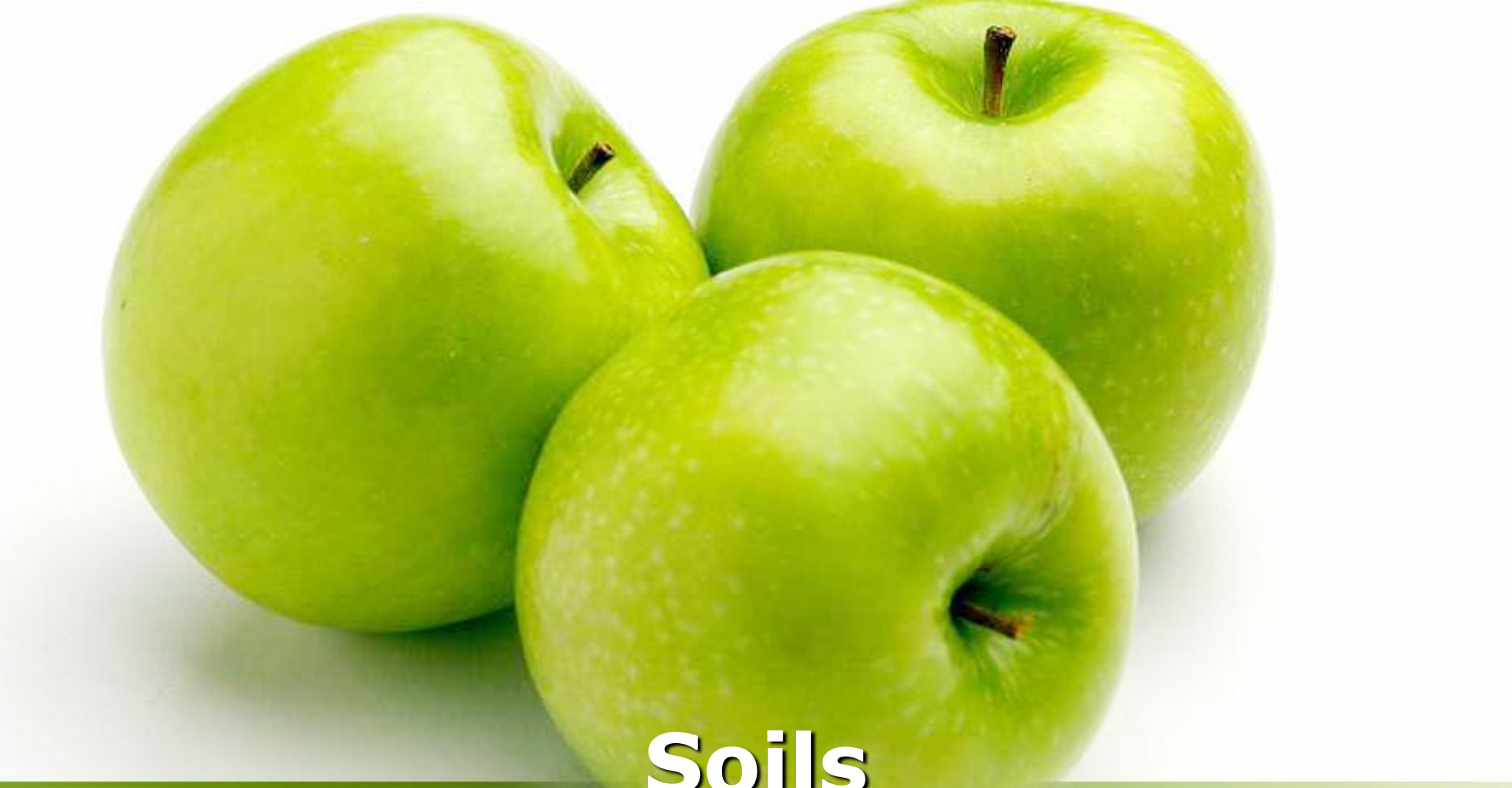


Soils & Management

Dr. Richard Rosecrance

California State University, Chico

A typical agricultural soil is usually

25%	1.	10% air and 90% solids
25%	2. ✓	50% solids and 50% pores
25%	3.	25% air and 75% solids
25%	4.	10% air, 40% water and 50% solids

Of the following soil types, which would most likely hold the most water at field capacity?

25%	1.	Silt
25%	2.	Sandy loam
25% ✓	3.	Clay loam
25%	4.	Loam

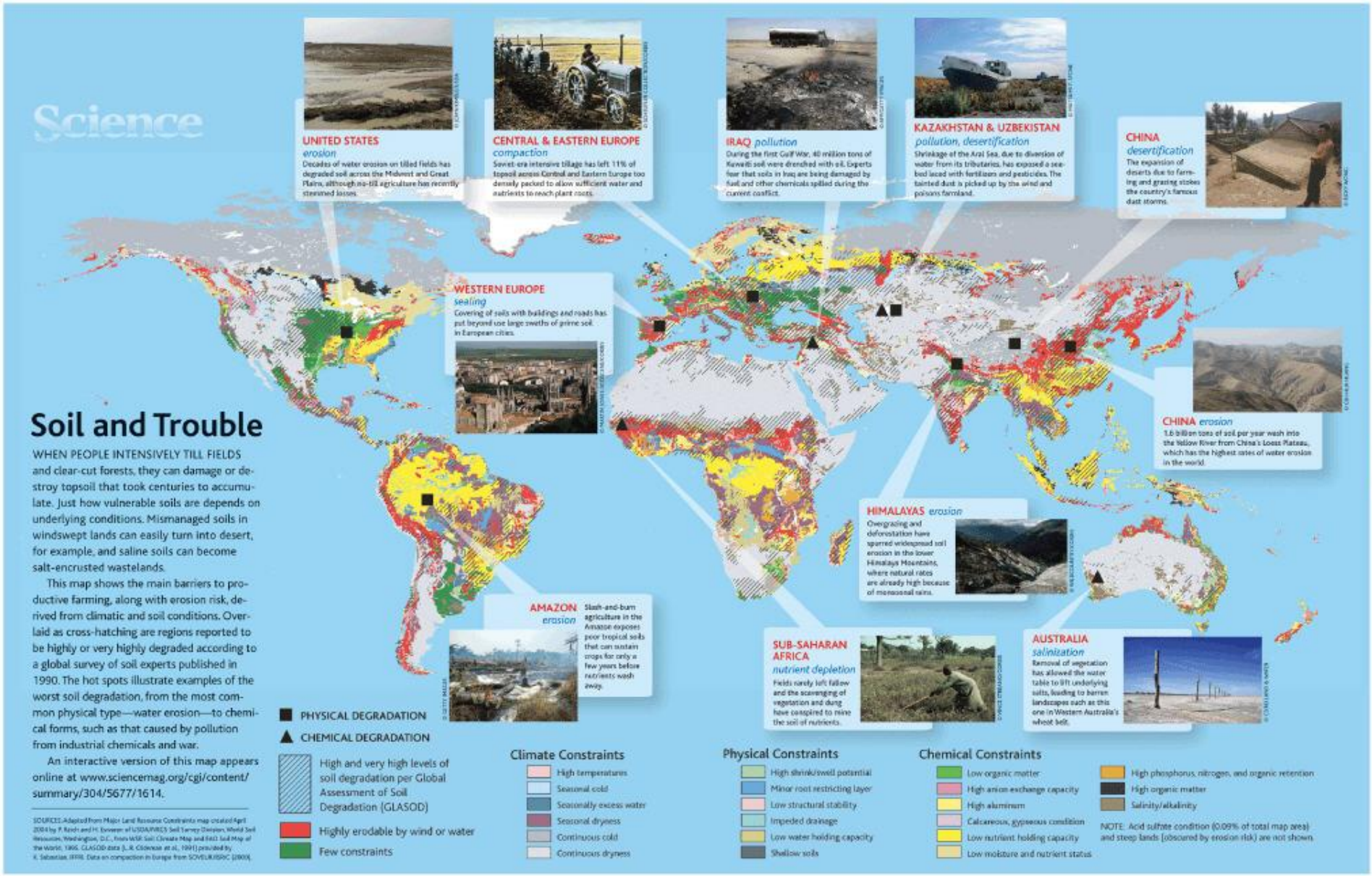
Which of the following is not a chemical property used to evaluate soil quality?

