Soil

Dirt is simply misplaced soil!

SOIL: A RENEWABLE RESOURCE

- Soil is a slowly renewed resource that provides most of the nutrients needed for plant growth and also helps purify water.
  - Soil formation begins when bedrock is broken down by physical, chemical and biological processes called ***weathering***.
- ***Mature soils*** have developed over a long time are arranged in a series of horizontal layers,***soil horizons***.

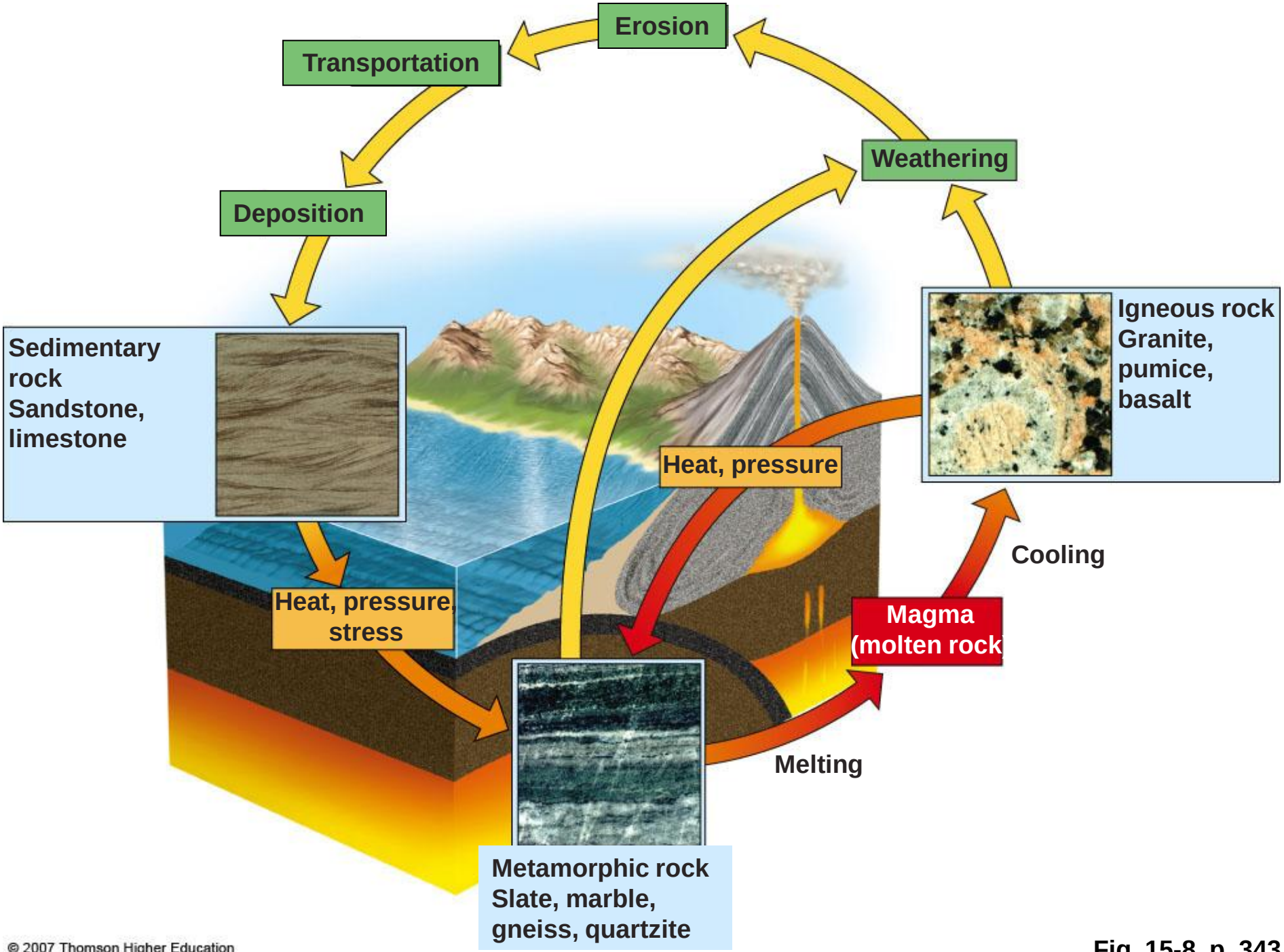


Fig. 15-8, p. 343

Layers in Mature Soils

- Infiltration: the downward movement of water through soil.
- Leaching: dissolving of minerals and organic matter in upper layers carrying them to lower layers.
- The soil type determines the degree of infiltration and leaching.

