COLOR INTERPRETATION AND SOIL TEXTURES

ACT PRESENTATION 1 SEPTEMBER 2013

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- ***Properly identifying soil morphology (soil characteristics observable in the field, including horizonation) is the most important step leading to a properly permitted, functional onsite sewage treatment and disposal system. If you make mistakes at this step, the worst-case scenario is that the system will not meet required health standards and put the public at risk of waterborne disease.***

Properties used in describing soil layers

Color: A key property in soil interpretation

- Most evident
- Influenced by Organic Matter (OM) and redox-sensitive metals such as Iron (Fe) and Manganese (Mn)
- REDOX=Oxidation/Reduction reaction- a process in which one or more substances are changed into others
- Wetness affects OM and redox-sensitive metals

Basics:

- ***Soil Color*** - the dominant morphological feature used to predict the SHWT
- ***Matrix*** – dominant (background) color(s) of soil horizon (can be ≥1 color)
- ***Mottle*** – splotch of color, opposite of matrix
- ***Redoximorphic (Redox) Features*** – specific features formed from oxidation-reduction reactions used to predict seasonal high water tables, includes certain types and amounts of mottles. They are caused by the presence of water and minerals in the soil.

Proper Coloring Methodology

- **USDA NRCS notation, methodology, and terminology is referenced by DOH regulations and therefore MUST be used for ALL OSTDS purposes when describing soils (i.e. soil textures and colors)**
- **No other methodology is acceptable.**

The Munsell Soil Color Charts

- **Newest book came out in February 2013.**
- **Can use older books if consistent with current information (more later).**
- **10YR AND 7.5YR replacement sheets currently available.**

Munsell Color Notation

- **Used to describe soil color for maximum accuracy and communication.**
- **Three descriptive elements are used and are always written in the following specific order.**

HUE VALUE/CHROMA

Example: **10R 5/8**

HUE

- ***Identifies the basis spectral color or wavelength (Red, Yellow, Blue, or in-between, such as Yellow-Red etc.)***
- **Normally one HUE on each page in the Munsell Soil Color Charts book (are exceptions such as Gley colors-more later)**
- **Most commonly used Hue in Florida is 10YR (but don't just look on that page)**

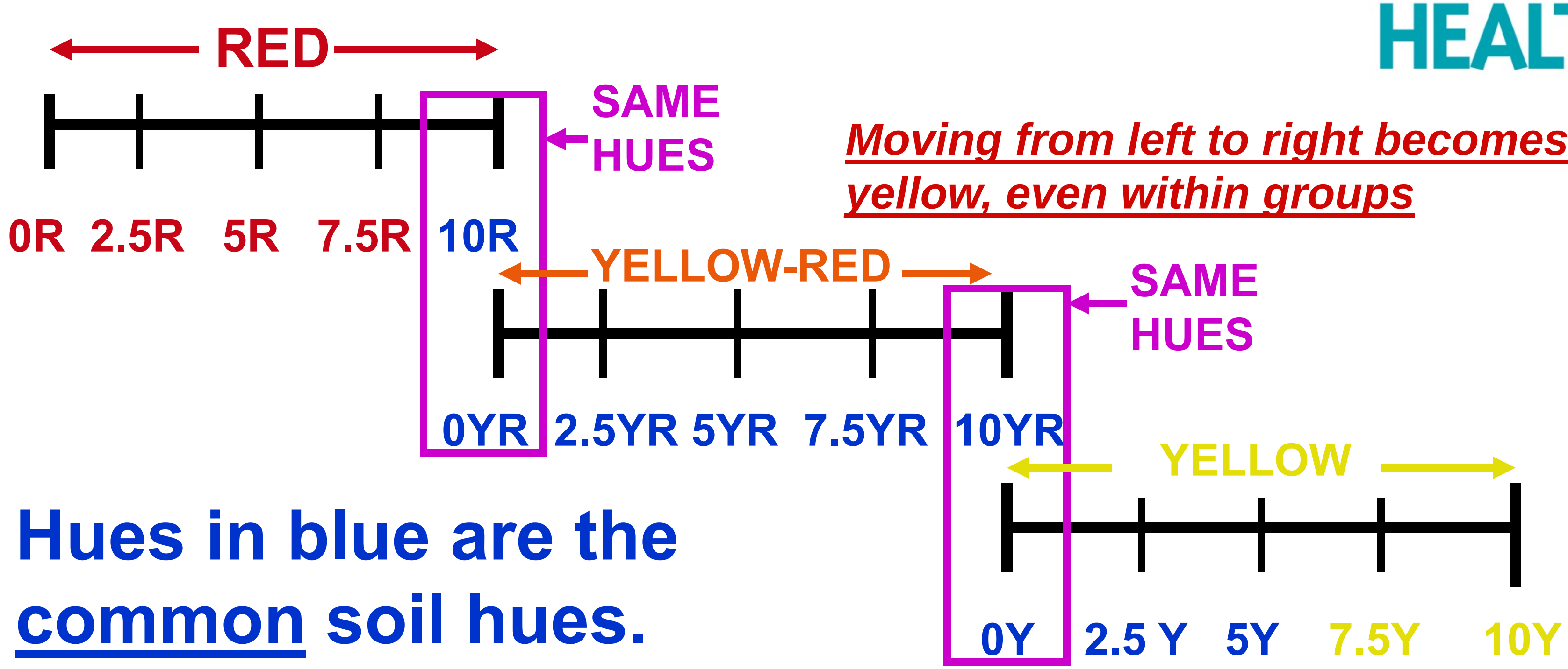
HUE Symbols (letter abbreviations)

- R = Red; YR = Yellow-Red; Y = Yellow
- The letter is preceded by numbers 0 to 10
- Within each letter range the Hue becomes more yellow and less red as the numbers increase. For example:
  - 2.5YR is more red than 5YR
  - 7.5YR is less yellow than 10YR
- Gley Charts include Neutral, Yellow, Green, Blue, Purple, and combinations.

HUE Symbols

- The middle of the letter range is at 5 and the 0 point is the same as the 10 point of the next redder Hue.
- Therefore, 5YR is in the middle of the yellow-red Hue, which extends from 10R (0YR) to 10YR (0Y).
- Pages in Munsell Book are prearranged from most red through most yellow.

Hue - basis spectral color; wavelength



Moving from left to right becomes more yellow, even within groups

Hues in blue are the <u>common</u> soil hues.

Note increments of 2.5 between each consecutive hue (this is one unit of hue)

VALUE

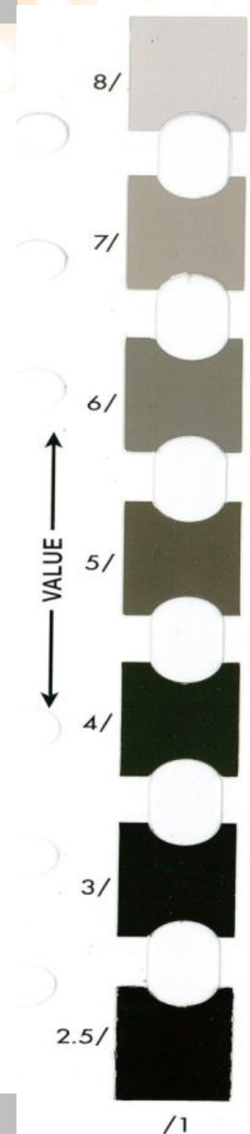
- ***Indicates the degree of lightness or darkness, or reflectance*** **of an object viewed in daylight**
- **Scale is from *0 for the ideal black to 10 for the ideal white*, in steps (units) that are visually equal.**
- **Lightness increases from black at the bottom of page, through the grays, to nearly white at the top of the page.**

PURE WHITE 10/0

Value

The Degree of Lightness or Darkness of the Spectral Color

GRAY 5/0



PURE BLACK 0/0

CHROMA

- ***The color intensity, saturation or relative strength of color.*** **Indicates the degree of departure from a gray of the same Value.**
- ***The scale is from 0 - 8 on the Munsell Color Chart.*** **0 indicates no strength (no color; gray) and 8 greatest strength (most color). Numbers are units of Chroma.**
- **Read from left (lowest) to right (highest).**

CHROMA – strength of color

“Neutral” Color

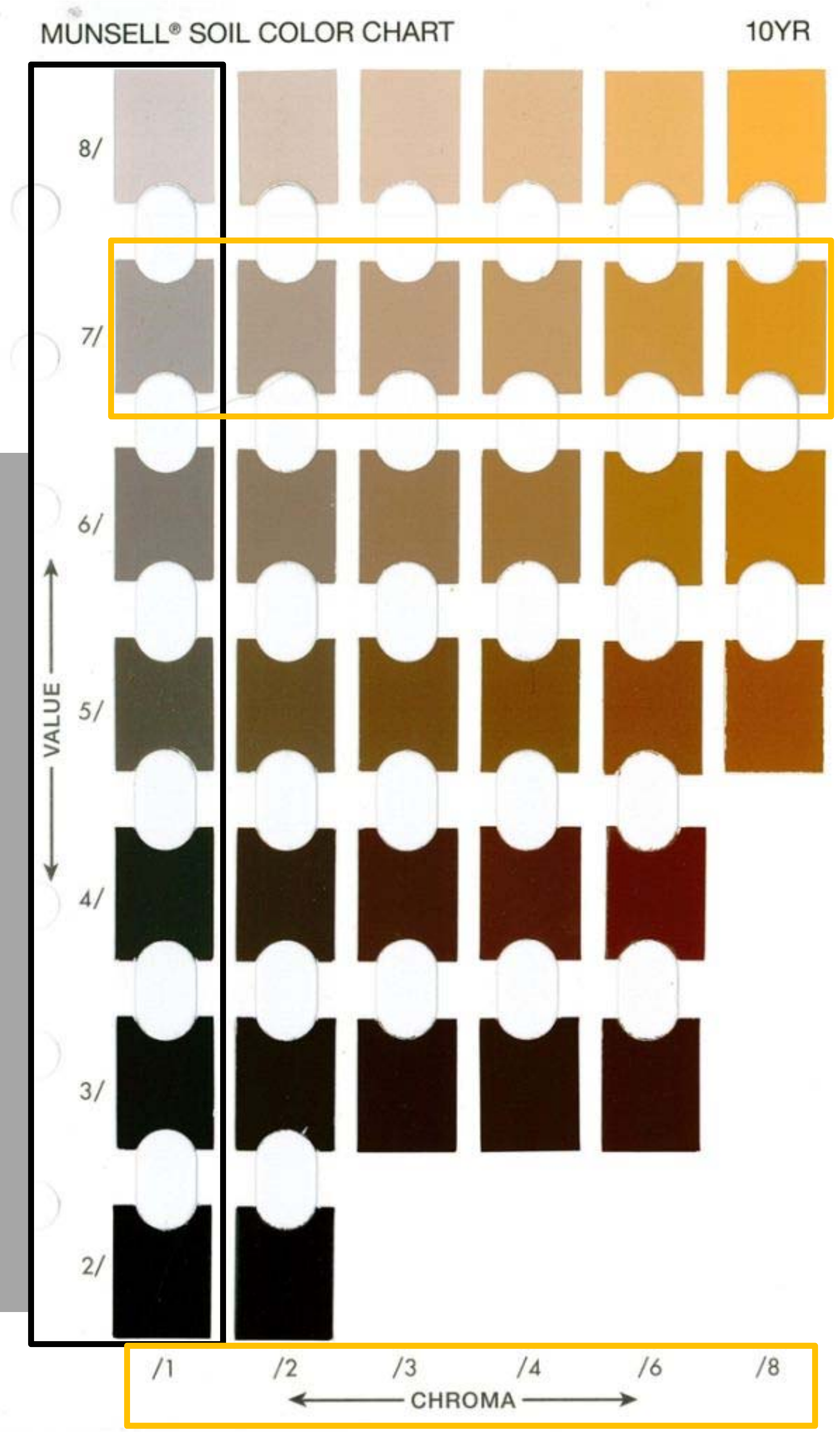
“Pure” Color

1 2 3 4 6 8

- Increasing strength of color (<u>at same Value)</u>

Increasing grayness

Value - measurement of soil organic matter (OM). Is the lightness or darkness of a color. Range is from 0 (pure black) to 10 (pure white).



Chroma- measurement of coloring agents like iron or manganese. Strength of color. Range is from 0 (no color) to 8 (most color).

Low Chroma Colors

- Throughout this course you will hear the term “low chroma colors”- What does it mean?

Low Chroma means: *<u>CHROMA 2 OR LESS</u>*

- All hues have chroma 2 or less on the pages, therefore all hues have low chroma colors.
- All Gley chart colors are comprised completely of low chroma colors.
- *<u>Specific</u>* low chroma colors have meaning regarding the SHWT determination (more on this later).

Colors BETWEEN Chroma Chips

- Colors exist between Chroma chips
- They are noted differently than others
- If the chroma is between two chips, note the lower one and add a "+" as a notation.
- Example: The soil has more color than 10YR 6/1 and not enough to be 10YR 6/2.
- The proper notation would be 10YR 6/1+

Colors BETWEEN Chroma Chips

- ***<u>DO NOT ROUND UP TO THE NEXT HIGHER CHROMA.</u>***

- ***<u>THIS IS ESSENTIAL WHEN DECIDING IF SPECIFIC COLORS CAN BE USED AS AN INDICATOR OF SEASONAL HIGH WATER TABLE (more later).</u>***

QUESTIONS?

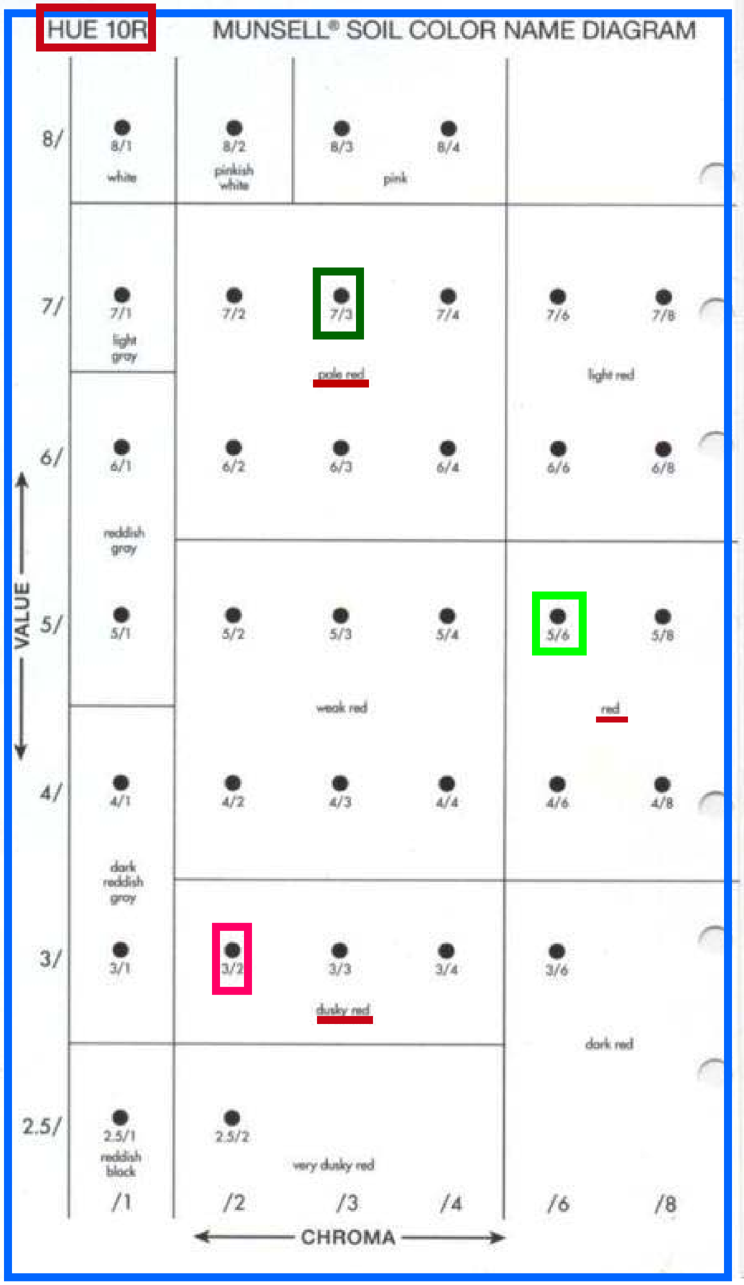
PROPER TECHNIQUE WHEN DETERMINING SOIL COLORS

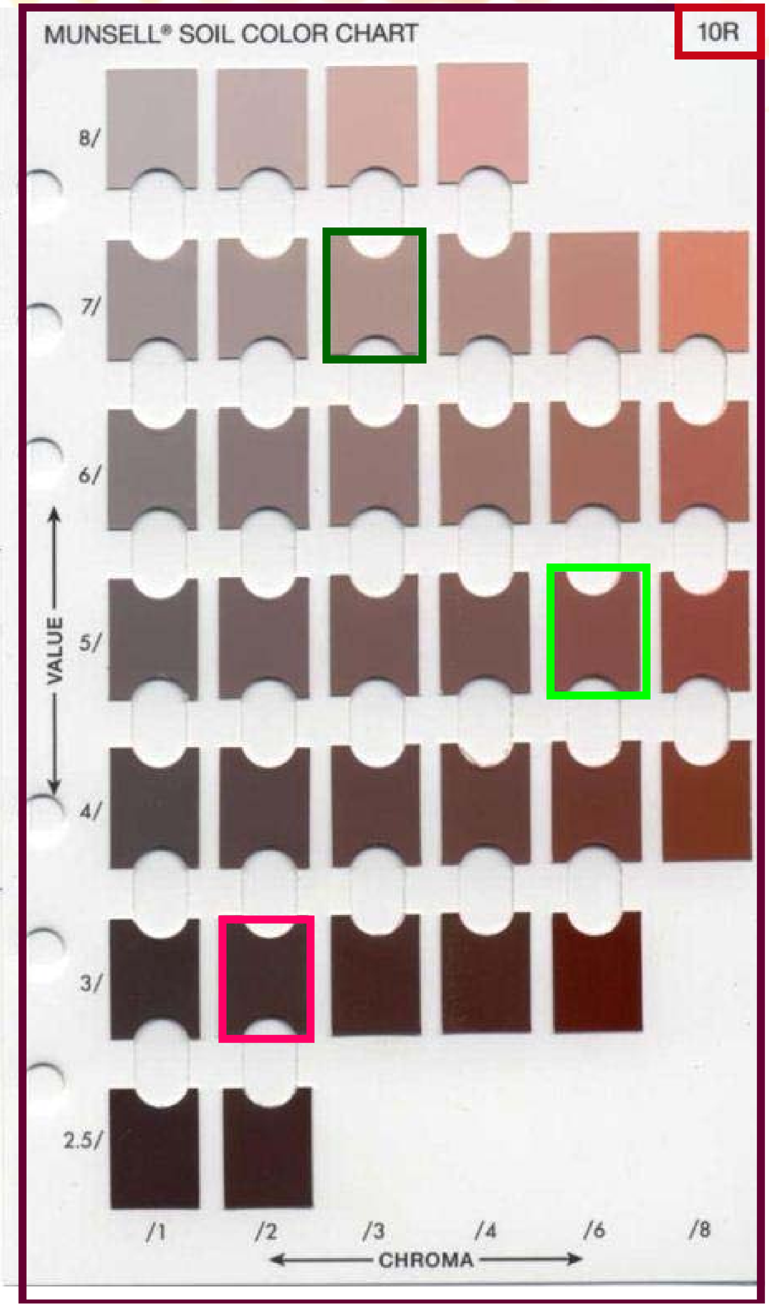
Correct Coloring Method

- **Hold soil <u>behind</u> the hue card with the color chips (the right side of the Munsell Book).**
- **Find the closest match from *<u>all</u>* choices in the book, read Hue Value/Chroma notation.**
- **Look to left side of Munsell book for soil color name and match Hue Value/Chroma from right side.**
- **See next slide for examples.**