25%	1.	pH
25%	2.	Organic matter
25% ✓	3.	Enzymes
25%	4.	Exchangeable calcium

Topics to Be Covered

Read Chapter 3 Soil & Fertilizer Mgt

1. Online soil survey
2. Soil texture and structure
3. Cation Exchange
4. Organic Matter



Return to article

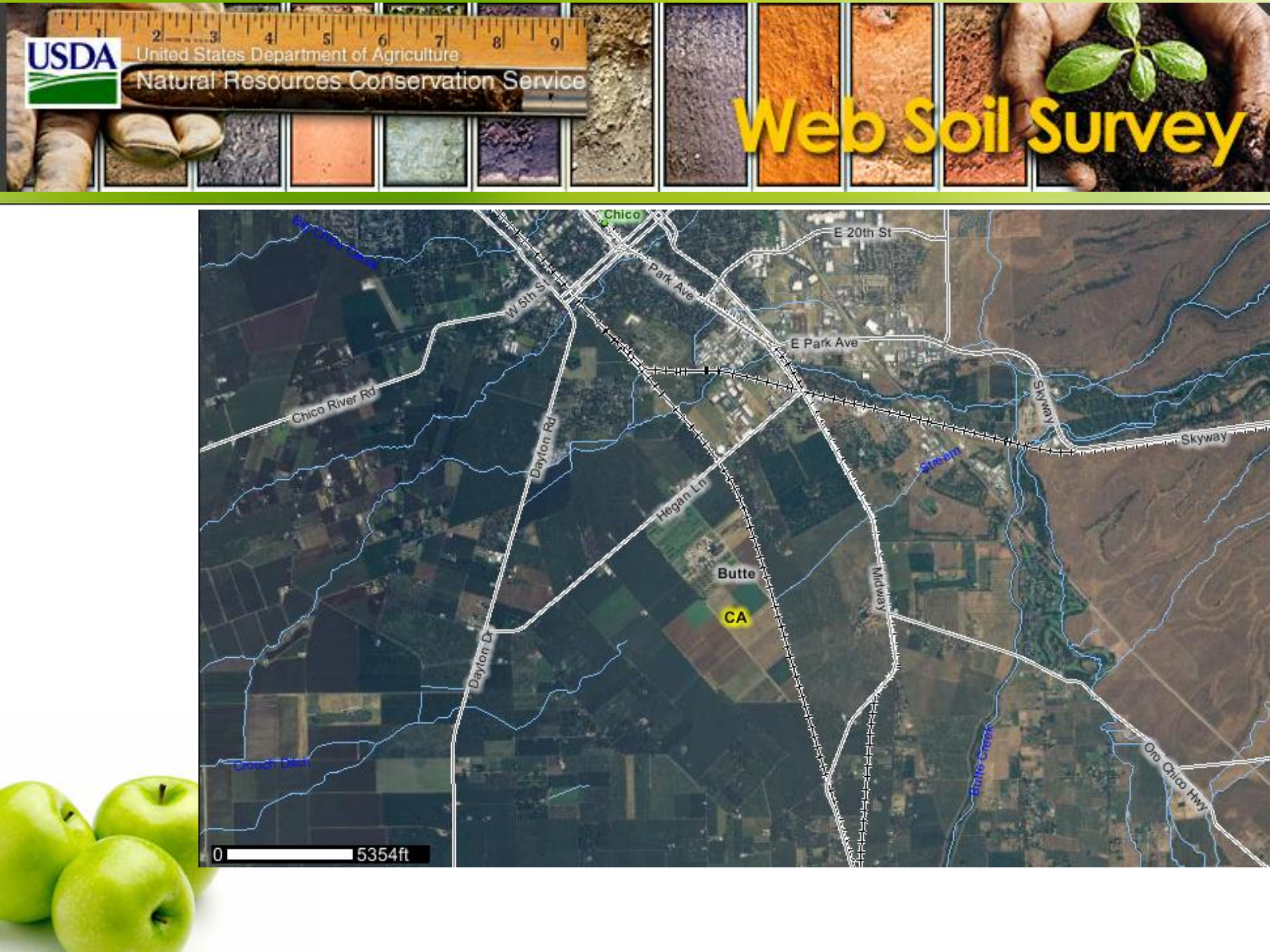
Armstrong's footprint on Moon. Is this soil? Why or why not?

What is soil?
What is your ideal soil?

You have 3 minutes to develop a group consensus definition.

Online Soil Survey

- Website: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
- Youtube instruction: http://www.youtube.com/watch?v=uBI7w2I9nl8


USDA
United States Department of Agriculture
Natural Resources Conservation Service
Web Soil Survey
Chico
E 20th St
Park Ave
W 5th St
E Park Ave
Chico River Rd
Dayton Rd
Skyway
Stream
Hegan Ln
Butte
CA
Midway
Dayton D
Oro Chico Hwy
0
5354ft

Search

Map Unit Legend

Butte Area, California, Parts of Butte and Plumas Counties (CA612)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
418	ALMENDRA LOAM, 0 TO 1 PERCENT SLOPES	22.4	97.5%
425	VINA FINE SANDY LOAM, 0 TO 1 PERCENT SLOPES	0.6	2.5%
Totals for Area of Interest		**23.0**	**100.0%**

Legend

Soil Map

Scale (not to scale)

Warning: Soil Map may not be valid at this scale.

