Soils and Soil Mapping

UNIVERSITY OF South Carolina

Week3 Lab GEOG201 2024Fall

Soil Science Lab Activities Overview

Understanding soil classification

Classifying soil types is crucial for agriculture.

Exploring soil properties

Soil properties affect plant growth and health.

Discover the Soils Around You

Mapping helps visualize soil variations across areas.

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Part 1: Background on Soil Properties

- Soil texture
- Soil Structure

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1. Soil Texture Overview:
   - Definition: Soil texture refers to the size of individual soil particles.
   - Key Components: Soil is primarily composed of three ‘true’ particle sizes: sand, silt, and clay.
   - Classifications: Soils are rarely made of only one type of particle but are usually a mixture. These mixtures are classified by their texture.

2. Importance of Soil Texture:
   - Why it Matters: Texture influences water retention, drainage, and fertility, which are crucial for agriculture, vegetation, and land management.
   - Examples: Red soils in the South contain high iron content (clay-rich); dark brown soils in Iowa indicate high organic matter.

3. Particle Size Categories (as per Table 1):

- Clay: Particles smaller than 0.002 mm.
- Silt: Particles between 0.002 and 0.05 mm.
- Sand: Particles between 0.05 and 2.0 mm, subdivided into very fine, fine, medium, coarse, and very coarse sand.

Category	Size (mm)
Clay	<0.002
Silt	0.002-0.05
Very fine sand	0.05-0.10
Fine sand	0.10-0.25
Medium sand	0.25-0.5
Coarse sand	0.5-1.0
Very coarse sand	1.0-2.0

Table 1. Classification of soil particle sizes (US Dept. of Agriculture)

Question:

Which type of material allows water to pass through it most easily?

A) Silt
B) Sand
C) Soil
D) Clay

Category	Size (mm)
Clay	<0.002
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Answer:
B) Sand

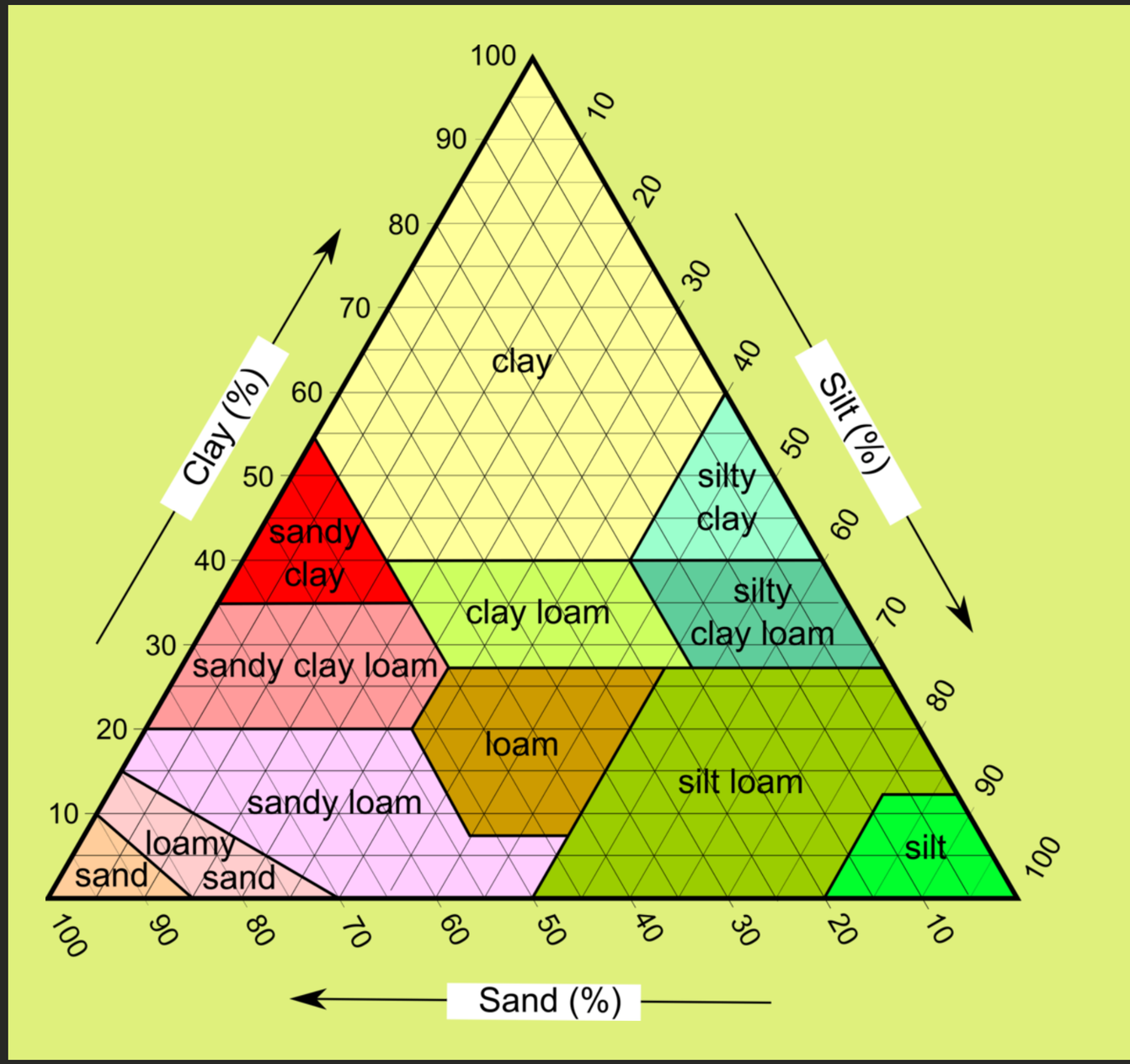
Why:

Permeability refers to how easily water can flow through a material. Sand has large particles with significant spaces (pores) between them, allowing water to pass through quickly. This makes sand more permeable than other materials like silt and clay, which have smaller particles and smaller pores, slowing down the movement of water.