COLOR NAME DIAGRAM

MUNSELL NOTATIONS

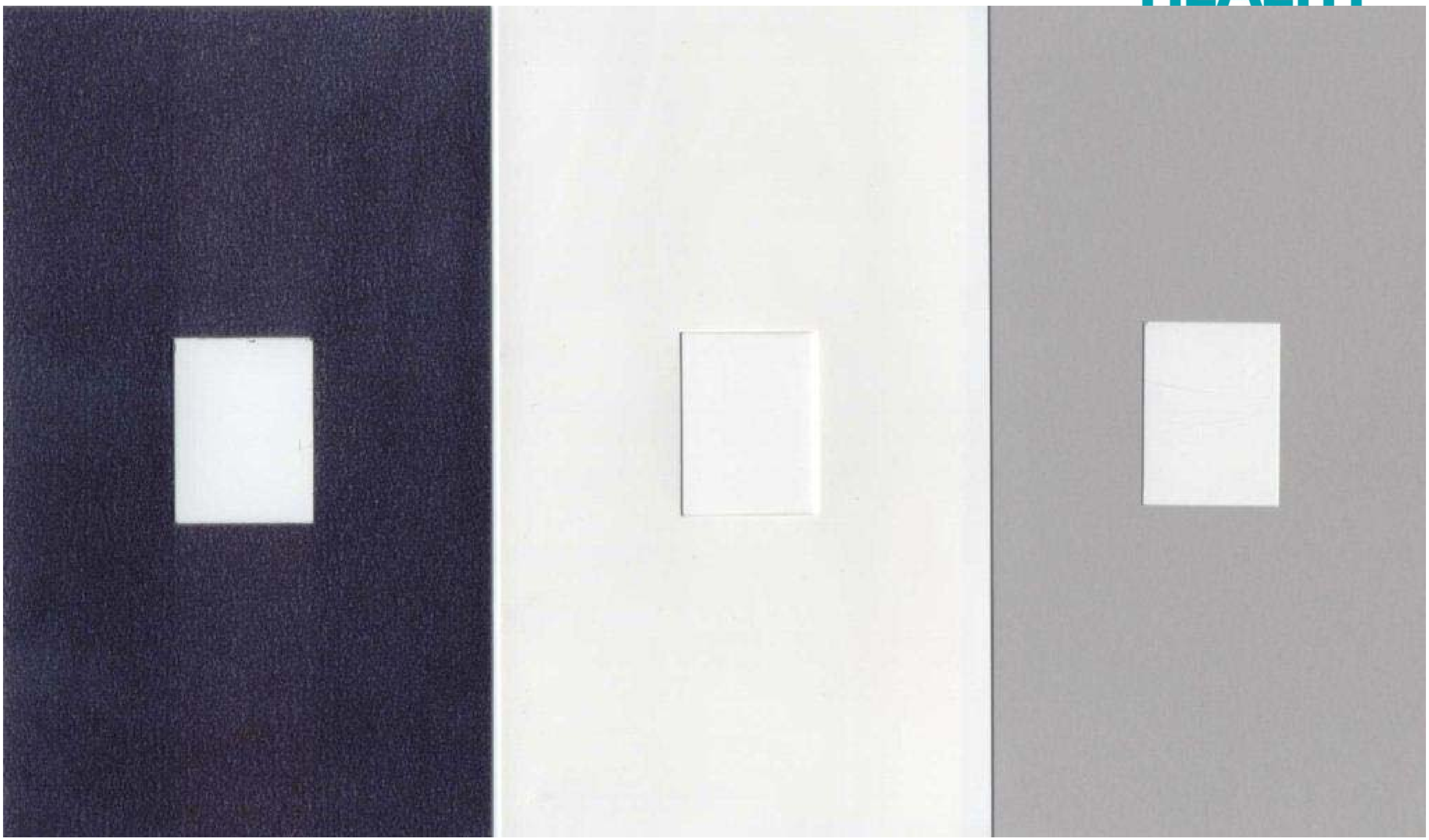




When using the Munsell book

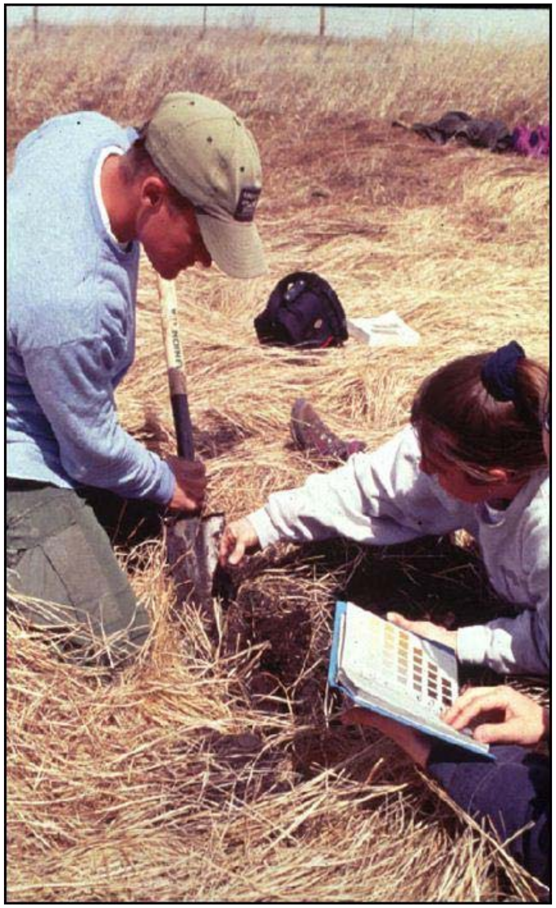
- <u>Use the book properly – Pages must be usable!!!</u>
- Do not take too long to read the color
- Use the <u>*chip masks*</u> if necessary
- <u>Use the mask closest in value to the soil sample being observed.</u> Use black mask for black/very dark samples, white mask for light colored soil samples, gray for everything else.
- The use of a chip mask will facilitate color matching when there is difficulty in choosing a color. The mask allows only 4 chips to be seen at one time. Located inside the back cover of the Munsell Book.

CHIP MASKS



Reading soil colors

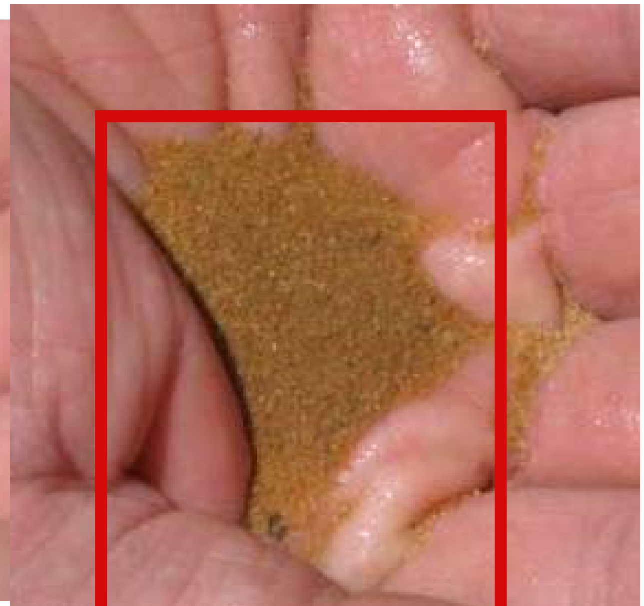
- Optimum conditions
  - Natural light
  - Clear, sunny day
  - Midday
  - Light at right angles
  - *Soil is <u>moist</u> (not wet or dry)*



Moist Soil

- *A moist sample will not get any darker when water is added to the sample, and it will not glisten. A sample that is too wet will glisten in the sunlight, or the water puddles on the sample.*
- *When texturing, the soil should be easily manipulated by your thumb and forefinger.*
- In non-sandy soils, this could be compared to moist putty.

Correct Moisture Content



DRY SOIL

Note higher value, lower chroma

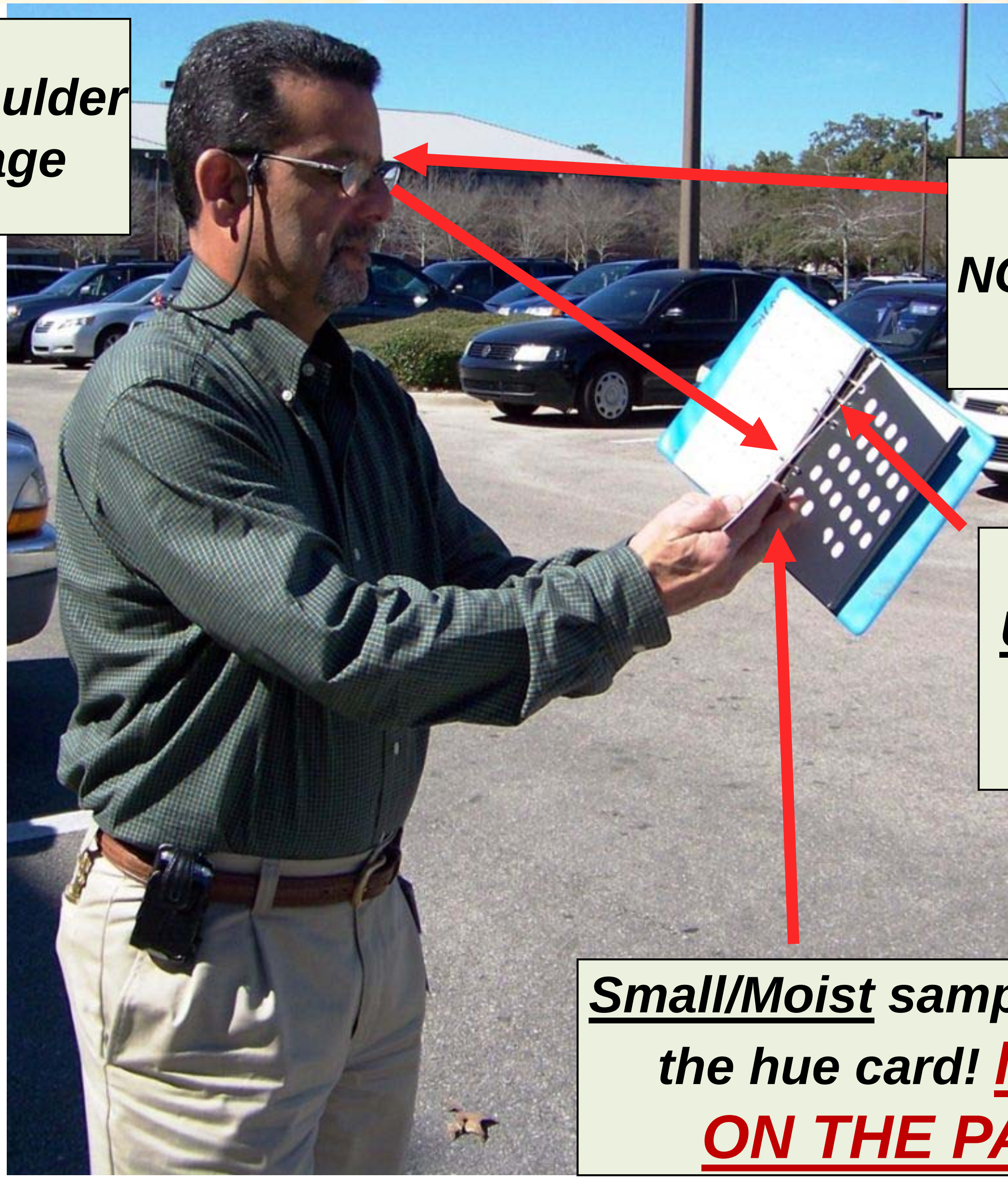
MOIST SOIL

MUST USE THIS ONE

TOO WET

Note Glistening

READING SOIL COLORS



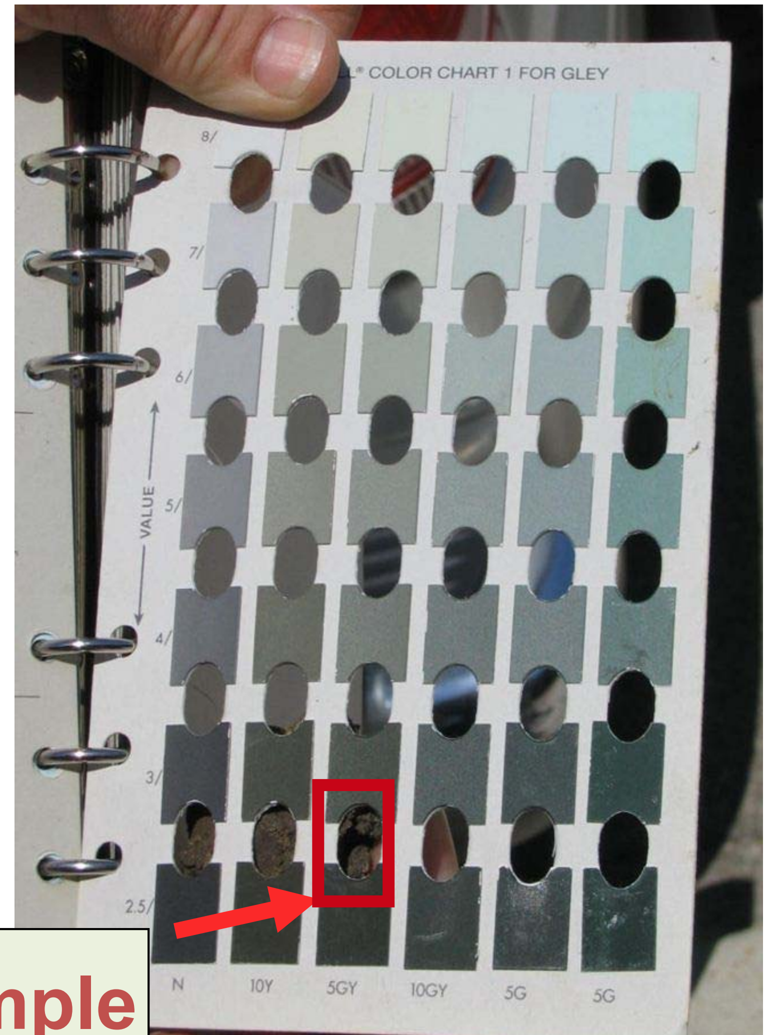
Sun over RT shoulder
RT angle to page

NO Sunglasses!!!

Pages are ***UNALTERED/ ORIGINAL/ CLEAN***

Small/Moist** sample **BEHIND** the hue card!* ***NEVER ON THE PAGE!!

Sample is behind the hue card



Sample

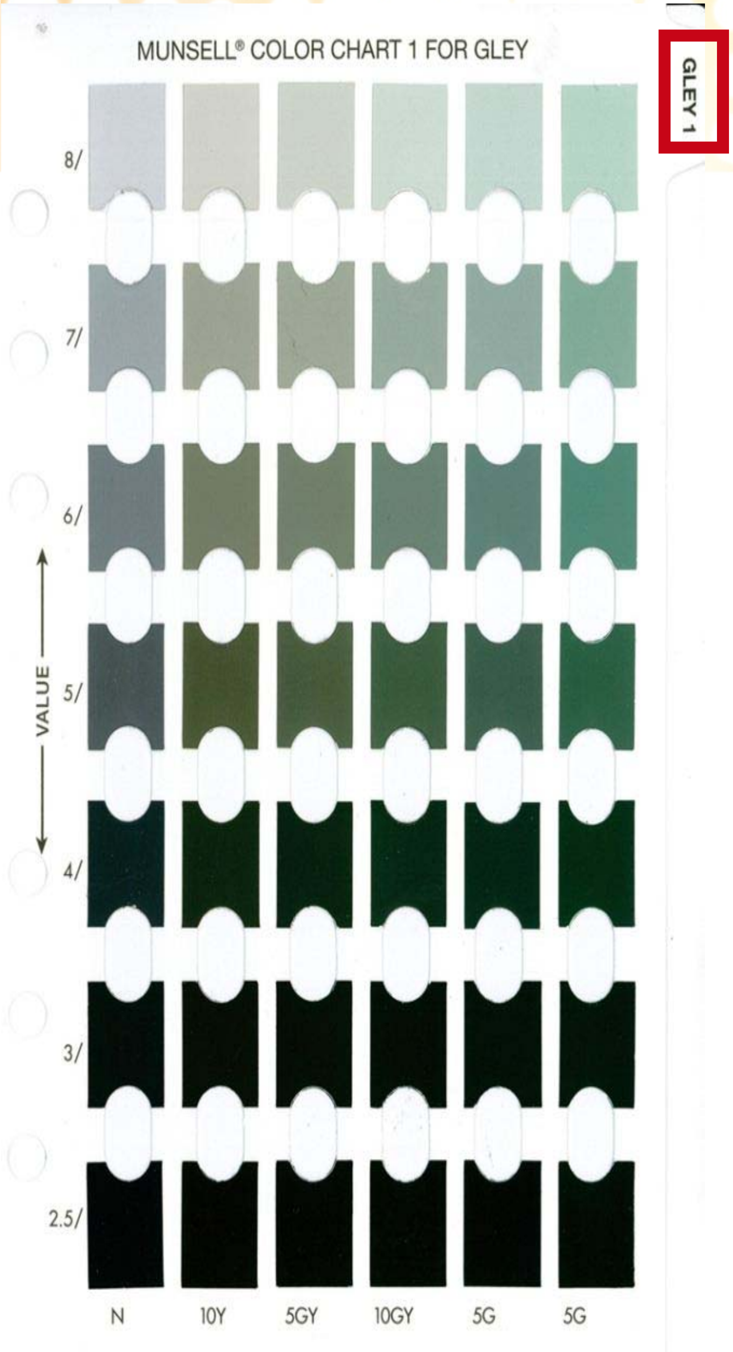
NOT THE RIGHT WAY!!!

