

Soil Notes



General Soil
Information

Definition

✦ Soil – relatively thin surface layer of the Earth's crust consisting of mineral and organic matter that is affected by agents such as weather, wind, water, and organisms.

Composition – 4 Distinct Parts

- ✦ Mineral particles (45% of “typical” soil)
- ✦ Organic matter (only about 5%)
- ✦ Water (about 25%)
- ✦ Air (about 25%)

Importance

- ✦ Organisms, **mainly microorganisms**, inhabit the soil & depend on it for shelter, food & water.
- ✦ Plants anchor themselves into the soil, and get their nutrients and water. Terrestrial plants could not survive without soil, therefore, **humans could not exist without soil either.**

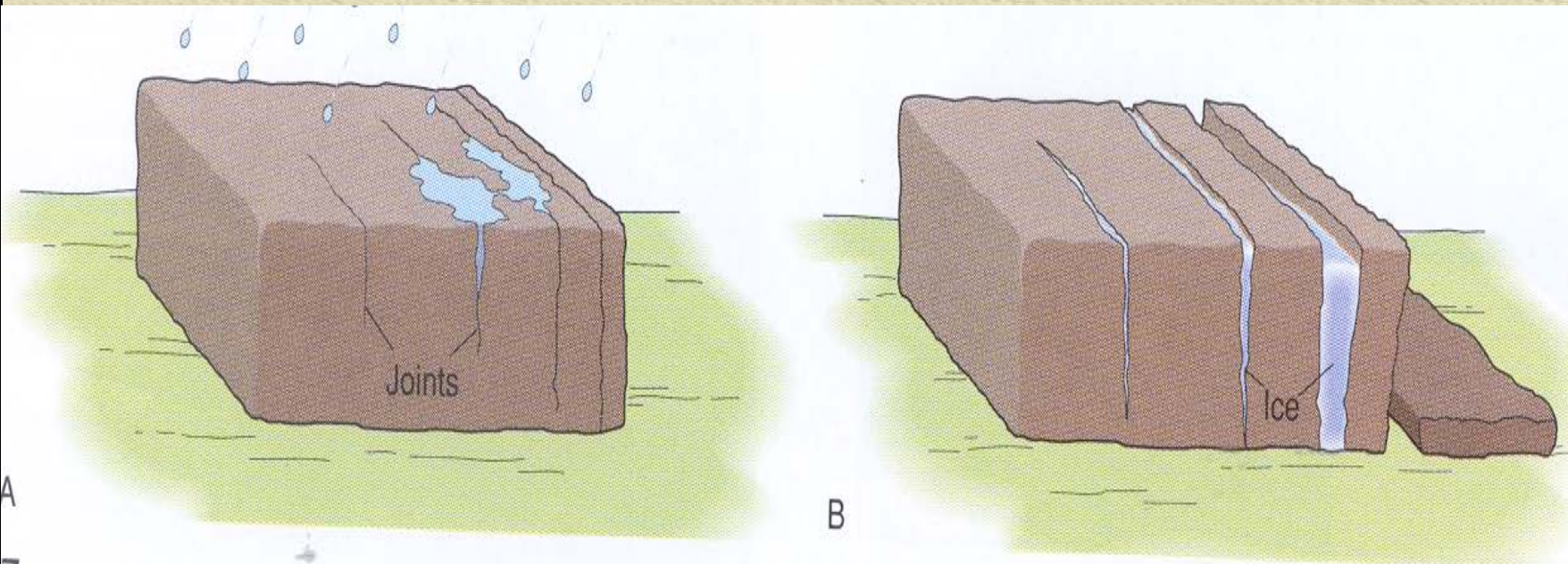
Soil Formation

Parent Material

- ✦ The rock that has slowly broken down into smaller particles by **biological, chemical, and physical weathering.**
- ✦ To form 2.5 cm (1 in.) it may take from **200-1000** years.

Physical Weathering

✦ Ex. erosion (wind, water, ice, etc.)



A

7

B

Chemical Weathering

✦ A plant's roots or animal cells undergo cell respiration and the CO_2 produced diffuses into soil, reacts with H_2O & forms **carbonic acid** (H_2CO_3). This eats parts of the rock away.

Renewable or Not?

✦ **Decomposition** produces new soil

✦ But, in the tropical rainforests, all of the nutrients are caught in the trees and when cut down & burned the soil cannot get the nutrients back.