Clay, in particular, has very fine particles, resulting in very little space between them. As a result, water moves through clay very slowly, making it the least permeable.

4. Classification Using the Soil Triangle:

- **Ternary Diagram**: A tool (see Fig. 1) used to classify soil based on its composition of sand, silt, and clay.
- How It Works: By plotting the percentage of each soil component (sand, silt, clay) on the diagram, you can determine the soil's texture class (e.g., loam, sandy loam, clay loam).



1. What is Soil Structure?

- **Definition**: Soil structure is how soil particles (sand, silt, clay) stick together to form clumps called **peds**.
- Formation: Physical, chemical, and biological processes help bond these particles together.

2. Difference Between Soil Texture and Structure:

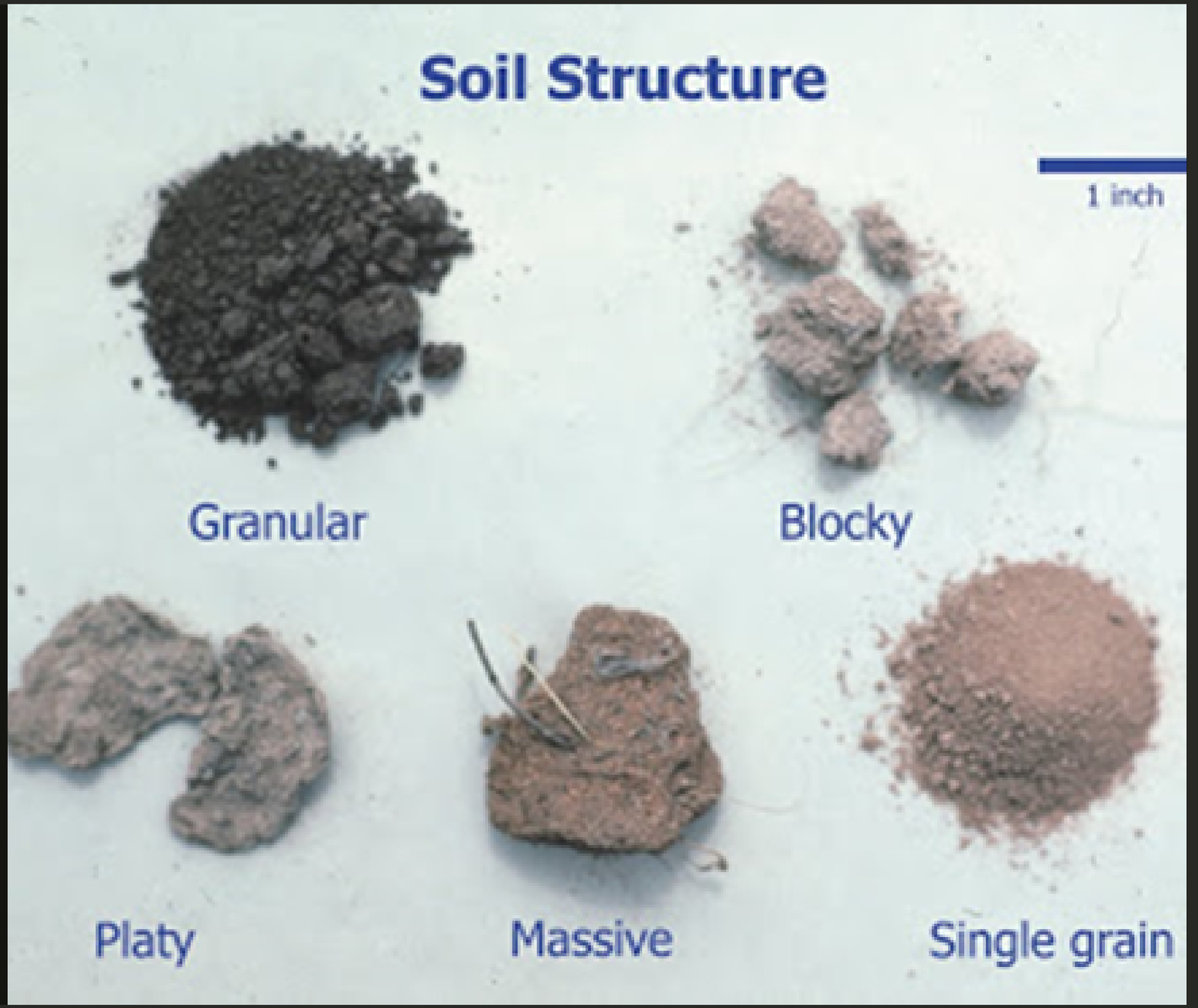
- Texture: Refers to the size of individual particles (sand, silt, clay).
- Structure: Refers to how these particles are grouped into larger clumps or aggregates.