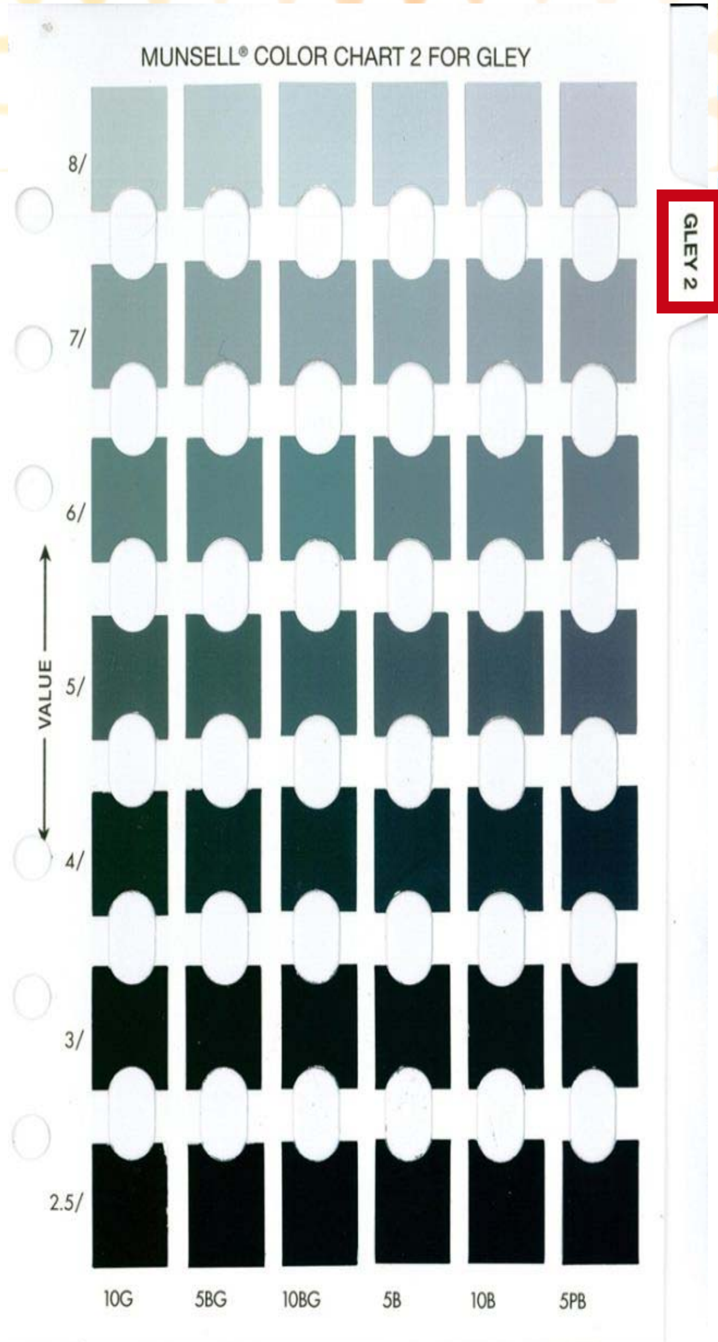
Different types of Colors:
The GLEY charts

These are read differently than the other charts

GLEY CHARTS

- **Two supplemental charts containing grayish, bluish and greenish colors *often found in very wet mineral soils* are contained on these charts. The charts also contain a Neutral Hue (no chroma). *Soils with specific colors on these charts are very wet and will be discussed in a separate presentation.***


MUNSELL® COLOR CHART 1 FOR GLEY
GLEY 1
8/
7/
6/
5/
4/
3/
2.5/
VALUE
N
10Y
5GY
10GY
5G
5G

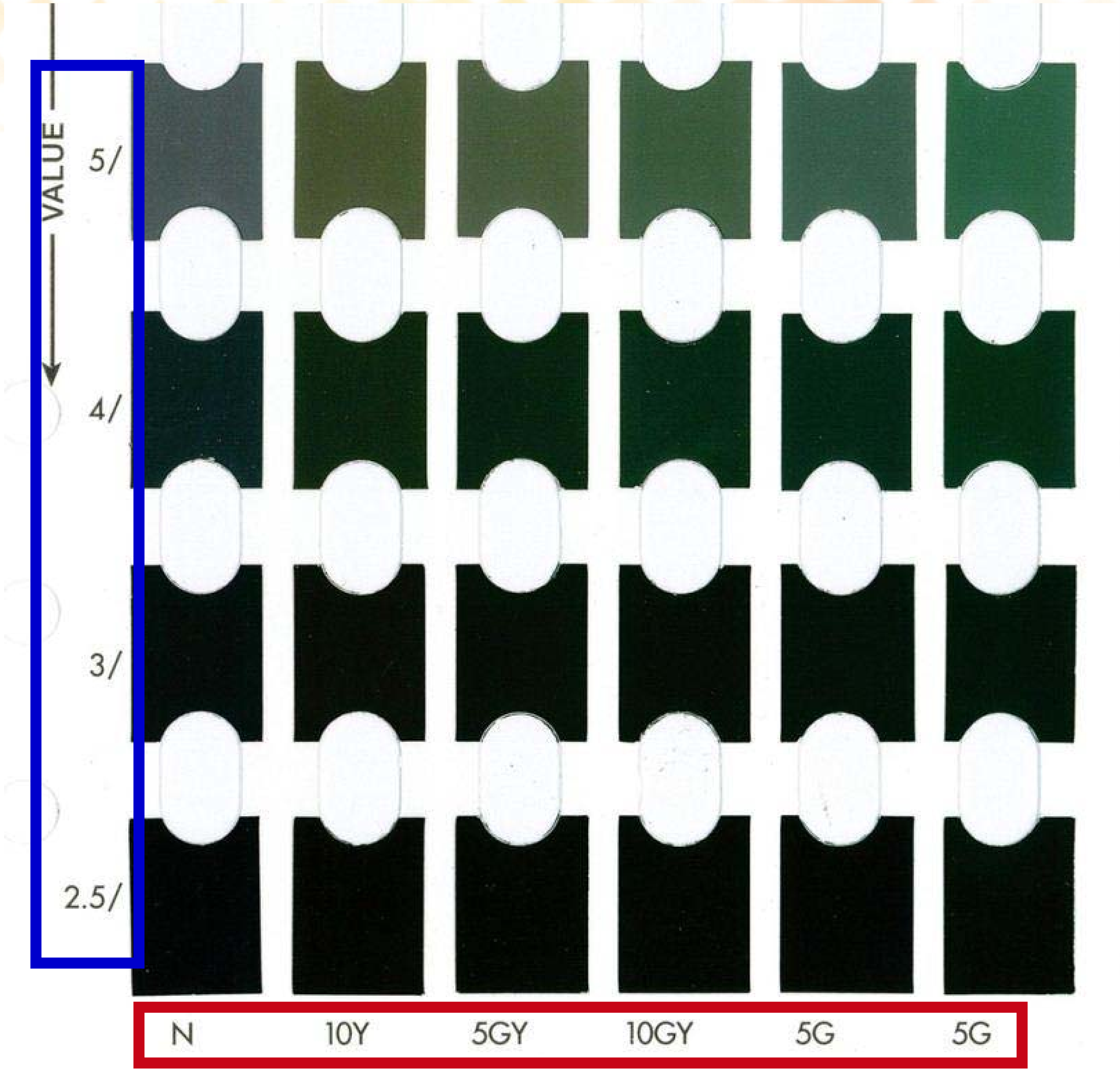

MUNSELL® COLOR CHART 2 FOR GLEY
GLEY 2
8/
7/
6/
5/
4/
3/
2.5/
VALUE
10G
5BG
10BG
5B
10B
5PB

The Gley Charts

Hues are found in EACH INDIVIDUAL COLUMN at the bottom of the page.

Values are on left, like other charts.

Values on left side

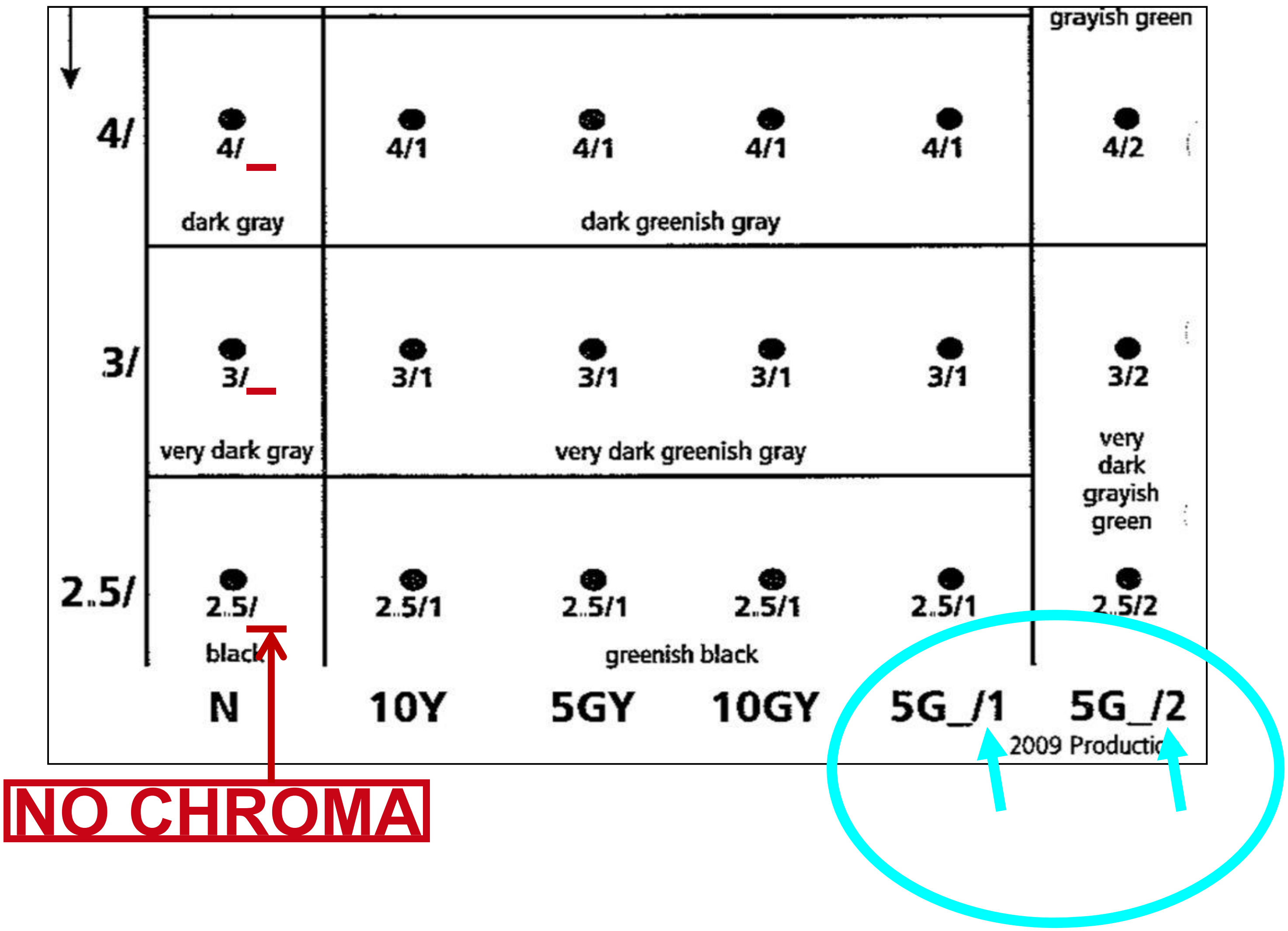


Different Hues on bottom

What about the *CHROMA* *for the Gley Charts*?

- ***Read chroma from the English name (left side) of the charts. Chroma designation will be to the right of the forward slash. See next slide.***

Read Chroma from right of forward slash



Note that all hues on the Gley Charts are chroma 1, except for two hues:

- N (Neutral) having 0 (*no*) chroma (this is due to lack of iron giving any color), and
- 5G _/2.

QUESTIONS???

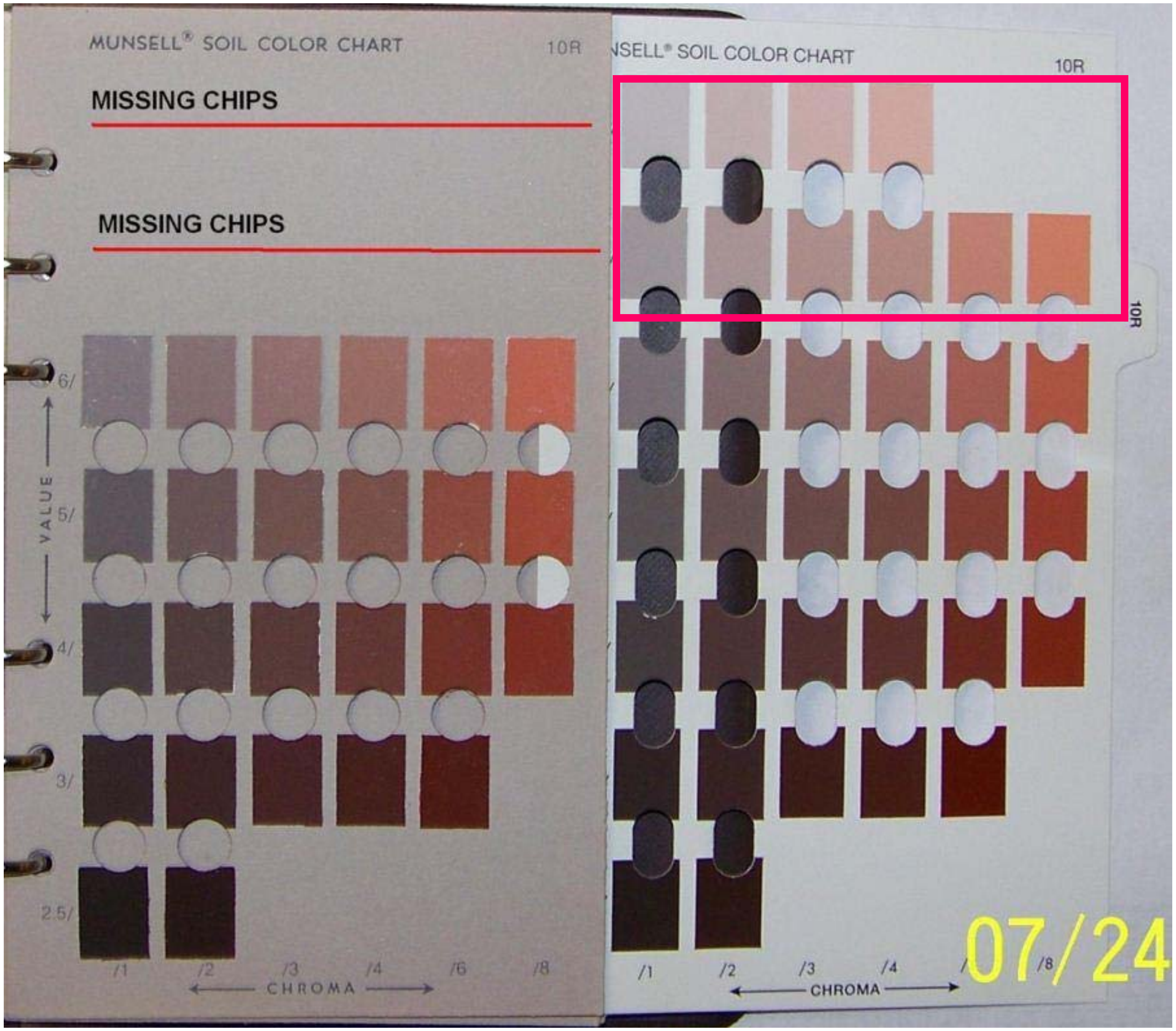
Examples of Munsell Books

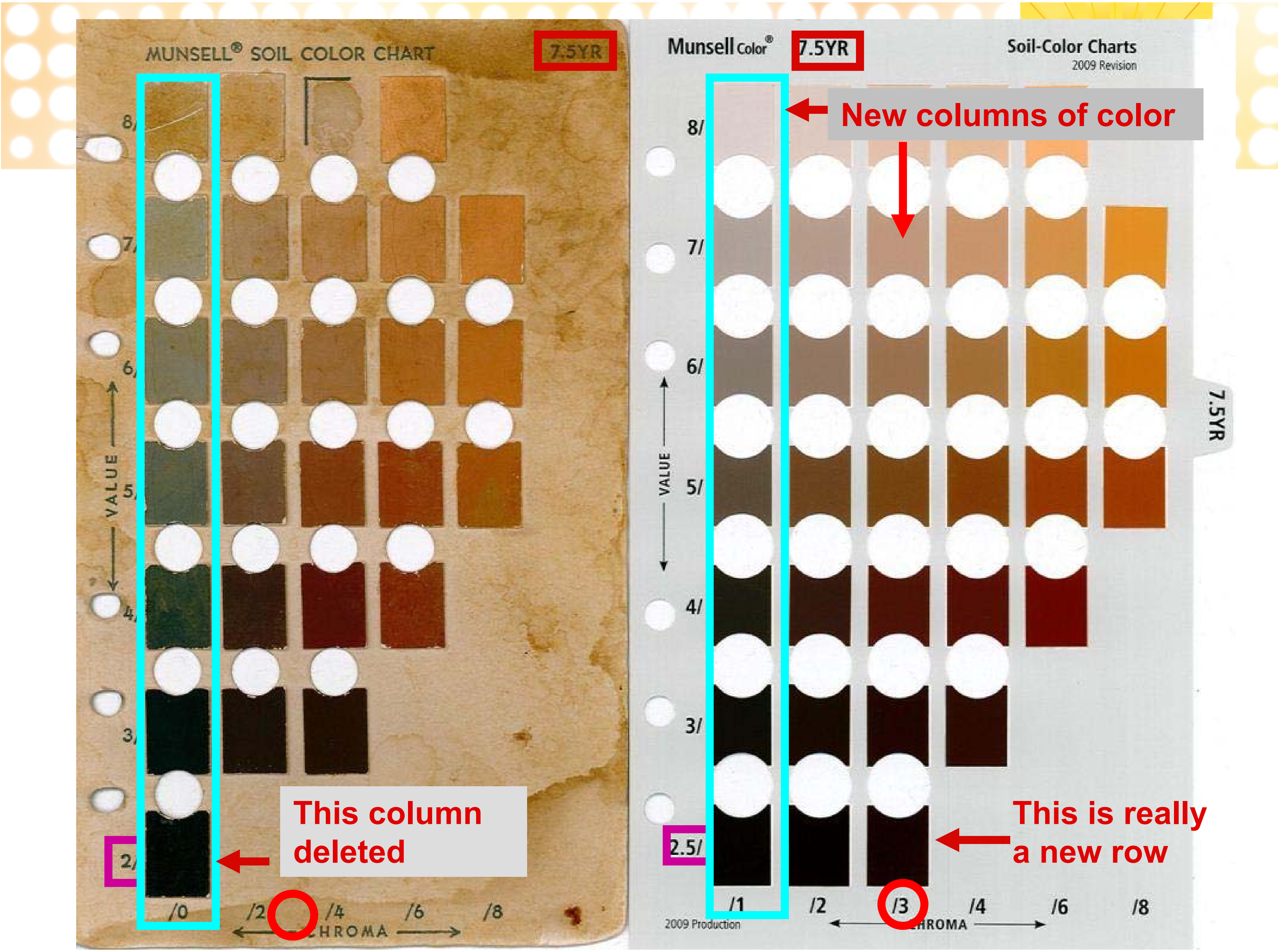
Which Munsell books/Hue cards you should and should not use (how to know when to get a new Hue card or new book)

Some of the problems

- Values or chromas have changed within the same hue between editions
- Addition of new hues
- Missing chips
- Dirty chips (no longer are correct color)
- Cracked/faded/discolored chips
- Chips taped to page
- The pages have been laminated.
- The book has been left in the rain and has mildewed, obscuring the colors.

