

Soil Ecosystems from Micro to Global Scales

Lecture #1: Introduction to Soil Science

Rule #1 of Soil Science: Soil is NOT just dirt!

Dirt




Soil



About Hayley
 Email: S12485-teachers@esp.mit.edu

- 4th year PhD student studying Environmental Engineering
- Undergraduate degree in Geochemistry (Spring 2015)
- Research methane production in soils



- ### Student Introductions
1. What is your name?
 2. What grade are you in?
 3. Have you participated in HSSP before, and, if so, what classes have you taken?
 4. Why did you decide to learn more about soil science?

Class Structure:

#	Date	Topic	Learning Objective(s)	Activity
1	2/23/19	Introduction to Soils	<ul style="list-style-type: none"> o Define soil and its components o Examine soil heterogeneity across length scales 	Importance of Soils
2	3/2/19	Soil Physical Properties and Water Flow	<ul style="list-style-type: none"> o Identify size fractions of soil particles o Understand how particle size distribution influences water flow 	Soil Texturing Lab
3	3/9/19	Soil Chemistry	<ul style="list-style-type: none"> o Describe soil mineralogy, pH, and organic matter o Understand how soil chemical reactions influence soil health and structure 	Soils as Water Filters
No class on 3/16/19 (Spark weekend!)				
4	3/23/19	Soil Ecology	<ul style="list-style-type: none"> o Identify soil organisms and chemical reactions mediated by organisms o Understand how soil biology affects soil physical and chemical properties 	Respiration in a Jar
5	3/30/19	Soil Classification	<ul style="list-style-type: none"> o Understand the soil-forming factors o Describe soil horizons o Define the twelve soil orders 	Web Soil Survey
6	4/6/19	Soil and Humans	<ul style="list-style-type: none"> o Synthesize concepts from soil chemistry, biology, and physics to understand how soils provide essential ecosystem services 	Summary Activity

- ### Today's Learning Objectives
- Define the four components of soil
 - Understand how the components of soil interact
 - Explain how soils form ecosystems

Today's Learning Objectives

- Define the four components of soil
- Understand how the components of soil interact
- Explain how soils form ecosystems
- **TL;DR** : What does the title of this class actually mean?

Soil Ecosystems from Micro to Global Scales

Lecture #1: Introduction to Soil Science

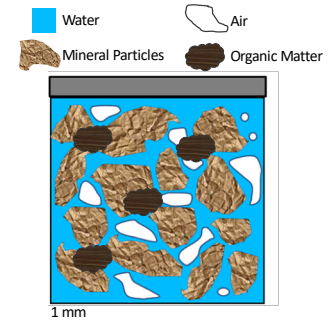
What is a soil?