Soil Properties: Texture

✦ The percentages (by weight) of different sized particles of sand, silt and clay that it contains.

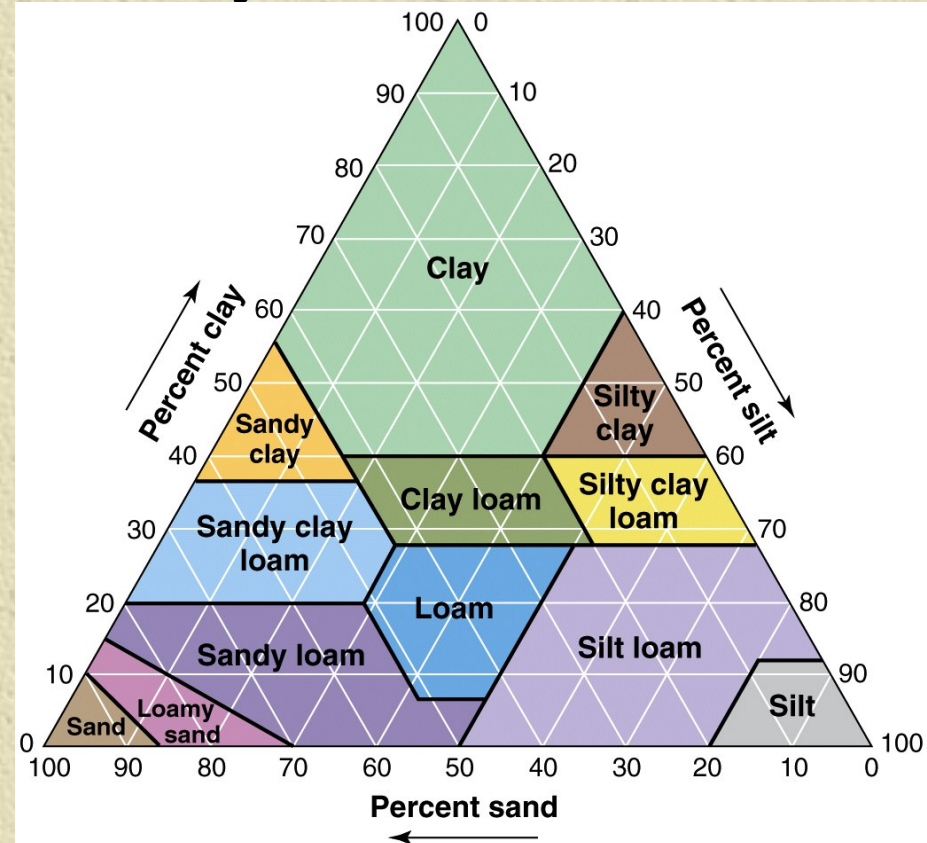


Figure 8-3 Environmental Science, 10/e
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Texture (Cont.)

- ◆ $>2\text{mm}$ in diameter = gravel/stones (not actually considered soil because it doesn't have direct value to plants).
- ◆ **0.05 to 2mm** = sand (the largest soil particles) can be seen easily with the eye.
- ◆ 0.002 to 0.05mm = **silt** – about the size of flour and barely visible with the eye.
- ◆ **$<.002\text{mm}$** = clay (has the greatest surface value) – only seen under and electronic microscope.

Texture

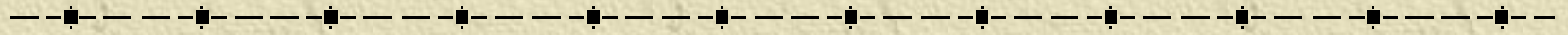
To tell the difference in soil, take the soil, moisten it, and rub it between your fingers and thumb.

Gritty -has a lot of sand

Sticky- high clay content and you should be able to roll it into a clump

Silt- smooth, like flour.

Structure



✦ How soil particles are organized and clumped together. (Sand, silt, clay)

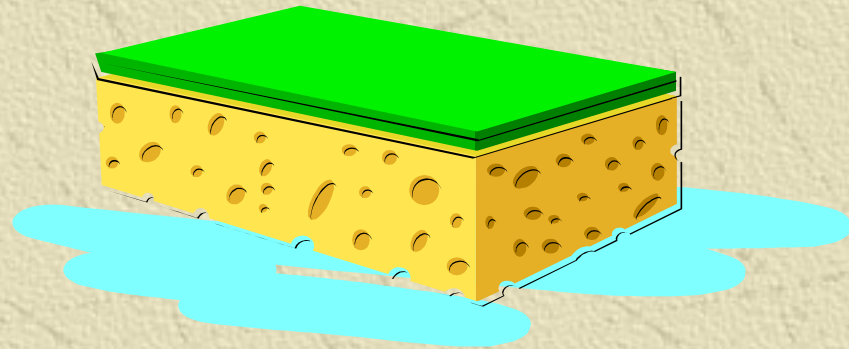
Friability

✦ How easily the soil can be
crumbled.