3. Common Soil Structures (as shown in Figure 2):

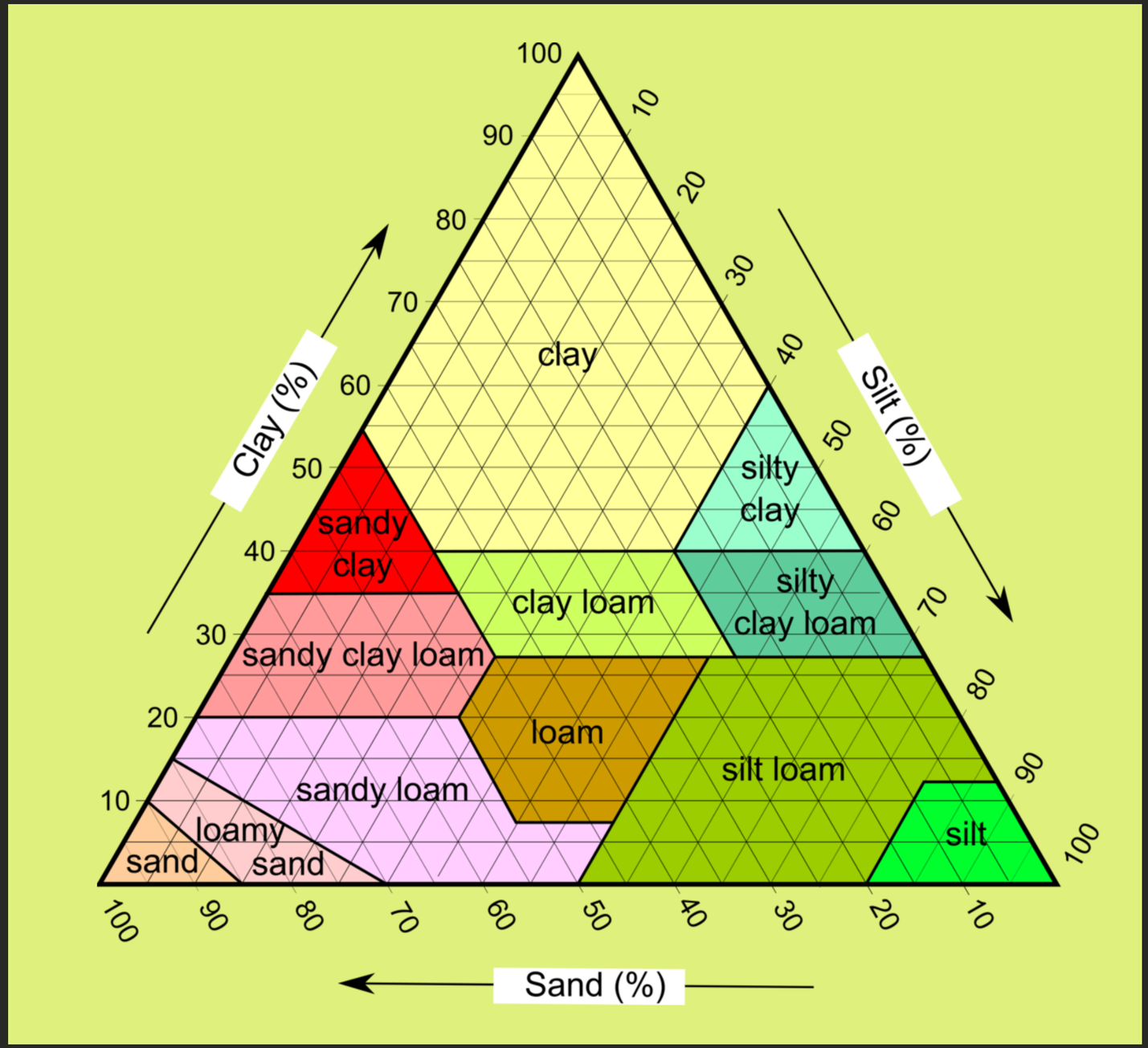
- **Granular**: Small, round clumps, often found near the surface.
- **Blocky:** Irregular, block-shaped clumps, common in subsoil.
- **Platy:** Flat, plate-like clumps, often due to compaction.
- **Massive**: No visible clumps, just one solid mass of soil.
- **Single Grain:** Loose particles that don't stick together, common in sandy soils.

4. What Affects Soil Structure?

- **Biological Activity:** Roots and soil organisms can change soil structure.
- **Chemicals**: Organic matter and minerals help particles stick together.
- **Physical Changes**: Wetting, drying, and human activities like farming can change structure.



Lab Activity I: Classifying Soils by Grain Size



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Answer the following questions using the soil texture triangle:

· If a soil survey tells you that you have a ‘sandy clay loam’ on your property, what does your soil have in the greatest abundance: sand, silt, or clay?

· Soil sample #1: You send a sample of soil to be tested and find out that it contains 15% clay, 65% silt, and 20% sand. What kind of soil do you have?