Soil Ecosystems from Micro to Global Scales

Lecture #1: Introduction to Soil Science

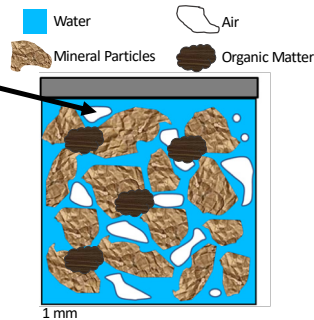
Abiotic Components of Soil

1. Air
2. Water
3. Minerals
4. Organic Matter



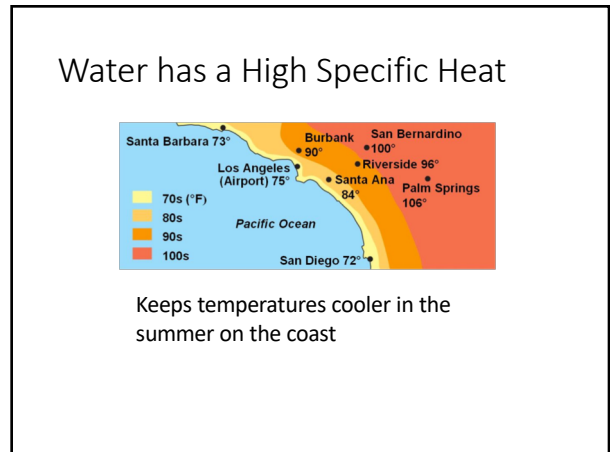
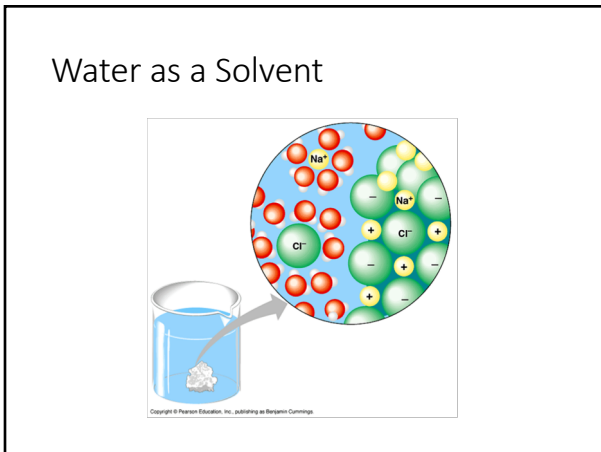
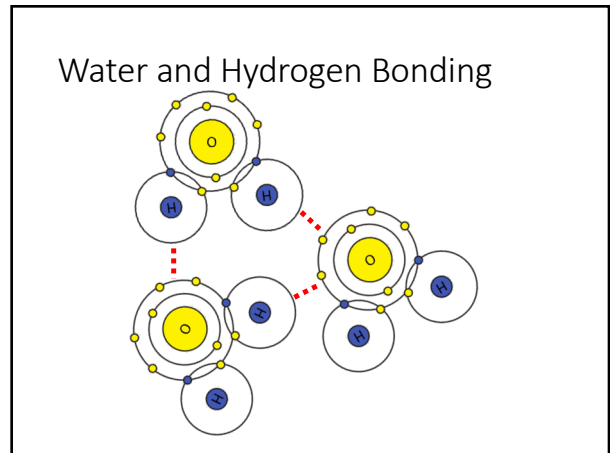
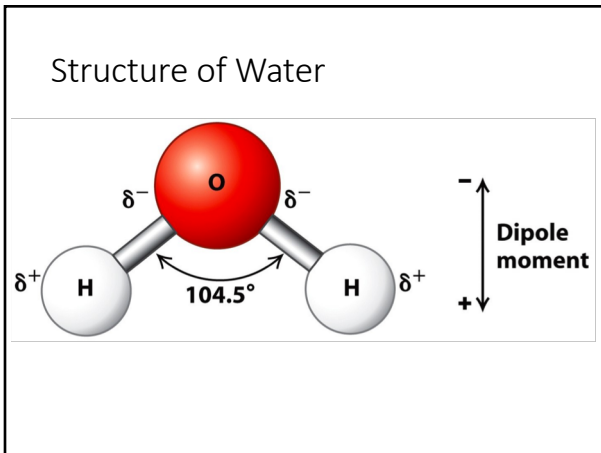
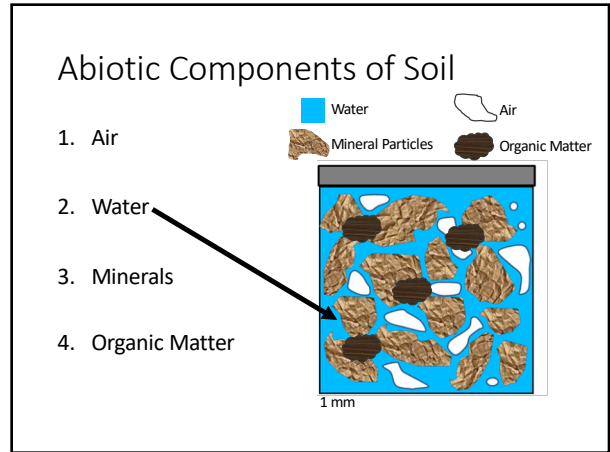
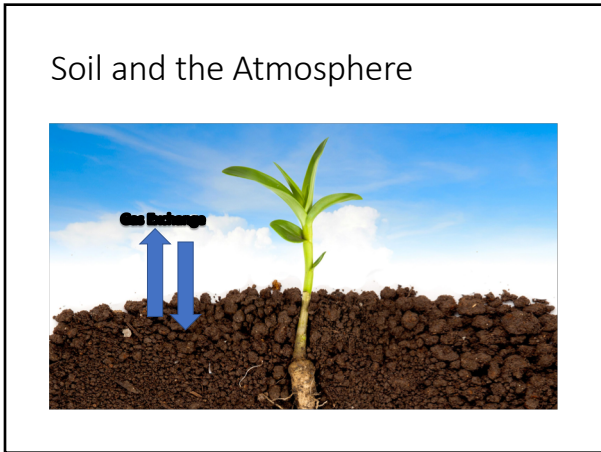
Abiotic Components of Soil