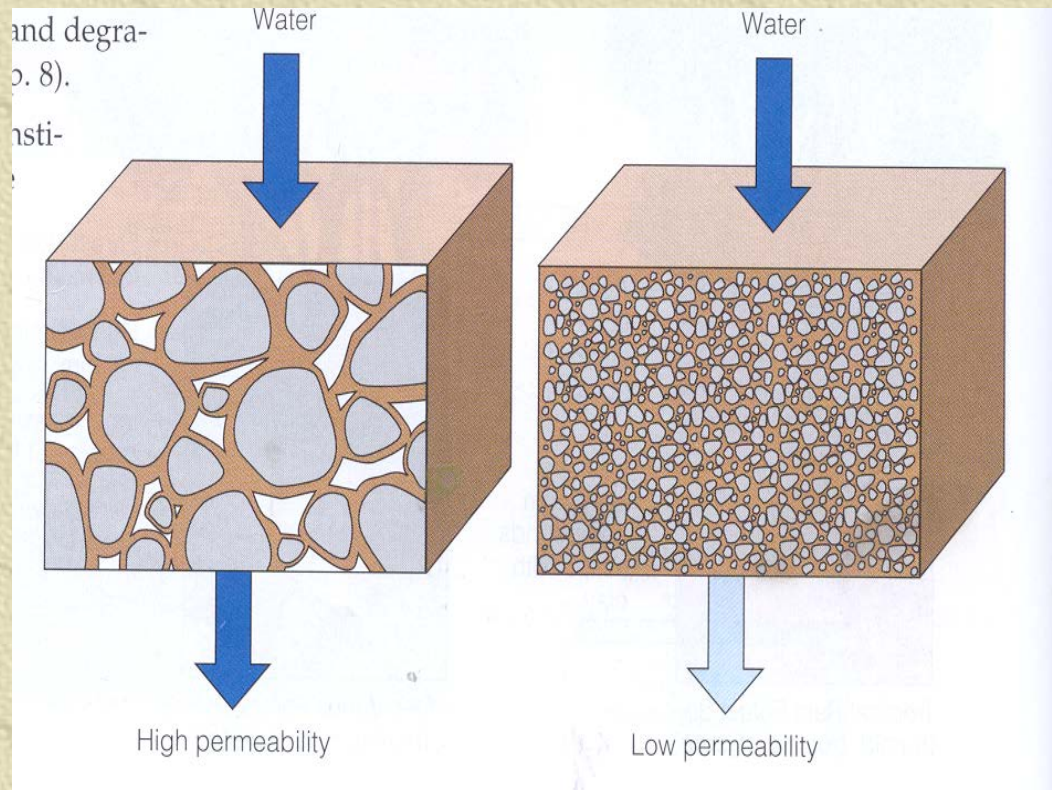
Porosity

✦ A measure of the **volume** of soil and the average **distances** between the spaces.



Permeability

✦ The rate at which **water and air** moves from upper to lower soil layers. It is distances between those spaces.



Shrink-Swell Potential

✦ Some soils, like clays, swell when H_2O gets in them, then they dry and crack. This is bad for house foundations, etc.



pH

✦ The pH of most soils ranges from 4.0 to 8.0.

✦ But, the soil of the Pygmy Forest in California is extremely acidic (2.8-3.9) and in Death Valley, California, it is very basic (10.5).

✦ Plants are affected by pH because of the solubility of nutrient minerals.

Slope

- ✦ Steep slopes often have little or no soil on them because of gravity.
- ✦ Runoff from precipitation tends to erode the slope also. Moderate slopes and valleys may encourage the formation of deep soils.