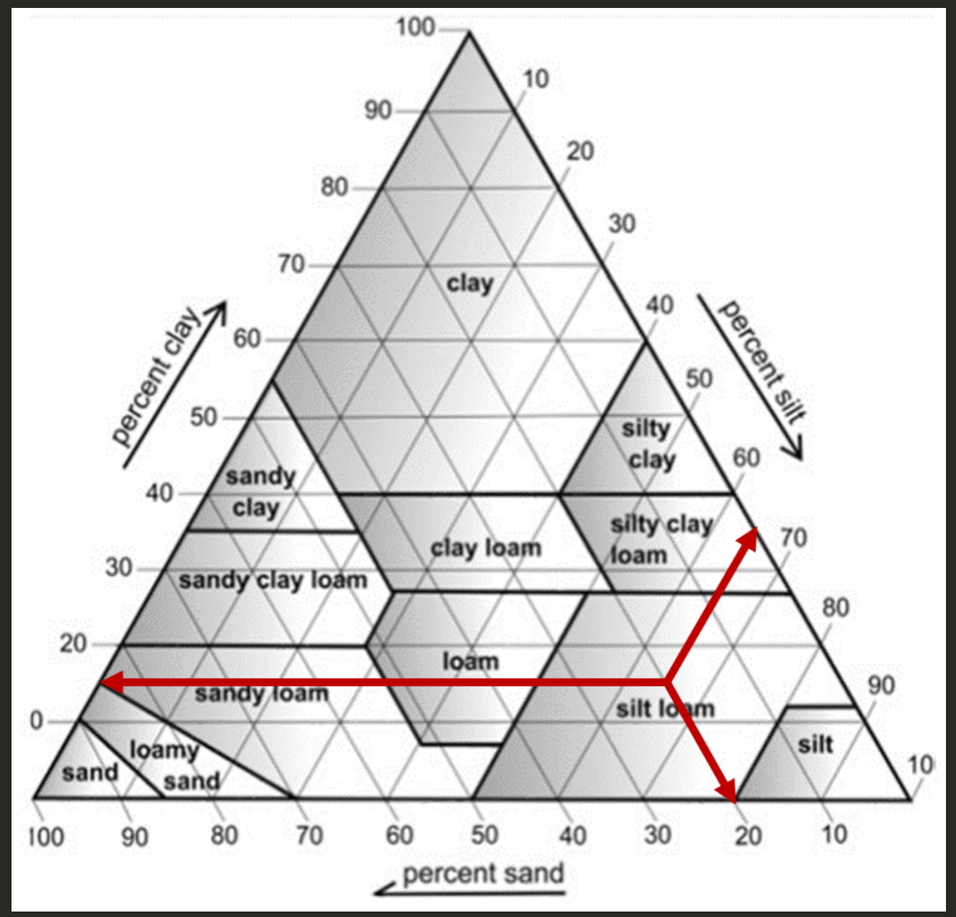
· Soil sample #2: You send a second soil sample to be tested and find out that it contains 60% clay, 10% silt, and 30% sand. What kind of soil is this?

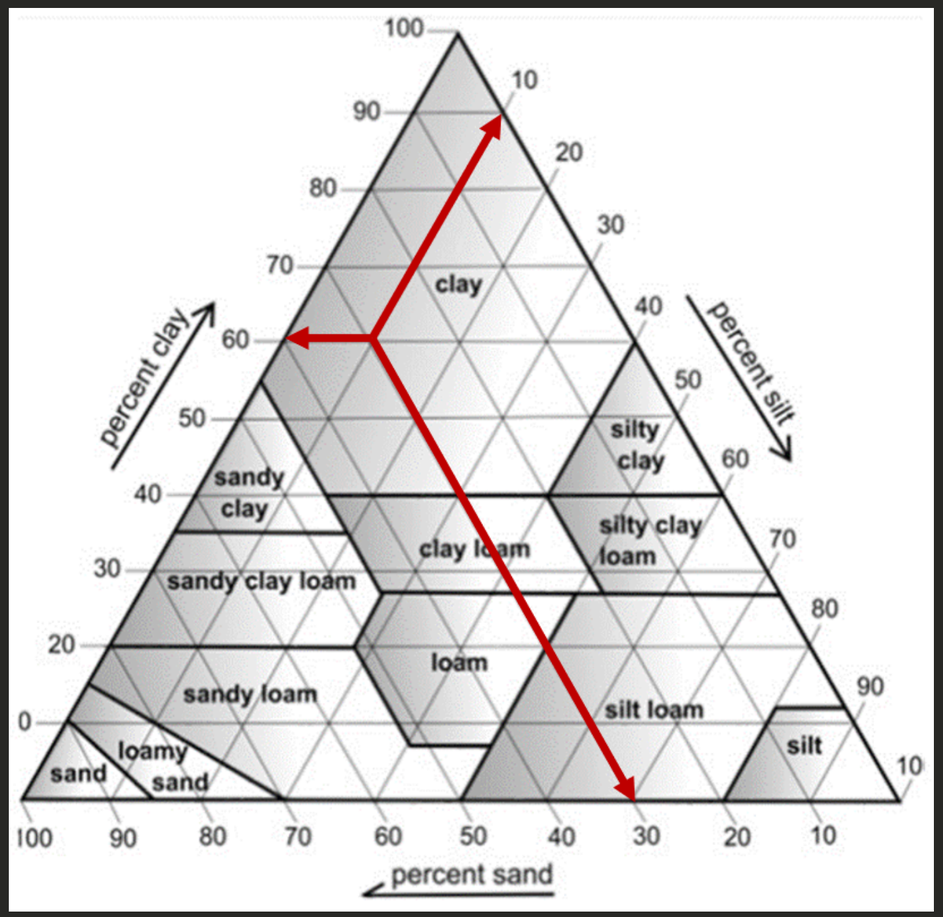
· Based on the information for Soil samples #1 and #2, which soil will have the greatest permeability? Briefly explain why.

