UTILIZATION OF THE SOIL PHYSICAL PROPERTIES DATA FOR THE DESIGNING OF AN EFFICIENT LANDSCAPE IRRIGATION PLAN

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A webinar presentation for Land F/X
December 9, 2011

The effect of surface configuration

It is the responsibility of the contractor to take sufficient number of soil samples from appropriates places and depths and take the samples to a certified soil laboratory for agricultural suitability testing.

The laboratory results should be submitted for approval to the project management prior to any field activities.

1. Soil data is for the designer and not for the contractor and /or the installer of a landscape irrigation and planting project

2. Plan your sampling before you begin to design

3. Please do not leave the contractor responsible to collect the soil samples

4. It is too late when he signs the contract to begin testing the soil

1. Walk the project site
2. Identify your sampling spots
3. Auger the spots and identify the variations in depth
4. Plan your sampling prior beginning to design
5. Soil data is more for the designer than the installer

1. Planting plan should be designed based on the soil properties
2. Irrigation pans should be designed based on soil report
3. Plan your sampling prior you begin to design

Sampling tips

1- Just one sample per depth would not be sufficient

2- Take auger samples, compare until you see the change in soil properties such as color, texture etc.

A **landscape** is a landform, that is distinctive from the surroundings by its:

- ✓ Shape and the size
- ✓ Surface configuration and the slope
- ✓Soil and/or geologic substratum
- ✓ Sustained natural and / or modified scenery