Depth

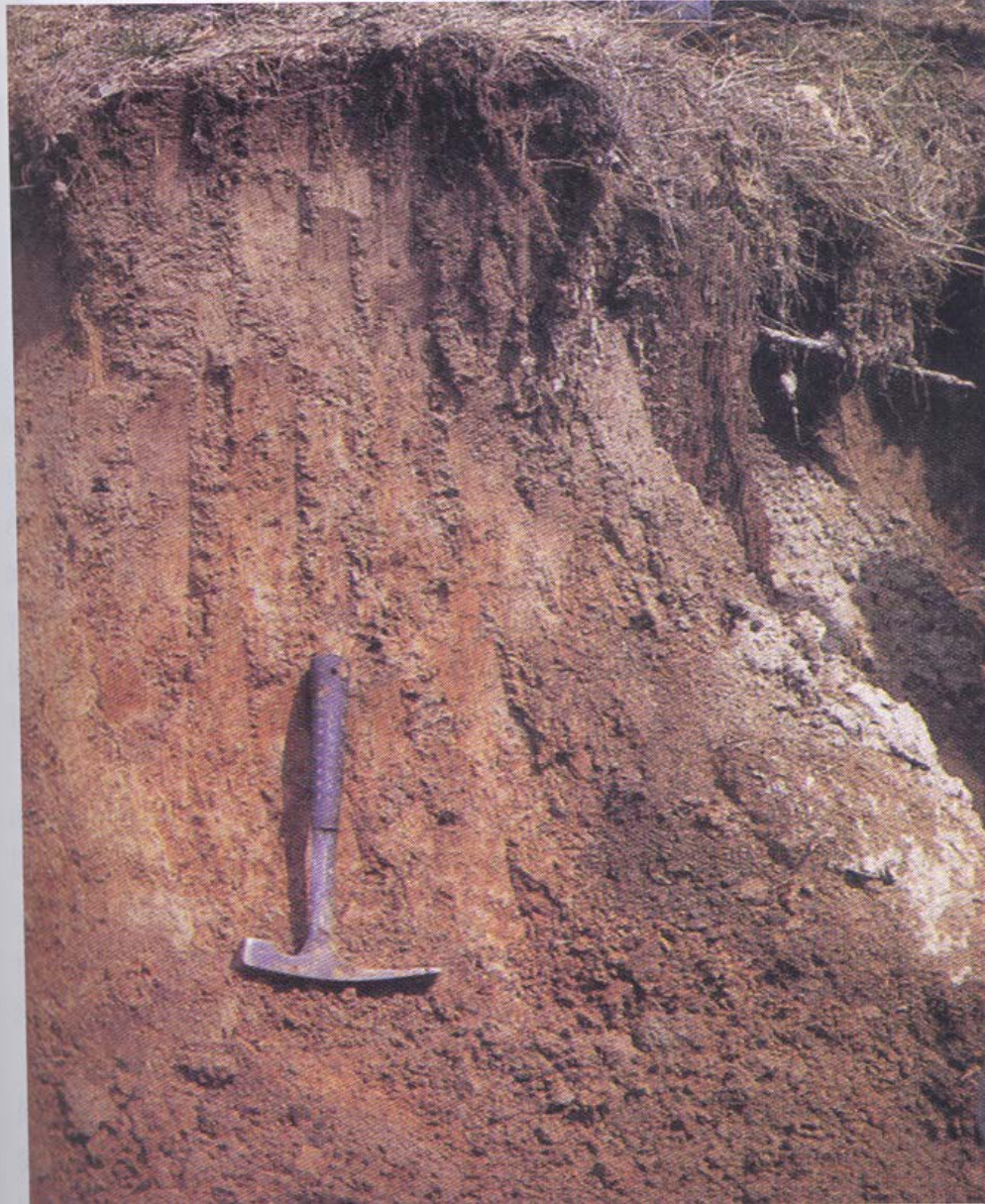
✦ Some soils are very shallow (like in some places in Dallas). It can be only two inches of soil and then you hit rock. Other areas can have soil **36 inches** deep or more.

Color

✦ Dark soil is rich with lots of organic matter.

✦ Light soil (like sand) is not so rich with very little organic matter.