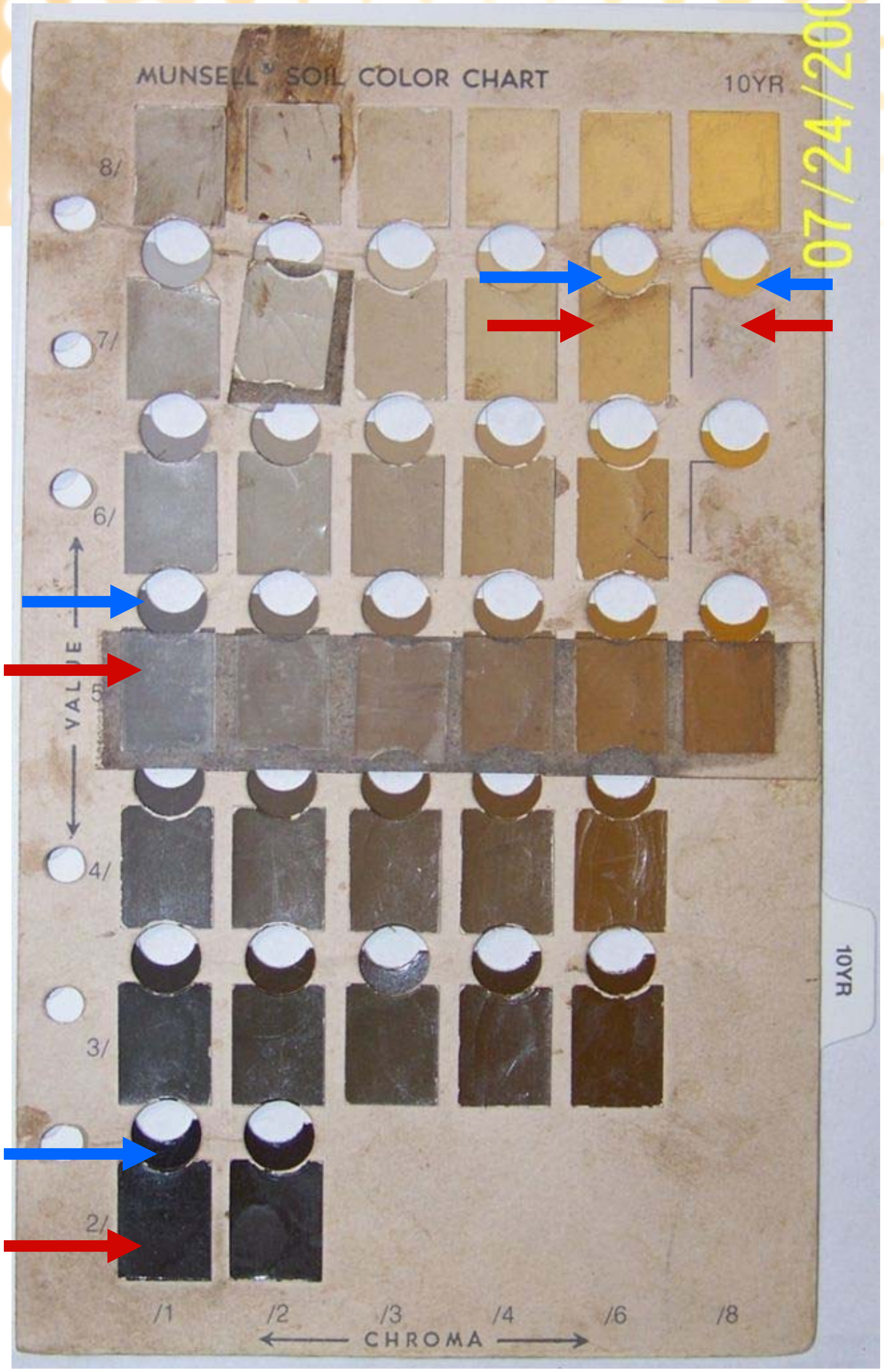
Two 10R pages from different years.
Note new chips.





MUNSELL® SOIL COLOR CHART
7.5YR
8/
7/
6/
5/
4/
3/
2/
VALUE
/0
/2
/4
/6
/8
CHROMA
This column deleted
Munsell Color®
7.5YR
Soil-Color Charts
2009 Revision
New columns of color
8/
7/
6/
5/
4/
3/
2.5/
VALUE
/1
/2
/3
/4
/6
/8
CHROMA
2009 Production
This is really a new row

Taped chips, missing chips, cracked chips, discolored (dirty/faded) chips. Older page on left, new on right.



Comparison of 2 cards (New behind old, look at differences in colors)

Use of the older cards would result in misidentification of soil colors, including the SHWT identification features, which will result in improper determination of the SHWT.

Soil Color Contrast

Determining Differences between soil colors

Hue Difference

- First must determine the difference in the HUES of each color
- Should use color wheel (later slide)
- Quick method for most colors is to count pages in accordance with following diagram. (Note: Δ signifies "change in" and "h" signifies Hue; therefore Δh means change in Hue)

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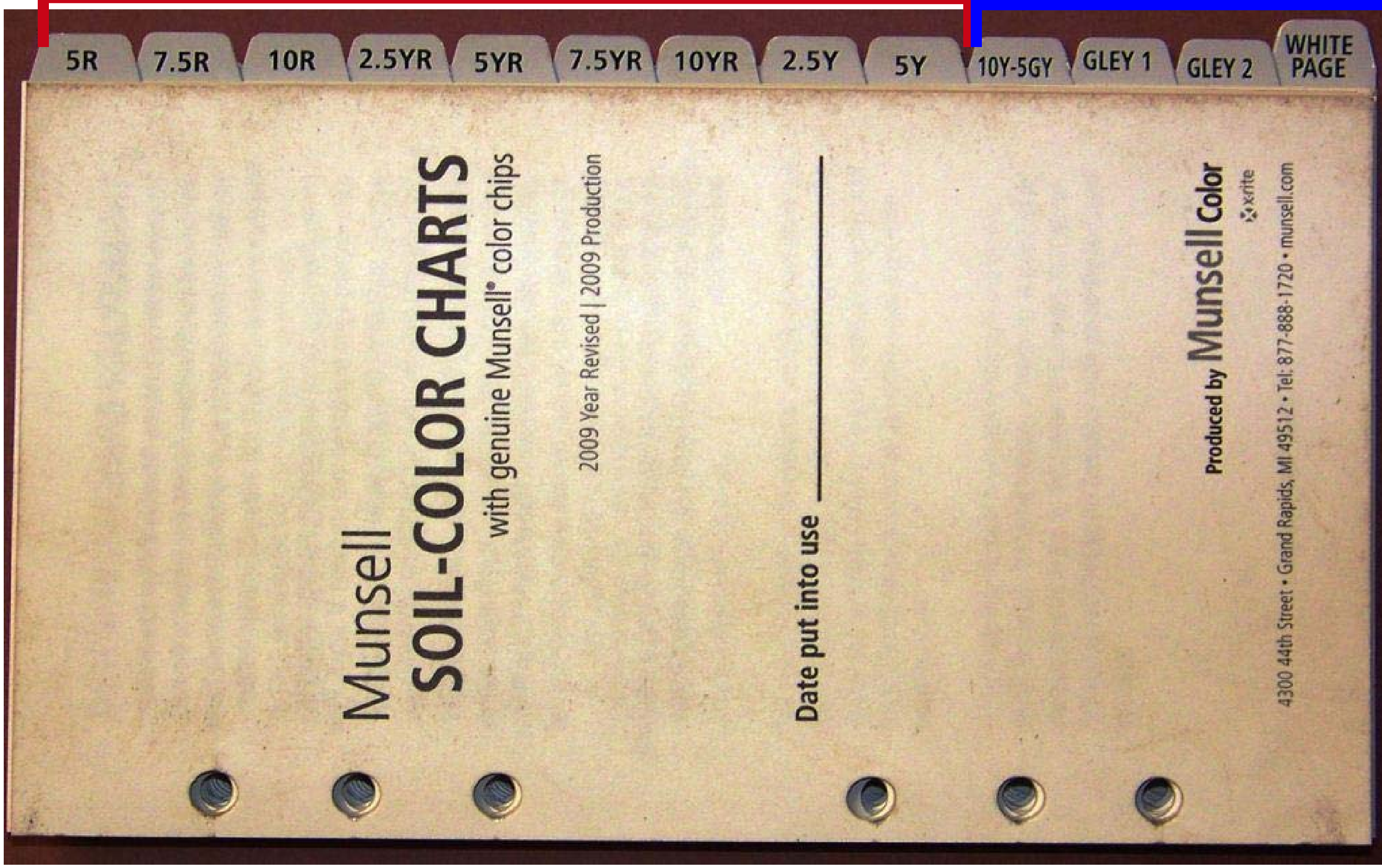
Δh≠1 per page. Count # of 2.5-unit intervals.

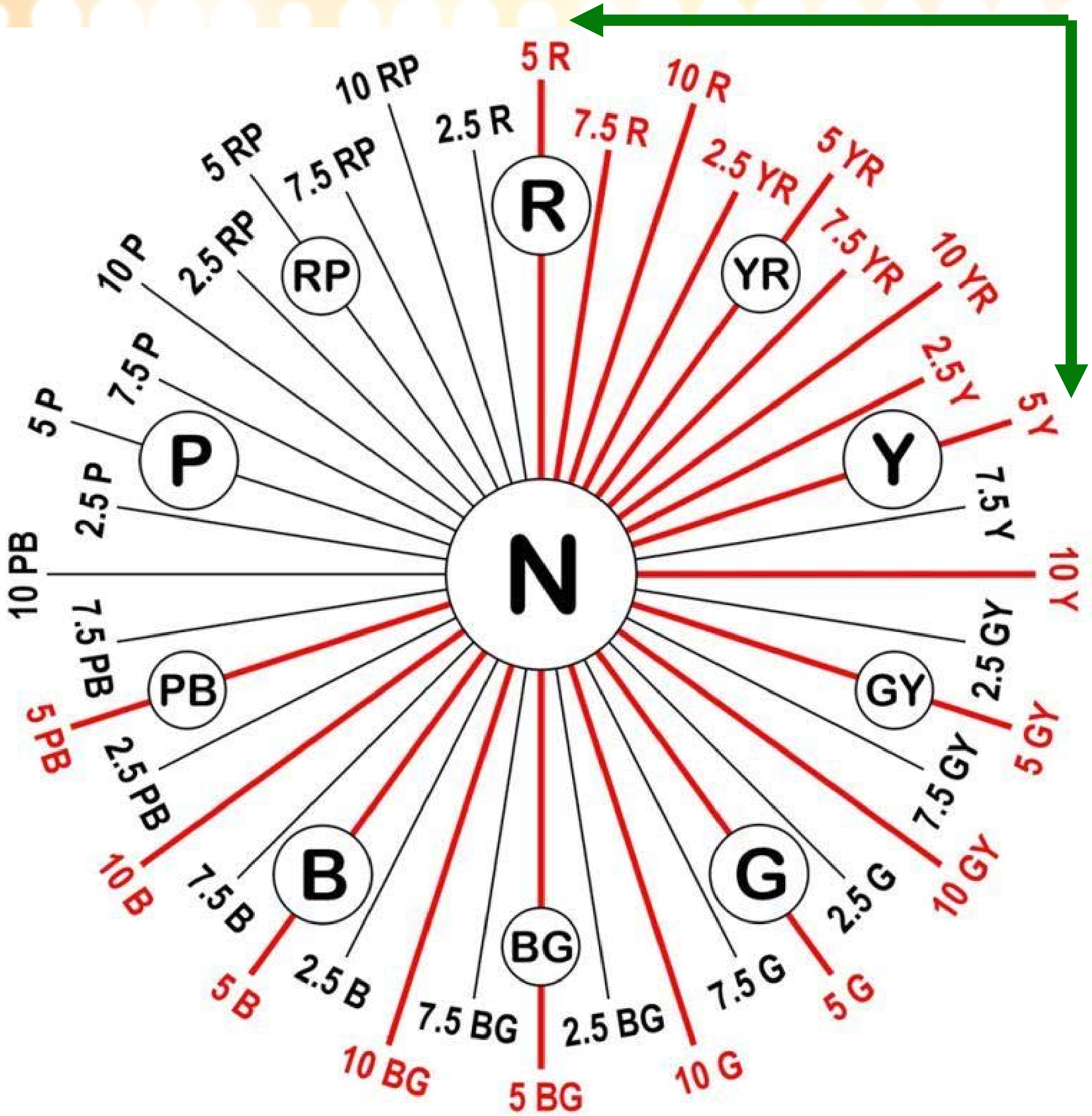
Δh=1 per page, count # of pages



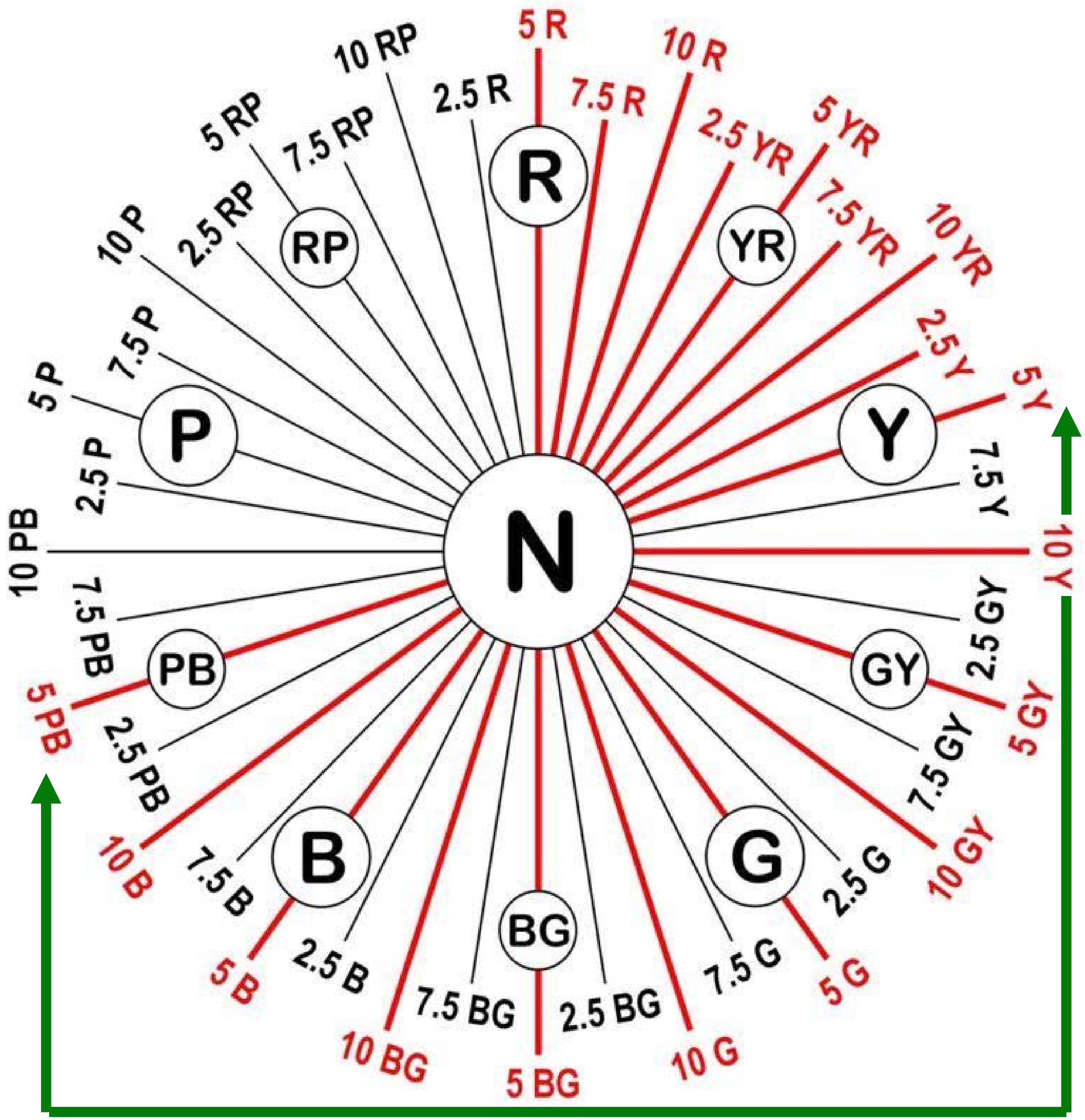
Use of the Munsell Hue Circle

USDA NRCS Technical Note 2

The hues shown in RED are the approved soil hues.



- **In a clockwise direction, <u>hues of 5R through 5Y are spaced at 2.5-unit intervals</u>.**
- **These hues are "normal soil hues."**
- ***<u>One 2.5-unit interval equates to a change of one unit of hue.</u>***



- **Of the remaining approved soil hues (in red), between 5Y and 5PB the interval between each soil hue is TWO 2.5-unit intervals.**
- ***This correlates to two units of hue between each soil hue***

To calculate Hue Change:

- **To determine the "difference in hue" between colors, *COUNT THE NUMBER OF 2.5-UNIT INTERVALS*.**
- **For example, hues of 2.5YR and 7.5YR differ by two 2.5-unit intervals (7.5-2.5=5, which is two 2.5 unit intervals), and so their difference in hue is counted as "2.“**
- **Hues of 5Y and 5GY differ by four 2.5-unit intervals, and so their difference in hue is counted as "4.“**
- ***Could also just use the wheel.***

Hue change from Neutral

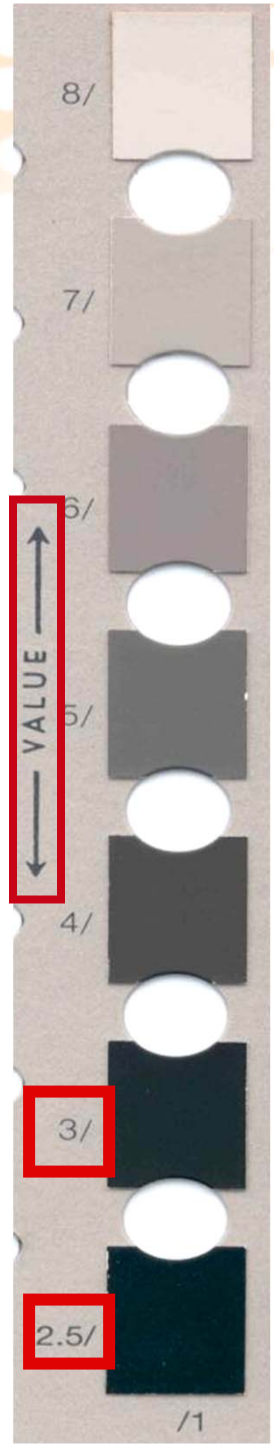
- ***<u>The Hue change from NEUTRAL to ANY OTHER HUE is a change of ONE UNIT OF HUE.</u>***

Units of Value Change

- Units of value range from 0 to 10. Normally, there is a one unit change between each color, but there may be less.
- For example:

The difference in Value between a 10YR 5/1 and a 10YR 7/1 is 2 UNITS. (The difference between 5 and 7 is 2.)