Q1 Answer: Sand. In sandy clay loam, sand is the dominant component, followed by clay and silt.

Q2. Soil sample #1: You send a sample of soil to be tested and find out that it contains 15% clay, 65% silt, and 20% sand. What kind of soil do you have?

Q3. Soil sample #2: You send a second soil sample to be tested and find out that it contains 60% clay, 10% silt, and 30% sand. What kind of soil is this?





Q4: Based on the information for Soil samples #1 and #2, which soil will have the greatest permeability? Briefly explain why.

Answer: Soil sample #1 (Silt loam)will have greater permeability.

Explanation: Silt loam has larger particles and more pore space than clay, allowing water to move through it more easily. Clay, with its very fine particles, holds water tightly and has poor permeability.

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Clay	<0.002
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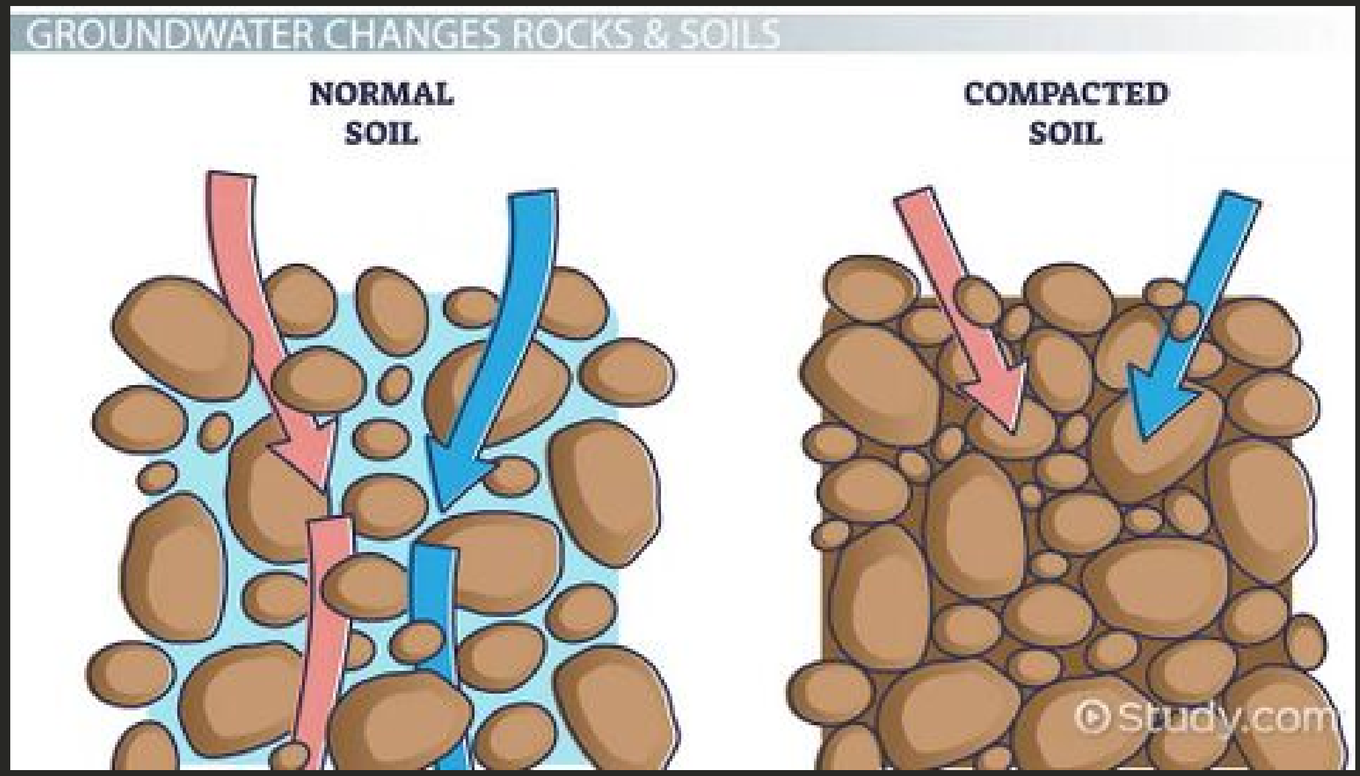
Lab Activity 2: Understanding Soil Properties

Understanding properties and classifications of soil



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Q1. What is meant by the permeability of soil?