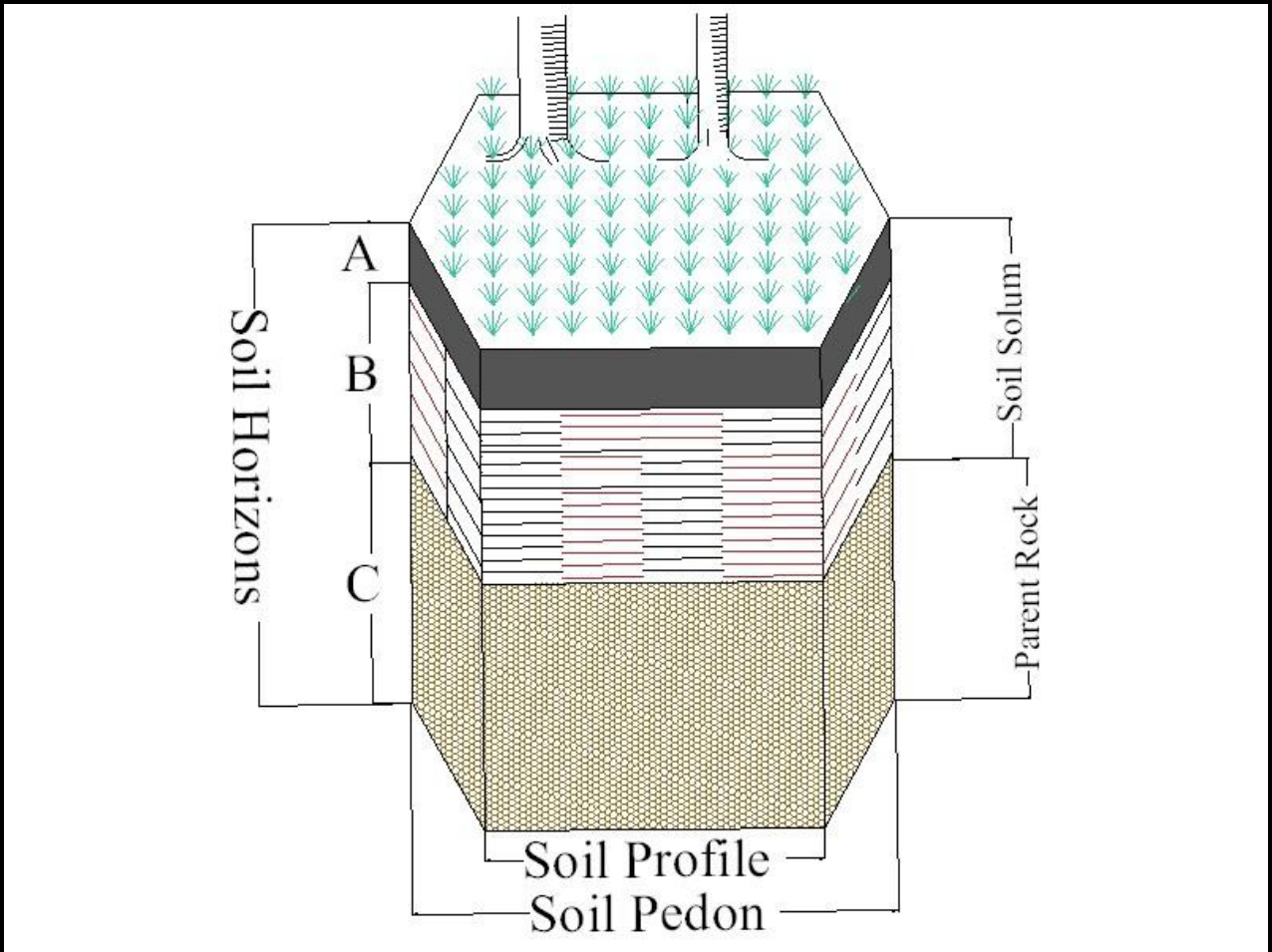
A landscape with sustained vegetation

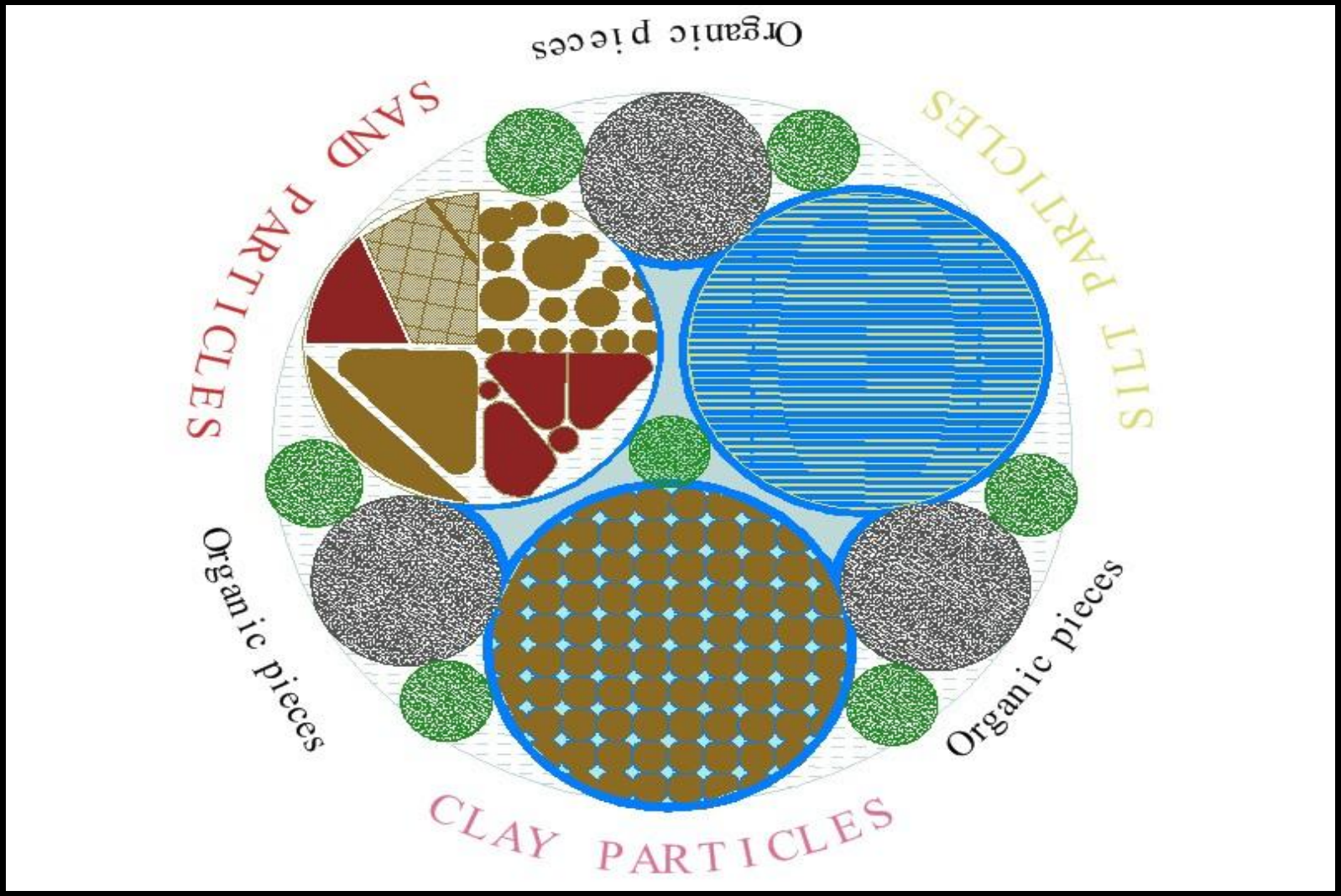
The effect of surface configuration

A landscape characterizes by its three major components

- ***soil***
- ***water***
- ***plant***

SOIL IS A VOLUME





It is inside the pores that soil-water-plant relate and create an open system for occurrence of physical, chemical and biological processes in soil

