable) Feature – Note sharp boundaries

A COUPLE OF "SPECIAL CASES" WITHIN THE LOAMY/CLAYEY GROUPING

Redoximorphic Features in Shubuta, Cowarts, Esto and Nankin Soil Series found in the Florida Panhandle

According to the USDA NRCS, these soils were formed in loamy, clayey or loamy/clayey sediments

- Many of the gray colors in these soils are thought to originate from parent material
- Are not a result of saturation (water movement)
- The gray colors normally mixed with redder and yellow-red and brown are not indicative of a SHWT as the color boundaries are sharp, not diffuse
- Diffuse boundaries would indicate SHWT

Shubuta, Cowarts, Esto and Nankin Soil Series

- Shubuta is a well drained soil (SHWT generally >6 feet)
- Cowarts is well drained or moderately well drained with a SHWT routinely >6 feet

Shubuta, Cowarts, Esto and Nankin Soil Series

- Esto is a well drained soil with SHWT routinely >6 feet
- Nankin is a well drained soil with redoximorphic indicators normally occurring below 40 inches

USDA Drainage Classes (agricultural)

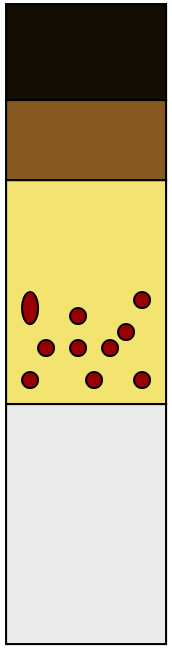
6 Classes common in Florida	SHWT
Very Poorly Drained	0 - 24 above
Poorly Drained	0 -18” below
Somewhat Poorly Drained	12-30” below
Moderately Well Drained	24-48” below
Well Drained	60” or more
Excessively Drained	>72”

QUESTIONS???

SOIL REMOVAL/ADDITIONS

- Where the natural soil has been altered by the action of humans (maybe animals) via soil removal and/or placement of fill material, all SHWT indicators must be judged using natural soil surface criteria accounting for what was added or removed

NATURAL SOIL SERIES



0-4” 10YR 2/1 FS

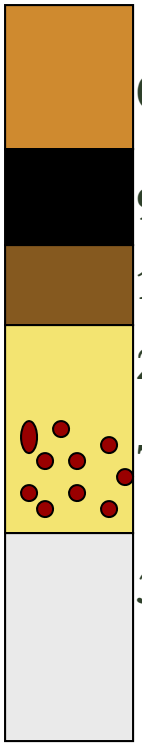
4-13” 10YR 4/6 FS

13-25 ” 2.5Y 4/6 FS

7.5YR 6/8 many/prm RF 19”

25-72” 2.5Y 8/1 FSL

9” FILL ADDED OVER SOIL



0-9” 10YR 6/8 FS FILL

9-13” 10YR 2/1 FS

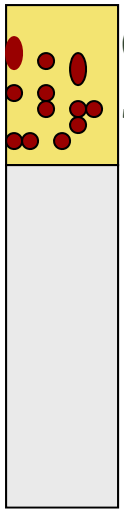
13-22” 10YR 4/6 FS

22-34” 2.5Y 4/6 FS

7.5YR 6/8 many/prm RF 28”

34-72” 2.5Y 8/1 FSL

16” NATURAL SOIL REMOVED

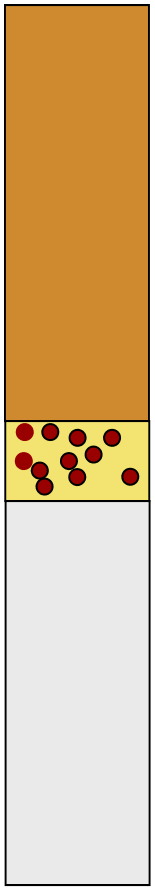


0-9 ” 2.5Y 4/6 FS

7.5YR 6/8 many/prm RF 3”