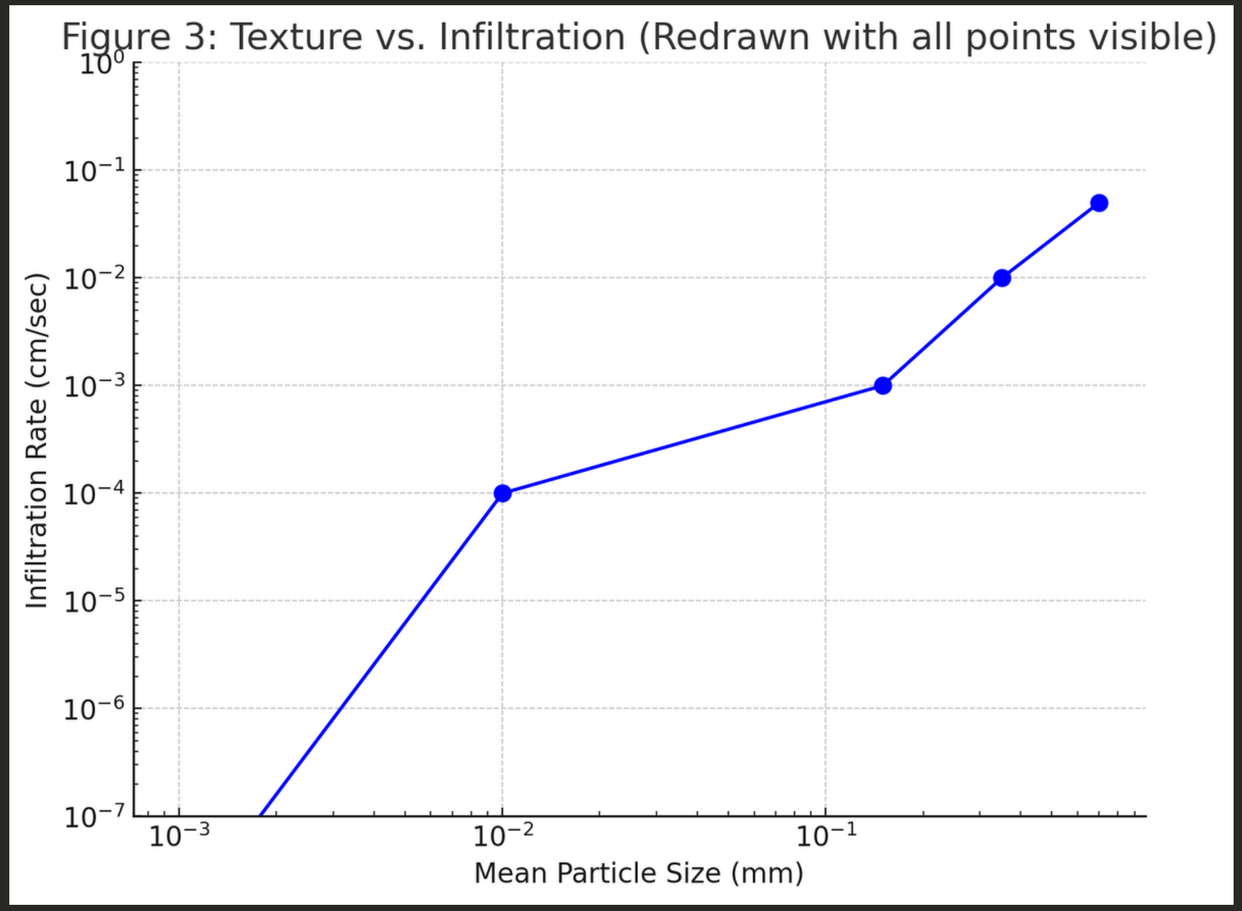
Q2. Graph mean particle size against infiltration rate (in Figure 3). You can do this either by printing out the next page and doing it by hand or digitally (e.g., by adding symbols to the document).

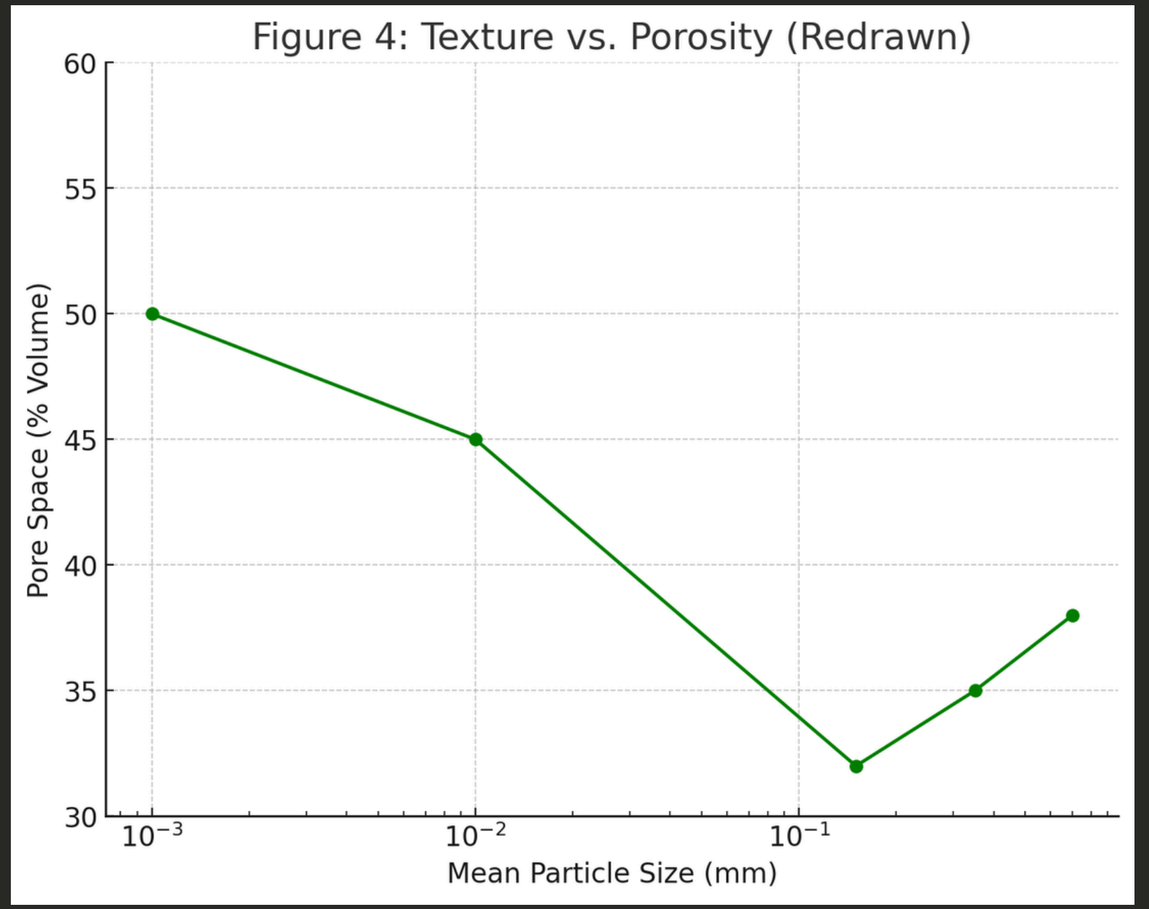
Q3. Based on these values, which type of soil is the most permeable? Which is the least permeable?

