24.10.29 earth science: soils-physical aspects

Soils provide minerals, hold moisture, allow air to pass, create a space for living creatures and bacteria, and physically hold plants to the ground. Without soil, agriculture as a whole would fail (there are small exceptions, like hydroponics)

Module 25: https://elab.hpa.edu/apes/texts/fr3e/modules/mod25-soils.pdf

We'll cover two aspects of soil: physical and chemical

physical aspects:

All soil comes from three parent materials (rocks):

- Igneous rocks (fire)
- Sedimentary rocks (layers)
- Metamorphic rocks (Kafka rocks, just kidding: changed by heat and pressure)

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Igneous Rocks:

- Comes directly from magma, and can be either basalt (low melting point, like our island or oceanic plates) or granite (lighter, what continents are made of)
- Granite breaks down into light-colored sand, makes for fertile soil.
- Basalt (like Hawaii) can make sand too, but less fertile (e.g. black sand beach).
- Fun fact: you can melt any rock on our island (not coral)

Sedimentary Rocks:

- just like it sounds, from mud, sand, or dust, usually in layers.
- you may have seen these in rock formations or cliffs
- often formed from layers of decaying stuff (plankton, diatoms)

Metamorphic Rocks

- changed by heat and/or pressure (slate, marble, or coal)
- Soil-formed by weathering (chemical or physical) of parent rock
- Erosion can be by water or air (wind)

Erosion:
The breakdown of parent rocks into minerals is erosion
Can be wind, chemical (eg. acid rain), water, or physical (glaciers)

Soil is the connection between geology and(e.g. rocks) and biology (e.g. living things)
Ecosystem services is a term to describe how soil is critical to these systems:

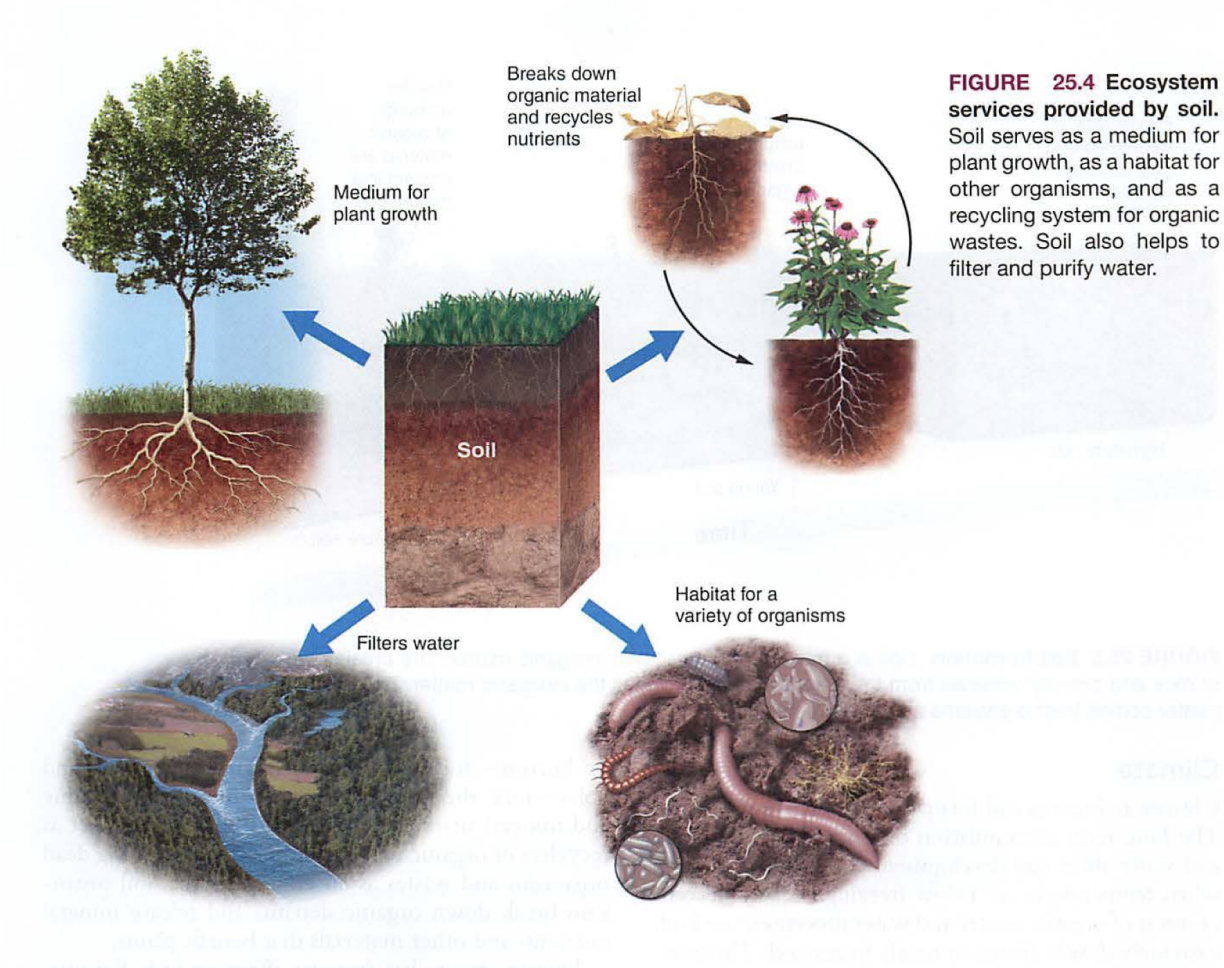


FIGURE 25.4 Ecosystem services provided by soil. Soil serves as a medium for plant growth, as a habitat for other organisms, and as a recycling system for organic wastes. Soil also helps to filter and purify water.

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Parent Material is a term to describe the rock the soil comes from
Influenced by:

- wind
- water
- climate
- topography

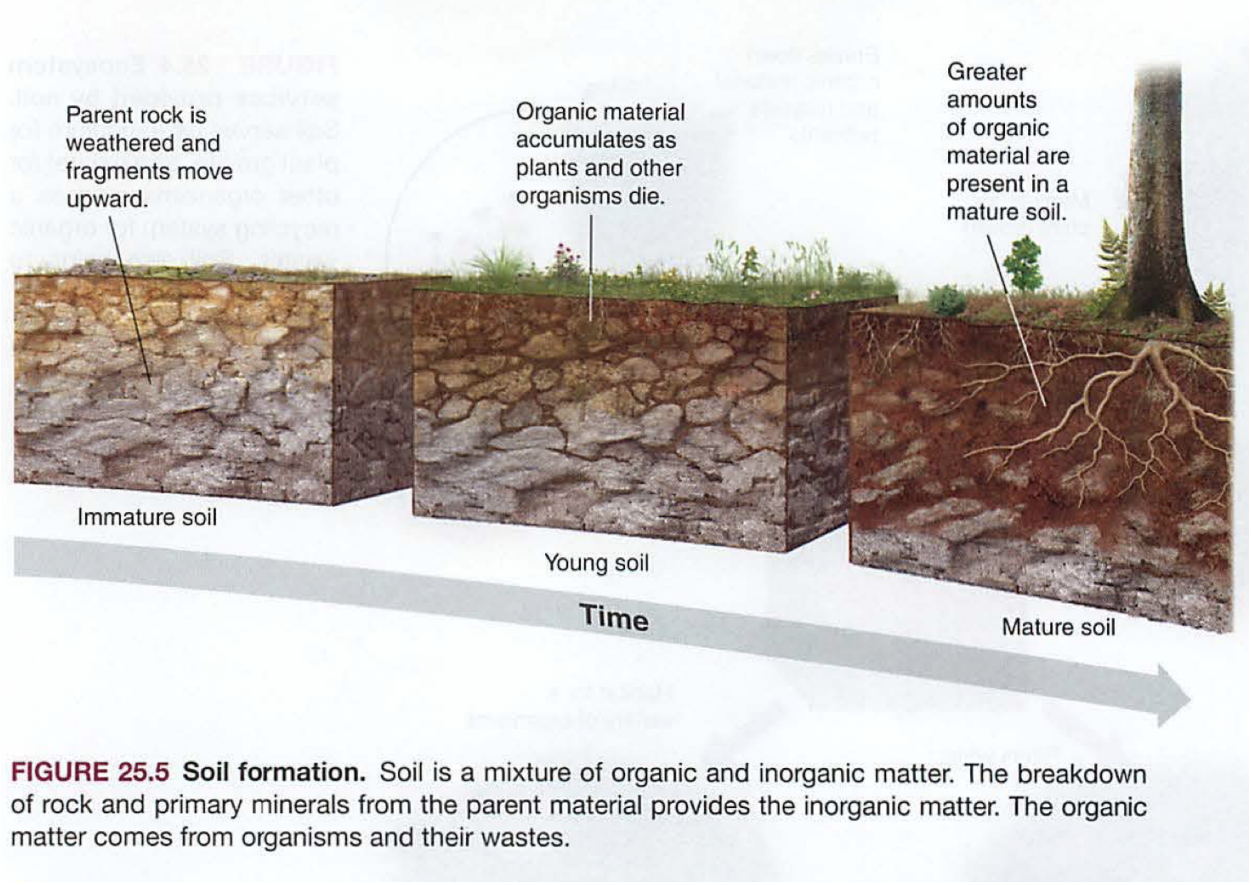


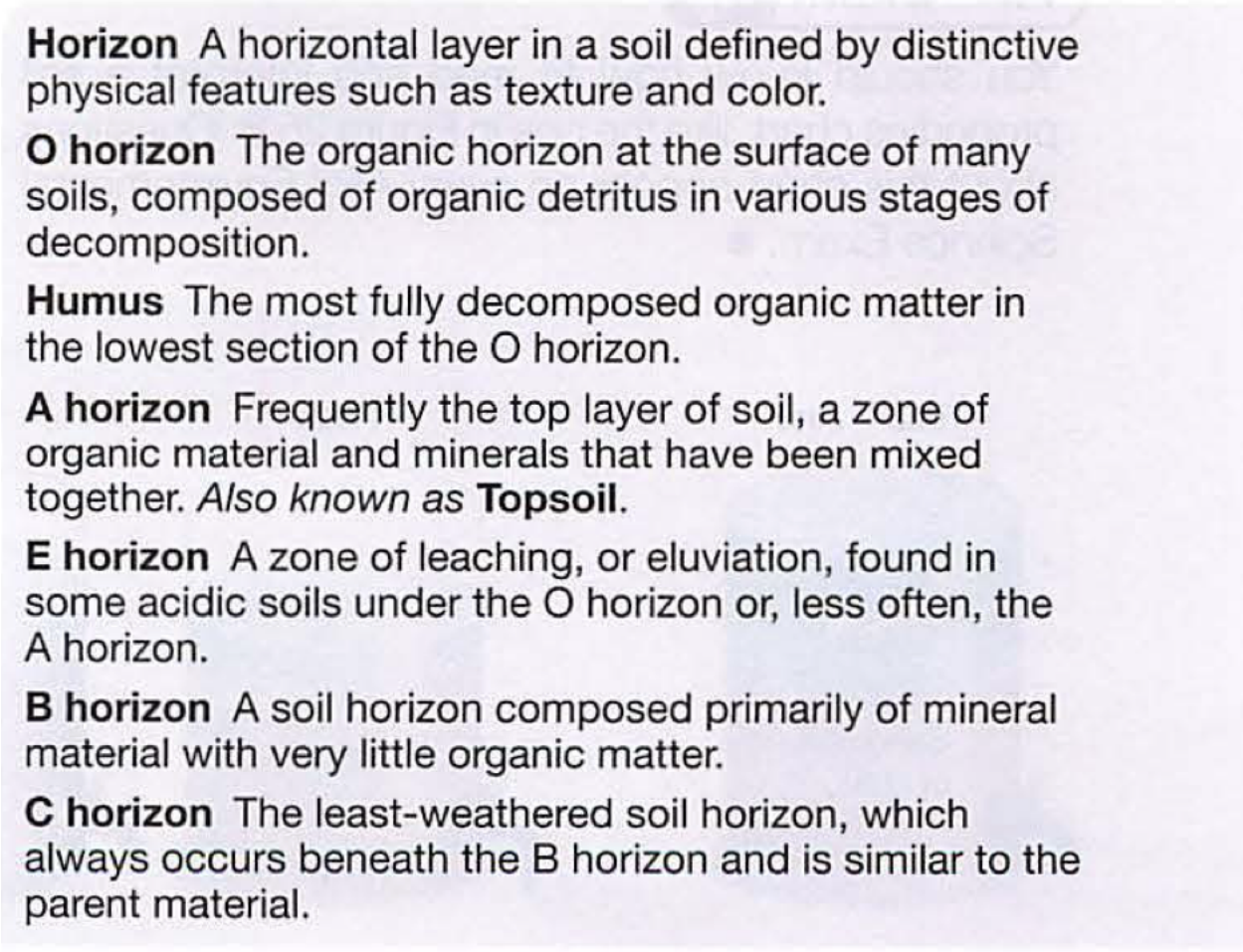
FIGURE 25.5 Soil formation. Soil is a mixture of organic and inorganic matter. The breakdown of rock and primary minerals from the parent material provides the inorganic matter. The organic matter comes from organisms and their wastes.