A DEFINITION FOR MINERAL SOIL

Soil support plants by physically holding them and by providing them with water, air, and nutrients

A mineral soil composes of :

- Unconsolidated inorganic particles
- Decomposed organic fragments
- Pores in between and within
  - soil water
  - soil air

SOIL IS A VOLUME

The inorganic volume of soil consists of

A. 2.00 mm ≥ sand > 0.05mm

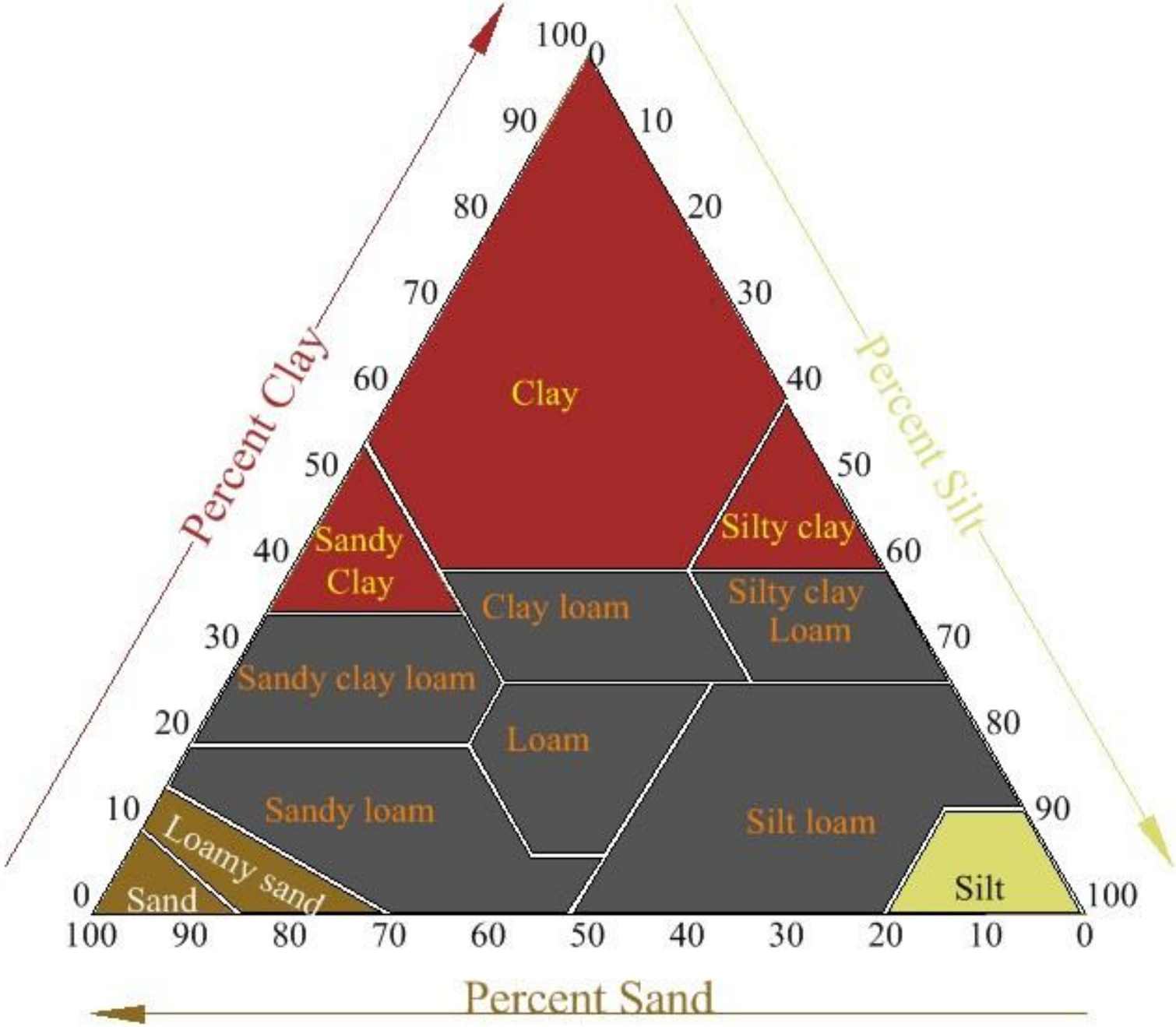
B. 0.05 mm ≥ silt >.002mm

A. 0.002 mm ≥ clay

SOIL PHYSICAL PROPERTIES

1. *Soil Texture* is a soil quality that describes by the quantitative mixing ratio of the inorganic or mineral particles in 100 g of an oven dried sample of soil.