- **Here, the values can change as little as 0.5 units within the same chroma.**
- **The difference between a value of 2.5 and a value of 3 (both at chroma 1) is 0.5 units (<1 unit of value change). If you were to count chips, the answer would be different, where the *wrong* answer would be a difference of 1 chip.**

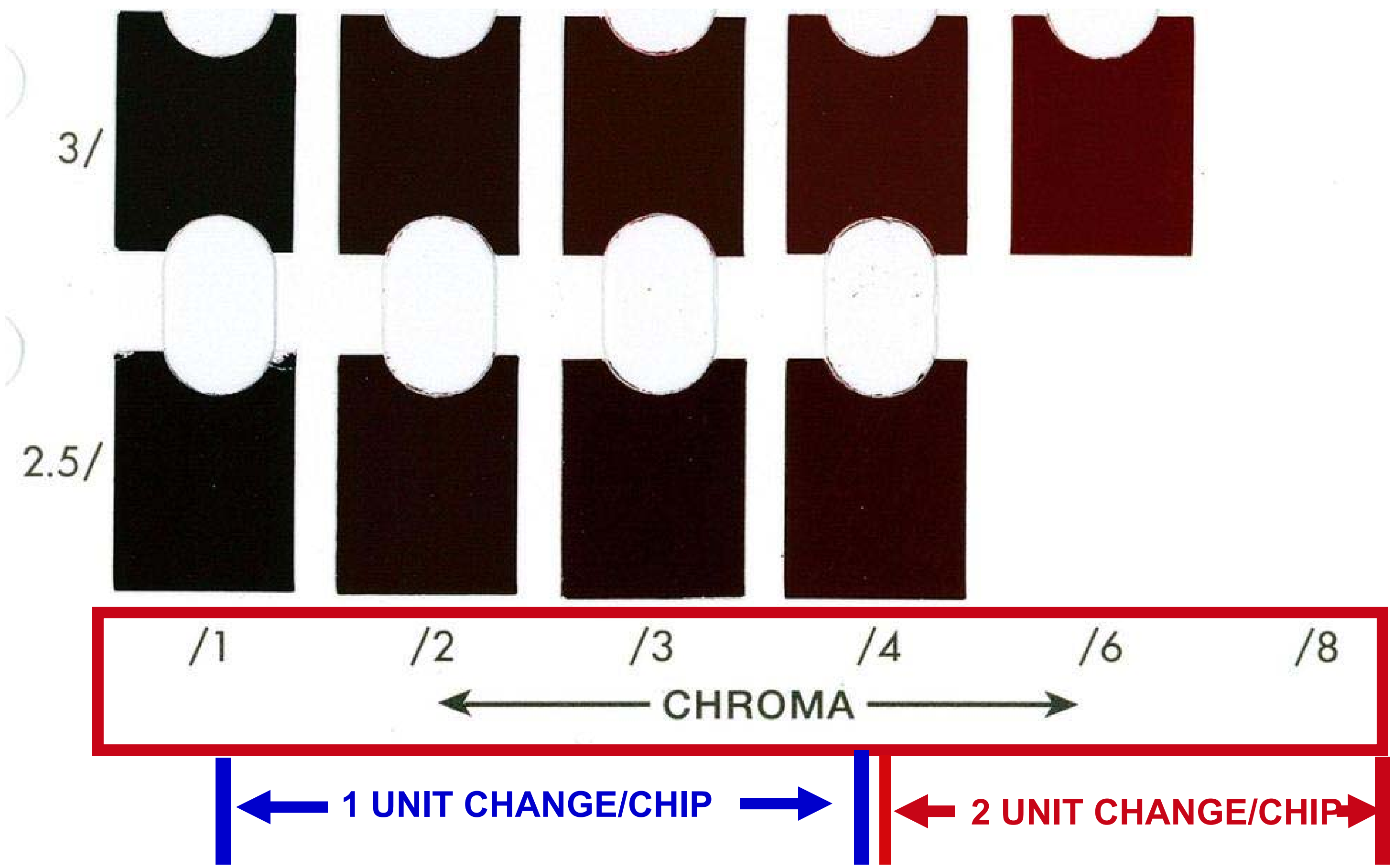


VERY IMPORTANT!!!

- ***TO DETERMINE VALUE CHANGE, CALCULATE DIFFERENCE BETWEEN THE UNITS (Value of 2.5, 3, 4, etc.) – DO NOT COUNT CHIPS !!***

Units of Chroma Change

- **Units for Chroma range from 0 to 8. There is a <u>one or two</u> unit change between each color.**



VERY IMPORTANT!!!

- ***TO DETERMINE CHROMA CHANGE, CALCULATE DIFFERENCE BETWEEN THE UNITS***
  (Chroma of 1, 2, 3, 4, etc.) –
  DO NOT COUNT CHIPS !!

Units of Chroma Change

- **For example:**

  The difference in Chroma between a 7.5YR 5/1 and a 10YR 5/2 is 1 unit. (2-1=1)

  The difference in Chroma between a 10YR 5/3 and a 10YR 5/6 is 3 units. (6-3=3)

Note that there is a change of *two chips* but is actually *a change of 3 units of chroma.*

Do not count chips!!!

Note

- **When reading values and chromas, *only those units are considered*. *Compare Value to Value and Chroma to Chroma.***
- **Change in hue does not affect the calculation of the difference between values or chromas, they are independent of each other.**
- **Simply determine the value or chroma in each color and calculate the difference without regard to hue.**

QUESTIONS???

Contrast between Soil Colors

Contrast refers to the degree of visual distinction between associated colors.

Faint – contrasts that are evident only on close examination.

Distinct -- contrasts that are readily seen but are only moderately expressed

Prominent -- contrasts that are strongly expressed.

QUESTION

- Can different people uniformly and consistently judge these subjective criteria with no other guidelines?

Not very likely!!!!

- **An objective method is used to judge Soil Color Contrast.**

USDA NRCS

Soil Survey Technical Note

No. 2

May 2002

Soil Color Contrast

Cover page

SOIL SURVEY TECHNICAL NOTE

USDA NRCS
Natural Resources Conservation Service

NATIONAL SOIL SURVEY CENTER
Federal Building, Room 152
100 Centennial Mall North
Lincoln, Nebraska 68508-3866

Soil Survey Technical Note No. 2

Soil Color Contrast

Purpose

This technical note provides uniform definitions for color contrast terms among the *Soil Survey Manual* (Soil Survey Staff, 1993), the *Field Book for Describing and Sampling Soils* (Schoeneberger et al., 1998), and the *Field Indicators of Hydric Soils in the United States* (U.S. Department of Agriculture, 1998). It also describes a new procedure to determine the difference in hue between colors.

Background

In an effort to synchronize the definition among the *Soil Survey Manual*, the *Field Book for Describing and Sampling Soils*, and the *Field Indicators of Hydric Soils in the United States*, a provisional definition for color contrasts was field tested nationally in 1998. After the testing period, a call for final comments was requested regarding final adoption of the provisional definition. The definition and other items contained in this technical note are the result of these collaborations and deliberations.

Introduction

Color contrast is the degree of visual distinction that is evident between one soil color compared with another in close proximity. In this application it is a visual impression of the prominence between a minor color component (mottle or concentration) and an associated major color component (matrix). The *Soil Survey Manual* provides three categories of soil color contrast:

1) *faint* for contrasts that are evident only on close examination,
2) *distinct* for contrasts that are readily seen but are only moderately expressed, and
3) *prominent* for contrasts that are strongly expressed.

This technical note provides guidelines to help the soil scientist assign contrast terms consistently. Determining soil color contrast is not always simple. Prominent mottles are likely the first thing one notices when observing a freshly broken piece of soil fabric. However, if a fabric has several shades and less contrast, it takes time and concentration to fully record colors and color patterns. The contrast between two colors decreases with decreasing value and/or chroma, and it becomes faint if value is 3 or less and chroma is 2 or less, regardless of differences in hue. Furthermore, there can be a considerable amount of error in distinguishing and contrasting the colors of two features, depending on the water state; the quality of light; the time of day; roughness

Definitions of soil color contrast terms

Note: If the mottle and matrix both have **values** of ≤ 3 and **chromas** of ≤ 2, the color contrast is ***Faint***, regardless of the difference in hue.

Faint - Evident only on close examination. The contrast is faint if the:

1) difference in hue = 0, difference in value is ≤2, and difference in chroma is ≤1, or
2) difference in hue = 1, difference in value is ≤1, and difference in chroma is ≤1, or
3) difference in hue = 2, difference in value = 0, and difference in chroma = 0, or
4) difference in hue is ≥ 3 and both colors have values of ≤3 and chromas of ≤2.

Distinct - Readily seen but contrast only moderately with the color to which compared. The contrast is distinct if the:

1) difference in hue = 0, and
   a. difference in value is ≤2 and difference in chroma is >1 to <4, or
   b. difference in value is >2 to <4 and difference in chroma is <4.
2) difference in hue = 1, and
   a. difference in value is ≤1 and difference in chroma is >1 to <3, or
   b. difference in value is >1 to <3, and difference in chroma is <3.
3) difference in hue = 2, and
   a. difference in value = 0 and difference in chroma is >0 to <2, or
   b. difference in value is >0 to <2 and difference in chroma is <2.

Prominent - Contrasts strongly with the color to which compared. Color contrasts that are not faint or distinct are prominent.

- **In the following slides, the symbol "Δ"(delta) means "change or difference in." For example: Δh=1 means the change of *<u>h</u>*ue between the two colors is *<u>one</u>* 2.5-unit interval.**
  Example 7.5YR to 10YR
  Use the method given in the technical note to determine hue difference.

IMPORTANT NOTE!!!

If the mottle and matrix both have values of ≤3 and chromas of ≤2, the color contrast is faint, REGARDLESS OF THE DIFFERENCE IN HUE.

Table 1 - Tabular key for contrast determination using Munsell® notation

Note: If both colors have values of ≤ 3 and chromas of ≤ 2, the color contrast is *Faint* (regardless of the difference in hue).

Hues are the same (Δ h = 0)

Δ Value	Δ Chroma	Contrast
0	≤1	Faint
0	2	Distinct
0	3	Distinct
0	≥4	Prominent
1	≤1	Faint
1	2	Distinct
1	3	Distinct
1	≥4	Prominent
≤2	≤1	Faint
≤2	2	Distinct
≤2	3	Distinct
≤2	≥4	Prominent
3	≤1	Distinct
3	2	Distinct
3	3	Distinct
3	≥4	Prominent
≥4	---	Prominent

Hues differ by 2 (Δ h = 2)

Δ Value	Δ Chroma	Contrast
0	0	Faint
0	1	Distinct
0	≥2	Prominent
1	≤1	Distinct
1	≥2	Prominent
≥2	---	Prominent

Hues differ by 1 (Δ h = 1)

Δ Value	Δ Chroma	Contrast
0	≤1	Faint
0	2	Distinct
0	≥3	Prominent
1	≤1	Faint
1	2	Distinct
1	≥3	Prominent
2	≤1	Distinct
2	2	Distinct
2	≥3	Prominent
≥3	---	Prominent

Hues differ by 3 or more (Δ h ≥ 3)

Δ Value	Δ Chroma	Contrast
Color contrast is prominent, except for low chroma and value.		Prominent

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Hues are the same (Δ h = 0)

Δ Value	Δ Chroma	Contrast
0	≤1	Faint
0	2	Distinct
0	3	Distinct
0	≥4	Prominent
1	≤1	Faint
1	2	Distinct
1	3	Distinct
1	≥4	Prominent
≤2	≤1	Faint
≤2	2	Distinct
≤2	3	Distinct
≤2	≥4	Prominent
3	≤1	Distinct
3	2	Distinct
3	3	Distinct
3	≥4	Prominent
≥4	---	Prominent

- **Δh = 0:**
- **3 Faint**
- **9 Distinct**
- **5 Prominent (Note that a Δ value or Δ chroma ≥4 is prominent)**

Hues differ by 1 (Δh = 1)		
Δ Value	**Δ Chroma**	**Contrast**
0	≤1	Faint
0	2	Distinct
0	≥3	Prominent
1	≤1	Faint
1	2	Distinct
1	≥3	Prominent
2	≤1	Distinct
2	2	Distinct
2	≥3	Prominent
≥3	---	Prominent

- **Δh = 1**
- **2 Faint**
- **4 Distinct**
- **4 Prominent (Note that a Δ value or Δ chroma ≥3 is prominent**

Hues differ by 2 (Δ h = 2)

Δ Value	Δ Chroma	Contrast
0	0	Faint
0	1	Distinct
0	≥2	Prominent
1	≤1	Distinct
1	≥2	Prominent
≥2	---	Prominent

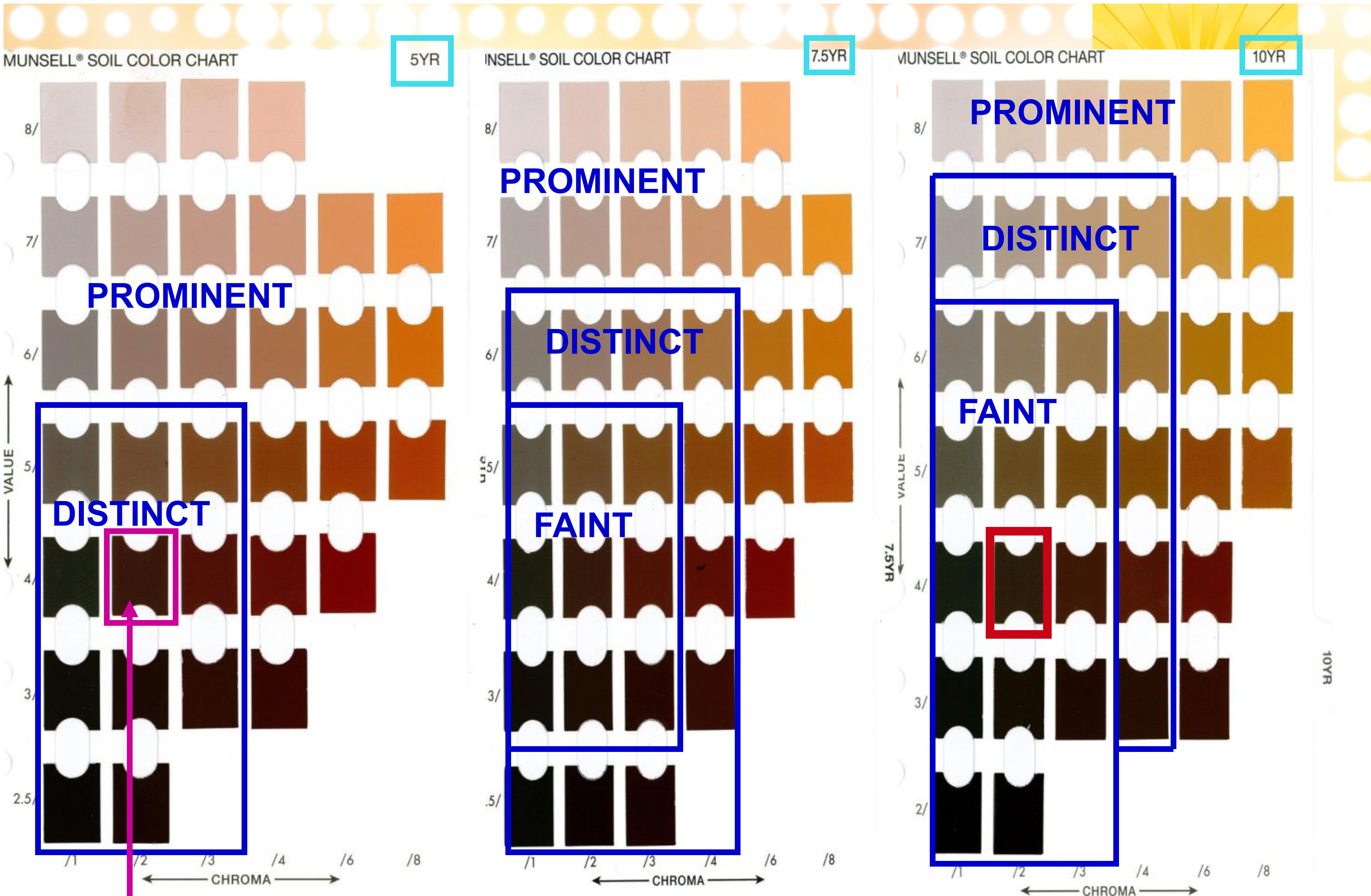
- **Δh = 2**
- **1 Faint**
- **2 Distinct**
- **3 Prominent (Note that a Δ value or Δ chroma ≥ 2 is prominent)**

Hues differ by 3 or more ($\Delta h \geq 3$)		
Δ Value	Δ Chroma	Contrast
Color contrast is prominent, except for low chroma and value.		Prominent

Δh = 3

<u>All color contrast is prominent by definition -</u>

<u>EXCEPT FOR THOSE VALUES ≤3 AND CHROMAS ≤2, WHICH ARE FAINT BY DEFINITION REGARDLESS OF HUE CHANGE</u>



Using matrix Color 10YR 4/2 (red box area) the soil color contrast comparison is:

If you believe you have found a discrepancy in the chart:

USE “DEFINITION OF SOIL COLOR CONTRAST TERMS”

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.
- So, what is the required volume redox features must occupy to count as "common" or "many"?

Quantity of Redoximorphic Features (few, common, many)

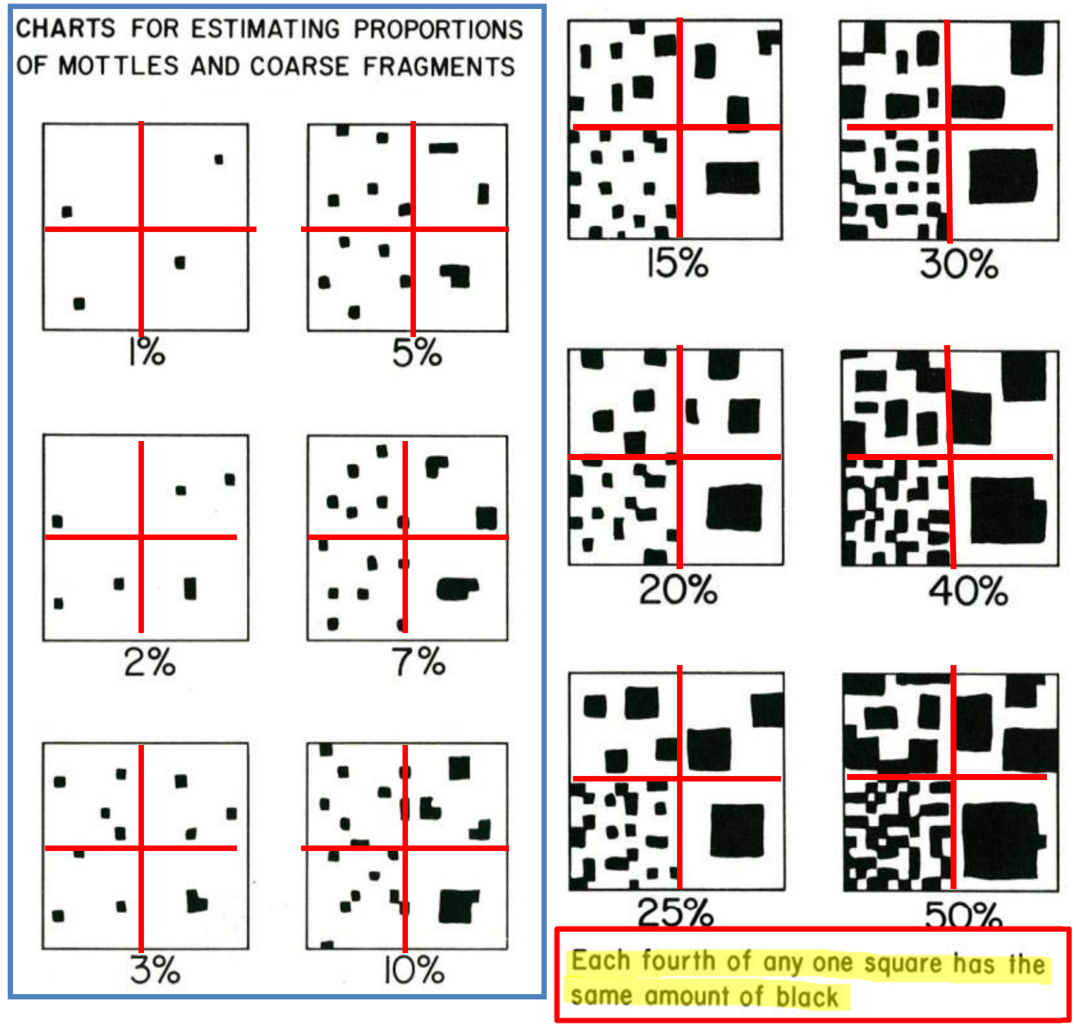
- **The following amounts correlate with *specific* percentages:**
- **Few -- less than 2% (<2%)**
- **Common -- 2 to 20% (2-20%)**
- **Many -- more than 20% (>20%)**

Determination of the quantity of Redox Features

- Use the "Charts for Estimating Proportions of Mottles and Coarse Fragments" found in the Munsell Soil Color Charts. These will quantify the amount of redox features.