SOIL: Horizons

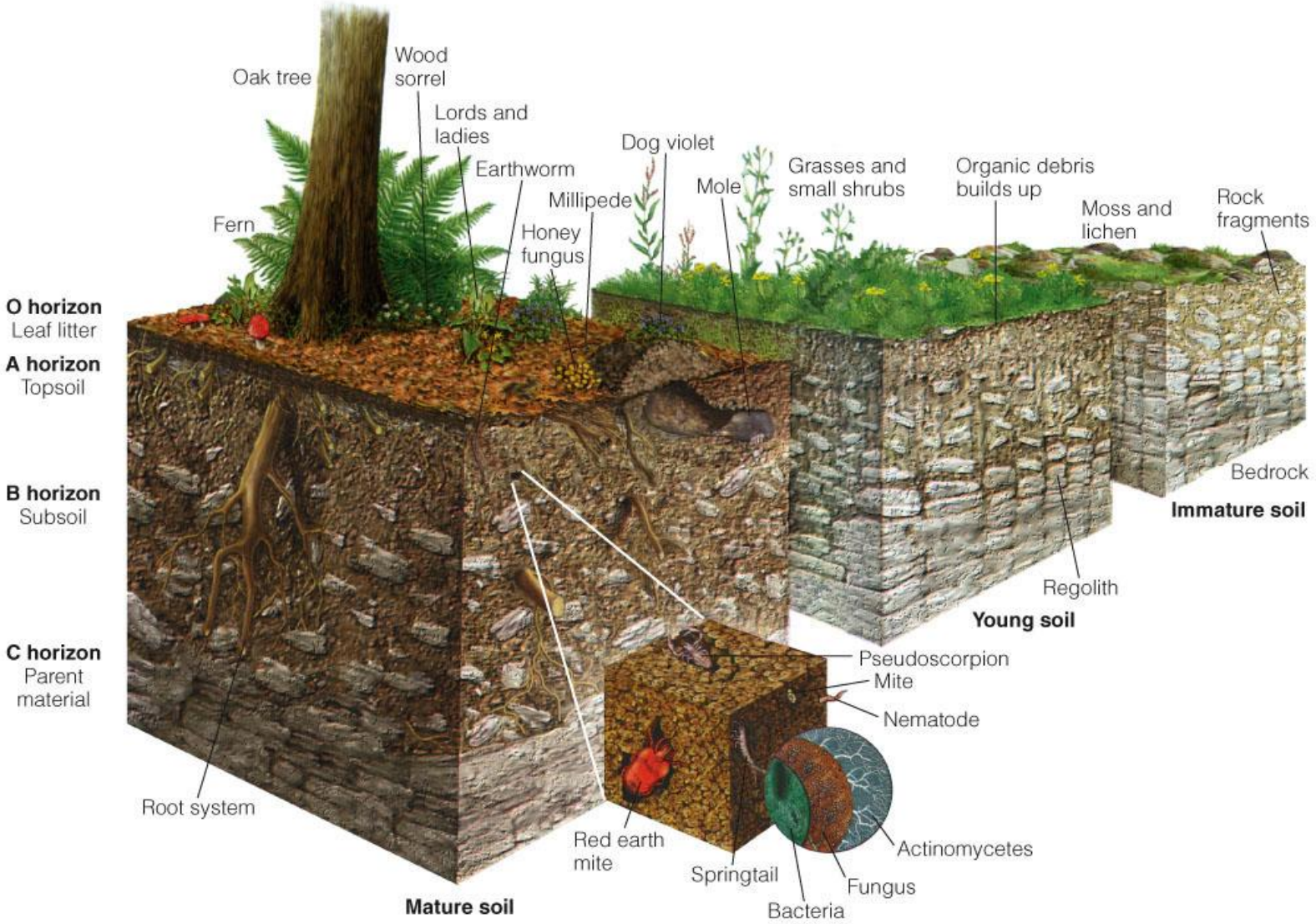


Figure 3-23

Soil Profiles

Soil Horizons

- O horizon: leaf litter
- A horizon: top soil
- E horizon: eluviation zone;
  - eluviation is the lateral or downward movement of dissolved or suspended material within soil when rainfall exceeds evaporation, a.k.a. infiltration.
  - A & E horizons comprise the “zone of leaching”
- B horizon: subsoil
- C horizon: parent material
- Bedrock

Soil Color

All Soil is Brown, Right?