9-72” 2.5Y 8/1 FSL

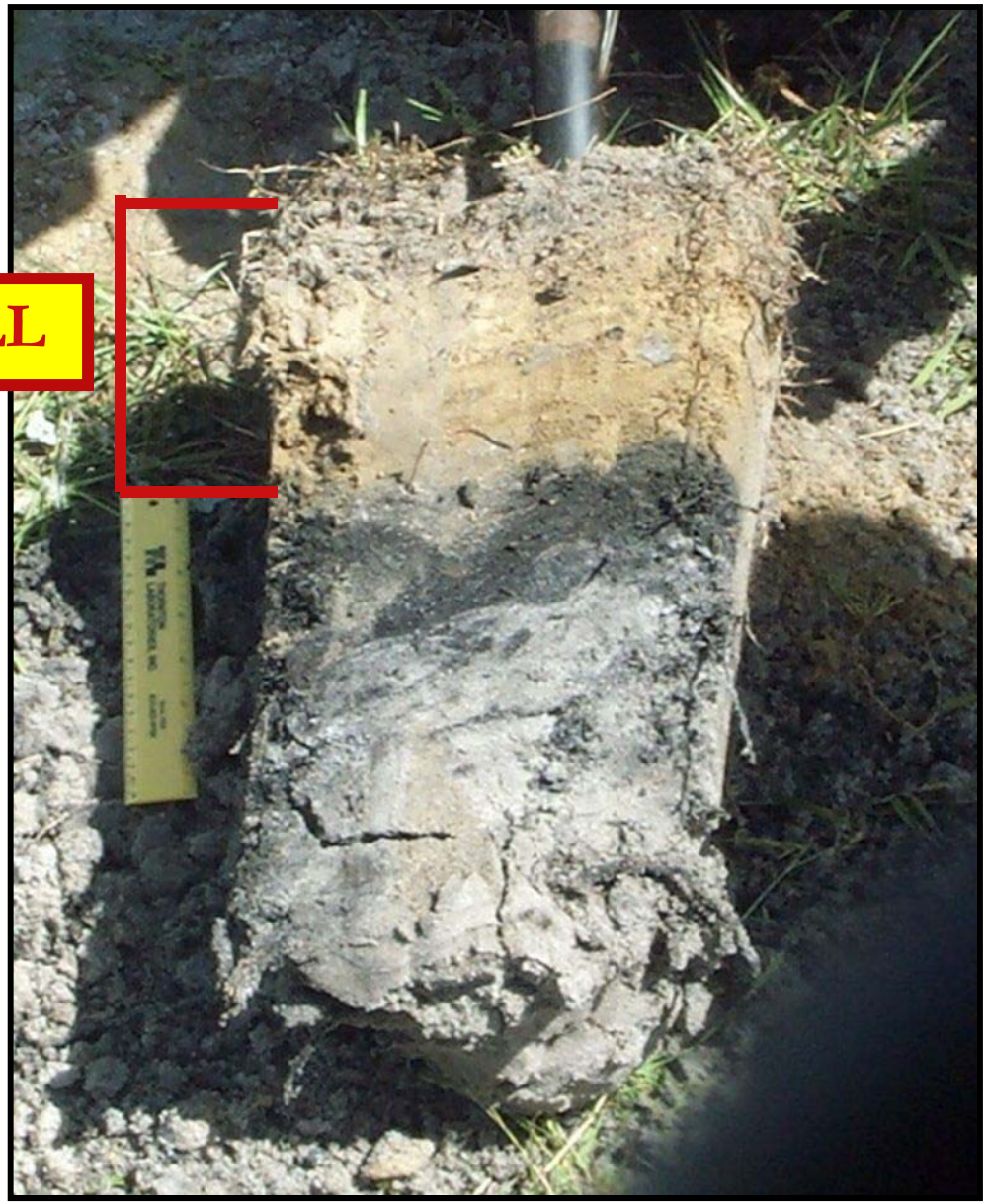
NATURAL SOIL REMOVED AND FILL MATERIAL PUT IN PLACE



0-35” 10YR 6/8 FS FILL

35-38” 2.5Y 4/6 FS with 7.5YR 6/8 many/prm RF

38-72” 2.5Y 8/1 FSL



REDOX FEATURES MAY FORM IN FILL MATERIAL AND EXTRA CARE MUST BE TAKEN DURING THEIR EVALUATION

What is texture of fill and how long has it been on site?

- Try and determine the amount of time that the fill material has been on site
- May be able to use Google Earth's historic imagery feature to look back to about 1994
- Could also use other aerial photography sites like Florida Aerial Photography at http://ufdc.ufl.edu/aerials

What is texture of fill and how long has it been on site?

- Some filled areas are much more recent
- Filled areas present additional problems
- It is advisable to conduct many more soil profiles in the area of the drainfield to properly view the possibly very different and complex soil properties

Anthropogenic Soils and SHWT

- Many areas in Florida have been filled for decades
- This occurred over large areas during the 1950's through the 1970's, especially in SW Florida
- One of the reasons that they were filled is because they were very wet and unbuildable

Use Hydric Soils Technical Note 5 (updated April 2005), abbreviated in next two slides

Redox Features in Fill Materials

- Use the information found in Hydric Soils Technical Note #5
- Sandy Soils: 3-5 years for contemporary features to form, if all “ingredients” are present for feature formation
- Loamy/Clayey soils: 8-10 years for contemporary features to form, if all “ingredients” are present for feature formation

Redox Feature Formation in Fill Material

- Sandy Soils: 3-5 years for contemporary features to form, if all “ingredients” are present for feature formation
- Loamy/Clayey soils: 8-10 years for contemporary features to form, if all “ingredients” are present for feature formation

Fill Materials

- Ensure the feature used to determine the SHWT was not transported with the fill material
- Feature must form based on the seasonal high water table at the site
- It is common to misread indicators in fill

NOTE

- A USDA NRCS soil scientist may be hesitant or possibly unwilling to make a determination regarding the estimated seasonal high water table based on the soil morphology in anthropogenic soils
- CHD personnel still required to determine the SHWT
- The CHD must always have a SHWT determination for OSTDS permitting

SEASONAL HIGH WATER TABLE INDICATORS (REDOX FEATURES)

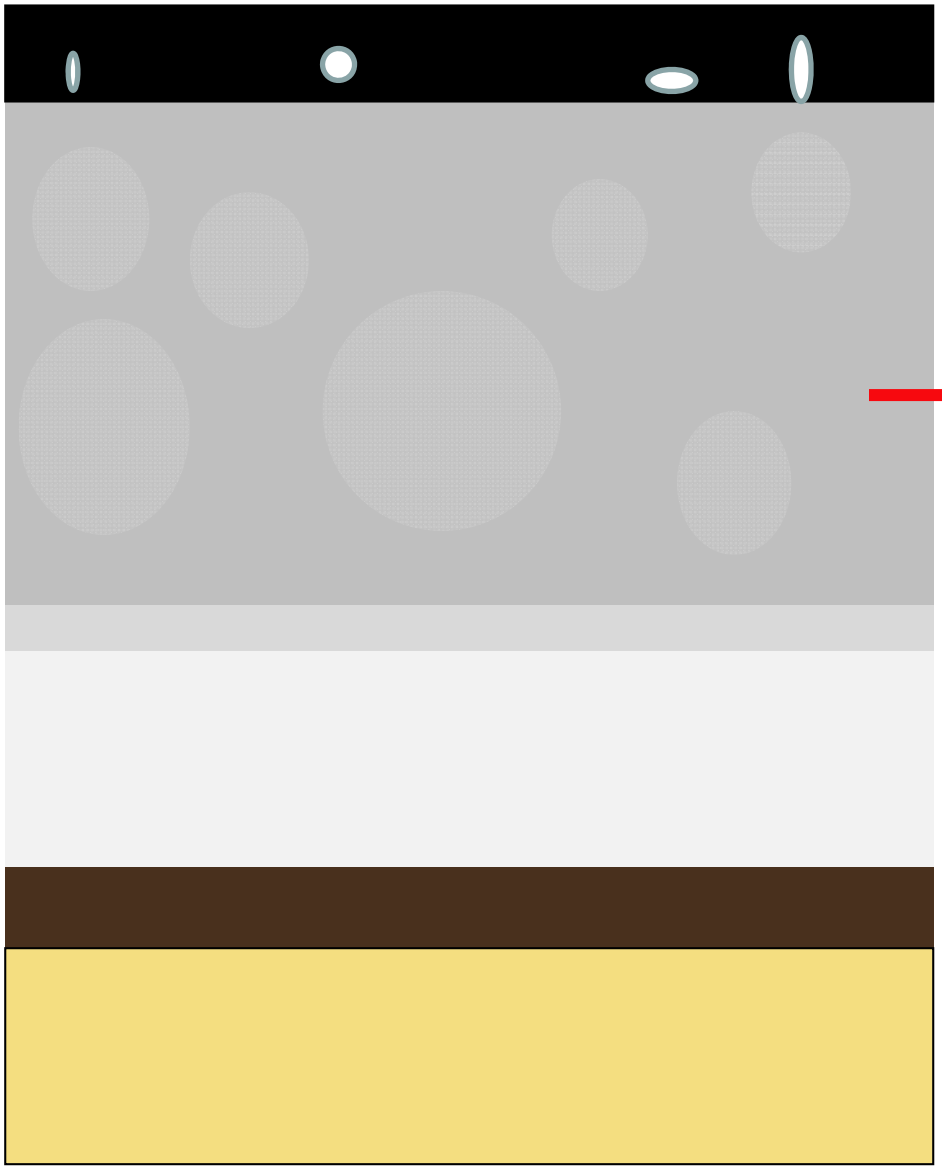
SHWT Indicators/Non-indicators

- Tongues - are not mottles but are old root channels (*not an indicator of SHWT*)
- Lamellae - are not mottles, are subsoil accumulations of clay in bands and contrasting colors (*not an indicator of SHWT unless is low chroma colors*)

Stripped Matrix (Stripping)

- Used in *Sandy soils only (except for LVFS)*
- The following definition has been adjusted to allow for non-hydric soils (compare to later definition found in HSI presentation)