Soil Horizons



Organic Layer (O-horizon)

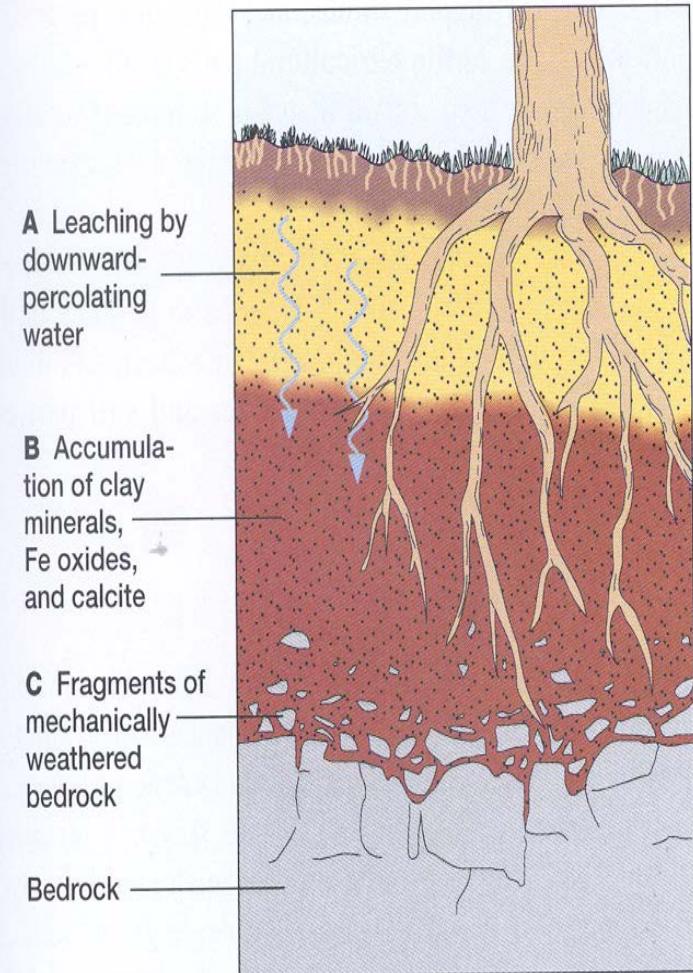
✦ The uppermost layer; it is rich in **organic material**.

✦ Plant litter accumulates in the O-horizon and gradually decays.

✦ In **desert** soils the O-horizon is completely **absent**, but in certain organically rich soils it may be the dominant layer.

Topsoil (A-horizon)

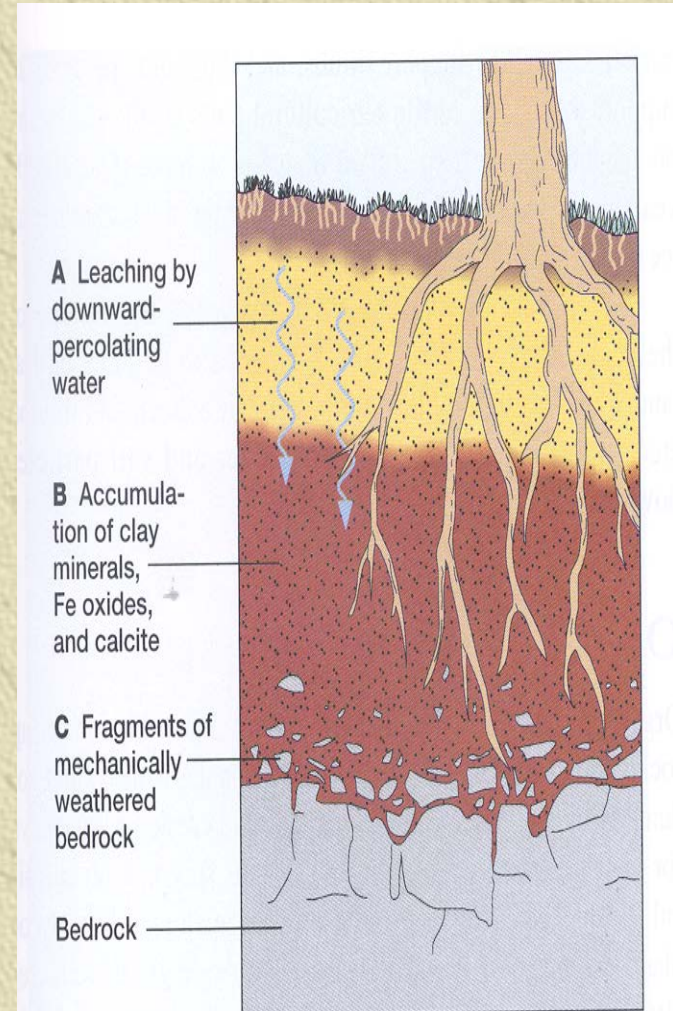
- ✦ It is dark and rich in accumulated organic matter and **humus**.
- ✦ It has a granular texture and is somewhat **nutrient-poor** due to the loss of many nutrient minerals to deeper layers and by **leaching**.



