Soil Components and Textures APRIL 2015

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OBJECTIVES

- Define and describe allowable methodology and proper use of USDA NRCS soil texturing methodology

NOTE

Additional information on certain slides will be found in the "NOTES" section and will only be visible in the "normal" view in PowerPoint. See ## to designate these slides.

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

The soils are divided by use of seasonal high water table (redoximorphic) features: those used for sandy soils versus finer textured soils

Soils using the Sandy Indicators

- 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

Soils using the Fine Indicators

- Loamy Very Fine Sand LVFS
- Coarse sandy loam COSL
- Sandy loam SL
- Fine sandy loam FSL
- Very fine sandy loam VFSL
- Loam L
- Silt loam SIL

Soils using the Fine Indicators

- Silt SI
- Sandy clay loam SCL
- Clay loam CL
- Silty clay loam SICL
- Sandy clay SC
- Silty clay SICL
- Clay C

Other "textures"

- Muck
- Mucky (soil texture modifier) Mk
- Peat
- Peaty (soil texture modifier) Pt
- Marl
- Soft or Hard rock
- Gravels GR
- Gravelly (soil texture modifier) GR

Organic Soil and Mineral Textures

- Texture refers only to mineral soil
- Organic soil names are used in place of textural class names when present in sufficient quantity
- They can also modify mineral soil names
- The organic soil type always modifies the mineral texture, e.g. mucky sand

**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:

1. Type/Color of redoximorphic features used to determine the seasonal high water table
2. Size of the drainfield/unobstructed area
3. Dosing requirements

Components of the Soil

There are 4 basic components of soil

- Minerals (particle size only)
- Organic Matter (abbreviated as OM)
- Water
- Gases

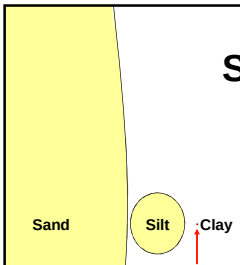
Soil Minerals: Particle Size

- For DOH purposes, only mineral particle size is considered, not mineral type
- 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
  (this is <2 millionths of a meter)

Soil Particle Size Comparison

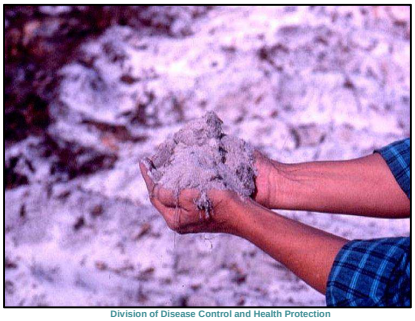


Clay particle (yes, the dot, but would really be a thin, platy or flaky structure)

Sand Facts (from natural grade)

- Largest mineral particle
- Broken down into five size groups
- Individual particles easily visible
- Gritty when rubbed (textured)
- Barely holds together when moist
- Water movement rapid/very rapid due to 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
- Coarse Sand
- Sand
- Fine Sand
- Very Fine Sand
- *SEE SOIL MANUAL FOR SAND GRADATION SIZES*

Silt Facts

- Smaller than sand, larger than clay
- When moist or dry it feels smooth and floury or silky
- Found mainly on floodplains of rivers and southern part of Florida
- Overall is rare in Florida, but is more abundant in SW Florida

Clay Facts

- Smallest mineral particle, is actually platy (flaky) in structure, not spherical
- Cannot see particle without powerful microscope
- Sticky when moist, easily malleable
- Water moves slowly through clay due to (many) small pores
- Rare to find pure clay in Florida

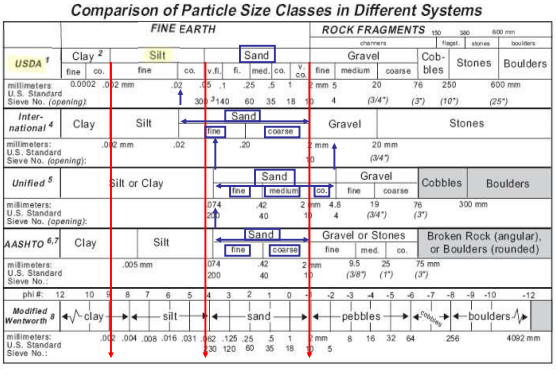
Soil Texture

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

Common Soil Textures in Florida

- *Sand (s) and Fine Sand (fs)-most common*
- Loamy Fine Sand (lfs)
- Loamy Sand (ls)
- Fine Sandy Loam (fsl)
- Sandy Loam (sl)
- Sandy Clay Loam (scl)
- Sandy Clay (sc)

Comparison of Particle Size Classes in Different Systems



QUESTIONS?