- Wrong! Soils vary in color depending on material make-up and location.
- The Munsell System of Color Notation is a color catalog.
  - Soil scientists compare the soil next to the color chips to find a visual match and assign the corresponding Munsell notation with the soil.
- The wide use and acceptance of the Munsell System allows for direct comparison of soils anywhere in the world.

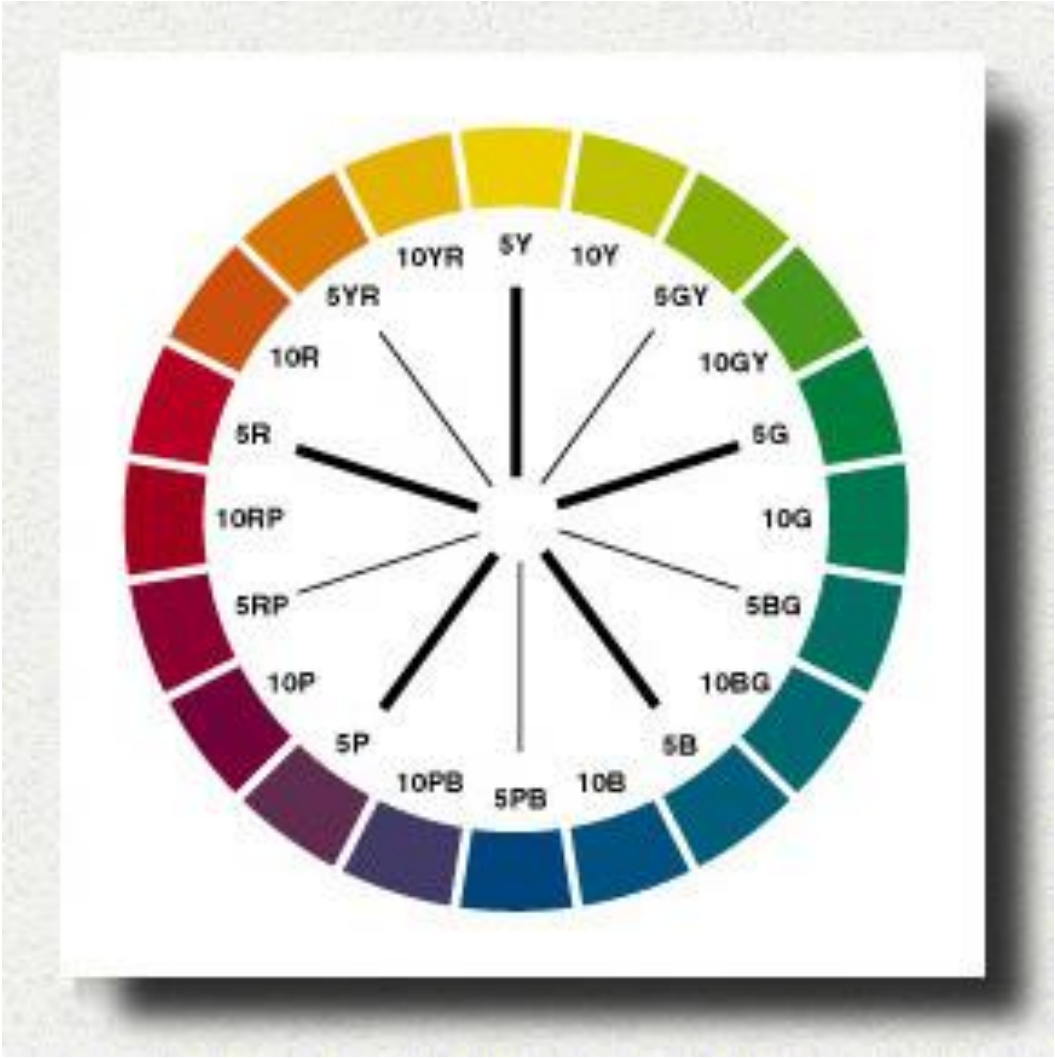
The Munsell system

The system categorizes by three components: hue, value, and chroma.