- Fe/Mn oxides and/or organic matter have been stripped from the matrix
- Exposes primary base color of soil materials (e.g. values 5-6)
- Stripped areas form a *faint, diffuse splotchy pattern of two or more colors*
- Stripped areas are ≥10% of the volume, rounded and approximately 1- 3 cm (0.5-1 inch) in diameter



Typical of Stripped Matrix

STRIPPED AREAS LIGHTER IN COLOR AND ARE ROUNDED AND ARE IN FAINT COLOR CONTRAST TO MATRIX

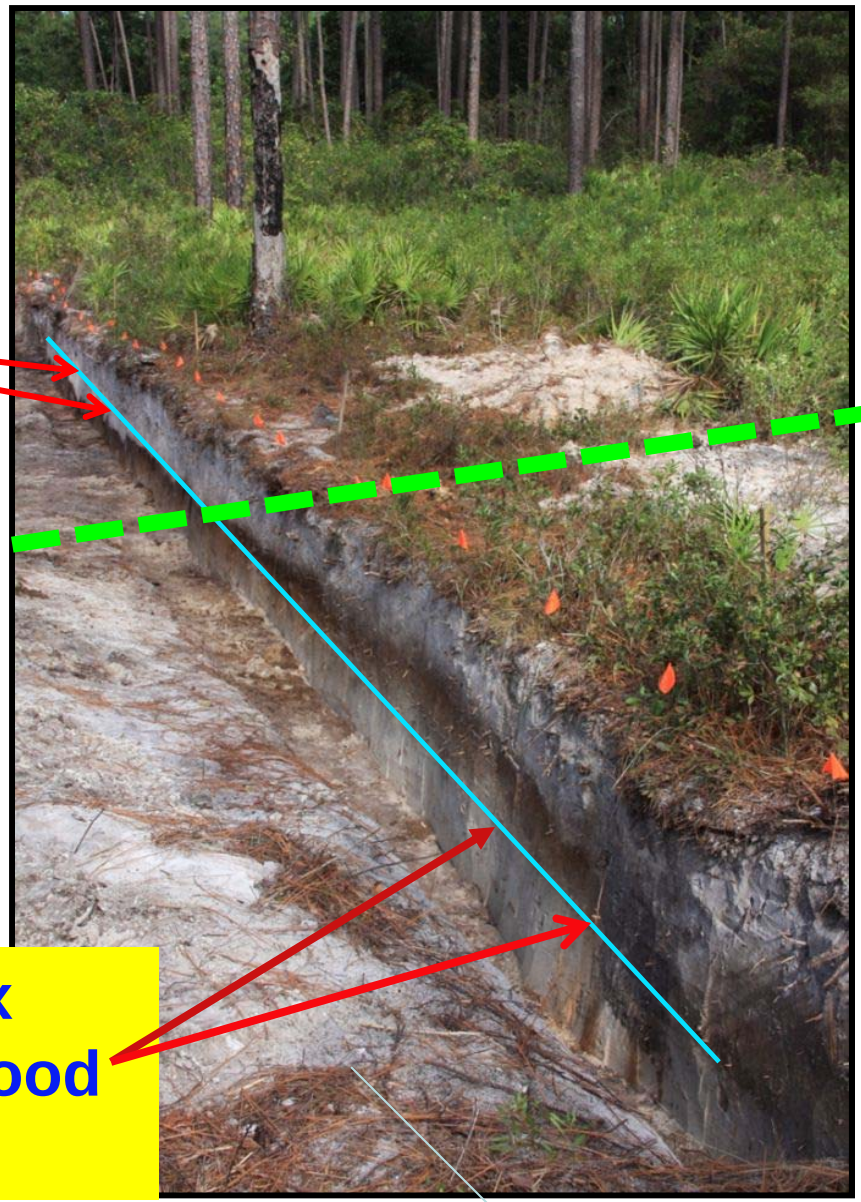
Stripped Matrix (also has high chroma redox)

