ab.

SOILS

1. Soil formation - The process of soil formation is discussed in lecture and is reviewed in the textbook. Recall that there are two main processes: chemical weathering and physical (or mechanical) weathering. The incorporation of organic material into the soil is also an important process.

2. Soil horizons and profile - "Mature" soils develop layers called horizons, which differ in chemistry, texture, and biota. These features often cause each horizon to be a different color. If a pit or trench is dug into the soil, these horizons can be readily observed. All the horizons, including the parent material, constitutes a soil profile.

Horizons:

O horizon (Ao to some people; organic horizon)
- O1 - largely undecomposed organic debris (leaves, twigs, animal remains, etc.)
- O2 - partly decomposed (humus)

A horizon (largely mineral)
- A1 - mineral soil mixed with humus. Rich, usually dark colored, horizon
- A2 - mineral soil. Usually lighter colored because of eluviation (leaching)
- A3 - portion of A horizon that is transitional to the B horizon

B horizon (mineral)
- B1 - portion of B transitional to A
- B2 - zone of maximum illuviation (e.g.,clay, iron, aluminum, humus)
- B3 - portion of B transitional to C

C horizon (parent material)
- mineral horizon that is only slightly affected by soil forming processes

R - bedrock

It is important to realize that not all horizons need be present in a soil. Soils can be identified not just on the basis on horizons, texture, and color, but also on the basis of missing horizons. For example, a young soil may be missing the B horizon (having not yet formed). An agricultural soil will probably not have O and A1 horizons. The O horizon may be lacking in desert soils where litter accumulation is very limited. Many wetland soils may have only organic horizons.

3. Soil texture - Soil texture refers to the percentage (by weight or specific gravity) of sand, silt, and clay particles. These soil separates are classified by diameter:

sand:	2.00 mm - 0.05 mm
silt:	0.05 mm - 0.002 mm
clay:	less than 0.002 mm

Once the proportion of each particle size is known, the soil texture class can be determined from a texture triangle (below).

Texture can be determined crudely by the "feel" method in which a small quantity of soil is dampened and held in the palm of the hand. By rubbing the soil between the thumb and fingers, one can quite accurately (with some practice) determine the texture class.

Texture is of considerable importance because it has some bearing on other soil properties (e.g., water holding capacity, mineral concentrations, aeration).

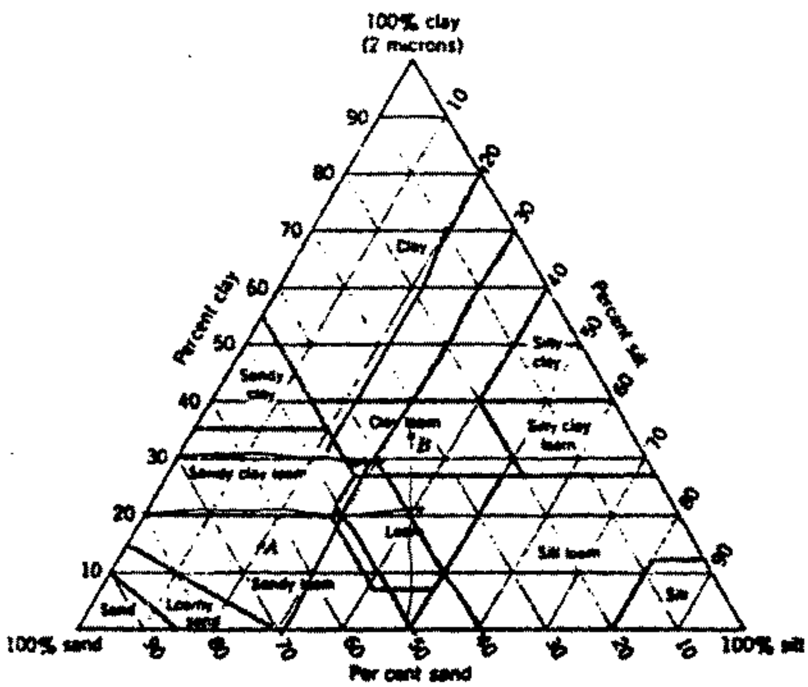

Fig. 3-3 The textural triangle shows the limits of sand, silt, and clay contents of the various texture classes.

The sum of the percentages of sand, silt, and clay at any point in the triangle is 100. Point *A* represents 15 percent clay, 65 percent sand, and 20 percent silt; the textural class name for this sample is *sandy loam*. A soil containing equal amounts of the three separates is a *clay loam* (point *B* in Fig. 3-3). The various soil classes are separated from one another by definite lines of division in Fig. 3-3. Their properties do not change abruptly at these boundary lines, however, but one class grades into the adjoining classes of coarser or finer texture.

4. Soil and vegetation - The physical and chemical characteristics of soil can determine, in part, the type of vegetation present. Obviously, plants that are tolerant of flooded soils will not be found growing on arid soils. More subtle differences in soils can have equally profound effects on vegetation.

Conversely, vegetation can also affect soil. Plants are rather "leaky" in that nutrient and other compounds can be leached from leaves (via rainwater) and roots. This can alter soil pH and nutrient status. Soil changes are more pronounced during succession and occur much more gradually under mature vegetation. Plant can actually cause the soil to become unsuitable for themselves. These changed soil conditions, then, may be suitable for a different group of species (which gradually replace the first). These vegetation-imposed changes in soil may be one factor driving plant succession.

From an ecological viewpoint, soils are very important. Most seeds germinate in or on the soil, so certain conditions must be met for plants to become established. Sites in which soil physical and chemical properties are conducive to germination and establishment are sometimes called safe sites. These safe sites are not large in area, being no more than a square meter or so. Obviously, conditions beyond that will have little direct effect on a seed.

As mentioned earlier, vegetation responds to various aspects of soil (water, nutrients, pH, texture, etc.). Changes in soil conditions (in space or time) may be correlated with changes in vegetation.

5. Soil surveys - Soil surveys are manuals published by the United States Department of Agriculture (USDA) Soil Conservation Service. Soil surveys contain information on the soils of a particular county. The soils in virtually every county in the US have been described. Because it takes so long to survey an entire county, analyze the soils, and publish a manual, the surveys are not regularly updated. For example, the soils of Delaware County were surveyed from 1961 to 1967; the survey was not published until 1972. By 1972, some of the data were already 10 years old. Soils don't change quickly, but policies regarding appropriate uses might. Furthermore, with improved varieties of crops, estimated yields (an important part of the survey) might also change rather quickly.

The soil surveys contain information on many topics, including (a) the kinds of soil in the county, (b) farm management and estimated crop yields, (c) suitability of each soil for road construction, buildings, woods, wildlife, etc.

Soils having profiles almost alike (in thickness of horizons and in other features) are called a soil series. A common soil series in Delaware County is the Pewamo series (see Soil Survey of Delaware County, Table 1, p. 8). Soils within this series (see p. 21) might differ in texture of the surface soil, slope, stoniness, etc.

The soil survey includes maps and aerial photographs showing the extent of soil types. Each type is abbreviated; for example, Pewamo silty clay loam in Pe (see p. 21-22). The Blount silt loam (p. 7-9) on nearly level ground is B1A, while that on steeper eroded slopes in abbreviated B12. These abbreviations are used throughout the surveys. You can find a known location on the maps, note the soil type(s), and then check its characteristics, potential uses, and limitations by referring to the tables and written descriptions.

FIGURE 3-16 *This shows the relative sizes of the largest clay, silt, and fine sand particles, each magnified 500 times. At the same scale, fine gravel (2 mm) would be a cube a little more than a yard on a side.*