- Hue: the specific color
- Value: the lightness or darkness of color
- Chroma: the light intensity

- Written: Hue Value/Chroma
  - 10 YR 3/2

Hue Spectrum
“The Rainbow”



Value Spectrum
“Light to Dark”

0

10

Chroma Spectrum
“Intensity”

Color Chip Comparison

Soil Color Factors

- Parent Material: Minerals relate to color
- Age/Time: Older soil is often more red
- Climate: May leach, remove coatings, or even enhance red
- Topography: Uplands are more brown and red; low lands are more grey.
- Vegetation : Conifers are more acid, more leaching, less color and Grasslands are more organic, darker colors

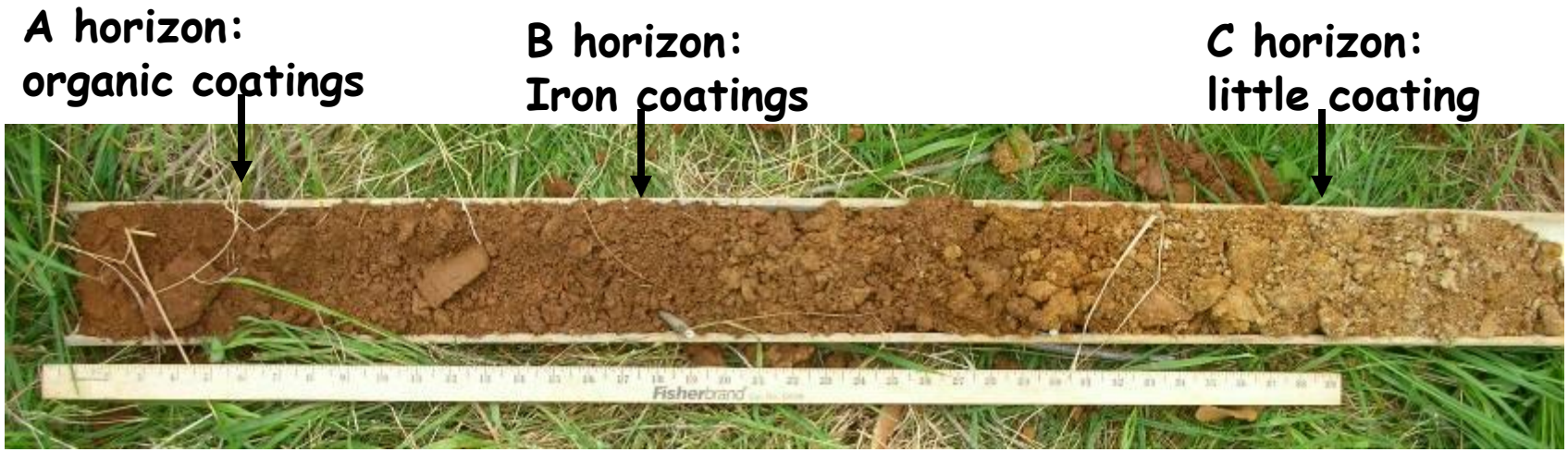
Diversity of Color

- All soil in a specific area is not all the same color.
- Soil within the same soil profile can have strong color variation.

What do the colors indicate?

- Reddish, yellowish, or brownish: Iron oxides (variation from amount of
  - Hematite – red
  - Goethite – yellowish brown
  - Ferrihydrite – reddish brown
- White: Carbonates, gypsum, other salts, or very leached
- Black/very dark brown: Organic matter
- Purple/black: Manganese oxides