Butte Area, California, Parts of Butte and Plumas Counties

418—ALMENDRA LOAM, 0 TO 1 PERCENT SLOPES

Map Unit Setting

Elevation: 110 to 230 feet
Mean annual precipitation: 20 to 26 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 245 to 255 days

Map Unit Composition

Almendra, loam, and similar soils: 85 percent
Minor components: 15 percent

Description of Almendra, Loam

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.83 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 3.0 mmhos/cm)
Available water capacity: High (about 9.5 inches)

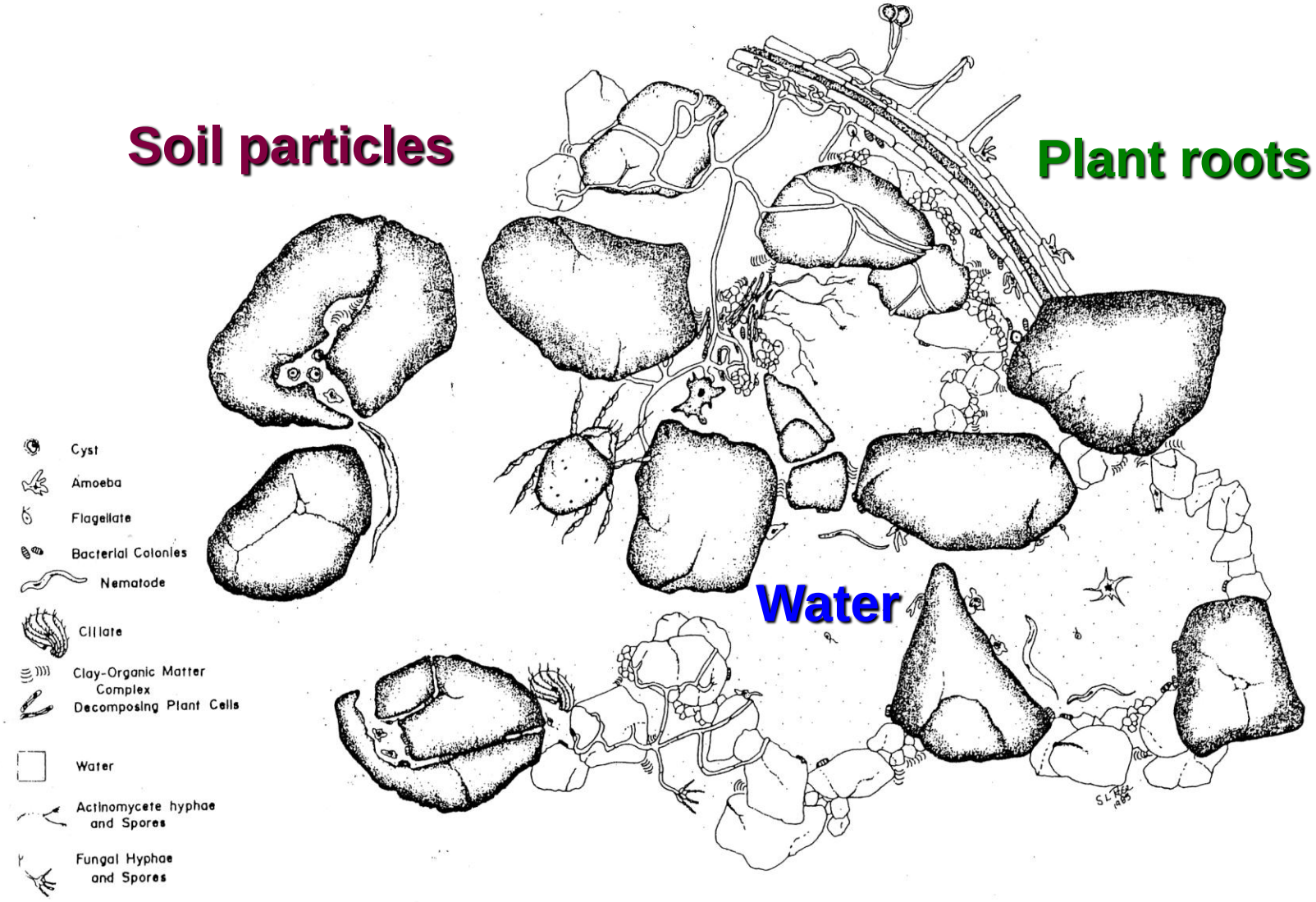
Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 3c

Typical profile

0 to 4 inches: Loam
4 to 14 inches: Loam
14 to 29 inches: Loam
29 to 40 inches: Loam
40 to 52 inches: Loam
52 to 74 inches: Very fine sandy loam
74 to 86 inches: Very fine sandy loam

Soil is a habitat




Soil is alive…
For example, in 1g of soil:
>100,000,000 bacterial cells
>11,000 species of bacteria
Also fungi and larger animals
ASM MicrobeLibrary.org©Smith

Part I: Definitions

- **Soil:**
- An ecological system consisting of inorganic minerals, decomposing organic matter, living organisms and growing plants

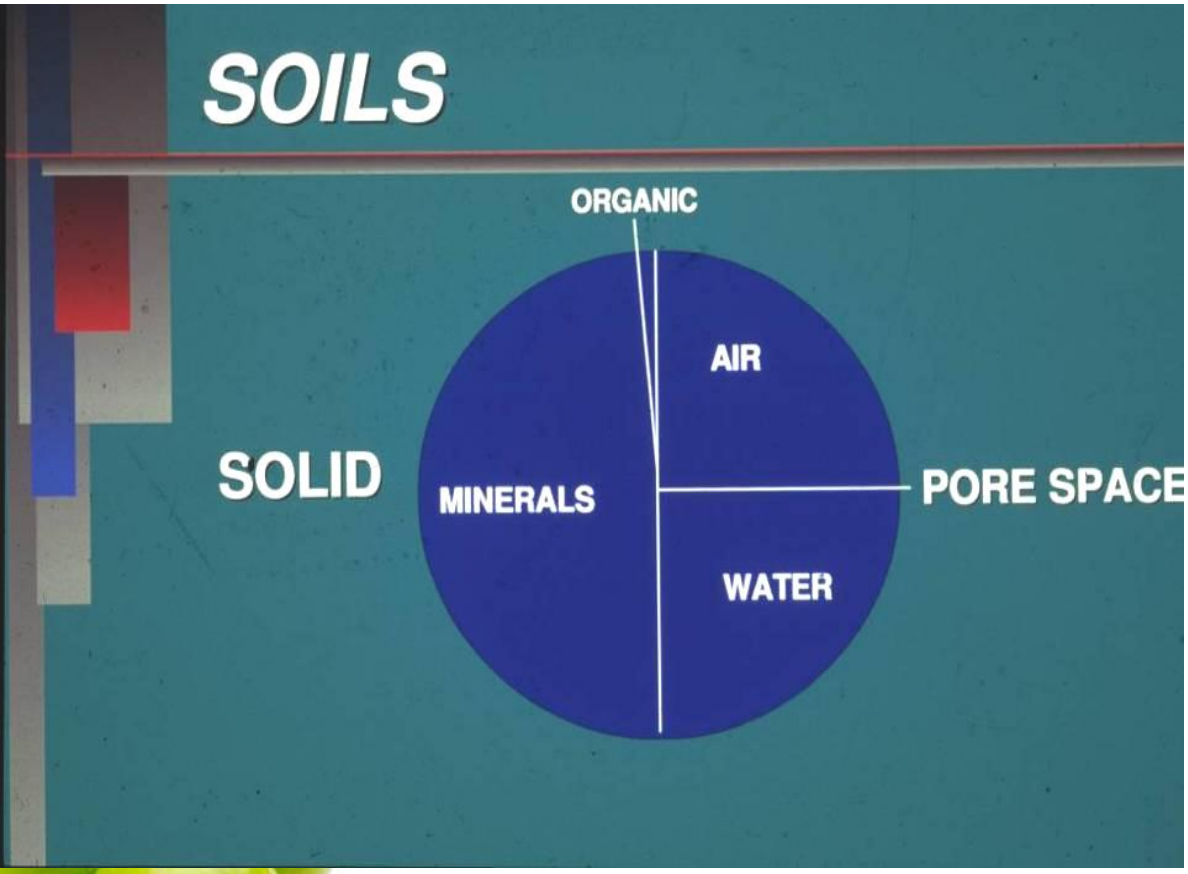
- **Soil health or soil quality:**
  A general term that describes the ability of a soil to function

Definitions: soil functions

- **Sustain plant and animal productivity**
- **Regulate water flow through the environment**
- **Buffer environmental changes in air quality, water quality and global climate**
- **Support human health and habitation**

The Ideal Soil is Rare!