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Soil degradation is the process of degrading the soil's ability to support plant growth:

- soil erosion
  - dust bowl: wind erosion removed topsoil
  - floods: water erosion removes topsoil
  - desertification: overuse of mineral-rich well water makes the soils too salty to support plants
  - over tilling: removes organic matter that protects the topsoil

Soil Horizons:



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Soil is made up of three general sized particles and organized into a soil triangle:

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How to read this:

1. always read clockwise
2. make sure to read each type (3)

Our Soil Sieve has 4 filters, with 5 layers:

- mesh 5 = 4 mm
- mesh 10 = 2 mm
- mesh 60 = .25 mm
- mesh 230 = 0.063 mm

Basically, most of what you find is silt and clay...

Go online and find your favorite soil triangle game!

https://www.purposegames.com/game/textural-triangle-soils-game

Soil, water and air

- These physical aspects impact the ability for soil to hold water and allow air between the spaces
- Smaller particles hold water better (capillary action, remember?) but don't allow air to pass
- Larger particles drain faster, enabling air passage, but have lower nutrient values (because they are washed so much) and hold water less (think of water on the beach)
- Organic particles (decaying plant matter) hold water like a sponge, making a perfect combination
- We measure these as:

> "
>
> > "
> >
> > 1. Water holding capacity: the amount of water held in the soil (organic matter does this)
> > 2. Permeability: the ability for water to transit through the soil (depends on soil particle sizes)

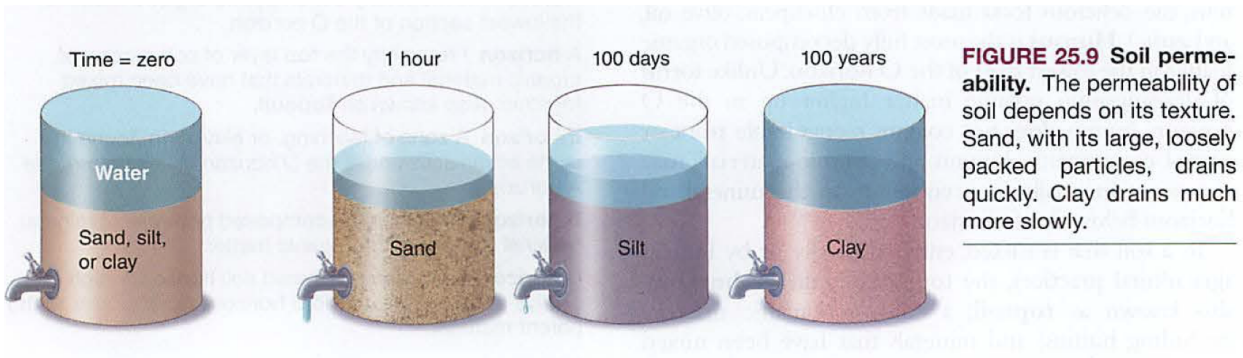


FIGURE 25.9 Soil permeability. The permeability of soil depends on its texture. Sand, with its large, loosely packed particles, drains quickly. Clay drains much more slowly.