Soil Color Variation



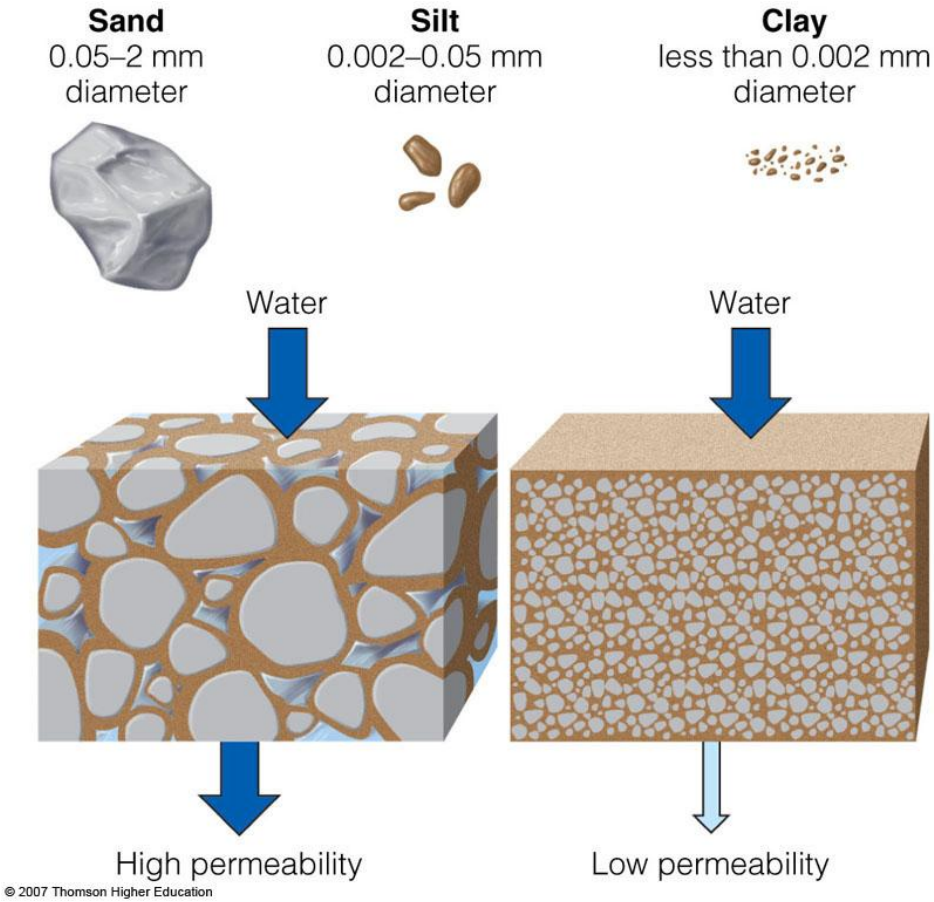
Soil Color Variation

Soil Separates

Most soils have a combination of soil particles sizes

- Sand
- Silt
- Clay

Soil Particles



- Soils vary in the size of the particles they contain, the amount of space between these particles, and how rapidly water flows through them.

Figure 3-25

Sand

- Gritty feel
- Can be seen with the naked eye
- Hand sampling:
  - No residue left on hand

Silt

- Dry: Powdery smooth feel, flour-like
- Wet: Creamy slick, slippery feel
- No sticky or plastic feel
- Can be seen with a hand lens or microscope
- Hand sampling:
  - Coats hand, able to brush off