What is soil composed of?



- Solid particles (sand, silt, clay)
- Soil pores (air, water)
- Soil organisms (OM)
- Chemistry (nutrients)

Soil Texture vs. Structure, what's the difference?

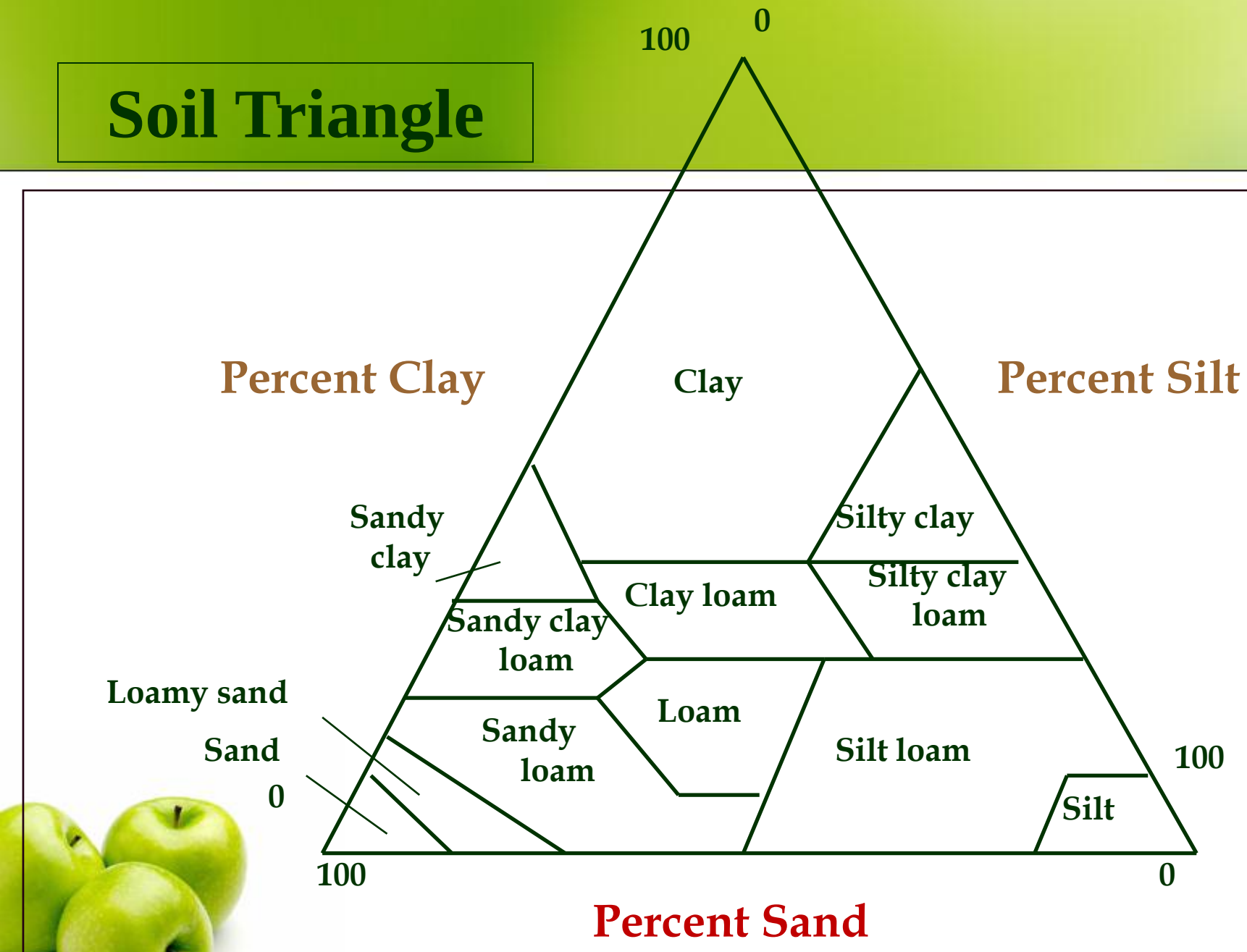
Texture – The percent sand, silt, & clay, based on the soil triangle

e.g., sandy loam, clay loam

Structure – The arrangement of primary particles into secondary units (aggregates)

Affected by compaction

Soil Triangle



What is the textural class name for a soil that contains 22% sand and 18% clay?