PROPER TEXTURING METHODOLOGY FOR MINERAL SOILS

Fine Earth Fraction

- Particle sizes ≤2 mm are soil particles, i.e. the Fine Earth Fraction, (including shell fragments) *used to determine the mineral soil texture*
- Particle size is what counts, not particle type (quartz, iron, etc.)
- Larger particles are coarse fragments (more later)

Touch Texture Method

CAUTIONS

- Ensure sample is only from the area you intend to sample
- Make sure the sample has not been contaminated from some other source

Contamination Sources

- 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 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
- See following picture

CLEAN YOUR HANDS FIRST!

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

Mineral Texture Determination

Mineral Texture Determination

- Mineral texture- the *soil texture due to the particle size of the minerals that are present*
- *DOES NOT* include any organic matter (OM) that may be in the soil sample
- If enough OM in the soil sample it may hold together because of OM, not from smaller mineral particle size, wouldn't be a ribbon
- *Be careful when texturing soils with OM as a component*

Amount of Soil for Texturing

- Enough to work with, depends on individual hand size
- Try a tablespoon or so
- Too much will take longer to properly process (break down soil particles)
- Too little will not allow the ribbon to be formed correctly

Forming the Ribbon

- Ribbon needs to be uniform thickness and width
- Thickness of ribbon should be about 2 mm for everyone-use a Presidential or Native American $1 coin for a 2mm gauge (##)
- Ribbon width will vary between people due to width of the thumb

Sandy Soils

- *Don't form ribbons*
- Loamy Very Fine Sand (LVFS) will act more like a silt and be somewhat gritty and malleable, *however it will not ribbon*

Loamy and Clayey Soils

- All loamy and clayey soils form ribbons
- Length of ribbon is deciding factor to determine soil texture
- *Loams form shorter ribbons*
- *Clays form longer ones*

Loam

- Is a soil texture, not a particle size
- Feels like equal parts (or activity) of sand/silt/clay
- Feels gritty, yet smooth and slightly plastic
- Comprised of specific percentages of the different soil particles
- When moist will form a cast that can be freely handled without breaking

What about texturing Silt?

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

Organic Matter (OM) and Texturing

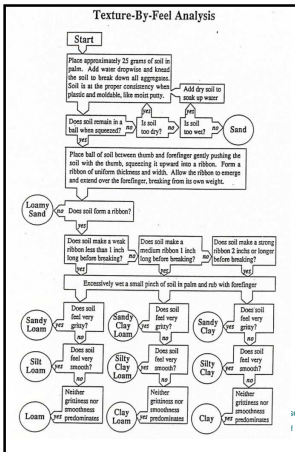
- OM *not included* in actual mineral texture
- *Remove OM from consideration*
- If enough OM in sample the name of the mineral texture *would be modified*
- Don't confuse a FS soil with some OM for a LFS, they *are not* the same

Organic soils/components##

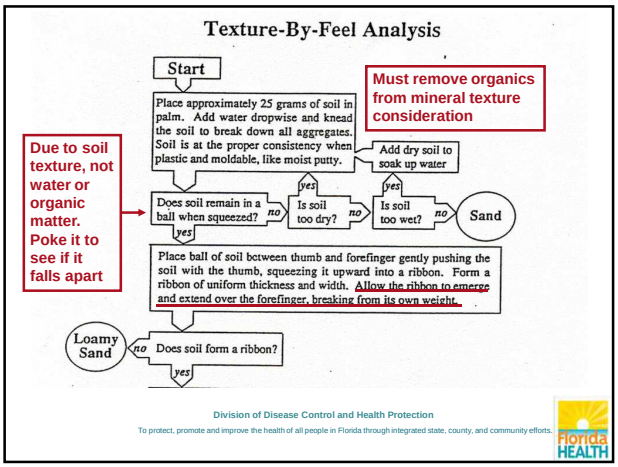
- OM in mineral soils adds difficulty in texturing
- Near Saturated Rub Test is used to determine presence of muck, mucky peat or peat