Stripped Matrix and Sandy Redox

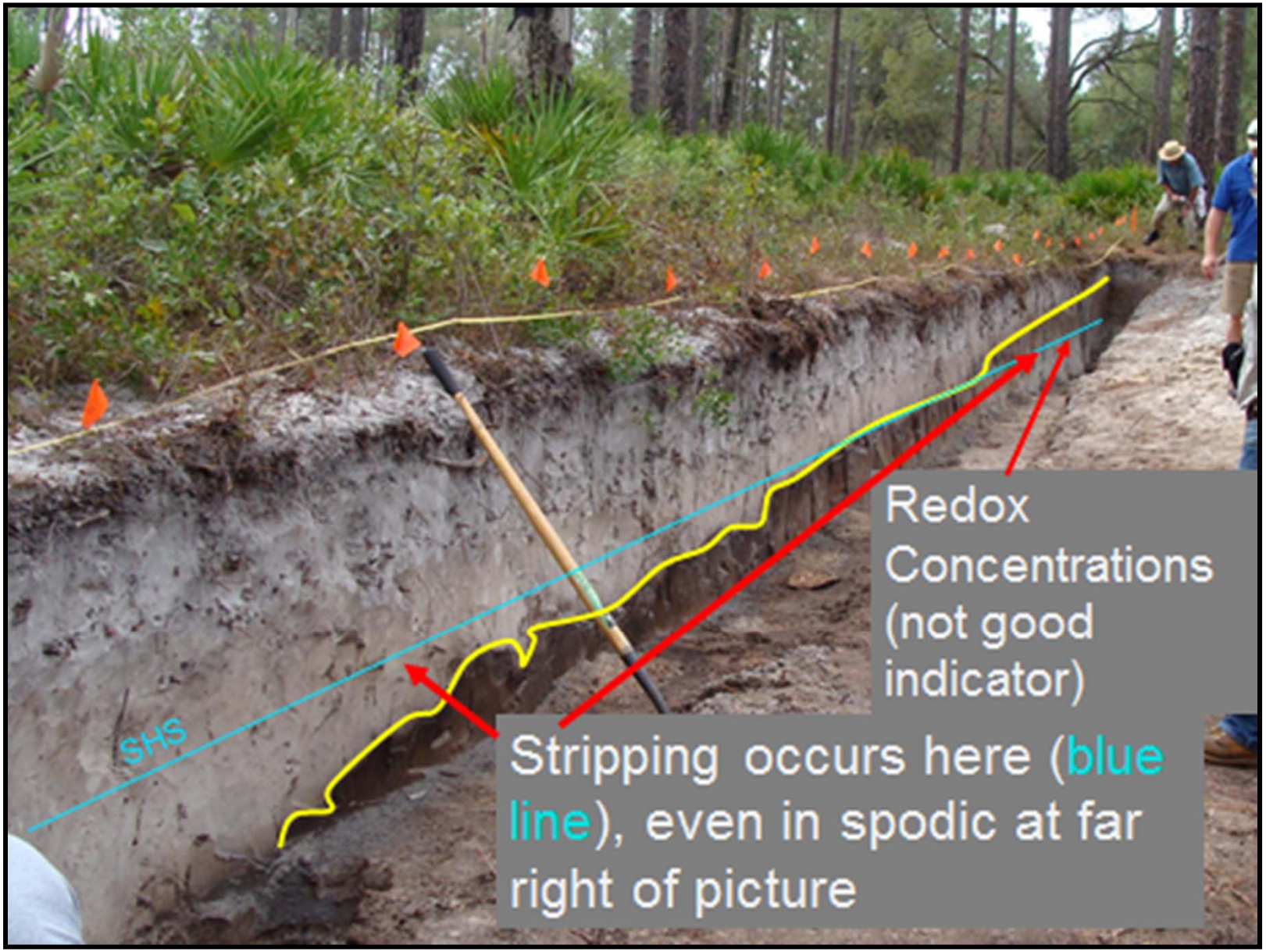
Stripping

Flatwoods

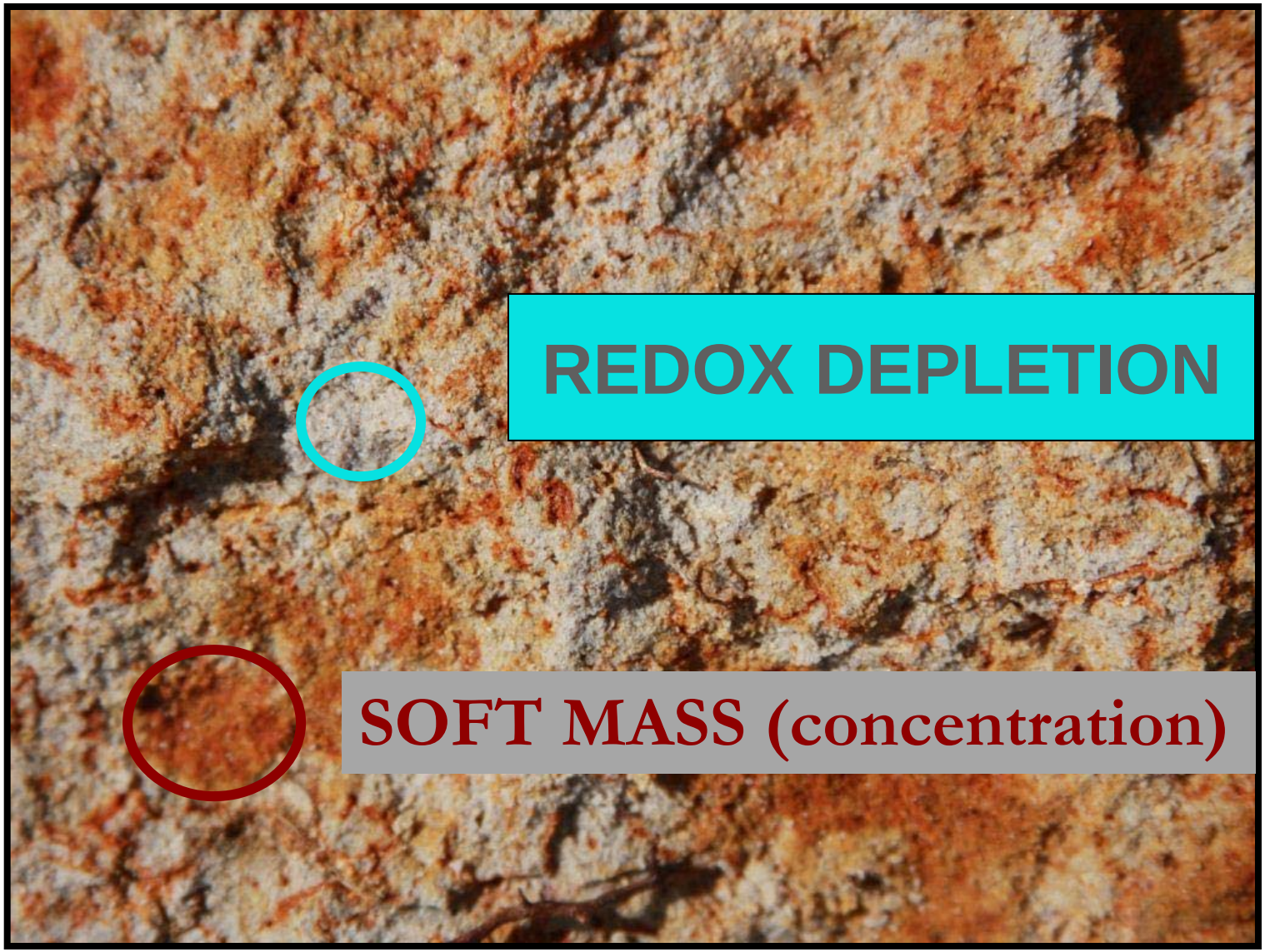
Sandhill



Stripped matrix and “redox concentrations” (RC not good indicator in spodic)


Redox Concentrations (not good indicator)
SHS
Stripping occurs here (blue line), even in spodic at far right of picture


Sandy
(redox concentrations and/or stripping)
SHS
Loamy/clayey
(redox depletions)


REDOX DEPLETION
SOFT MASS (concentration)

QUESTIONS?

Seasonal High Water Table indicators in Organic Soils

- Muck - muck at surface, SHWT is at or above the natural soil surface
- Mucky Mineral - SHWT is at 0 - 6 inches below the natural soil surface
- Peat – SHWT is at 0 - 6 inches from the natural soil surface
- See Hydric Soil Presentation for information

What if there are really no redox features at all?

Barring anything else-

- Make note of whole landscape hydrology
- Make multiple soil profile observations
- Observe natural vegetation
- Ask co-workers who have been in area
- Consult with USDA NRCS Soil Scientist