1. Air
2. Water
3. Minerals
4. Organic Matter



Soil and the Atmosphere





Cohesion and Adhesion in Water

Adhesion Cohesion Adhesion

Polar or Charged Object

Surface Tension

Soil and the Hydrosphere

The water cycle

Condensation

Transpiration

Precipitation

Evaporation

Percolation

Abiotic Components of Soil

1. Air
2. Water
3. Minerals
4. Organic Matter

Water Air

Mineral Particles Organic Matter

1 mm

Table Salt

Halite Crystals NaCl

Table Salt NaCl

250 µm

25 mm

Table Salt NaCl

1 mm

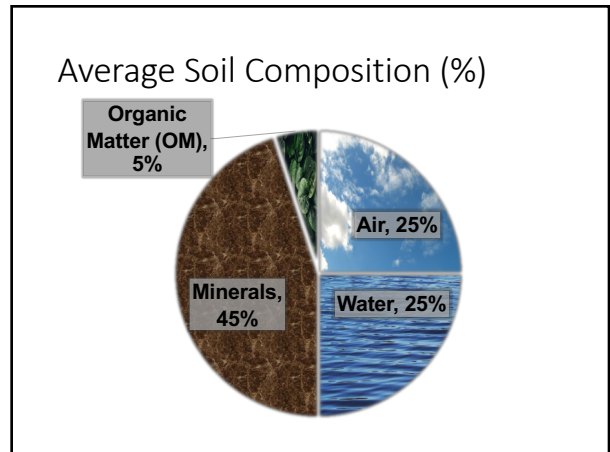
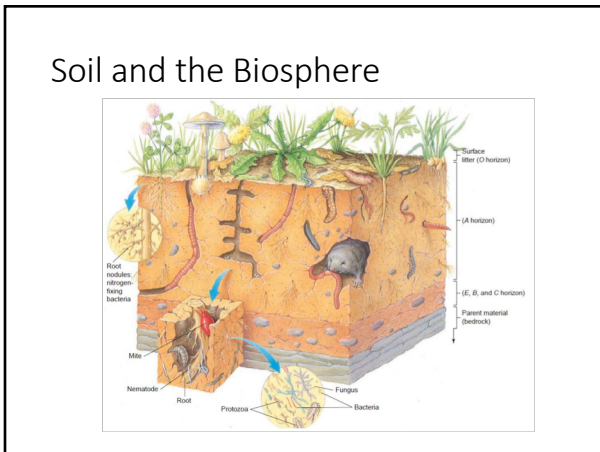
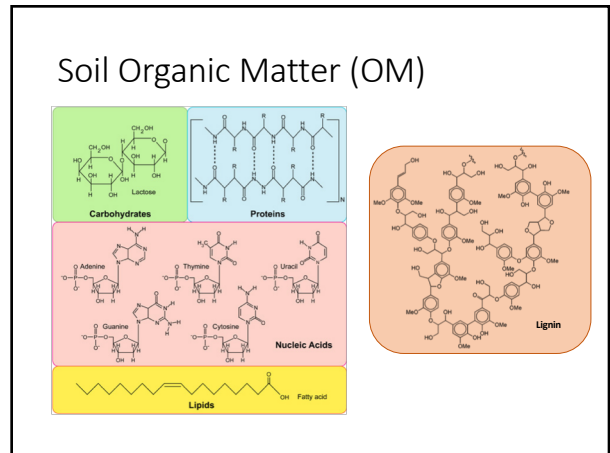
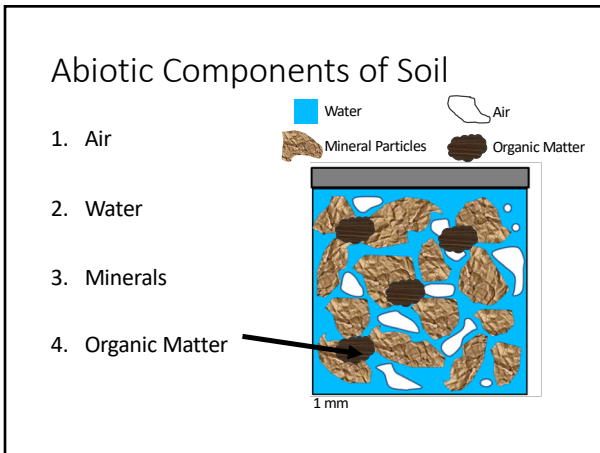
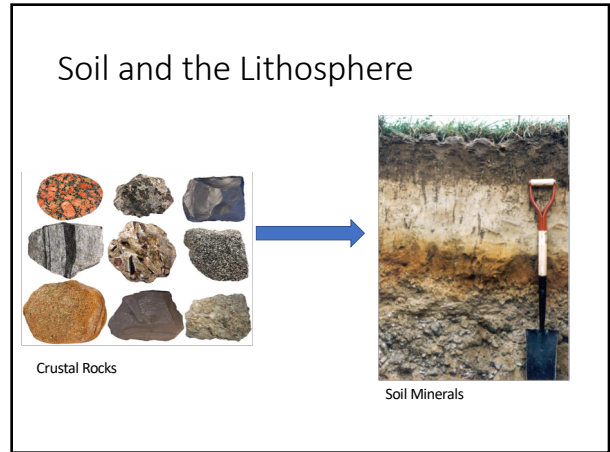
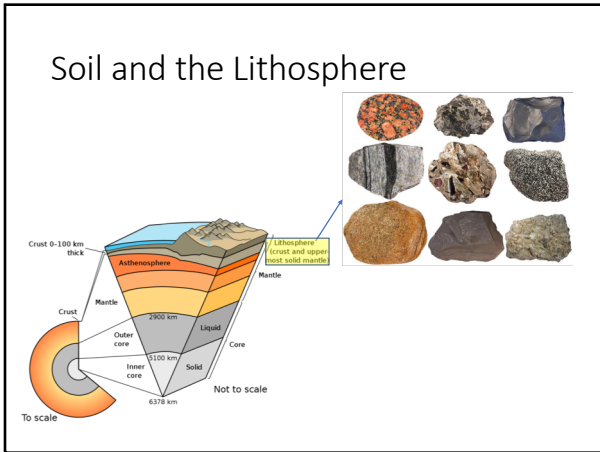
Cl⁻ Na⁺