2%

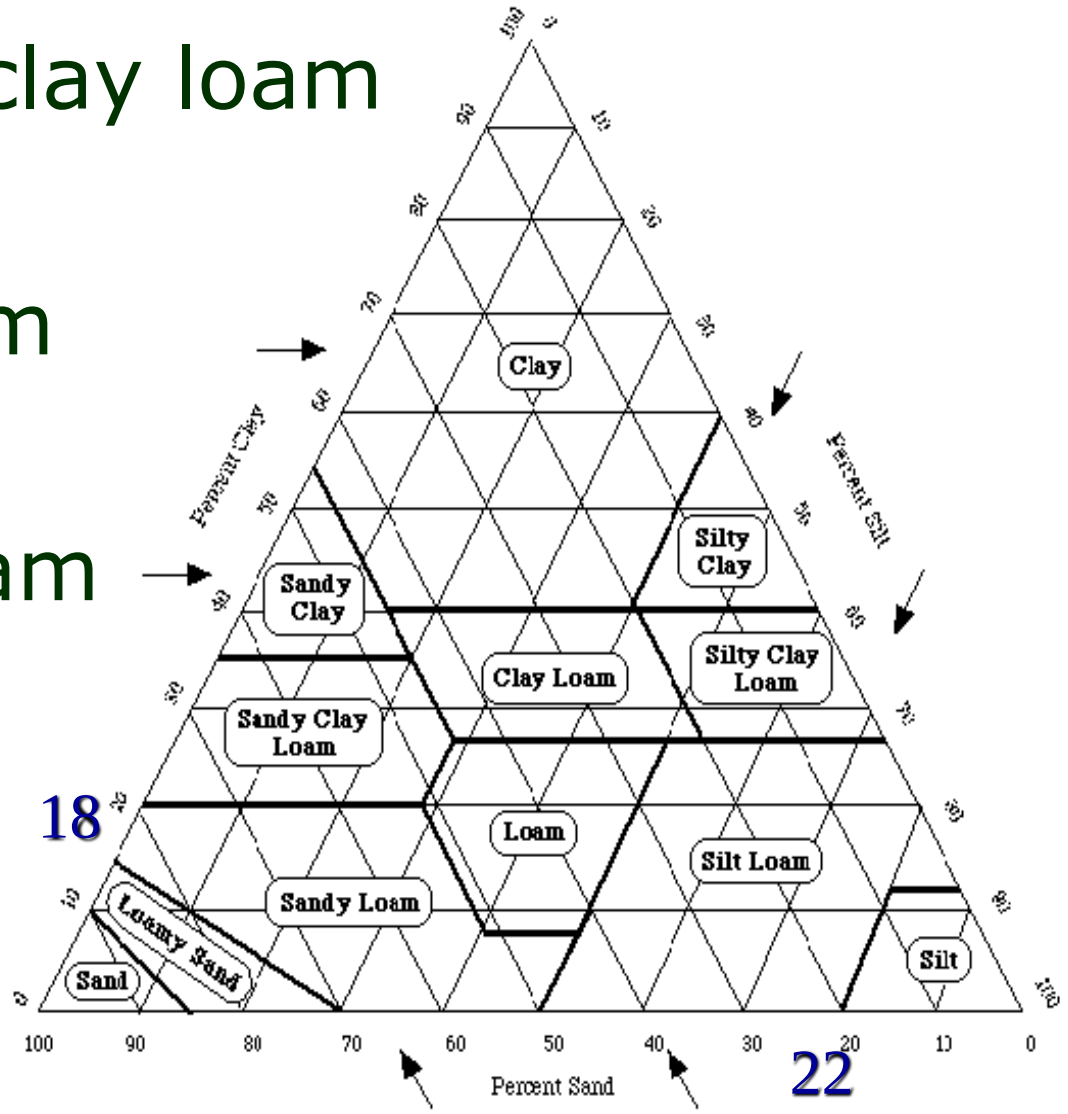
0%

95%

2%

0%

1. sandy clay loam
2. clay
3. silt loam ✓
4. loam
5. clay loam



Sandy

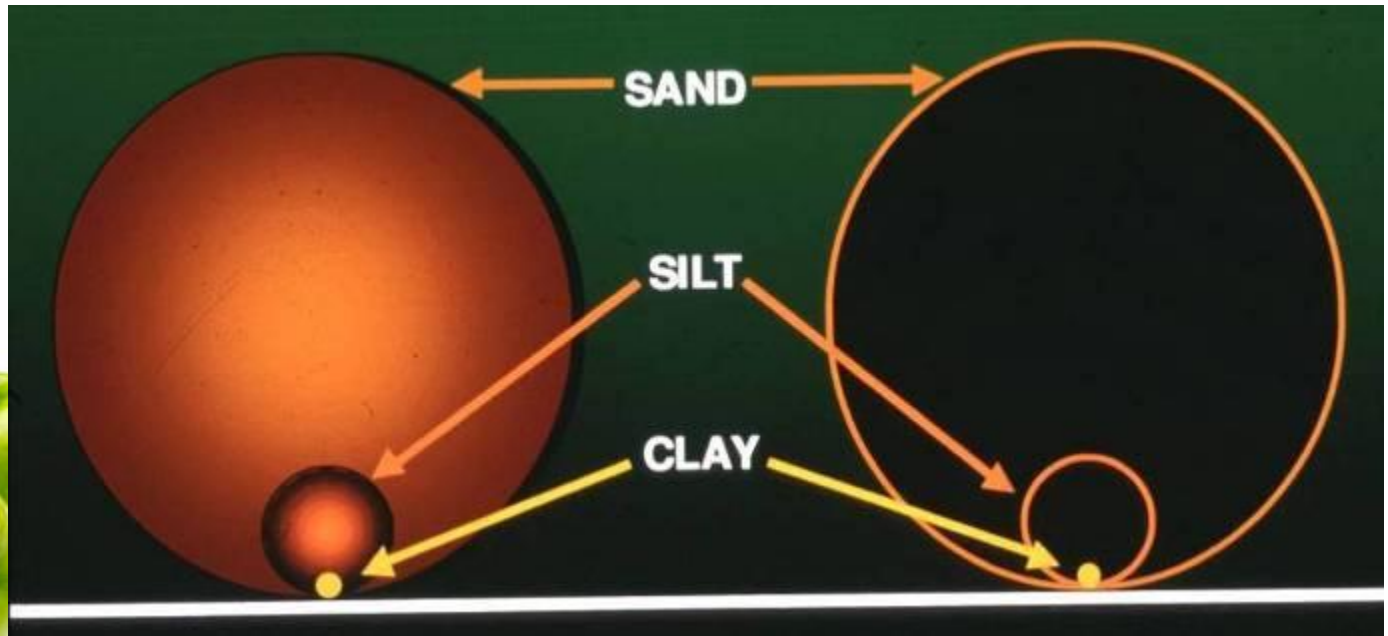
Clayey

Soil Particle Sizes

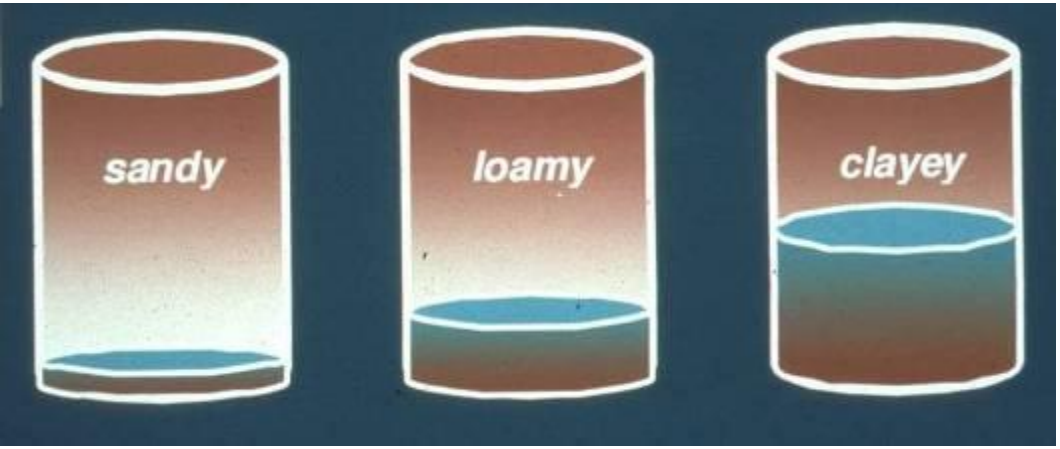
Sand 2.00 to 0.05 mm

Silt 0.05 to 0.002 mm

Clay 0.002 to <0.0002 mm

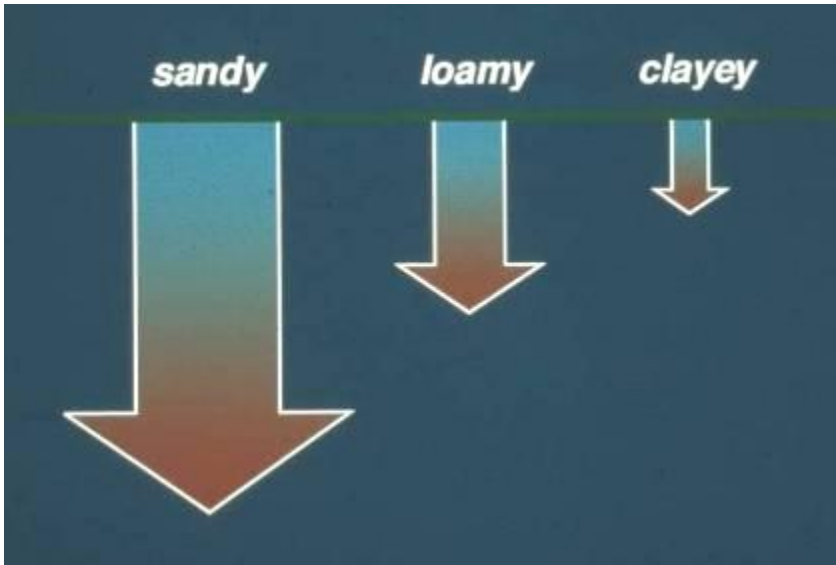


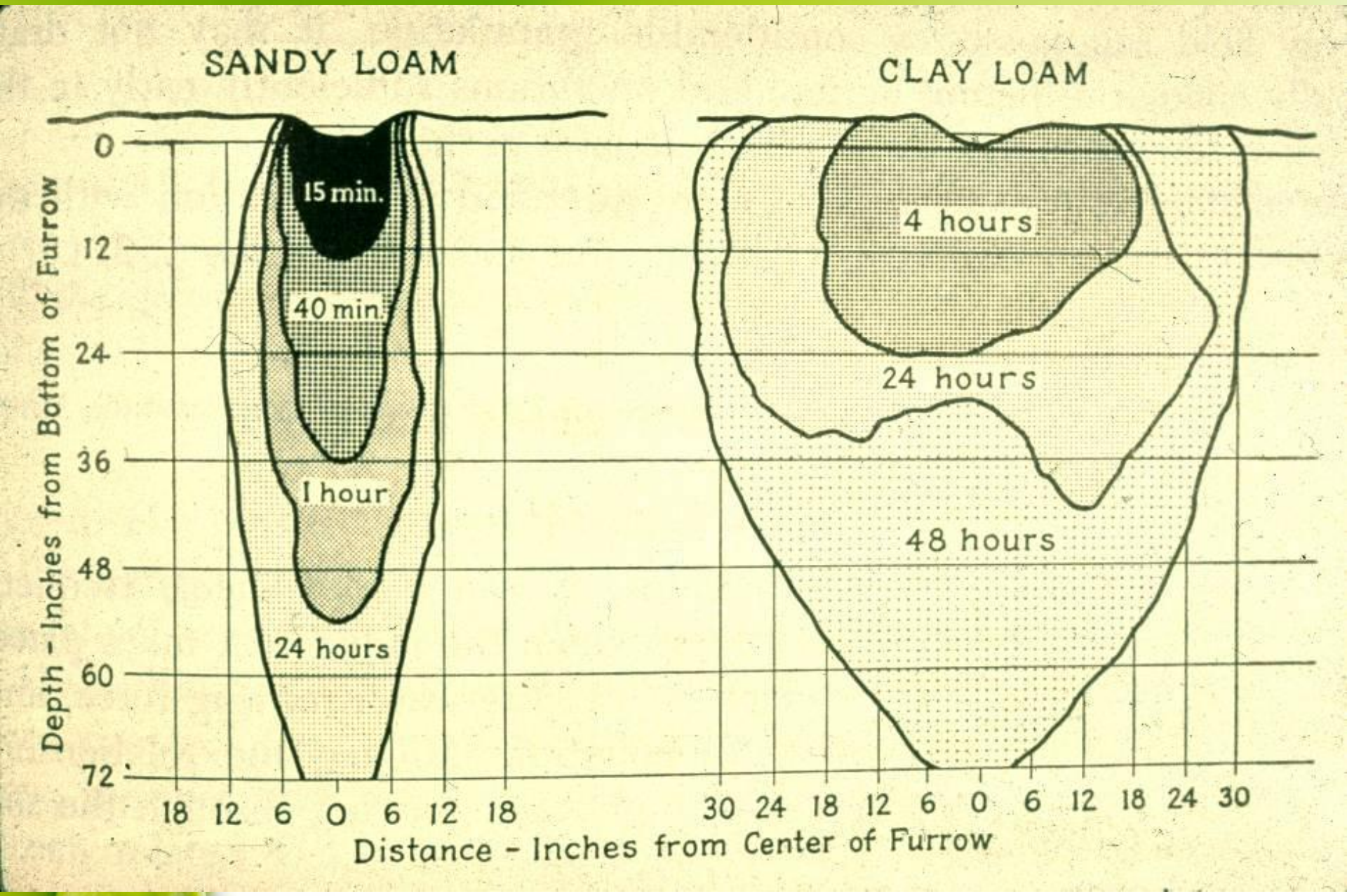
Soil Texture Affects Soil Moisture



Water Holding Capacity

Permeability




SANDY LOAM
CLAY LOAM
15 min.
40 min.
1 hour
24 hours
4 hours
24 hours
48 hours
0
12
24
36
48
60
72
Depth - Inches from Bottom of Furrow
18 12 6 0 6 12 18
30 24 18 12 6 0 6 12 18 24 30
Distance - Inches from Center of Furrow

Properties Influenced by Soil Texture

	Sand	Loam	Clay
Aeration	excellent	good	poor
Water holding	low	moderate	high
Available	7%	16%	11%
Permeability	high	moderate	low
Nutrient holding capacity	limited	moderate to high	high

What is Soil Cation Exchange Capacity?

Which of the following statements are true concerning soil CEC?