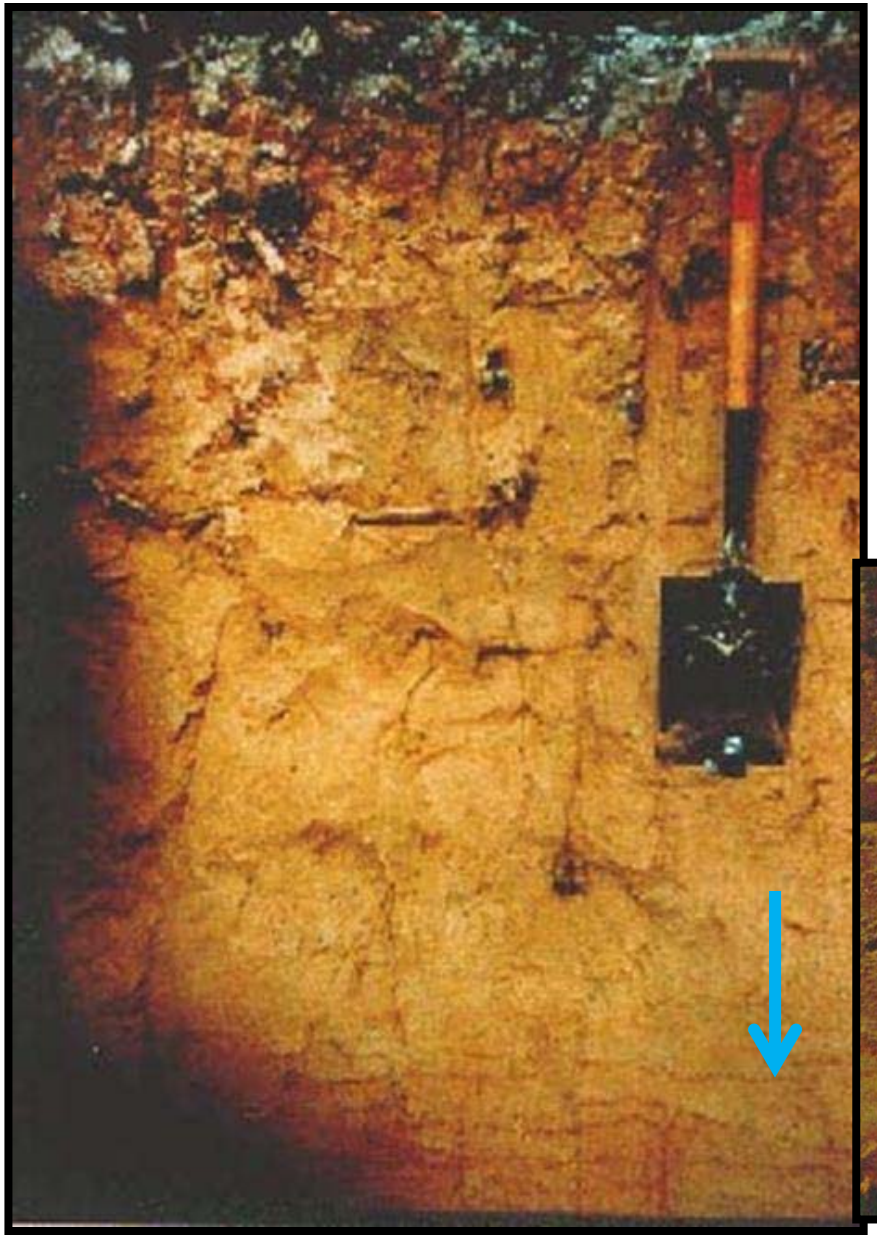
Where no other indicators:

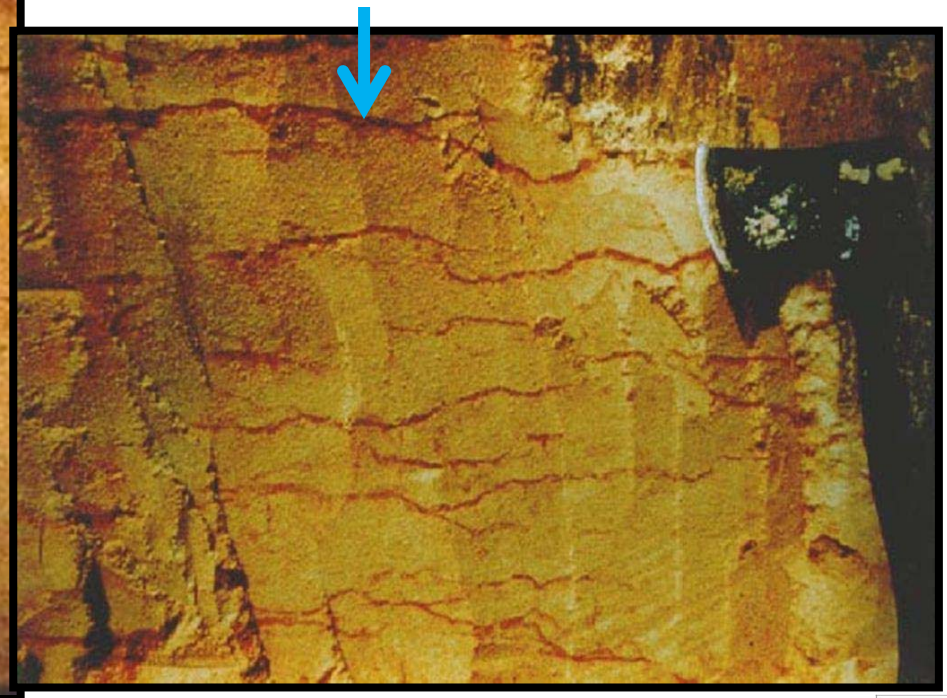
- The following moist colors of surface horizons (the A horizon) can be correlated with SHWT's:
- Black--0 to 9 inches (within 12")
- Very Dark Gray--about 12 inches (9-15")
- Dark Gray--greater than 15 inches
- DIG LOTS OF HOLES IF NECESSARY AND BE OBSERVANT !!!!

Some things that do not indicate the SHWT

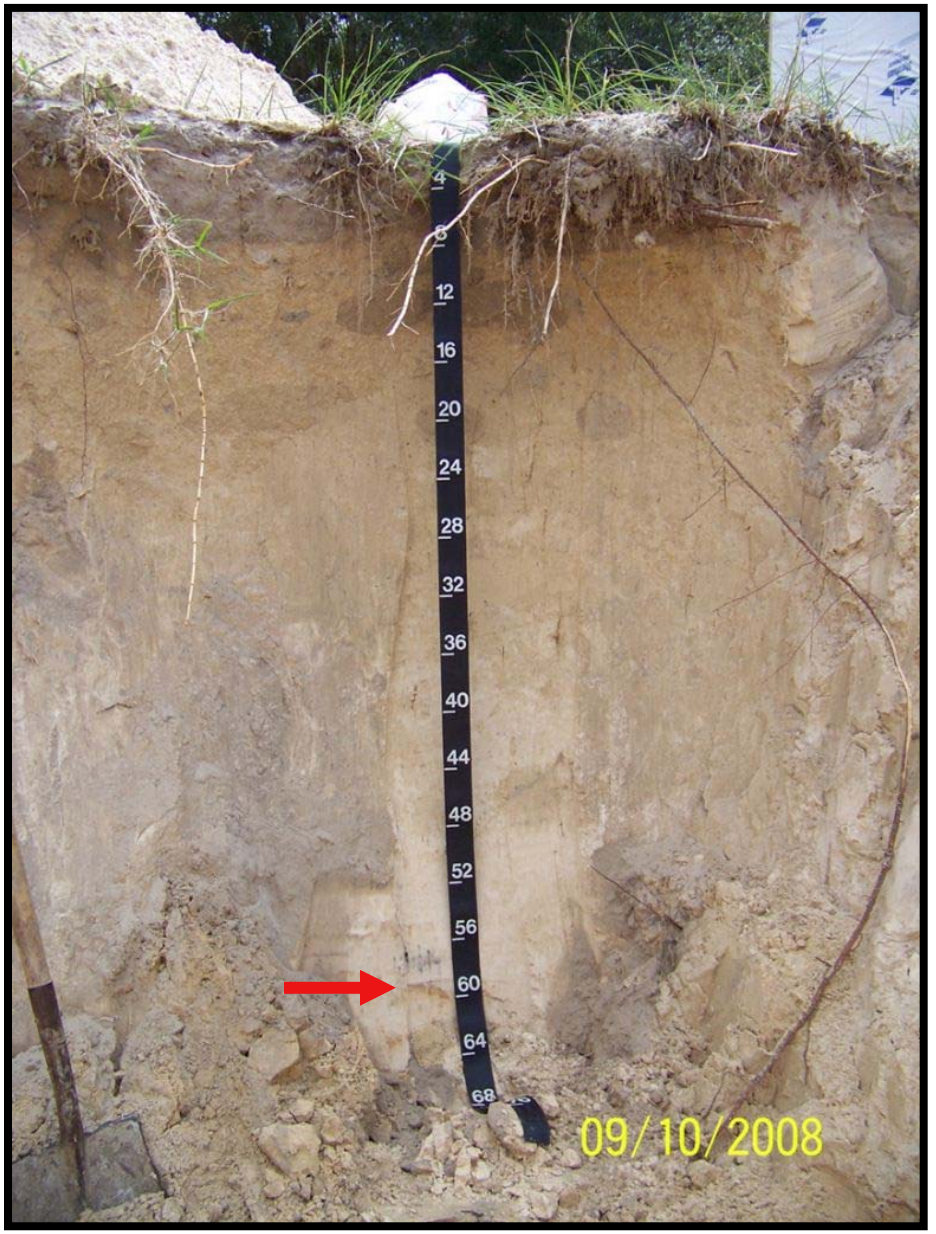
- Lamellae - Some sandy soils contain a subsoil accumulation of clay that is distributed in fine lateral bands called lamellae
- Lamellae usually appear in contrasting colors, and are not indicative of wetness (unless the lamellae are low chroma colors)