Abundance and Size of Color Contrasting Areas

- **Size of mottles**
  Fine < 5 mm
  Medium 5 to 15 mm
  Coarse > 15 mm
- ***Note that the size of the mottles do not matter, only the amount.***



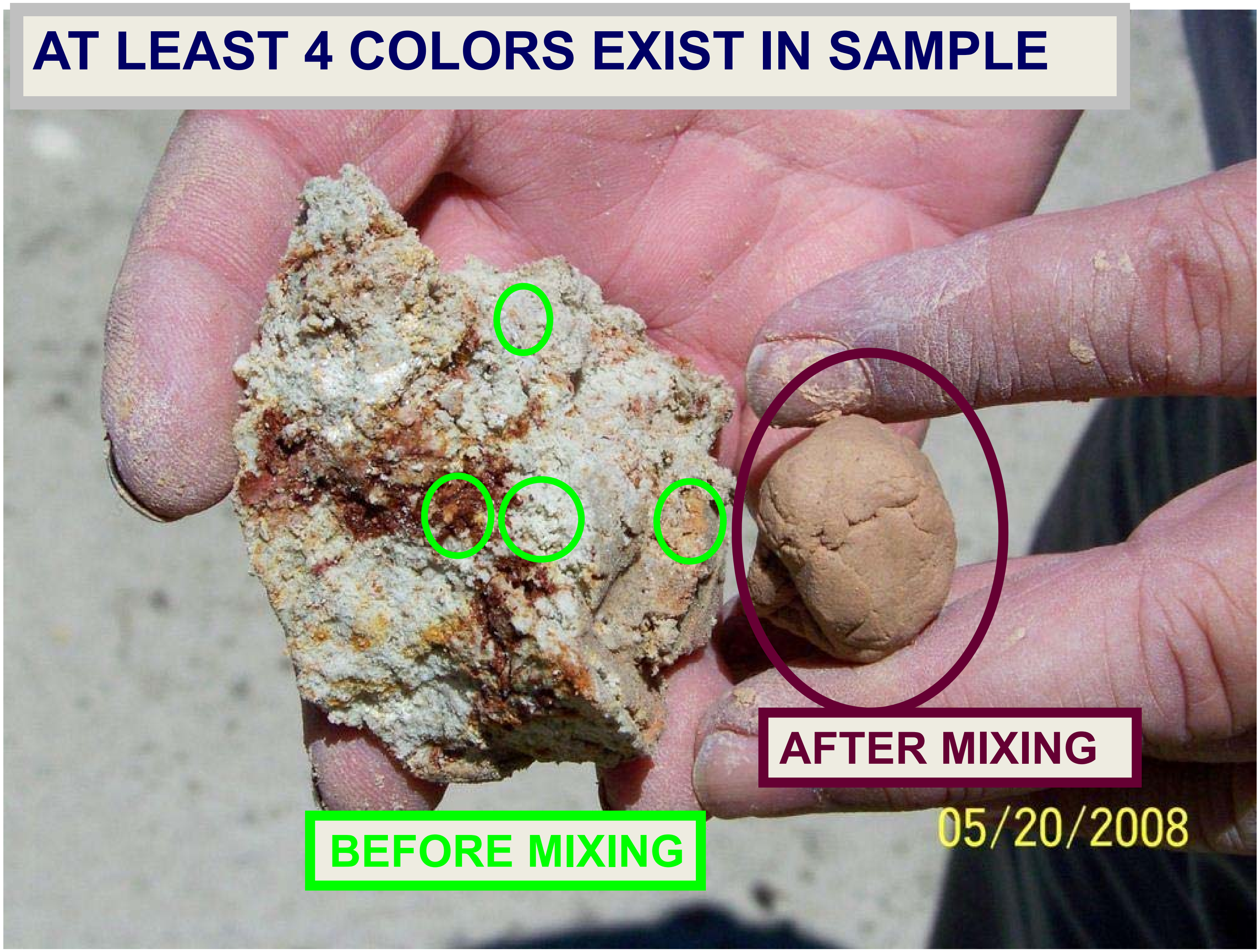
QUESTIONS??

Florida HEALTH

Is texturing or coloring performed first?

- Coloring-Redoximorphic features could be overlooked due to the physical manipulation of the soil if it was textured first.
- All colors in the sample are recorded before texturing. Multiple colors easily blend.
- The same soil sample should be used to both color and texture, increasing the accuracy of the profile.

See what happens?



Where is the best place to get the soil sample?

- The sample to be colored (and textured) should come from an area that has not been disturbed or contaminated from the process of taking the sample (e.g. turning of the soil auger). For example, in heavier textured soils, the outside of the sample is often marred by the turning of the auger and is contaminated by soil above it. The true color (or texture) of the soil is not necessarily on the outside of the sample.

Heavy textured soils (loams and clays)

- The sample must be obtained from the area of least disturbance, normally the middle of the sample.
- The soil sample should be broken longitudinally to observe the colors and to collect the sample for texturing.

EXAMPLE IN AUGER BUCKET

Outside of sample-air got to sample, reduced matrix forming

INSIDE THE AUGER BUCKET

Inside of sample-no oxidation-depleted matrix is observed

Sandy soils

- Sandy soils are not easily removed from the bucket in one or two large pieces.
- The sample still must come from an unadulterated area. Make sure that what you are looking at is from the horizon in question, not debris from a different source (soil falling into hole or onto sample).


SANDY SOIL WITH REDOX

- **Careful observation is required. Redox features can be missed when using a bucket auger. Take the time necessary to make proper observations.**
- ***<u>Use a sharpshooter-type shovel</u> to remove a plug of soil to determine the depth to the uppermost SHWT feature. The larger soil sample size makes it easier to see soil features. Some redox features are harder to see in an auger.***

Florida HEALTH

Approximate comparison between samples found in auger and sharpshooter-type shovel

Soil Formation - Horizons

What is a "Soil Horizon"?

Soil Horizon Basics

- A soil horizon is a layer of soil, approximately parallel to the surface, having distinct characteristics produced by the soil-forming process.
- Soil has natural organization and is biologically active. This is a result of several factors that will be discussed in a later presentation.
- Individual kinds of soils are distinguished by their specific sequence of horizons, or “soil profile.” The characteristics and vertical sequence of these horizons vary in natural patterns across the landscape.

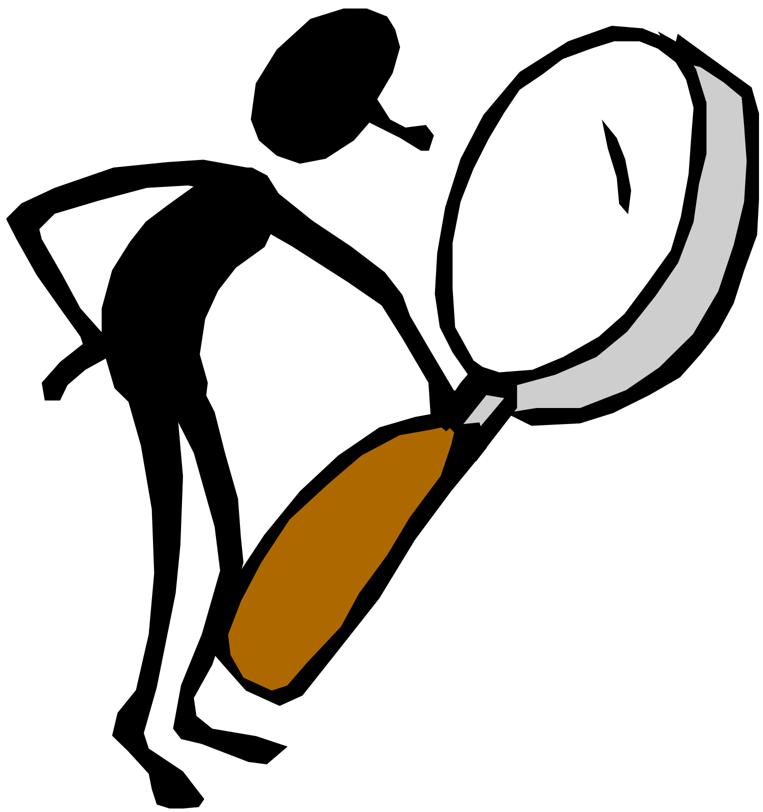
Horizon

Florida Soil

- Individual layers within a soil where changes occur.

All are a soil "horizon"

SOIL: COMPONENTS AND TEXTURES



The following are the soil textures employed by USDA NRCS (therefore by DOH)

- ***Note that very coarse sand and coarse sand are combined into the classification of "coarse sand" when determining textures.***
- ***Red indicates Sandy SHWT indicators used***
- ***Gray means Loamy/Clayey SHWT indicators used.***

VCOS very coarse sand	COS coarse sand	S sand
FS fine sand	VFS very fine sand	LCOS loamy coarse sand
LS loamy sand	LFS loamy fine sand	LVFS loamy very fine sand
COSL coarse sandy loam	SL sandy loam	FSL fine sandy loam
VFSL very fine sandy loam	L loam	SIL silt loam
SI silt	SCL sandy clay loam	CL clay loam
SICL silty clay loam	SC sandy clay	SIC silty clay
C clay	MARL is written out	MK mucky
PT peaty	GR gravelly or gravels	MUCK is written out
PEAT is written out	Hard Rock is written out	Soft Rock is written out

**NOTE **

- THE TEXTURE OF LVFS IS CONSIDERED TO BE A LOAMY TEXTURED SOIL FOR PURPOSES OF REDOX FEATURE IDENTIFICATION.

Why is Soil Texture Important?

- Soil texture controls which redoximorphic features are used to determine the seasonal high water table.
- Soil texture also controls the size of the drainfield/unobstructed area (assuming same estimated daily sewage flow).

COMPONENTS OF THE SOIL

There are ***4 basic components*** of soil.

- ***Minerals (particle size)***
- ***Organic Matter***
- ***Water***
- ***Gases***

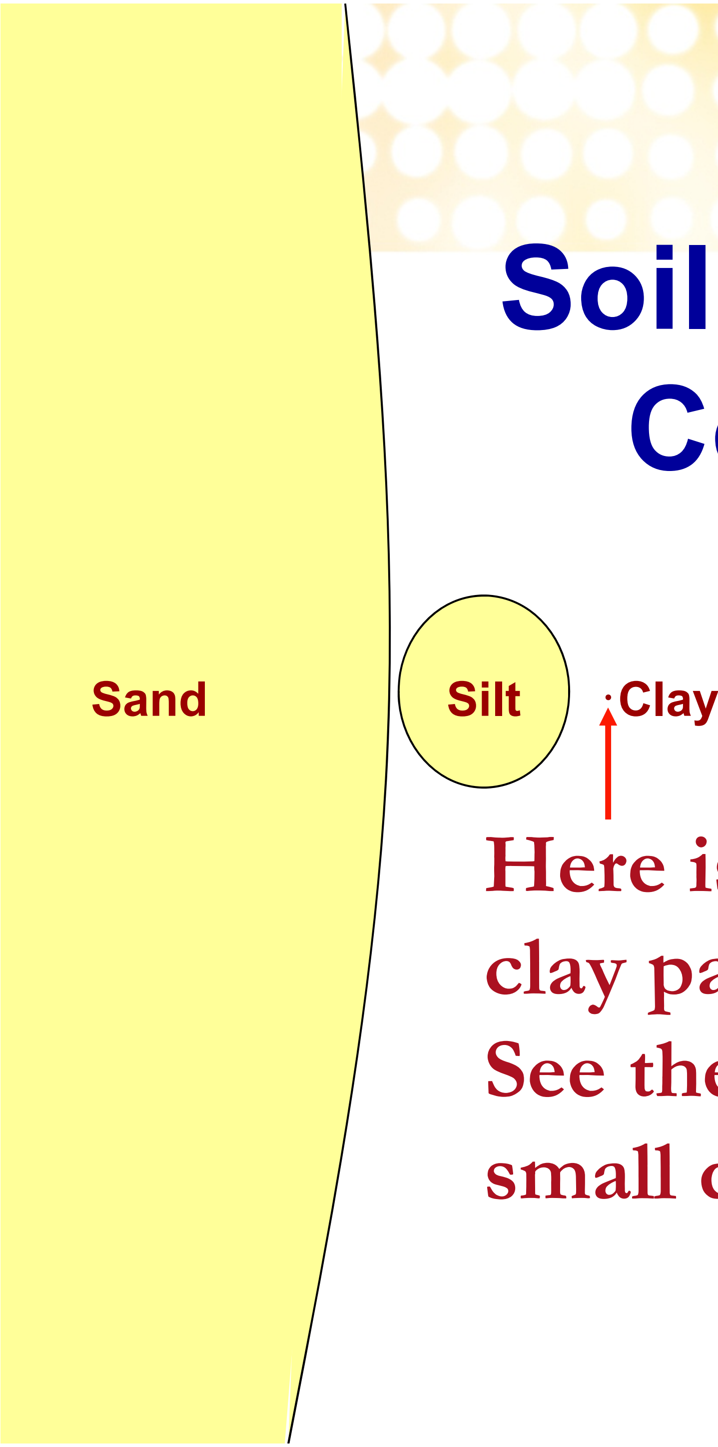
Soil Minerals: Particle Size

- For DOH purposes, only mineral particle size is considered, as opposed to the material from which the particle is made.
- Mineral size is broken down into three main categories.

Three Mineral Particle Sizes

- *Sand:* 2.00-0.05 mm
- *Silt:* 0.05-0.002 mm
- *Clay:* <0.002 mm
  (2 millionths of a meter)

Soil Particle Size Comparison



Here is the clay particle. See the very small dot?

SAND facts

Largest Mineral Particle

- **Size is 2.0 mm to 0.05 mm in diameter**
- **Individual particles visible without magnification**
- ***Gritty when Rubbed***
- ***Barely holds together when moist***
- **Water Movement is Rapid to Very Rapid (large pores)**

Note how the sand does not hold together

SAND Size Subdivisions

- Fine Sand and Medium Sand (medium sand is referred to as "sand") are the most common of the sand sizes that are found in Florida.

- Sand is the only particle size that is subdivided into smaller categories for texturing purposes.

SAND Size Subdivisions

- **Very Coarse Sand: 2.00 - 1.00 mm; t*hickness of nickel to just under a dime***
- **Coarse Sand: 1.00 – 0.50 mm; *about 4 sheets of standard paper thickness (smallest)***
- **Medium Sand ("*Sand*"): 0.50 – 0.25 mm; *sugar grain size***
- **Fine Sand: 0.25 – 0.10 mm *pen point or strand of hair, thickness of business card***
- **Very Fine Sand: 0.10 – 0.05 mm *use magnifying glass to see***

Silt

SILT facts

- **Intermediate in diameter between sand and clay**
- **Size is 0.05 mm to 0.002 mm in diameter**
- **Difficult to see without magnification**
- ***When moist or dry, feels smooth and floury; silky***
- ***Primarily found on floodplains of rivers and areas in the southern part of Florida* – (rare in Florida, but more abundant in SW Florida)**

Clay

CLAY facts

- *Smallest mineral particle*
- **Size is <0.002 mm in diameter**
- **Individual particles can only be seen with a strong microscope**
- **Water moves slowly through clay (small pores)**
- ***Sticky when moist – molds easily into shapes***
- **Rare to find pure clay (common to find pure sand)**

Soil Texture

The percentage of *Sand, Silt* and *Clay* particles in sample of soil material.

If we have sand, silt and clay size particles, what is *LOAM*?

Loam

- **Is not a soil particle size.**
- **Is a *soil texture* composed of specific percentages of sand, silt and clay.**
- **When texturing, a loam *feels like* equal parts of sand, silt and clay (feels somewhat gritty, yet fairly smooth and slightly plastic. When moist, it forms a cast that may be handled quite freely without breaking). It does not have equal parts of each separate, but can be thought of as all the separates having approximately equal activity.**

Common Soil Textures in Florida

Fine Sand (FS)

Sand (S)

Loamy Fine Sand (LFS)

Loamy Sand (LS)

Fine Sandy Loam (FSL)

Sandy Loam (SL)

Sandy Clay Loam (SCL)

Sandy Clay (SC)

most common

QUESTIONS?

PROPER TEXTURING METHODOLOGY FOR MINERAL SOILS

Touch Texture Method

First, a note on WHAT to texture

- *MAKE SURE THE SAMPLE HAS NOT BEEN CONTAMINATED!!*

- **The soil to be textured *must not* be contaminated from *any* other source material. For example:**
- **Soil falling in from above the sample**
- **Soil translocated from above, such as the outside of the sample having soil material from above adhering to the auger**
- **Soil material *covering your hands from previous texturing.***
- **The sample *must* be from the horizon in question.**

- For loamy and clayey soils, it is normally best to get the sample from the interior of the auger sample (for ***texturing and coloring***). Break the soil sample along the long axis and retrieve the sample from the middle.
- And don't forget------

CLEAN YOUR HANDS FIRST!!!!