Q4. Sketch in a ‘best fit’ line through the points that indicate the relationship between texture and infiltration for these samples. If you have a different soil sample from the same general area with a mean particle size of 0.25 mm, what would you estimate its infiltration rate?

Q1: What is meant by the permeability of soil?

Answer: Permeability refers to the soil's ability to allow water to pass through it. High permeability means water moves through the soil easily, while low permeability indicates that water moves slowly or is retained.





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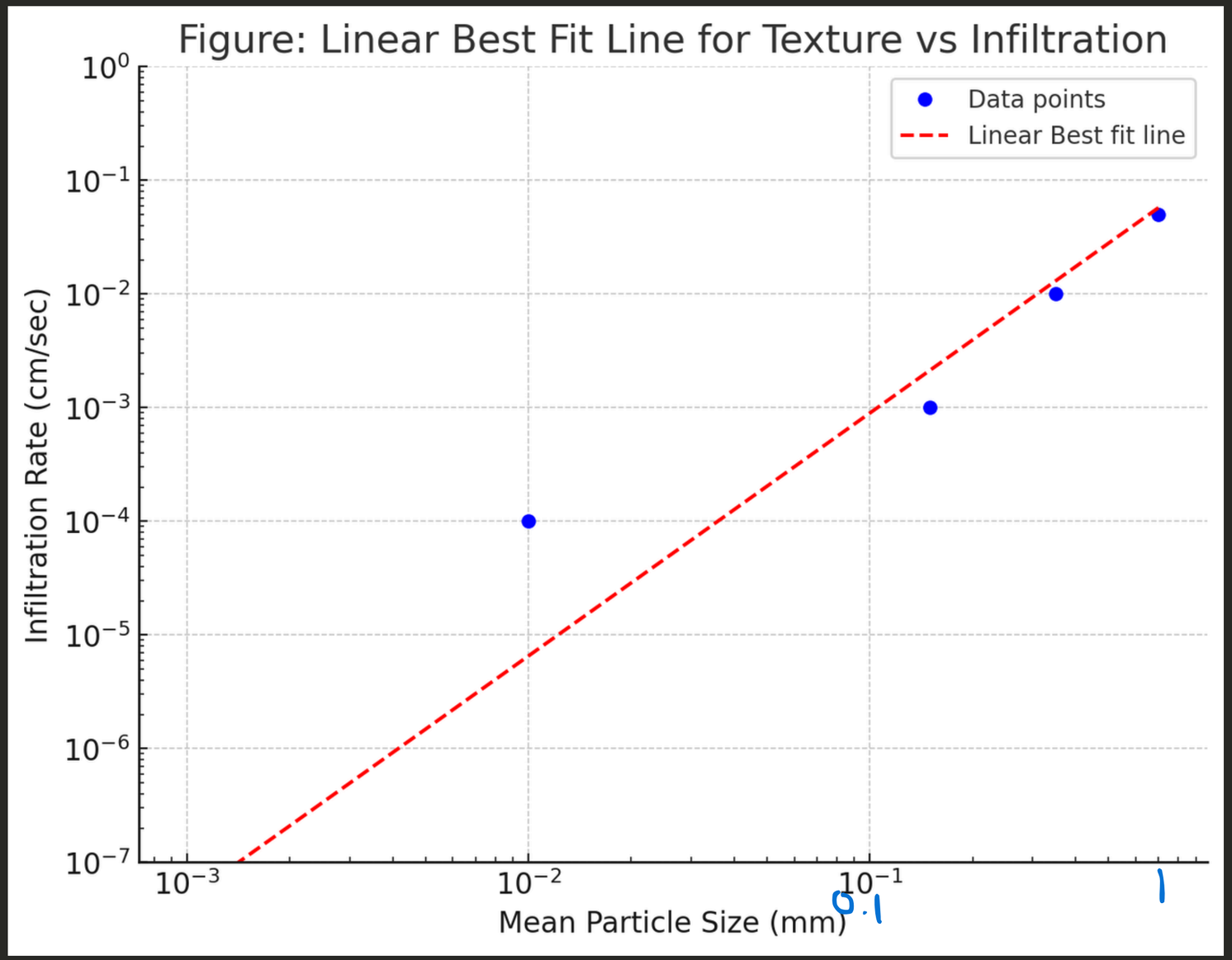
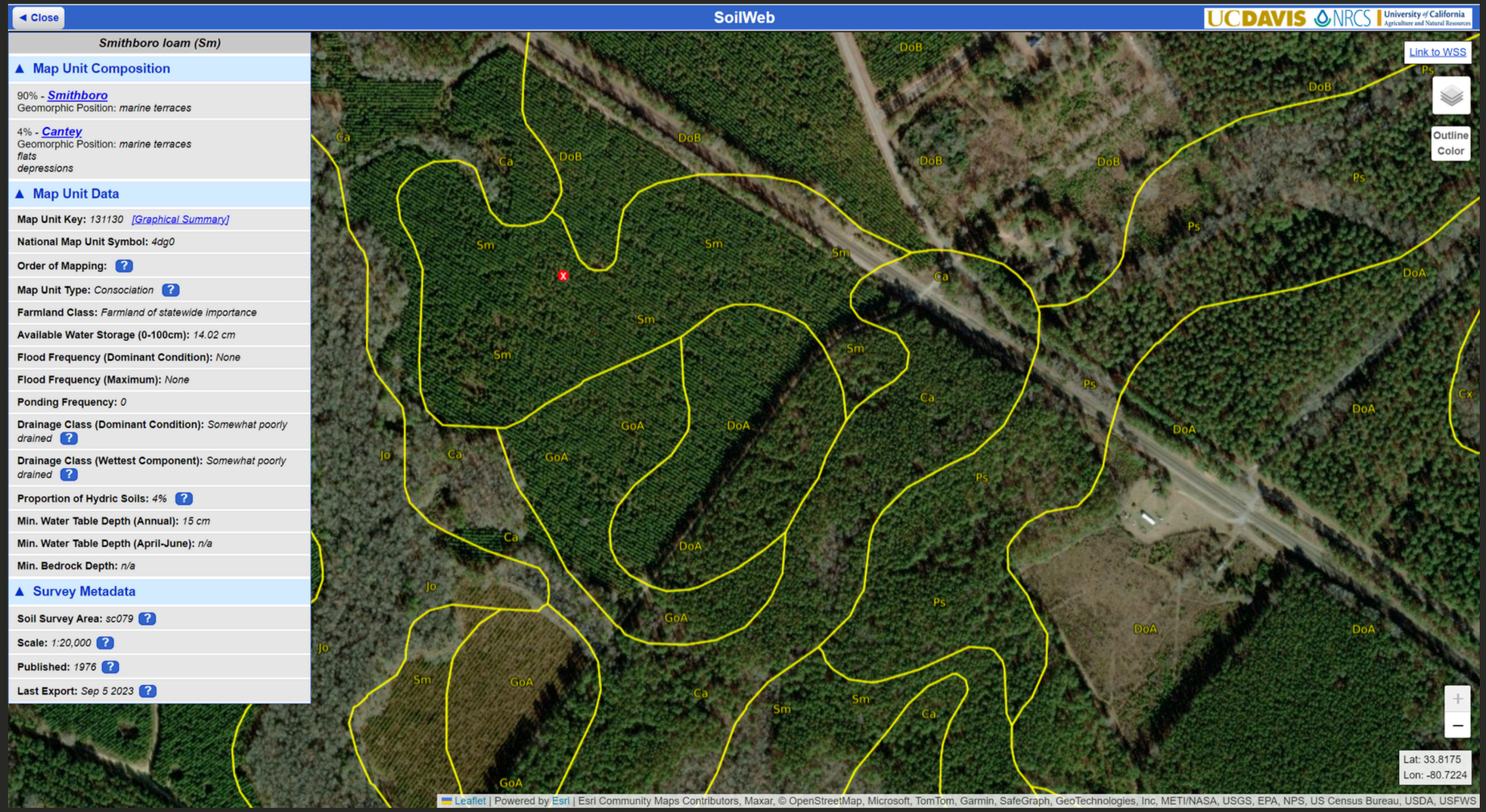


Q4. Sketch in a 'best fit' line through the points that indicate the relationship between texture and infiltration for these samples. If you have a different soil sample from the same general area with a mean particle size of 0.25 mm, what would you estimate its infiltration rate?

Here is the linear best fit line for the relationship between mean particle size and infiltration rate.

For a soil sample with a mean particle size of 0.25 mm, the estimated infiltration rate is approximately 0.0064 cm/sec based on this linear fit.

Lab Activity 3: Discover the Soils Around You



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https://casoilresource.lawr.ucdavis.edu/gmap/

"Soil is the foundation of life, supporting ecosystems and human civilization alike."

Jane Smith Doe