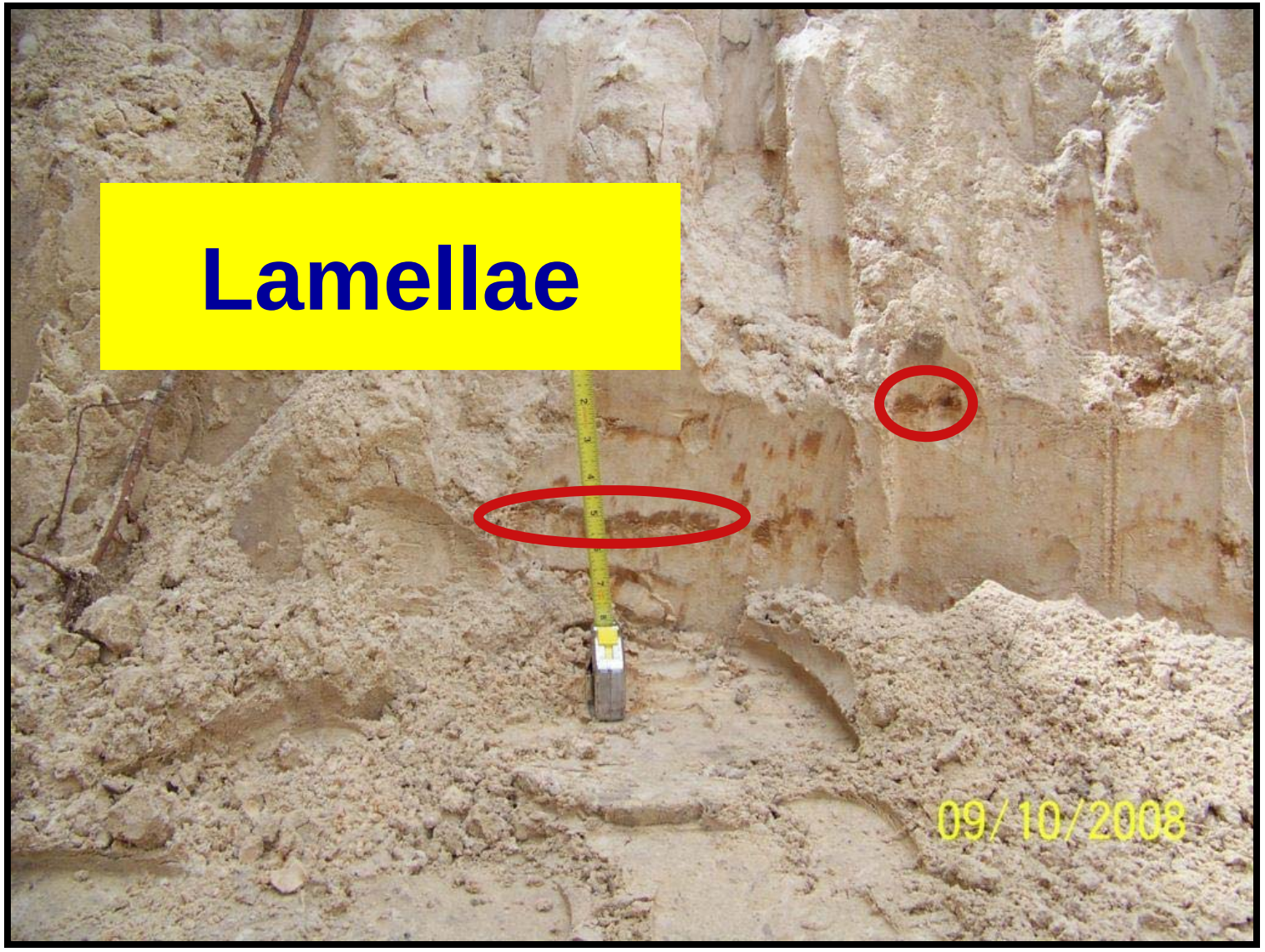
Lamellae – Thin accumulations of finer textured soils within a soil horizon





Lamellae




Lamellae
09/10/2008

Plinthite

- Iron-rich, highly weathered mixture of clay, quartz and other minerals
- Occurs commonly as red mottles that can be removed from the soil in one piece
- Usually platy, polygonal or reticulate patterns

Plinthite

- Can be crushed between the fingers, in moist soil it can be cut with a spade
- Changes irreversibly to ironstone or irregular aggregates on repeated wetting and drying, especially if exposed to heat from the sun