Subsoil (B-horizon)

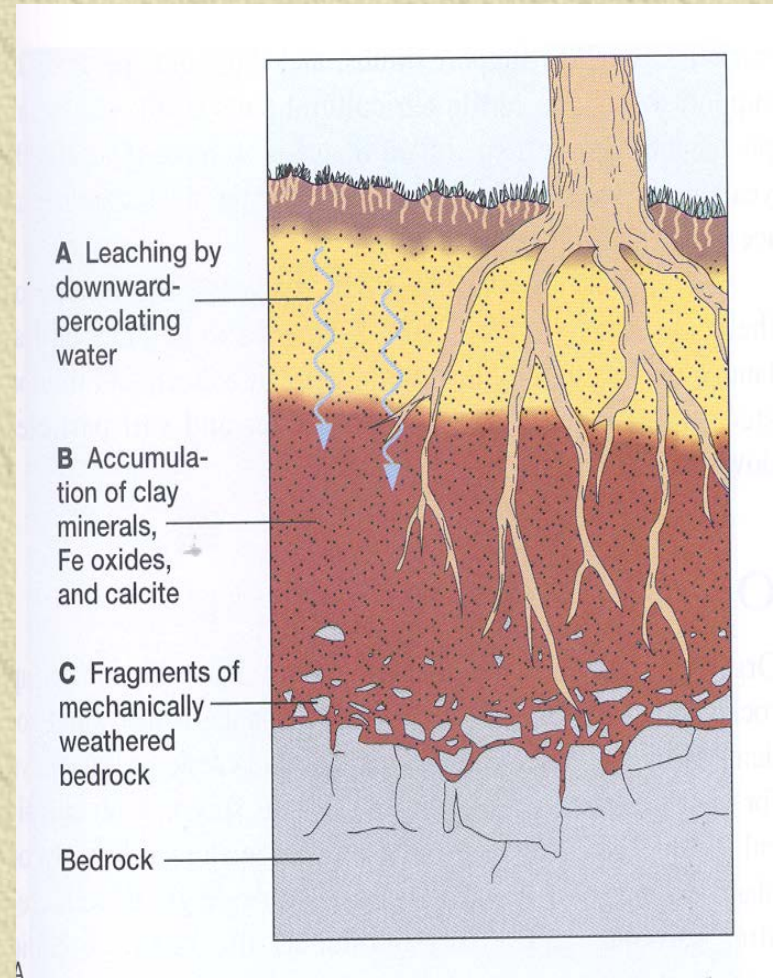
✦ The light-colored subsoil beneath the A-horizon; it is often a **zone of illuviation** where nutrient minerals have leached out of the topsoil and litter accumulate.

✦ It is typically rich in **iron and aluminum** compounds and **clay**.



Parent Material (C-horizon)

✦ This contains weathered pieces of rock and borders the unweathered solid parent material. Most roots do not go down this deep and it is often saturated with groundwater.