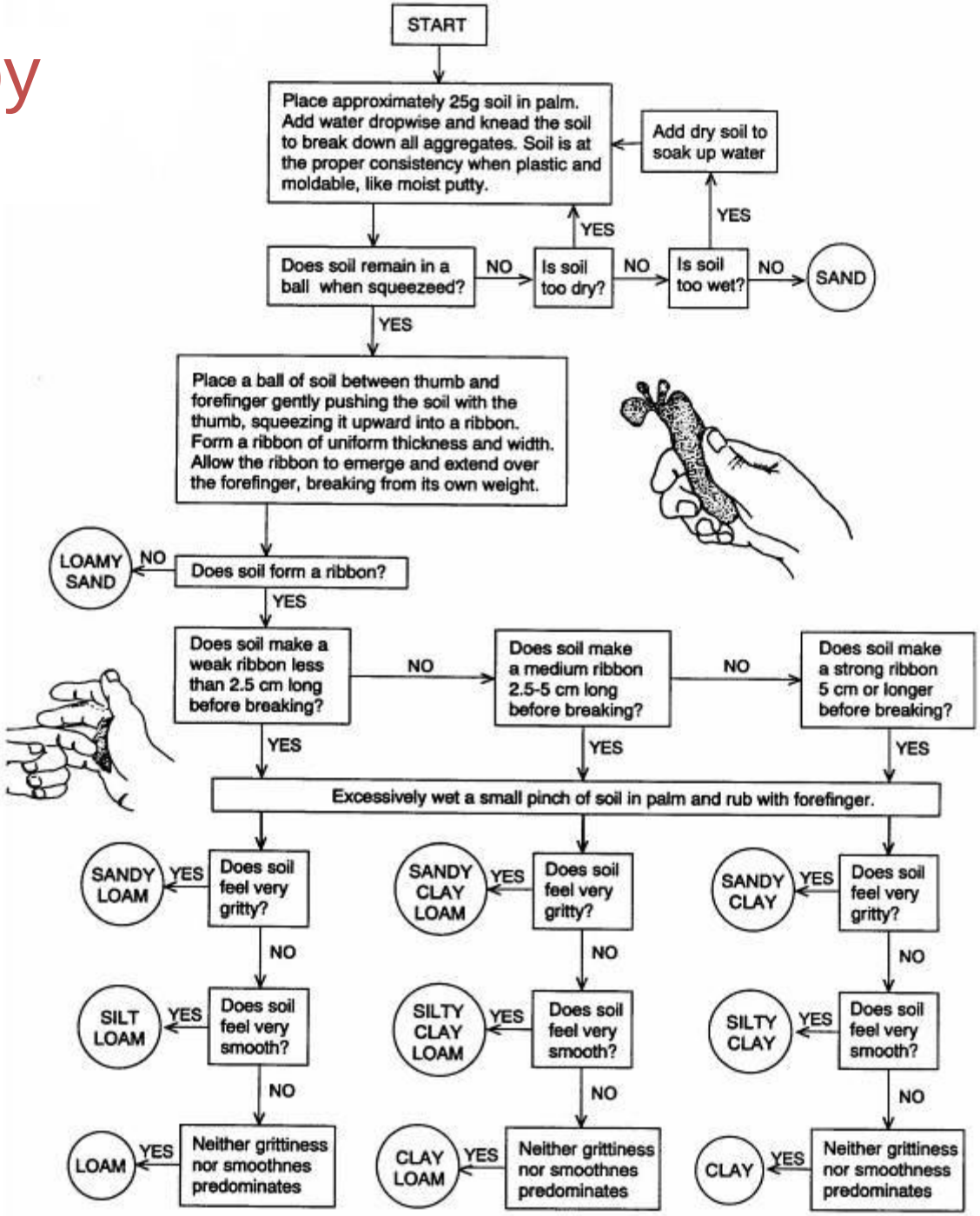
Clay

- Dry: Hard feel
- Wet: Sticky, plastic feel
- Can be seen with an electron microscope
- Hand Sampling:
  - Sticks to fingers

Particle Sizes

- Clay: less than 0.002 mm
- Silt: 0.002-0.05 mm
- Sand: 0.05-2 mm
  - 0.05-0.24 mm fine
  - 0.25-0.49 mm medium
  - 0.5-0.99 mm coarse
  - 1- 2 mm very coarse
- Gravels: 2-75 mm
- Cobbles:75-250 mm
- Stones: 250-600 mm
- Boulders: >600 mm

Texture by Feel



Fine Textured Soil

- Large amounts of silt and clay, making it "muddy" when wet
- Pore spaces are small, but numerous and hold more water
- As clay soils begin to dry, they may still hold large quantities of water, but adhesive and cohesive properties of water make it unavailable for root uptake

Fine Textured Soil

Coarse Textured Soil

- Large pore spaces and allows water to easily run through it beyond the reach of roots
- Drought-prone
- Little surface area for the particle volume, reducing fertility