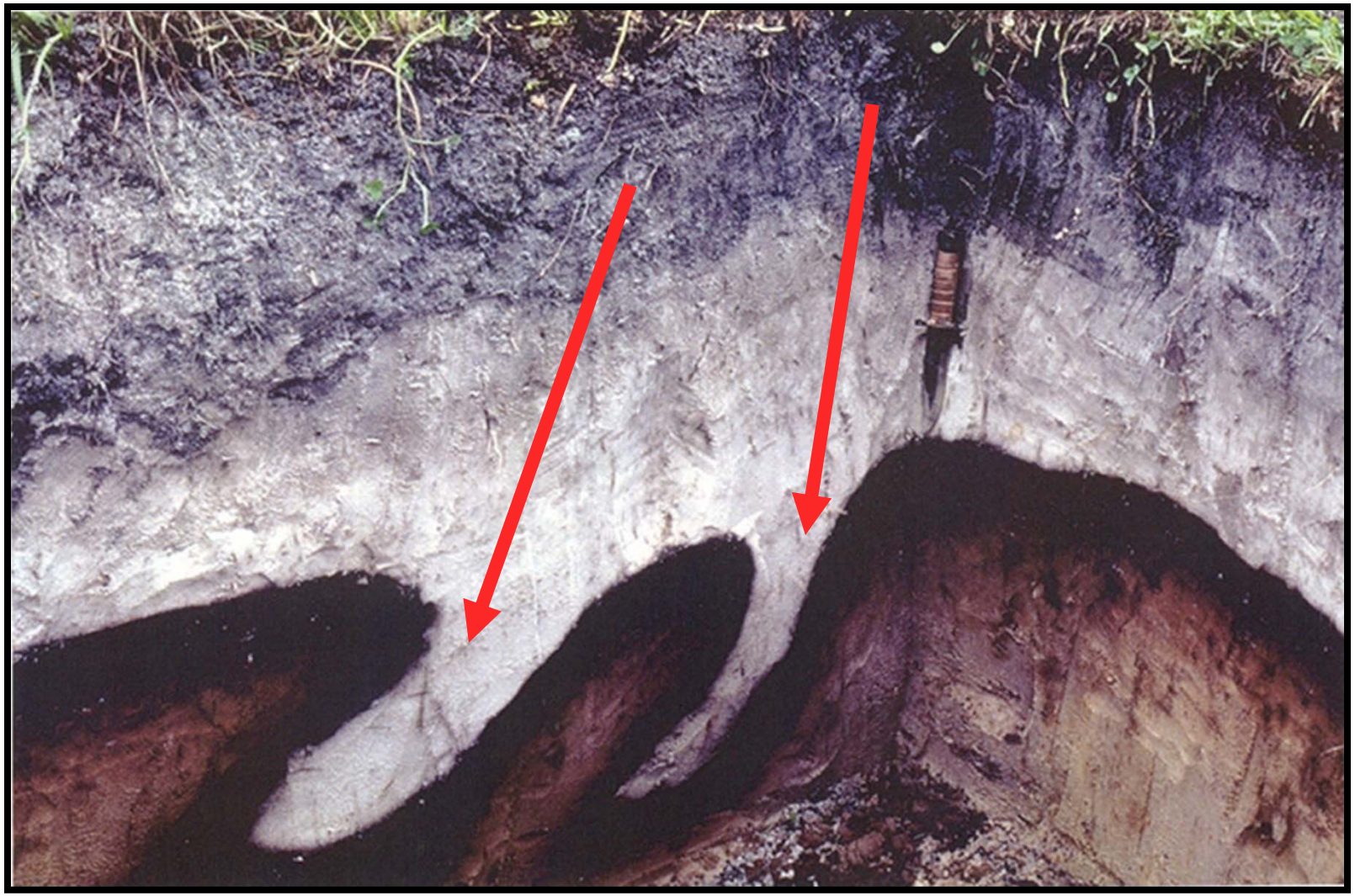
Plinthite in SCL

Plinthite – can crush between fingers

Tongues

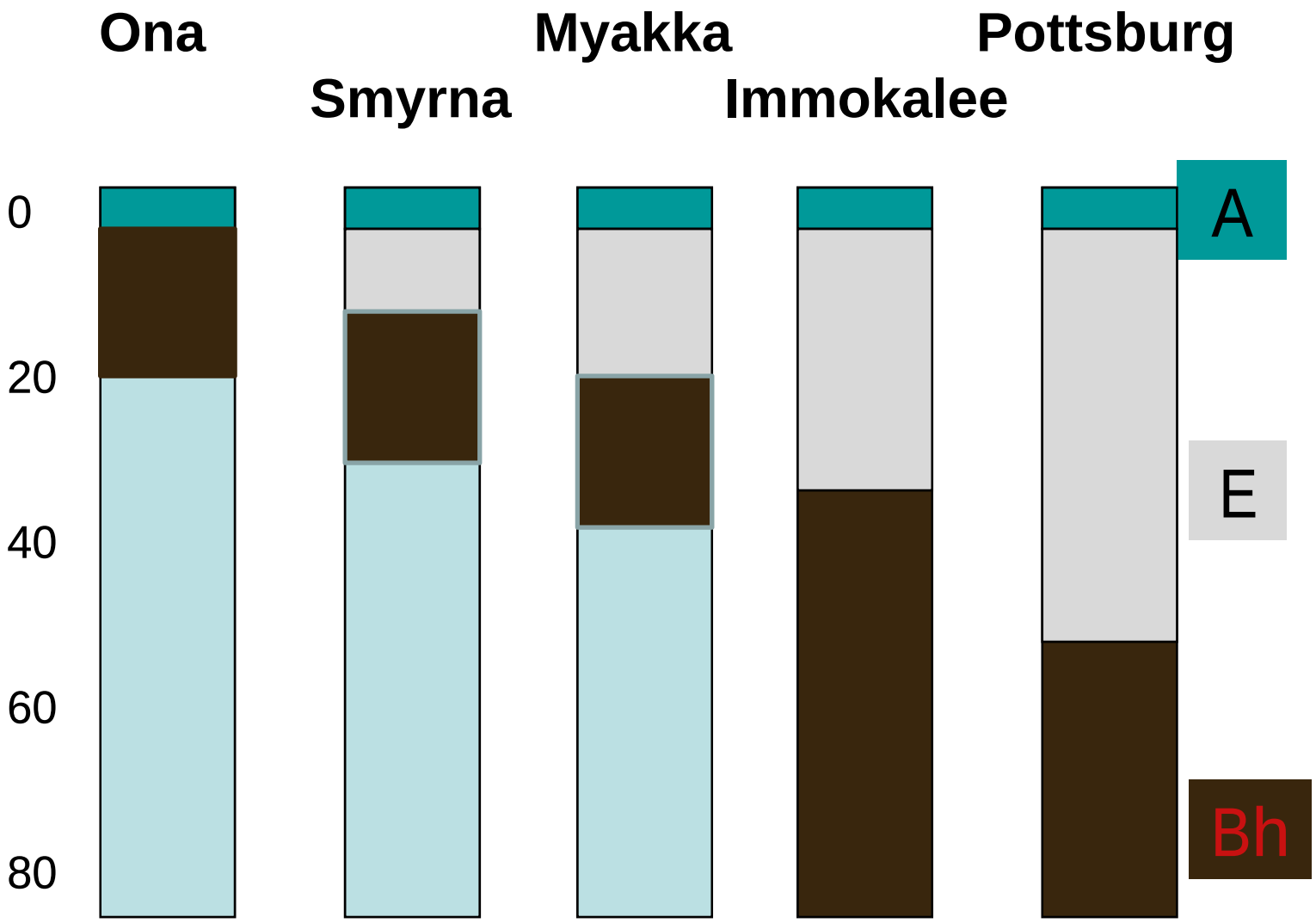
- Are not mottles or redoximorphic features, but are old root channels left in the soil from when the root rotted away
- Could also be animal burrows

Tongues of E horizon into spodic layer



Spodosols and SHWT

Soils with spodic layers in the profile. What do the following spodosols have in common?