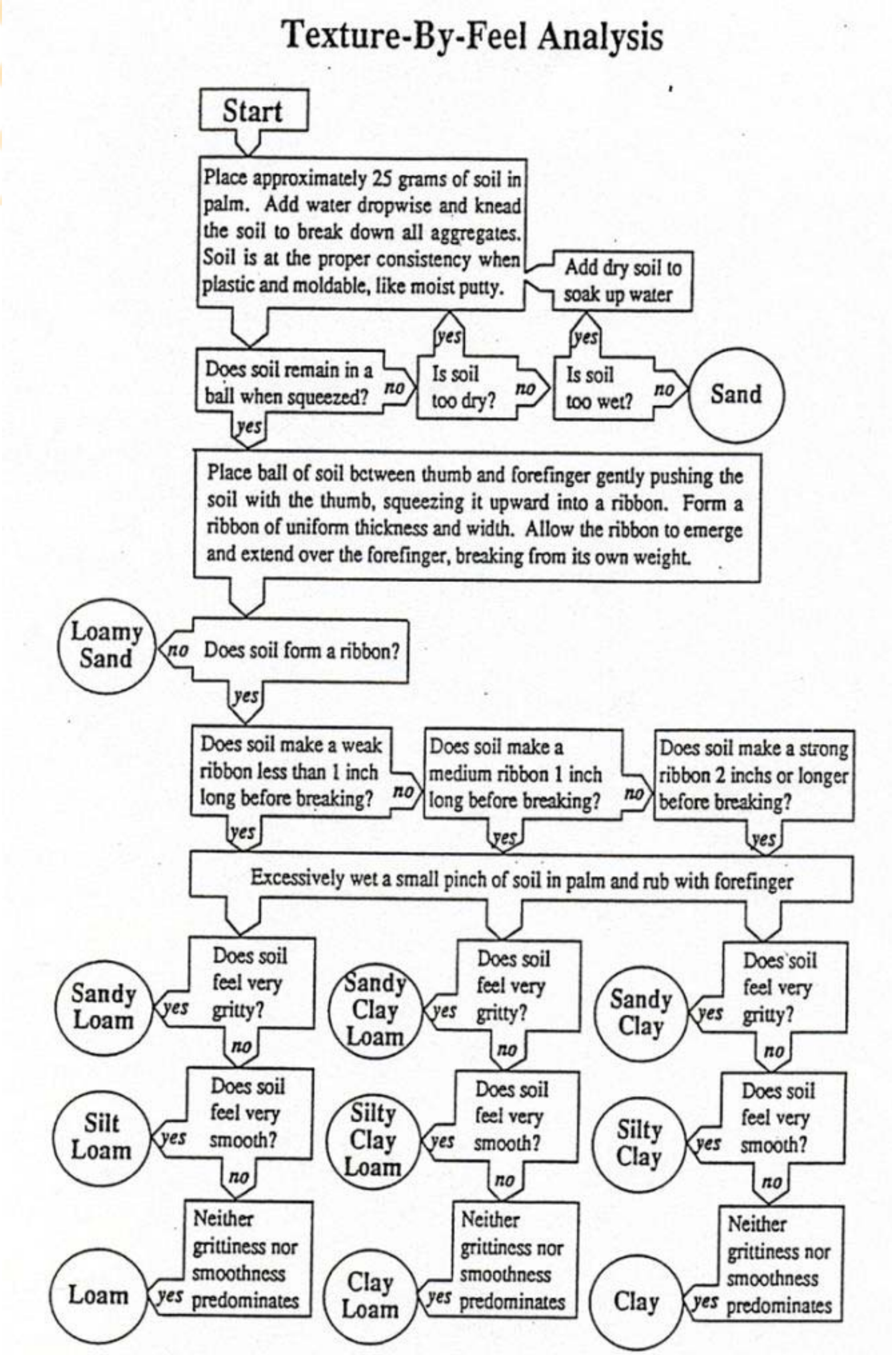
- *Misidentifying the texture can easily lead to using the wrong Redoximorphic Features!!!*
- Loamy Sand: Redox Concentrations
  Sandy Loam: Redox Depletions

Correct methodology for Mineral Texture determination

What is Mineral Texture?

- Mineral texture is the *soil texture due to the particle size of the minerals that are present*.
- This *DOES NOT* include any organic portions that may be in the soil sample.
- If there is enough organic material in the soil it may hold together, but it really does not qualify as a soil ribbon for mineral soil, therefore it is unusable for texturing.

- How much soil? Really need enough to work with, depends on your hand size. Try a tablespoon or so. Don't get too much/little.
- Ribbon needs to be uniform thickness and width. *Thickness of ribbon should be approximately 2 mm. The thickness of a nickel is 1.95 mm.* A quarter is 1.75 mm thick and a dime is about 1.35 mm thick.
- Ribbon width will vary between people due to width of the thumb.

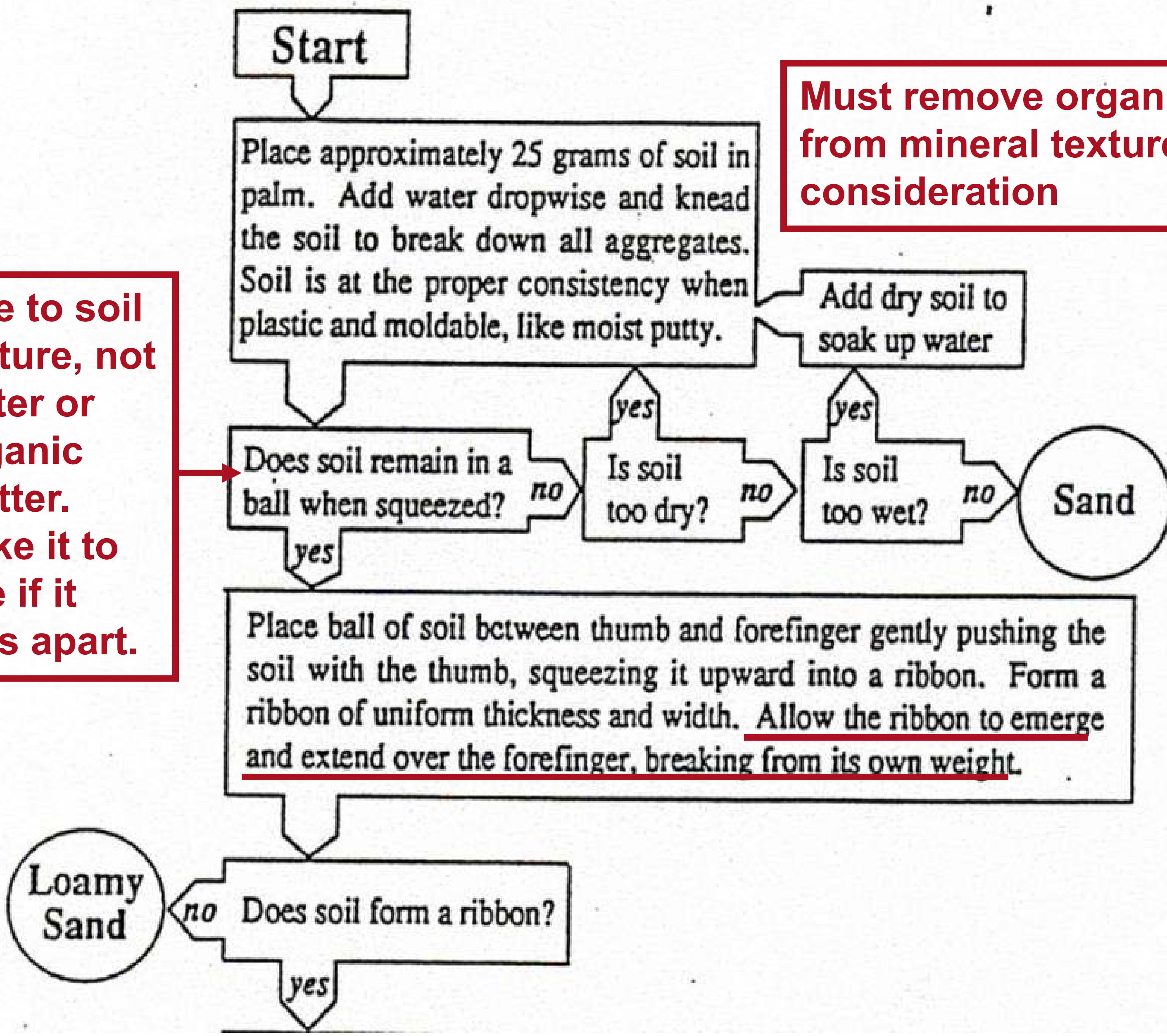


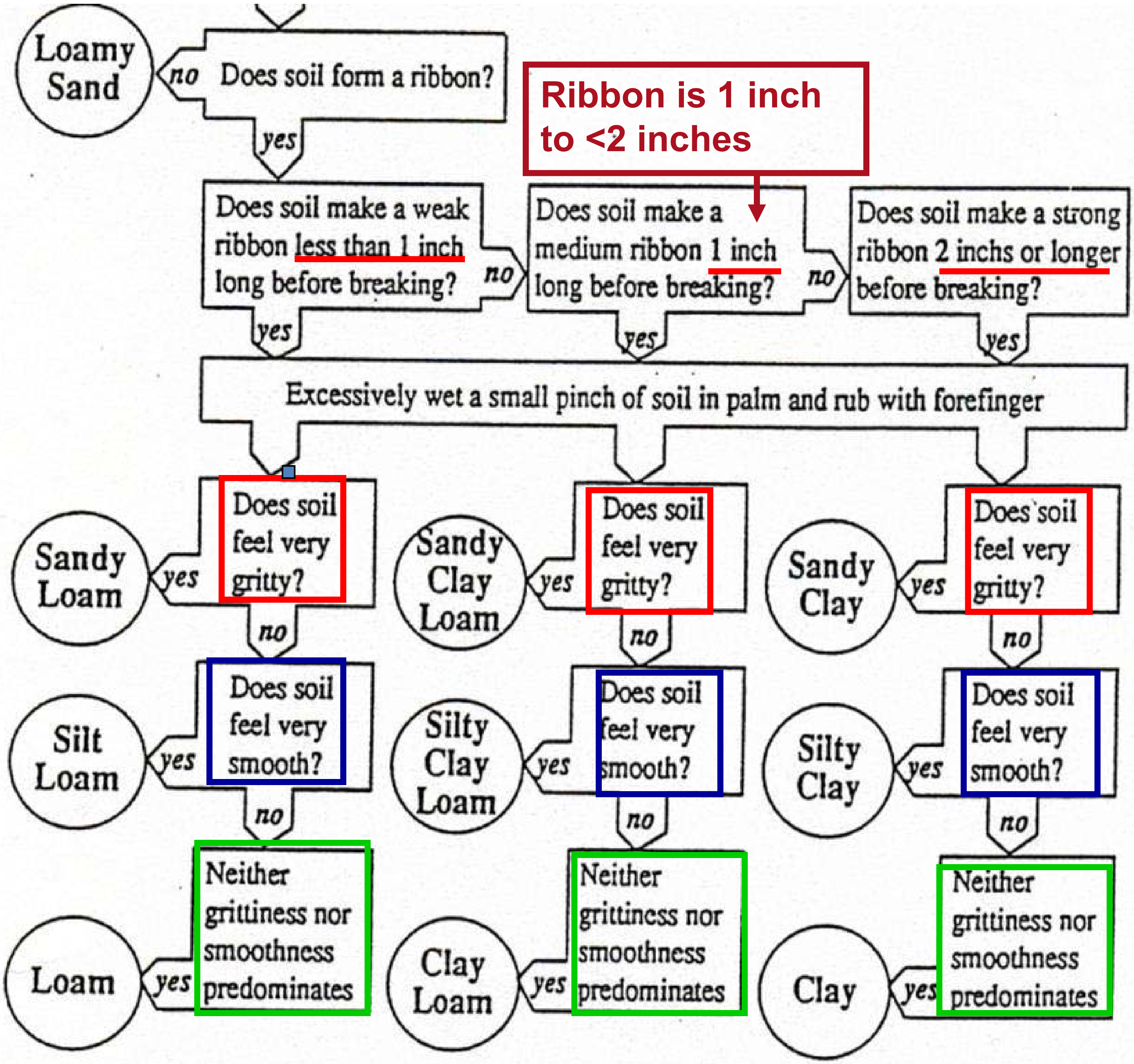
- Texture-by-Feel
- Methodology *__Mineral Soil Only__*

Texture-By-Feel Analysis

Must remove organics from mineral texture consideration

Due to soil texture, not water or organic matter. Poke it to see if it falls apart.





Loamy Sand
no
Does soil form a ribbon?
yes
Ribbon is 1 inch to <2 inches
Does soil make a weak ribbon less than 1 inch long before breaking?
no
Does soil make a medium ribbon 1 inch long before breaking?
no
Does soil make a strong ribbon 2 inchs or longer before breaking?
yes
yes
yes
Excessively wet a small pinch of soil in palm and rub with forefinger
Sandy Loam
yes
Does soil feel very gritty?
no
Sandy Clay Loam
yes
Does soil feel very gritty?
no
Sandy Clay
yes
Does soil feel very gritty?
no
Silt Loam
yes
Does soil feel very smooth?
no
Silty Clay Loam
yes
Does soil feel very smooth?
no
Silty Clay
yes
Does soil feel very smooth?
no
Loam
yes
Neither grittiness nor smoothness predominates
Clay Loam
yes
Neither grittiness nor smoothness predominates
Clay
yes
Neither grittiness nor smoothness predominates


Note how the ribbon extends past the finger

Sandy Soils

- *DO NOT FORM RIBBONS!!!!*
  (Loamy Very Fine Sand will act more like silt and be somewhat gritty and malleable, but won't ribbon.)

Loamy and Clayey Soils

- All loamy and clayey soils form ribbons with length being the deciding factor to determine texture.
- *Loams form shorter ribbons*
- *Clays form longer ones.*

What about texturing Silt???

- Silt lacks grittiness and feels extremely floury or silky when moist or dry. It will not ribbon and forms a weak ball that bears careful handling without breaking. Is malleable (able to be shaped/formed).

Organic Matter (OM) and Texturing

- Mineral Texture does not include OM
- Must remove OM from consideration of mineral portion
- If enough OM in sample, the texture of mineral material would be modified
- Do not confuse a FS soil with enough organics to make it form a ball with a LFS – *THEY ARE NOT THE SAME*.

Organic soils/components

- Organic material in mineral soils add difficulty in texturing.
- For example, soil from a spodic layer may adhere, *but it is not due to the content of mineral particles* (sand, silt and clay). It is due to the adhesiveness of the organic particles.
- *The Near Saturated Rub Test is used to determine muck, mucky peat, or peat. This information is then added to the mineral component, if any. This procedure will be discussed in the Hydric Soils Presentation.*

Soil Texturing: Sand

Soil Texturing: Clayey soil

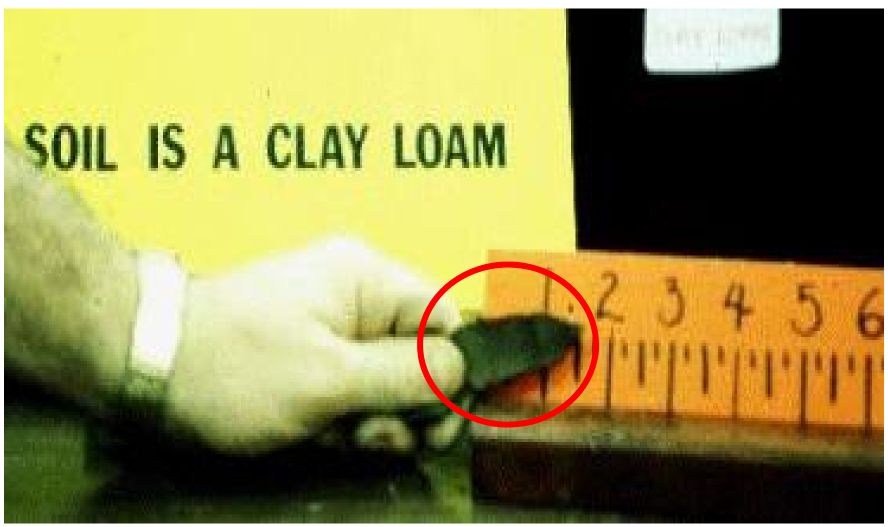
Clayey soil starting to ribbon

Clayey soil >2” ribbon

Soil Ribbon Comparison


SANDS WILL NOT
FORM A CAST


SOIL IS A LOAM
1 2 3 4


SOIL IS A CLAY LOAM
1 2 3 4 5 6


SOIL IS A CLAY
1 2 3 4 5

Soil Texture Names

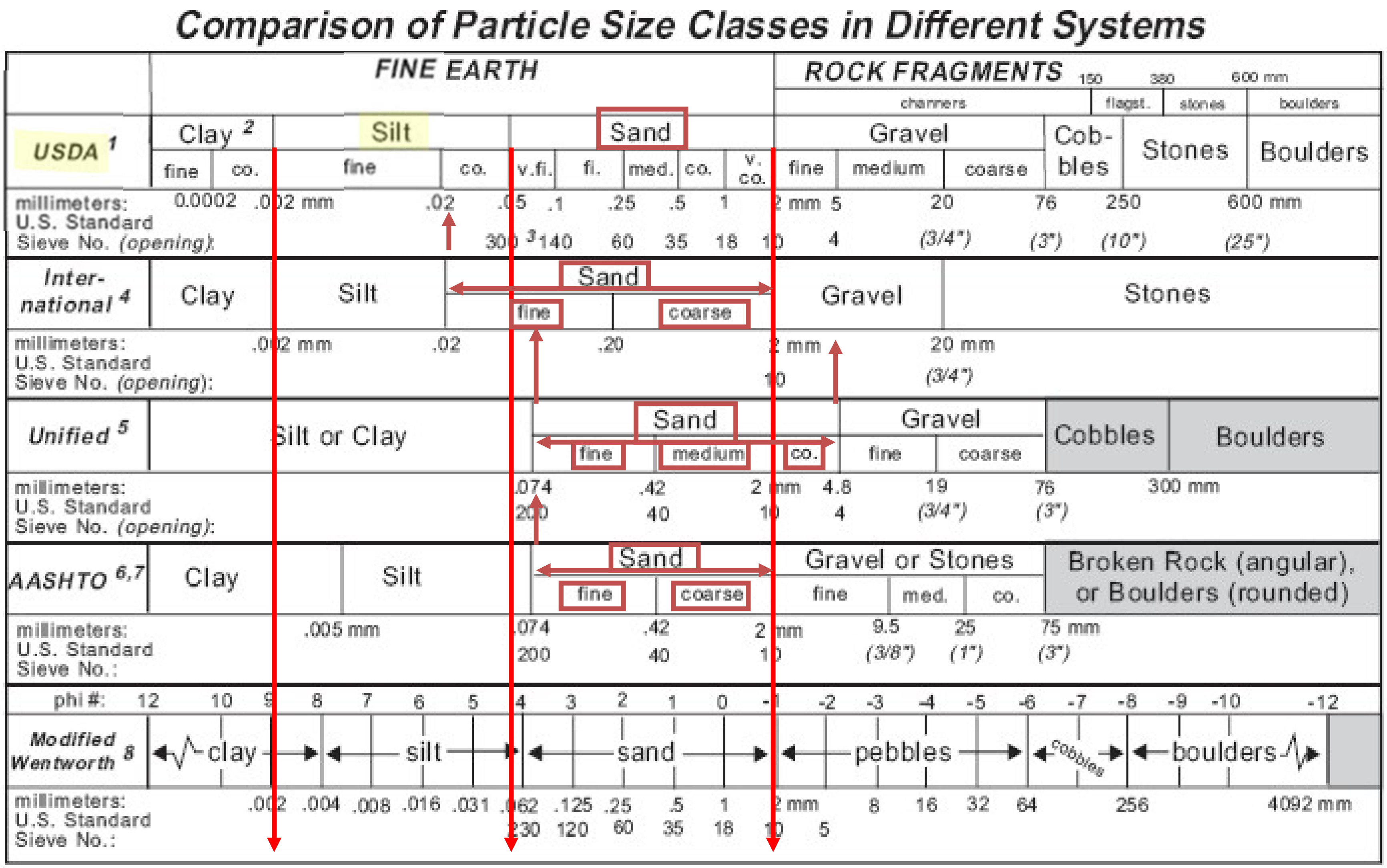
- The major fraction is the *LAST* part of the name.
- So, a sandy soil includes:
- All things with SAND as the dominant particle size (e.g. loamy sand or LS).
- The texture of Sand can also be broken down to Very Coarse, Coarse, Medium, Fine and Very Fine.