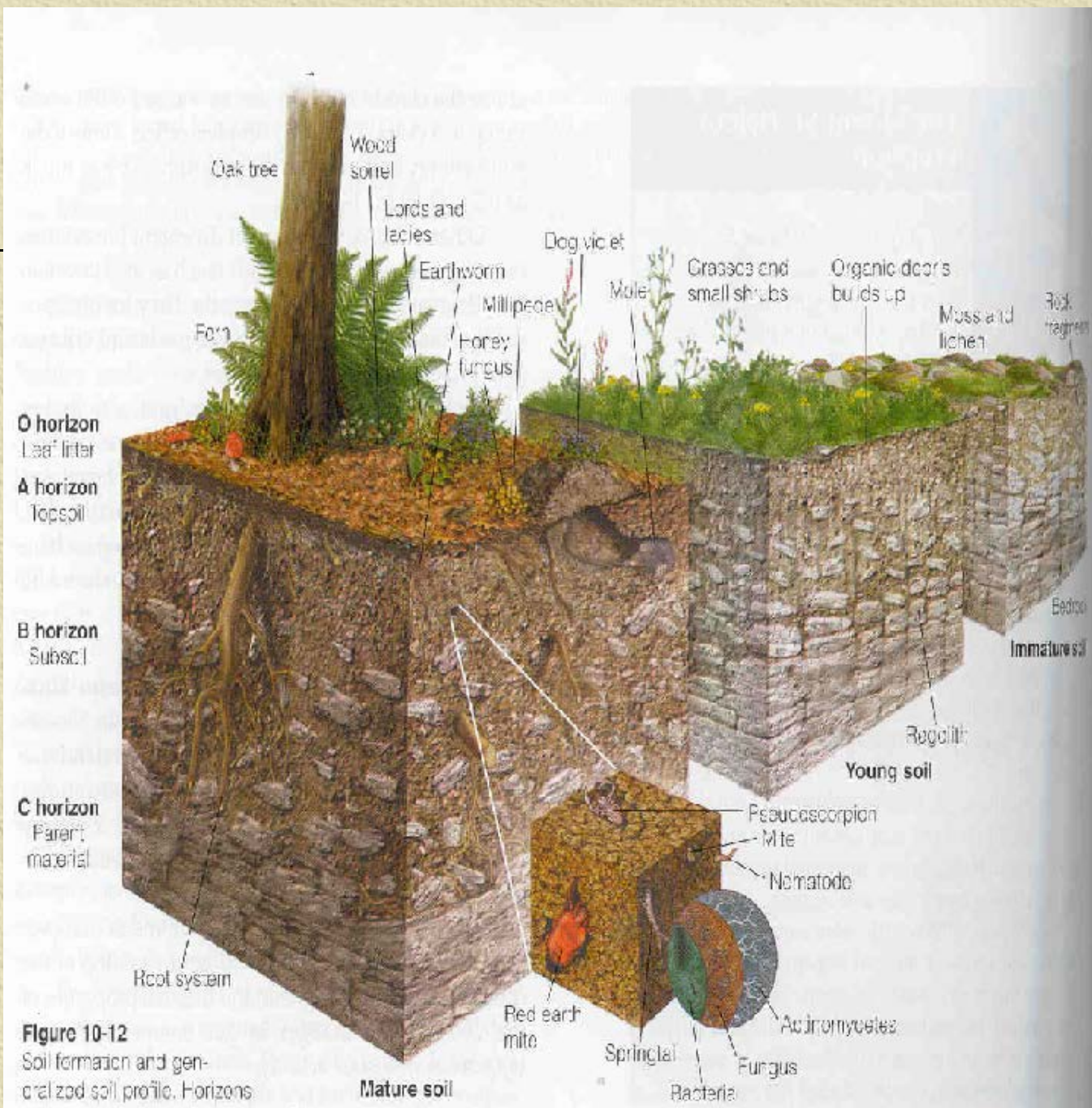
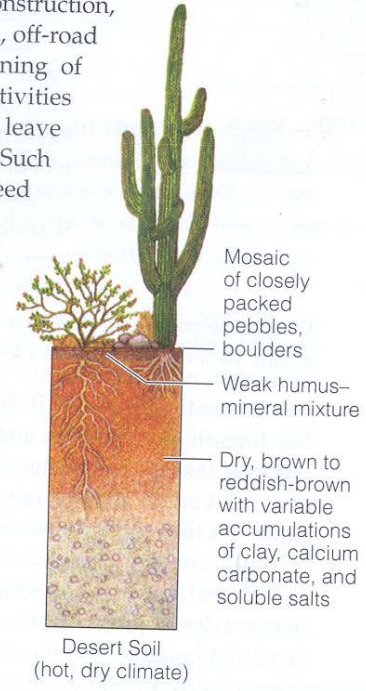


Figure 10-12
Soil formation and general soil profile. Horizons

Farming, logging, construction, overgrazing by livestock, off-road vehicles, deliberate burning of vegetation, and other activities that destroy plant cover leave soil vulnerable to erosion. Such human activities can speed up erosion and destroy in

Figure 10-15 Soil profiles of the principal soil types typically found in five different biomes.



- *Rill erosion* (Figure 10-18) occurs when surface water forms fast-flowing rivulets that cut small channels in the soil.
- *Gully erosion* (Figure 10-18) occurs when rivulets of fast-flowing water join together and with each succeeding rain cut the channels wider and deeper until they become ditches or gullies. Gully erosion usually happens on steep slopes where all or most vegetation has been removed.