Ona
Smyrna
Myakka
Immokalee
Pottsburg
0
20
40
60
80
A
E
Bh

Spodics and SHWTs

- Ona Soil - Spodic is between 6-20”, *SHWT is within 10” of soil surface*
- Smyrna Soil - Spodic starts above 30”, is 4-18” thick, *SHWT is within 10” of soil surface*
- Myakka Soil - Spodic is between depths of 20 to 36”, *SHWT within 10” of soil surface*

Spodics and SHWTs

- Immokalee Soil - Spodic is below 30”, about 10-50” thick, *SHWT within 10” of soil surface*
- Pottsburg Soil - Spodic is below 50” and about 24” thick, *SHWT is within 10” of soil surface*

CONCLUSIONS:

- A spodic layer *does not* have a direct relationship to the SHWT, it occurs due to a fluctuating water table
- The spodic layer *is not* a SHWT indicator
- The SHWT can be above, within OR below the spodic layer
- High chroma colors within the spodic layer *is not* a SHWT indicator

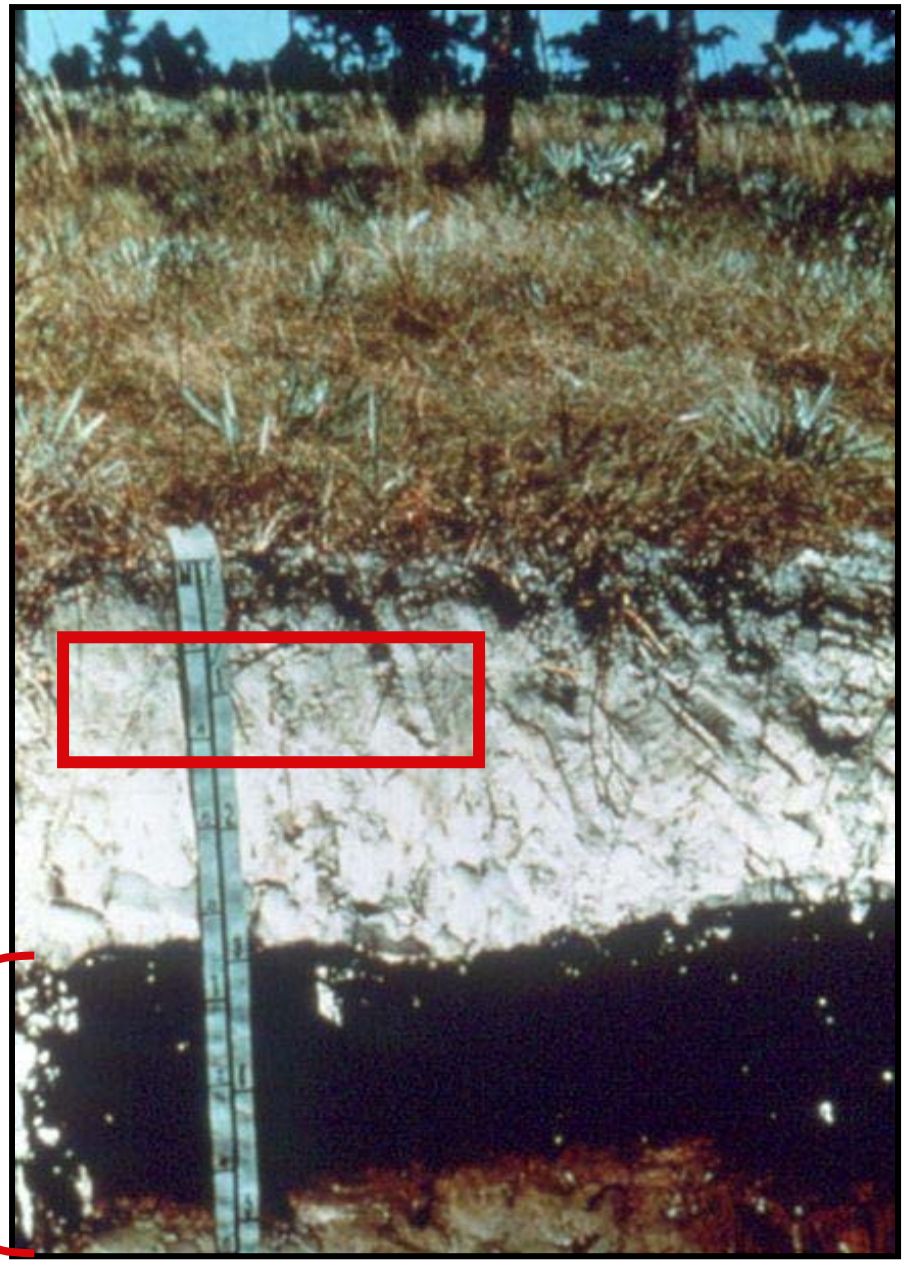
There are approximately 80 differentiated spodosols in Florida

Only about 3 of them have seasonal high water tables found normally below the spodic layer

Spodosol

SHWT found in this area

Spodic layer



Leon soil, Bay County, FL
SHWT at 12”

Spodic Material – Note different colors

Spodosol in a pit – observe differences

Example of a Common Spodic Layer Description

Myakka Series

- Spodic is between depths of 20 to 36”, SHWT within 10”
- Bh1--20 to 24 inches; black (N 2/0) sand; weak coarse subangular blocky structure; many fine and medium roots; sand grains coated with organic matter except for common fine pockets of uncoated sand grains; very strongly acid; clear wavy boundary. (2 to 13 inches thick)

- Bh2--24 to 32 inches; dark reddish brown (5YR 2/2) sand; common coarse faint vertical tongues of very dark brown (10YR 2/2) weak coarse subangular blocky structure; many fine and medium roots; sand grains coated with organic matter; very strongly acid; clear smooth boundary. (0 to 23 inches thick)

- Bh3--32 to 36 inches; dark reddish brown (5YR 2/2) sand; weak fine granular structure; very friable; few fine roots; sand grains coated with organic matter; strongly acid; clear wavy boundary. (0 to 16 inches thick)

A word about Spodic Soils

What if you don’t see redox features??

Other indicators of the SHWT

- Thickness and color of the surface layer ("A" horizon), and stripped matrix, if present
- *Note that high chroma colors <u>WITHIN</u> the spodic IS NOT a SHWT indicator. Stripped matrix can occur within the spodic and can be used*

Spodosol with SHWT below the Spodic Layer – KUREB Series

- Kureb –Rapid permeability. Depth to seasonal high water table is more than 6 feet during most of the year

- A--0 to 3 inches; dark gray (10YR 4/1) sand; single grained; loose; organic matter and quartz grains have salt and pepper appearance; many fine and large roots; neutral; clear wavy boundary (2 to 5 inches thick)

- E--3 to 26 inches; light gray (10YR 7/1) sand; single grained; loose few large roots; neutral; clear irregular boundary. (4 to 45 inches thick)

- C/Bh--26 to 51 inches; brownish yellow (10YR 6/6) sand; single grained; loose; few tongues of light gray (10YR 7/1) extend from above horizon; dark brown (7.5YR 3/4) and few bands and bodies (Bh) of dark reddish brown (5YR 3/2); (continued next slide)

- (C/Bh continued) bands are intermittent at horizon contact and vertically along walls of tongues; many clean and coated sand grains; neutral; gradual wavy boundary. (4 to 46 inches thick)

- C--51 to 89 inches; pale brown (10YR 6/3) sand; single grained; loose, slightly acid

KUREB Soil (Franklin County, FL

KUREB Soil (Franklin County, FL

THE END

QUESTIONS?