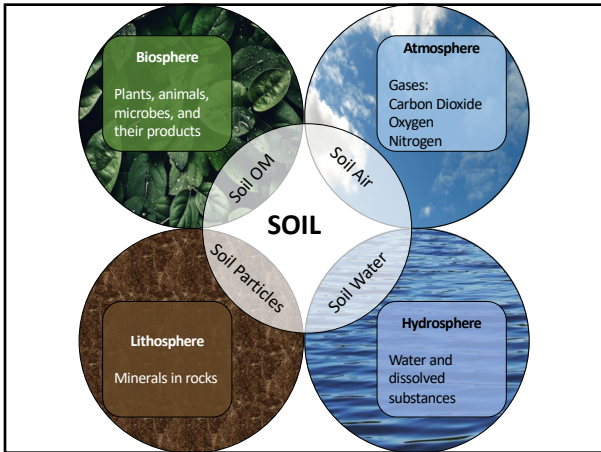
Is sucrose (table sugar) a mineral? Why or why not?

Sucrose (saccharose)

Is sucrose (table sugar) a mineral? Why or why not?

Sugar cane!





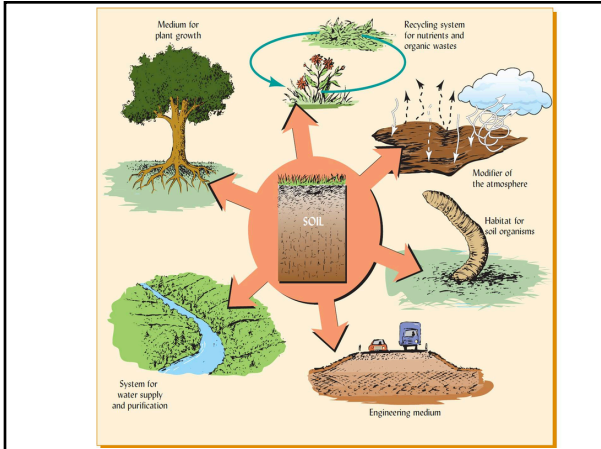
Why are soils important?

Farmer

Biologist

Engineer

Paleontologist



Soil Ecosystems from Micro to Global Scales

Lecture #1: Introduction to Soil Science

What is an ecosystem?

Soil Ecosystems from Micro to Global Scales

Lecture #1: Introduction to Soil Science

Hierarchy of Biology

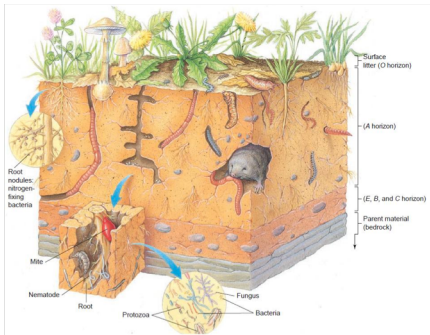
Individual

Population

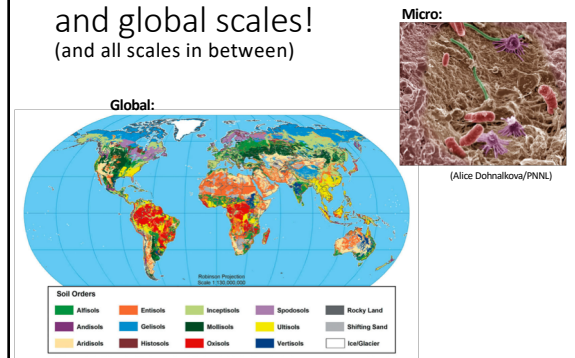
Community

Ecosystem

Soil Ecosystem



Soils are heterogenous at micro
and global scales!
(and all scales in between)



Wrap Up Sheet

1. What is the most important and/or interesting thing you learned today?
2. What questions do you have about the material we covered today?