Organic soils/components

- This information would then be added to the mineral component, if any, to properly name the soil texture
- The Near Saturated Rub Test will be discussed in the Hydric Soils Presentation

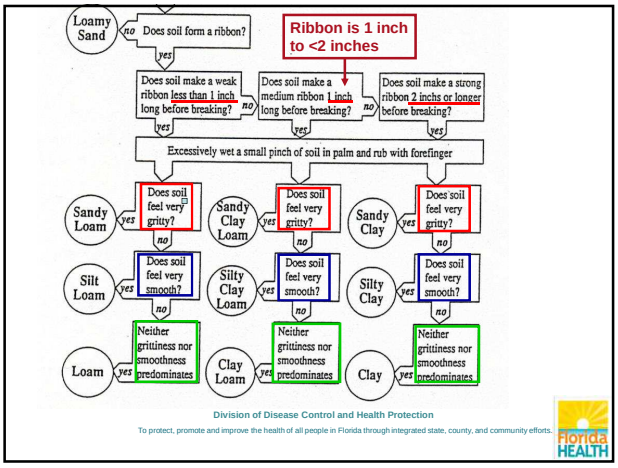


Texture-by-Feel Methodology *Mineral Soil Only*



Must remove organics from mineral texture consideration

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



Ribbon is 1 inch to <2 inches

Soil Texturing: Sand

Soil Texturing: Clayey soil

Ribbon Formation

<2 inch ribbon >2 inch ribbon

Soil Ribbon Comparison

Soil texture Naming Convention##

- Major component named LAST
- Loamy sand means that the sample is comprised mostly of sand with loam as a modifying influence
- Sandy clay loam means the sample is mostly loam with clay the next largest portion and sand the least prominent

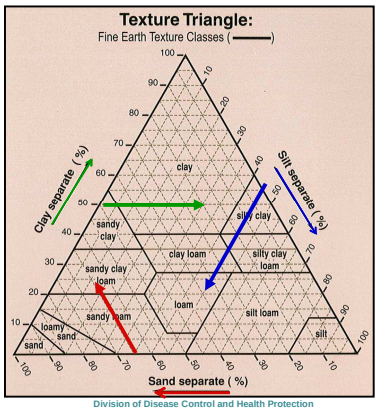
- Sand is the only particle size divided into smaller subgroups
- When naming soils the same information is normally used
- Fine sandy loam means loam is the major fraction, however the sand part is fine sand
- Compare to Fine Loamy Sand –<u>which does not exist because loam is not further divided, so fine loam cannot exist</u>

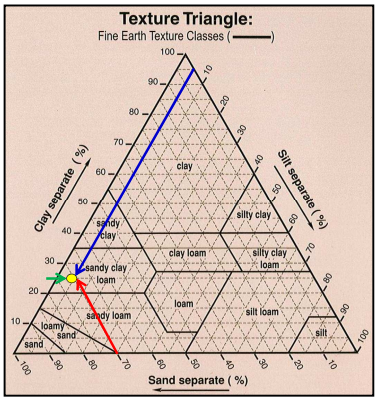
Organic Soil Modified Textures

- When mineral soils contain organic parts in sufficient volume, the organic soil portion modifies the actual mineral texture
- Muck, mucky peat or muck would be added before to the mineral texture to name the soil
- Mucky sand would be allowed, sandy muck is not

The Textural Triangle

- Simplifies description of particle size mixtures when lab analysis performed
- Only scheme allowed by Chapter 64E-6
- 12 classes of soil texture shown on a 3-axis graph
- ***NOTE: The graph has a single sand category, therefore it does not show what grade of sand exists in the sample, only that sand exists***





70% Sand
25% Clay
5% Silt
is SCL

What if the texture falls on a line?

- By USDA NRCS methodology the more stringent (i.e. finer) soil texture is used
- Example: If the point falls on the line between loamy sand and sandy loam the texture of the sample must be classified as sandy loam

Sieve Analysis

- Can be used only if the texture of the sample material is coarser than loamy coarse sand (coarse sand, sand, fine sand, very fine sand, or one of these classes containing gravels)

Lab Analysis for OSTDS Use##

- Must use proper USDA NRCS sieve stack (see notes)
- The results must account for sand size gradation as well as silt and clay content
- Loamy sand and loamy fine sand have different loading rates (0.8 vs. 0.65 gal/sf/day in a trench)
- Ramifications?

QUESTIONS?