Coarse Textured Soil

Loamy Soil

- A mix of sand, silt, and clay that optimizes agricultural productivity

34 % Sand

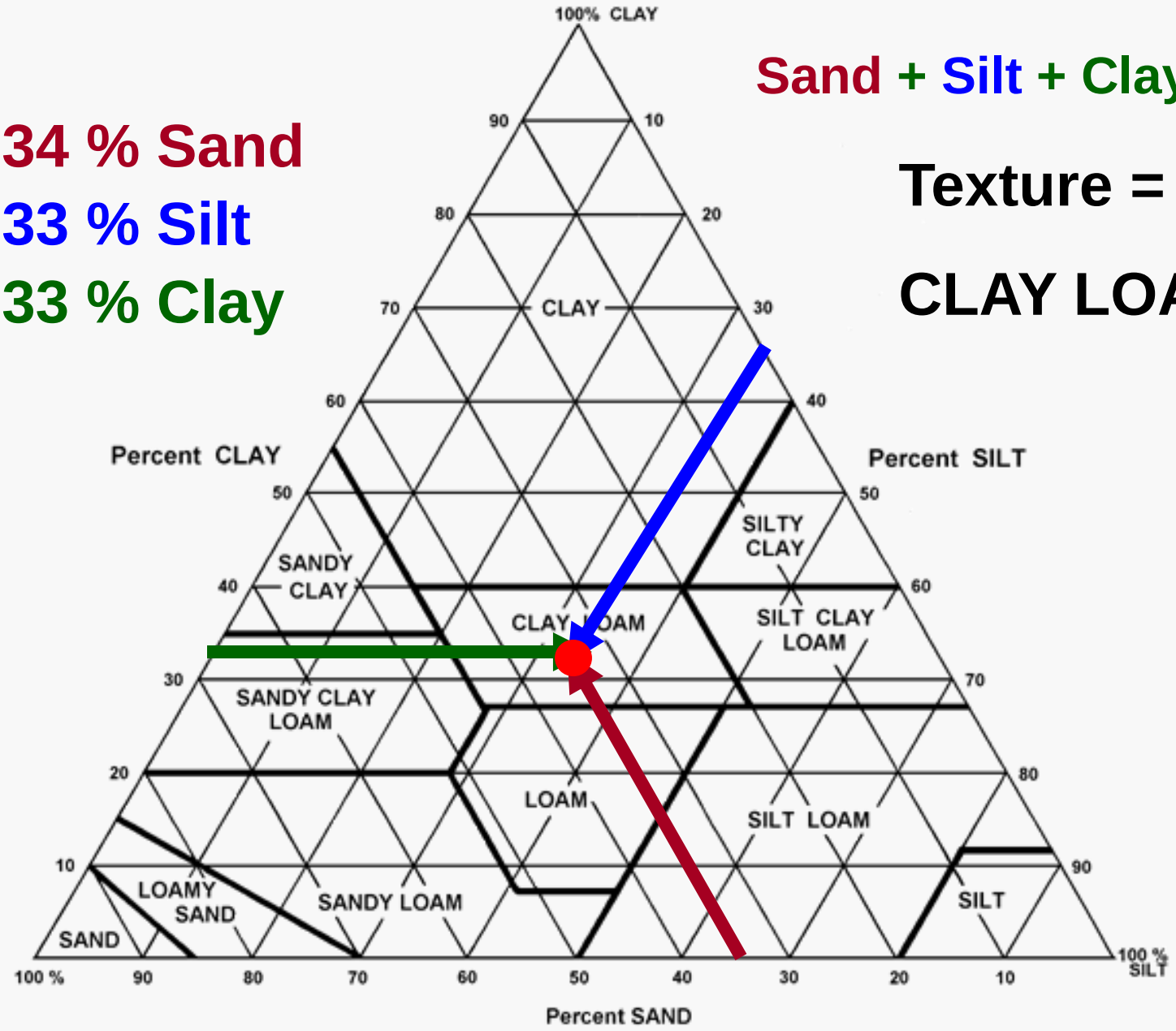
33 % Silt

33 % Clay

Sand + Silt + Clay = 100%

Texture =

CLAY LOAM



General Influence of Soil Separates on Properties and Behaviors of Soils

Property/Behavior	Sand	Silt	Clay
Water holding	Low	Med-high	high
Aeration	Good	Med	Poor
OM decomposition	Fast	Med	Slow
Water erosion pot.	Low	High	Low
Compact-ability	Low	Med	High
Sealing (ponds)	Poor	Poor	Good
Nutrient supplying	Poor	Med-high	High
Pollutant leaching	High	Med	Low

Soil Texture and Surface Area

- As particle size decreases, surface area increases
  - Clay has about 10,000 times as much surface area as sand
- Surface area has a big effect on:
  - Water holding capacity
  - Chemical reactions
  - Soil cohesion
  - Ability to support microorganisms