Example: Sandy Clay (S% =52, Si% =8, C% =40)



USDA Soil Textural Classes

SOIL PHYSICAL PROPERTIES

2- Soil Structure is a soil quality that defines by the physical arrangement of the inorganic particles in structural unit of soil, a ***"ped"***

Example: Granular structure

SOIL PHYSICAL PROPERTIES

3- Soil Density that is the mass of a unit volume of soil. It expresses in two ways:

1. Particle or true density (gm/cc) or lb/cf
2. Bulk density (gm/cc) or lb/cf

Bulk density *Db* – The mass per unit volume of dry undisturbed soil

Db= w/vb

Db = gm/cc Db=lb/cf Dp = ton/cy

Db = Bulk density

w= weight of the dry soil

vb = volume of undisturbed soil including pores

A table of conversion

1 cf of water weighs 62.37 lb	
1 cy of water weighs 1685 lb	
1cy of water weighs .84 ton	
g/cc = 62.37 lb/cf	lb/cf = (g/cc)/62.37
g/cc = 1685 lb/cy	lb/cy =(g/cc)/1685
g/cc = .84 ton/cy	Ton/cy =(g/cc)/.84

- Soil porosity is the volume of the existing pores or empty spaces between individual soil particles within the soil volume.

- Soil porosity expresses as percent pore space that calculates as:

% PS=[(*Dp*-*Db*)/*Dp*] x100 or

For a piece of land with the following lab data how many cf of water is needed to fill 40% of the soil space.
Area of the land = 1.5 acre.
Depth of watering 18 in. and soil texture is Sandy loam

Soil volume = 1.5 x 43560 sf x (18/12)ft = 98,010 cf

Db = 1.32g/cc that is equivalent to 82.37 lb /cf

Dp = 2.65g/c that is equivalent to 165.4 lb/cf

PS = (2.65g/cc -1.32g/cc)/2.65g/ccx100]

PS = (165.4 lb/cf - 82.4 lb/cf)/165.4ld/cf]x100

PS = 50.18 %

40% of the pore space = 50.18 x .40 =20.07%

Volume of water =98,010 x 20.07/100=19,673 cf.

θw = 19,673 ~~cf~~ x1.5 ~~ft~~/98,010 ~~cf~~ x12 in/~~ft~~ = 3.61 in of water /1.5 ft of soil

Soil texture vs infiltration rate

Soil Textural Class	Average Infiltration Rate (in/hr)	
Coarse Sand	0.75	1.00
Fine sand	.50	.75
Fine sandy loam	.35	.50
Silt loam	.25	.40
Clay loam	.10	.30
Irrigation Fifth Edition. Published by Irrigation Association pp 74		

Permanent Wilting Point (PWP), Field Capacity(FC), Plant Available Water (PAW) as affected by Soil Textural Classes (Inch of water/ft. of soil)

Soil Textural Class	PWP	FC	PAW	PAW%
	In /ft	In/ft	In/ft	θ
Medium Sand	.28	1.18	.90	7.50
Sandy Loam	.59	1.97	1.38	11.5
Fine Sandy Loam	.79	2.56	1.77	14.8
Loam	1.18	3.15	1.97	16.4
Silt Loam	1.38	3.43	2.05	17.1
Clay Loam	1.77	3.74	1.97	16.4
Clay	2.56	3.94	1.38	11.5

An run off example

Slope 4%
Sandy Clay
Infiltration Rate .31 in/hr
Precipitation Rate* .42 in/hr
Extra Water .42-.31= .11in/hr

Area 54 x576 = 31104 sf
31104 x (.11)/12
Run off = 285 cf.

Slope 14%
Sandy Clay
Infiltration Rate .12 in/hr
Precipitation Rate* .42 in/hr
Extra water .42-.12=.30 in/hr

Area 54 x 576 = 31104 sf
31104 x (.30)/12
Runoff = 778 cf.

Have a pleasant day

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Please feel free to contact me