100%

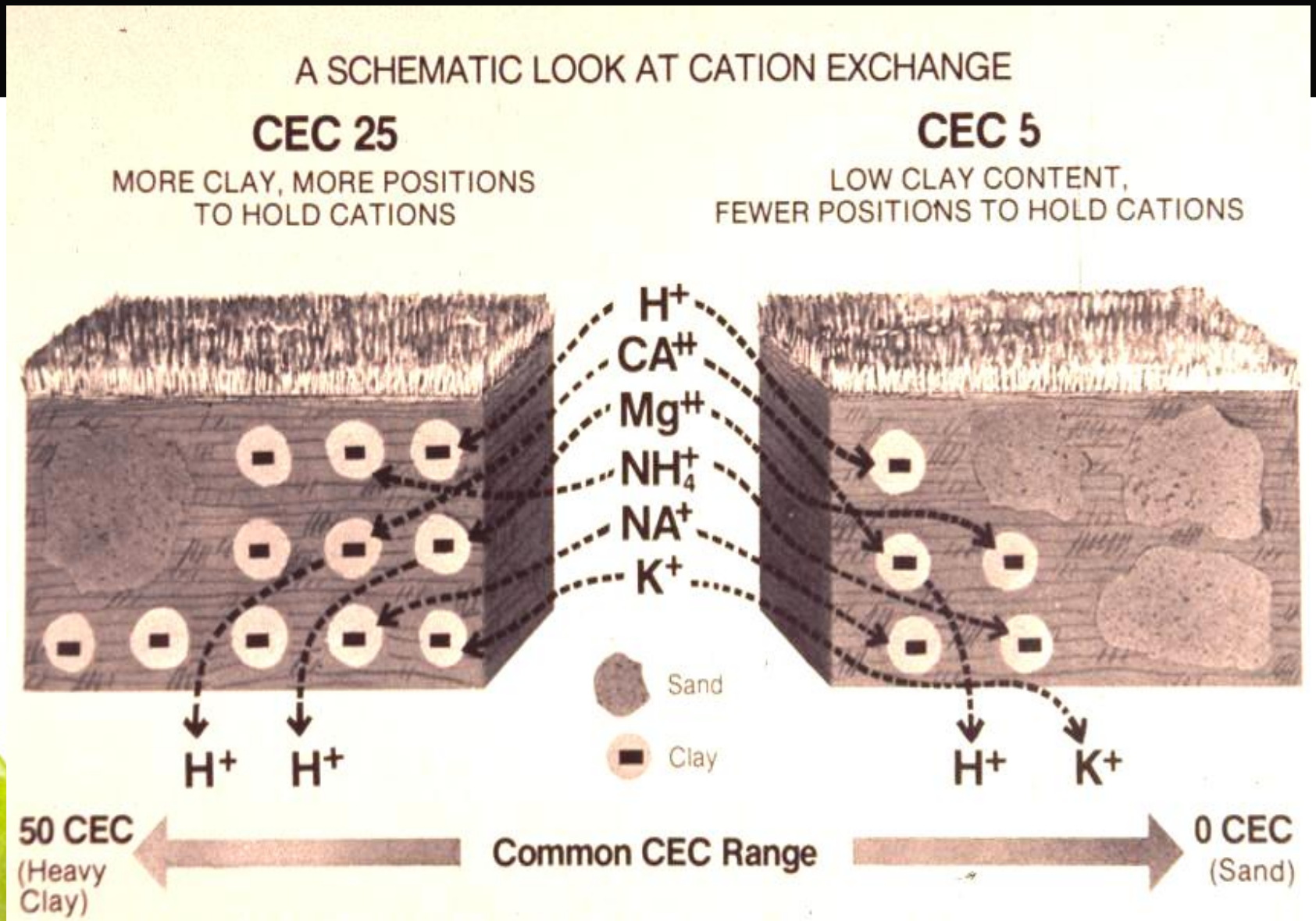
0%

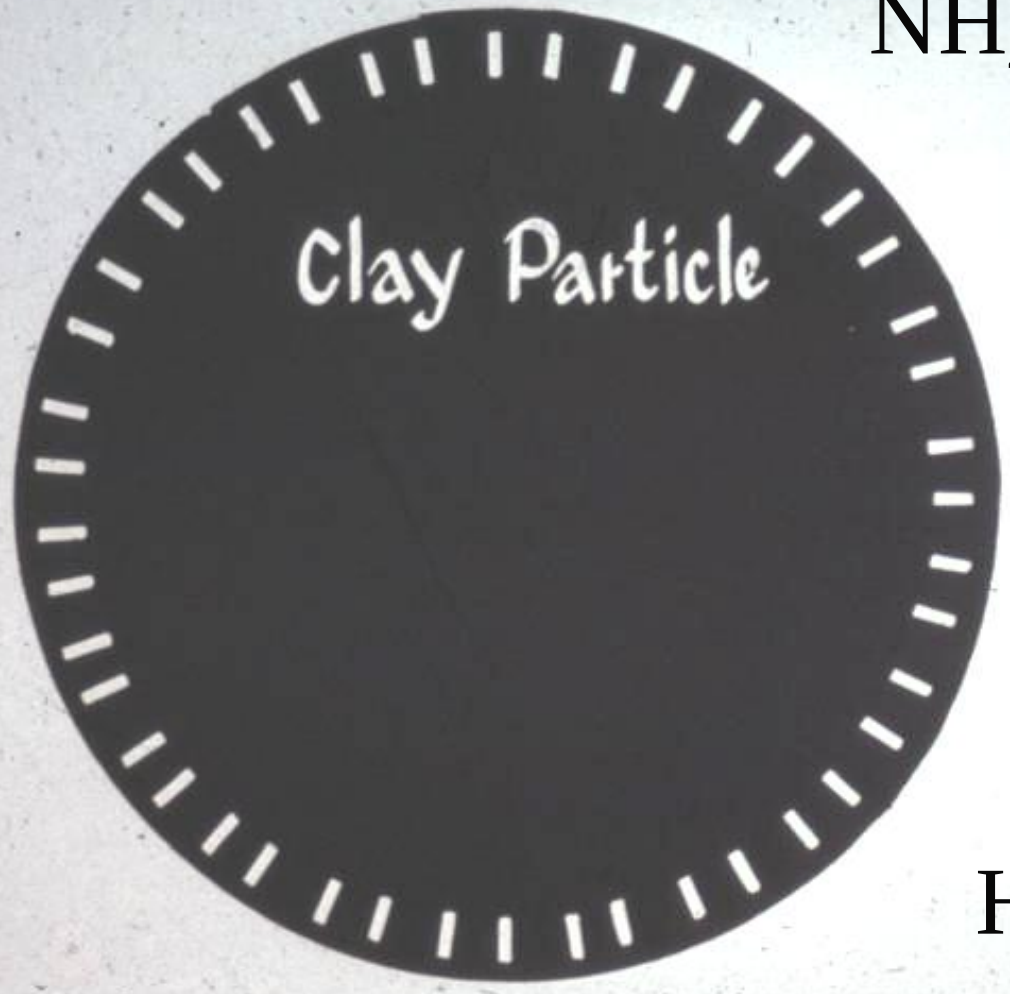
0%

0%

1. High CEC soils can adsorb more exchangeable cations, and can store more plant nutrients than soils with a low CEC
2. Higher CECs are found in soil low in organic matter than soils high in organic matter.
3. High CEC soils do not retain nutrients
4. Higher CECs are found in sandy soils than clay soils

Cation Exchange Capacity





K^{+}

NH_4^{+}

Na^{+}

Ca^{++}

Mg^{++}

H^{+}

Fe^{+++}

Zn^{++}

Soil Structure

Structure - the arrangement of soil particles into aggregates

Various types: blocky, platy, prismatic

Good structure: holds water (micropore space) and has air space (macropore space).

Poor structure lacks adequate macropore space.