Coarse Fragments in the Soil

- Larger than soil-sized particles (>2mm)
- Are *non-soil particles*
- Once coarse fragments reach 15% of the volume of the horizon, the soil texture must be modified with the correct adjective
- Still need to know the texture of the fine earth fraction (i.e. mineral texture)

Coarse Fragments##

- Fragments can be shells, rocks, etc.
- The modifier *gravelly* or "GR" is used when the fragment content by volume is ≥15% to <35%. Gravels range in size up to 75mm (3 inches)
- See notes section for complete breakdown

Coarse Fragments##

- Shape and size of the coarse fragment determines description
- Shapes can be Spherical (including cube-like) or Flat
- See notes section for further information

Separate Non-Soil from Soil Particles

- If coarse fragments are ≥15% by volume of the soil horizon, must remove the non-soil particles from consideration of the soil-size particles in order to get actual mineral soil texture
- Determine soil texture, then modify name as necessary

Mineral Texture

- Remove gravels from consideration as they are >2 mm in size and do not count as part of the mineral soil texture
- 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

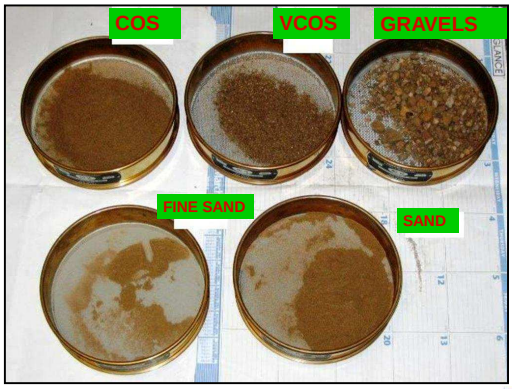
Coarse Fragment Example

- 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
- Note: NOT “shelly sand”
- Use the "Charts for Estimating Proportions of Mottles and Coarse Fragments" found in the Munsell book to determine the percentage of fragments

Comparison of Particle Size Classes in Different Systems

	FINE EARTH MINERAL SOIL FRACTION										ROCK FRAGMENTS					
USDA [1]	Clay [2]		Silt		Sand						Gravel			Cobbles	Stones	Boulders
	fine	co.	fine	co.	v.fi.	fi.	med.	co.	v. co		fine	medium	coarse			
millimeters:	0.0002	.002 mm		.02	.05	.1	.25	.5	1	2 mm	5	20	76	250	600 mm	
U.S. Standard Sieve No. *(opening)*:					300	[3] 140	60	35	18	10	4	*(3/4")*	*(3")*	*(10")*	*(25")*	

- Mineral Soil Sizes in Green includes all mineral particles (quartz, shells, etc.)
- Coarse Fragments (non-soil particles) in Blue includes rock fragments



Class Exercise on Texturing Please get your hands dirty!

Organic Matter (OM)

- The second solid component of soils
- Consists primarily of pieces and parts of plants that are in various states of decay
- Sometimes called humus
- Different types of OM based on amount of decomposition and amount present

Effects of OM on Mineral Soil

- Darkens soil color (black/brown)
- Increases water holding capacity, acts like a sponge
- Reduces compaction (adds tilth)
- *OM accumulates more in wetter soils compared to dry soils*

Types of Organic Matter

- Muck is well decomposed organic soil material (*Sapric* material)
- Peat consists of raw undecomposed organic soil material (*Fibric* material)
- Mucky peat designates materials intermediate in decomposition between muck and peat (*Hemic* material)

Water: The Third Soil Component

- Water (or any liquid) moves through the soil (is mobile)
- Moves over and between soil particles in the pore spaces
- Most soils have approximately 50 percent pore space
- Filled with gases or liquid

Gases

- The fourth basic component of soil
- Occupies the pore space that does not have liquid in them
- Can be any type of gas

Porosity/Permeability of Soils

- Porosity - the amount of pores in a given area
- Permeability - the rate at which water moves through the soil
- Permeability and Porosity are linked
- The movement of liquids (and gases) through the soil is *VERY* important for OSTDS considerations

Compaction

- Decreases porosity
- Reduces permeability
- Effects may be limited to certain depths based on site-specific factors
- *Diminishes* the ability of the soil to transfer liquids and gases between soil particles
- No transfer means improper treatment

Soil Compaction

The previous picture is a MOUND SYSTEM

End of Presentation

QUESTIONS?