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Lots of cool things live in the soil, changing the physical and chemical properties of the soil:

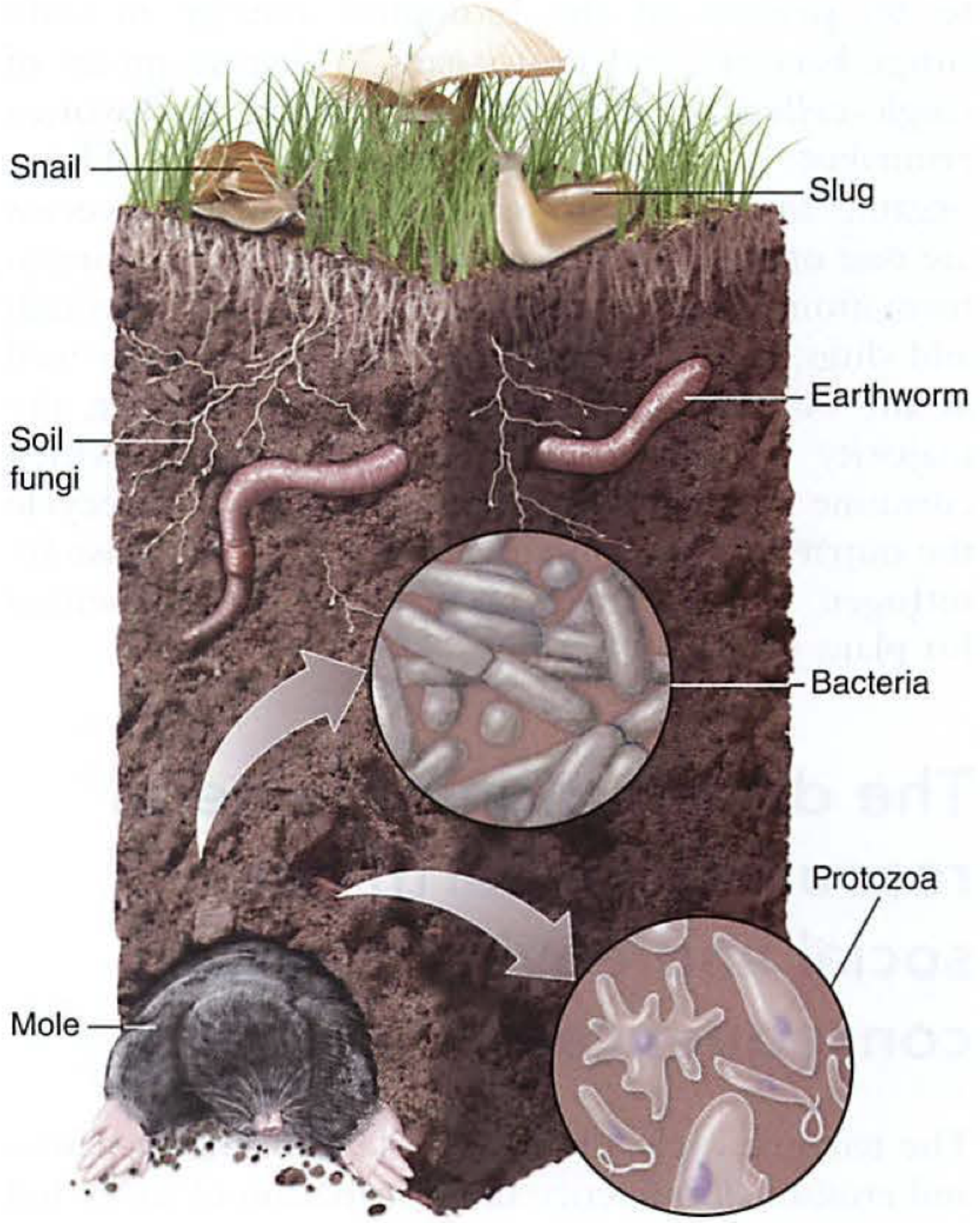


FIGURE 25.10 Soil organisms. Bacteria, fungi, and protozoans account for 80 to 90 percent of soil organisms. Also present are snails, slugs, insects, earthworms, and rodents.

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Important safety tip: when discussing soils with soil folks, never call it "dirt". Soil folks get angry when you confuse these...

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