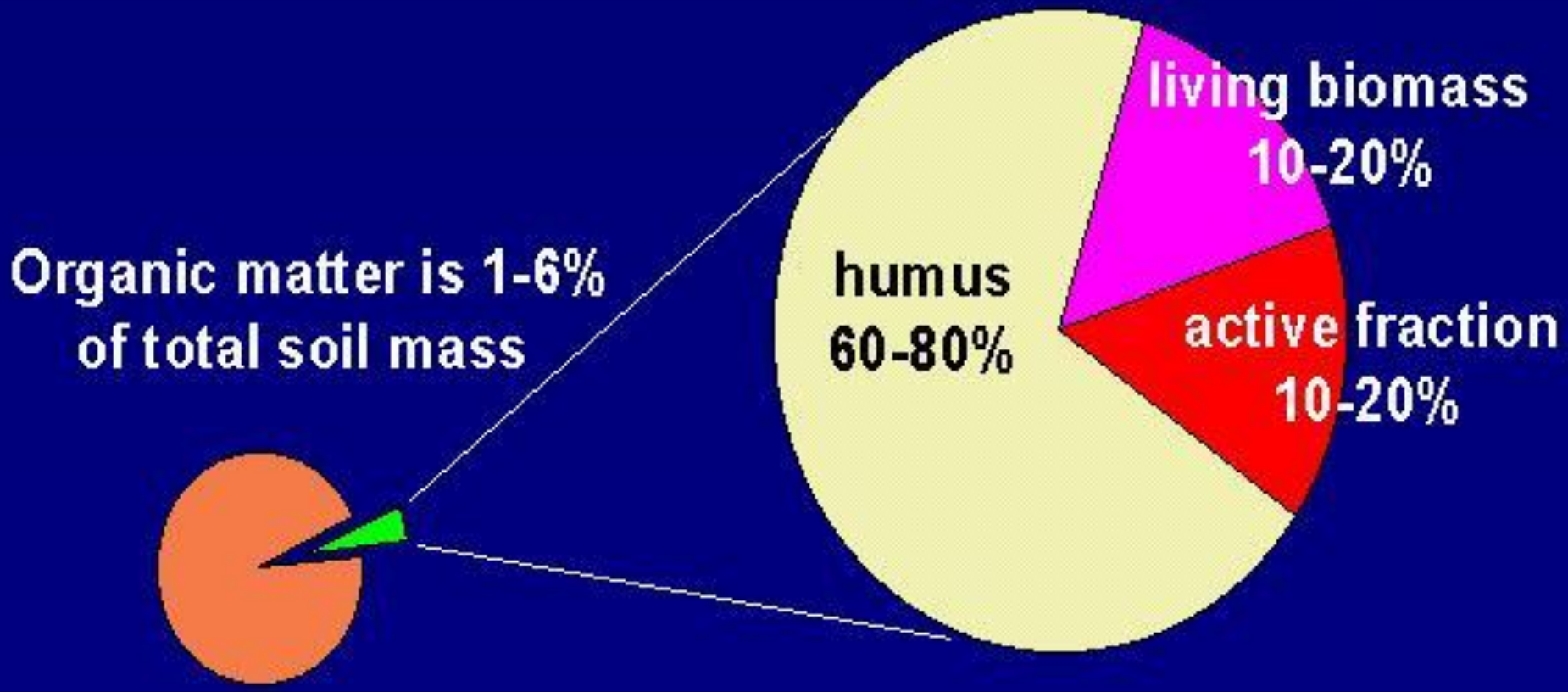
Soil structure & texture can be highly variable across small areas

Planters and medians can have very poor soil structure


POOR SOIL STRUCTURE
(MASSIVE - COMPACT)


GOOD SOIL STRUCTURE
(GRANULAR)

Soil organic matter (SOM)



Role of soil organic matter

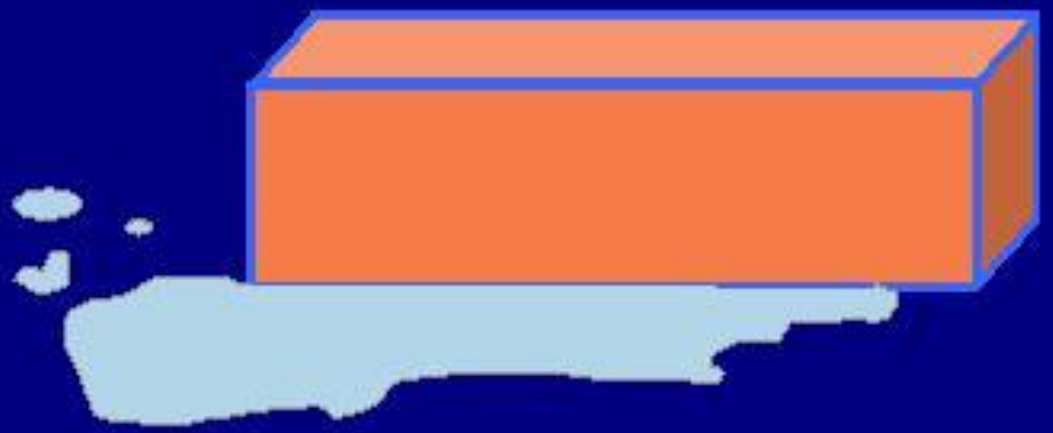
Two major components:

- **Effects of the organic matter itself**
  soil structure, chelation of micronutrients, pH buffering capacity
- **Effects of decomposition of organic residues**
  aggregation, nutrient release, biological activity, disease suppression

Soil Structure:

Water holding capacity

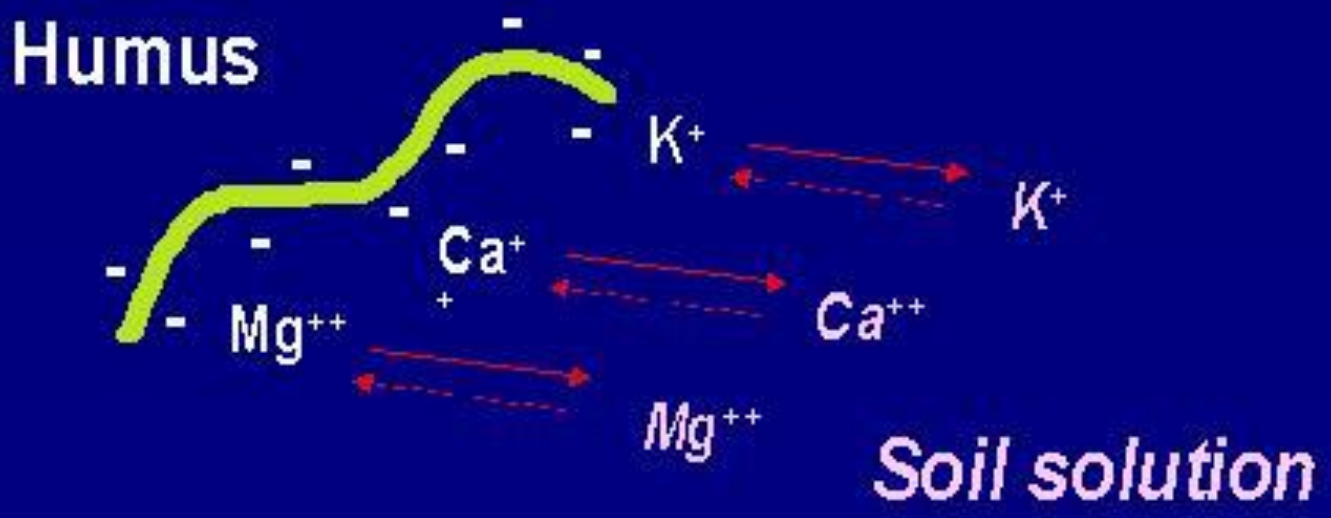
- Organic particles can hold more water than mineral particles




SOIL
COMPOST
700
600
500
400
300
200
100

Nutrient reservoir:

Cation exchange capacity



Effects of OM additions

Add organic matter

Increase biological activity (& diversity?)

May reduce soil-borne disease

Decomposition

Pore structure improved

Aggregation increased

Nutrients released

Humus formed

Improved tilth

HEALTHY PLANTS

How Can we increase SOM?

Cover Crops