- As stated earlier, the only soil particle size that is divided into smaller subgroups is SAND.
- This means that when naming soils, the same information is used.
- For example: Fine Sandy Loam (FSL) means the soil is mostly loam, and the sand portion is fine sand. Compare to "Fine loamy sand" – there is ***NO*** texture recognized with this name. Loam is not further divided, so one cannot have a "fine loamy" anything.

Organic modified textures:

- When organic soils are found in combination with mineral soils, the organic soil is the modifier, not the prominent portion.
- Muck, mucky peat or peat would be added to any soil texture BEFORE the texture is named.
- This means that while a Mucky Sand is allowed as a name, Sandy Muck is not.

Comparison of Particle Size in Different Systems

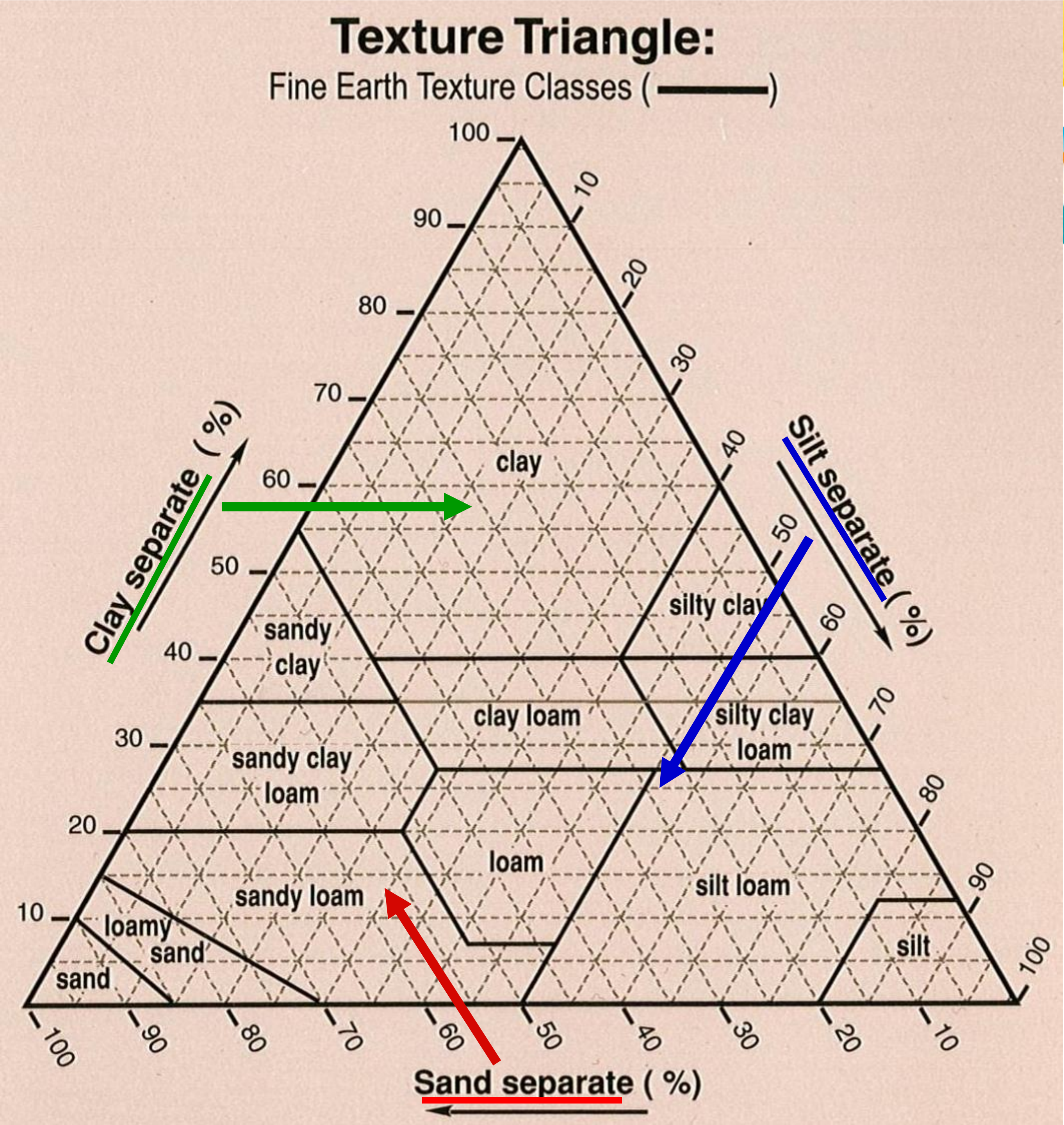


The Textural Triangle

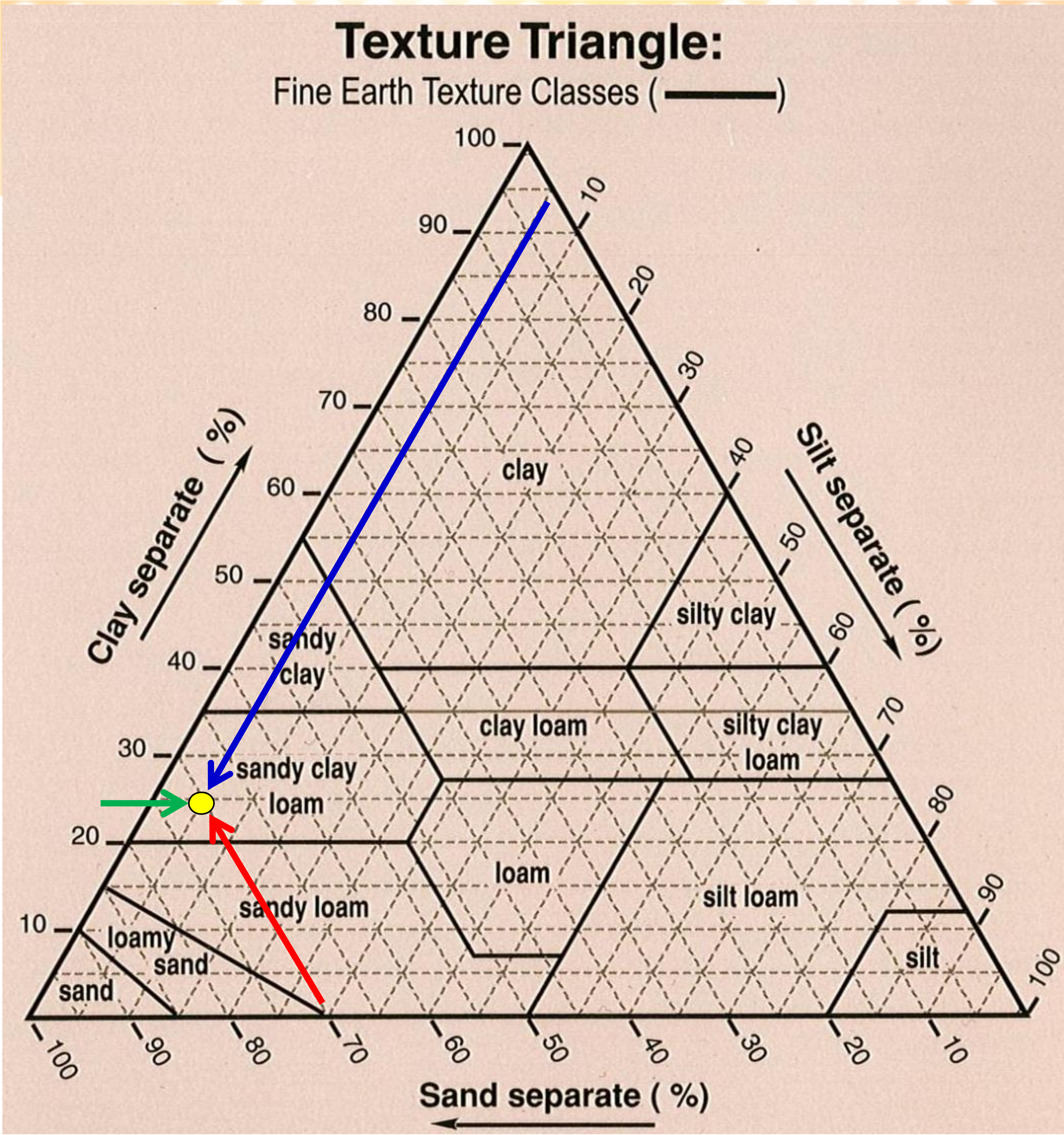
- **Used to simplify description of particle size mixtures (i.e. texture, but is limited for OSTDS purposes as it does not differentiate sand sizes)**

- **USDA NRCS Soil Textural Classification is required by rule. *Only scheme acceptable by regulation.***

- **12 classes of soil texture are depicted on a 3-axis graph**



Texture Triangle:
Fine Earth Texture Classes (▬)
Clay separate (%)
Silt separate (%)
Sand separate (%)
clay
sandy clay
silty clay
clay loam
silty clay loam
sandy clay loam
loam
sandy loam
silt loam
loamy sand
sand
silt



70% Sand (size?)
25% Clay
5% Silt
is SCL

Whenever the point falls on a line, the evaluator MUST go with the more stringent soil texture according to NRCS methodology.

- This means finer texture.
- If the point falls on the line between loamy sand and sandy loam, the texture is classified as Sandy Loam.

CAUTIONS ON LAB ANALYSIS

- MAKE SURE THAT THE RESULTS ARE UNDERSTOOD!
- WHAT METHODS WERE USED?
  SIEVE ANALYSIS?
- *THE RESULTS MUST ACCOUNT FOR SAND GRADATION AS WELL AS SILT/CLAY CONTENT*

When supplying soils samples to a lab always ensure a <u>complete texture determination</u> is made. This must include a sieve analysis to determine the sand size.

Read the “Bits and Pieces” presentation for more information on Coarse Fragments.

QUESTIONS?

Class Exercise

on

Texturing

Please get your hands dirty!!!

TEXTURE MODIFIERS

Particle Sizes Larger Than The Fine Earth Fraction

A.K.A.

"Bigger Than Soil" Particles

- Particle sizes ≤2 mm are soil particles, i.e. the FINE EARTH FRACTION, (including shell fragments). *This is what is used to determine the mineral soil texture*.
- As long as fragments that are >2 mm occupy <15% of the *volume* of the sample, the soil name is not modified.
- Once 15% is reached, name is modified.

TEXTURE MODIFIERS - Conventions for using "Rock Fragment Texture Modifiers" and for using textural adjectives that convey the "% volume" ranges for **Rock Fragments - Size and Quantity.**

Fragment Content % By Volume	Rock Fragment Modifier Usage
< 15	No texture adjective is used (noun only; e.g., *loam*).
15 to < 35	Use adjective for appropriate size; e.g., *gravelly.*
35 to < 60	Use "very" with the appropriate size adjective; e.g., *very gravelly.*
60 to < 90	Use "extremely" with the appropriate size adjective; e.g., *extremely gravelly.*
≥ 90	No adjective or modifier. If ≤ 10% fine earth, use the appropriate noun for the dominant size class; e.g., *gravel.* Use **Terms in Lieu of Texture.**

NON-SOIL PARTICLES (Coarse Fragments)

- Particles >2 mm are not soil particles (i.e. the fine-earth fraction), they are Coarse Fragments and have several names. They do figure into the overall texture of a soil by ***modifying the mineral soil texture***.

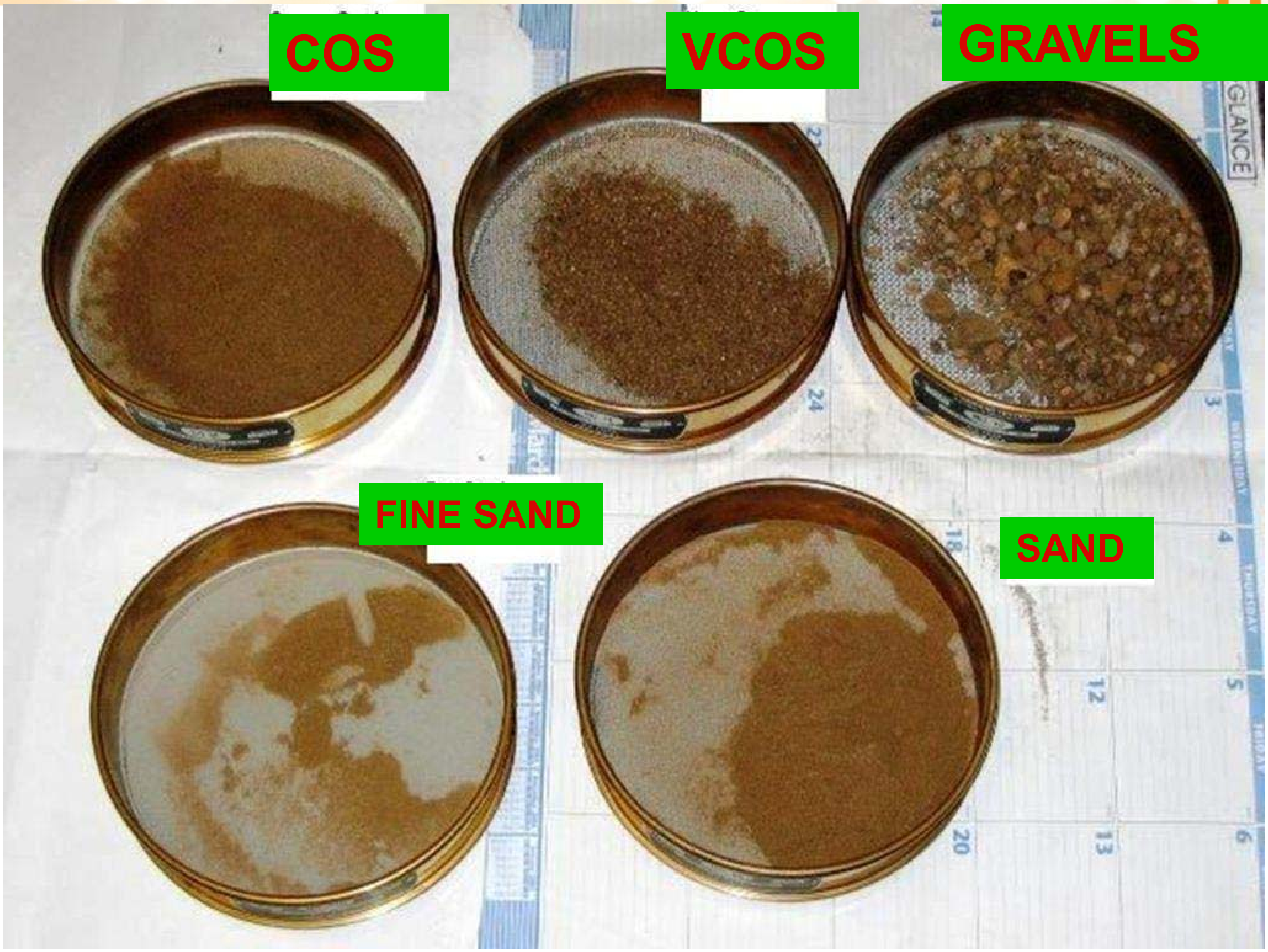
- When the particle size <u>exceeds</u> 2mm, it moves out of the very coarse sand texture and is no longer a soil particle. These items can include shells, rocks, or other non-soil (non-fine earth) items. The modifier *gravelly* or "GR" is used when the fragment content by volume is $\geq$15% to <35%. Gravels range in size up to 75mm (3 inches).

For example

- If there are 20% shell fragments that are 3-75mm in size and the soil texture is sand, the proper texture for that soil would be gravelly sand, or GR S. This example is an unsuitable soil type, as it is severely limited and could not be used for system installation. Use the "Charts for Estimating Proportions of Mottles and Coarse Fragments" found in the Munsell book to determine the percentage of fragments.

Soil Texture Determination

- Must remove the gravels (non-soil particles) from consideration of the soil-size particles in order to get actual soil texture (if ≥ 15% by volume of the soil horizon). (See next slide for example)
- This is done by running the soil sample through a nest of sieves.
- After the non-soil particles are removed, the remaining sample is the entire soil sample and will be used to determine the texture of the mineral soil (fine-earth) fraction.


COS
VCOS
GRAVELS
FINE SAND
SAND

Mineral Texture

- Remove gravels from consideration as they are >2 mm in size and <u>do not count as part of the mineral soil texture.</u>
- The remaining sieves with the VCOS, COS, S, FS, and VFS (plus the pan) comprise 100% of the mineral soil sample.
- The gravel portion will modify the mineral texture name only if it occupied at least 15% of the volume of the soil horizon.

Soil Texture Determination

- Once mineral soil texture is determined, will add the proper adjective (e.g. gravelly, very gravelly, etc.) to properly name the soil.
- Example:
  Gravelly Loamy Fine Sand indicates that ≥15% and <35% gravels occupies the volume of the soil horizon whose soil texture was a Loamy Fine Sand.

Notes on Proper Use of Texture

- There is no acceptable texture such as "shelly sand" as the word "shell" has no actual meaning for size. Shell is a type of particle, *not the size of a particle*.
- Use the proper adjective to describe the coarse fragments of the soil horizons.

Read the “Bits and Pieces” presentation for more information on Coarse Fragments.

Organic Matter (OM)

The second solid component of soils and consists primarily of pieces and parts of plants that are in various states of decay. Sometimes called humus.

Organic Matter (OM)

- Effects of Organic Matter on Mineral Soils

  -increasing water holding capacity
  -adds tilth, less compacted or loosen
  -*DARKENS THE SOIL COLOR*

- Organic Matter in Dry vs. Wet Soils

  Which has more?? (Wet has more)

- Kinds of Organic Material (Most to Least decomposed)

  \- Muck *(Sapric);* Mucky Peat (*Hemic*);
  Peat (*Fibric*)


NOTE REDDISH
COLORATION

Water: The Mobile Soil Component

- The third component of soils. Water moves over and between soil particles in the pore spaces.
- Pore spaces - most soils contain approximately 50% pore space and they are filled with gas (e.g. air) or water. *Porosity* is the amount of pores in a given area.
- The movement of liquids (and air/gases) through the soil is *VERY* important for OSTDS considerations.
- Permeability – the rate at which water moves through the soil.

Gases

- The fourth basic component of soil.
- Occupies the pore space that does not have liquid in them.

Soil Compaction

- Compaction ***decreases*** the permeability and porosity of the soil
- ***Reduces*** the ability of the soil to transfer liquids or gases between soil particles.

Compaction?

The previous picture was from a MOUND SYSTEM.

End of presentation

QUESTIONS???