Soils

Chapter 18

Soil

- **Soil** is a mixture of minerals, organic matter, gases, liquids, and countless organisms that together support life on Earth.

- Soil has four important functions:
  - it is a medium for plant growth;
  - it is a means of water storage, supply and purification;
  - it is a modifier of Earth's atmosphere;
  - it is a habitat for organisms; all of which, in turn, modify the soil.

Soil Science

- **Soil science** is the study of soil as a natural resource on the surface of the Earth including soil formation, classification and mapping; physical, chemical, biological, and fertility properties of soils; and these properties in relation to the use and management of soils.

Soil Profile

- A vertical section of soil extending from the surface to the deepest extent of plant roots or to regolith or bedrock

Soil Horizon

- A **soil horizon** is a layer generally parallel to the soil crust, whose physical characteristics differ from the layers above and beneath.
- Horizons are defined in most cases by obvious physical features, chiefly color and texture.

O - The overlying organic horizon
A - Humus horizon

B - Mineral horizon

C - Pedogenic substrate

R - Parent rock

Soil Fertility

Soil fertility refers to the ability of a soil to sustain agricultural plant growth, i.e. to provide plant habitat and result in sustained and consistent yields of high quality.

- A fertile soil has the following properties:
  - The ability to supply essential plant nutrients and soil water in adequate amounts and proportions for plant growth and reproduction
  - The absence of toxic substances which may inhibit plant growth.

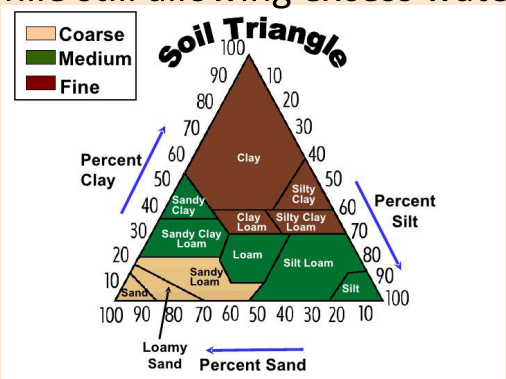
Soil Fertility

The following properties contribute to soil fertility in most situations:

- Sufficient soil depth for adequate root growth and water retention;
- Good internal drainage, allowing sufficient aeration for optimal root growth (although some plants, such as rice, tolerate waterlogging);
- Topsoil with sufficient soil organic matter for healthy soil structure and soil moisture retention;
- Soil pH in the range 5.5 to 7.0 (suitable for most plants but some prefer or tolerate more acid or alkaline conditions);
- Adequate concentrations of essential plant nutrients in plant-available forms;
- Presence of a range of microorganisms that support plant growth.

Loam

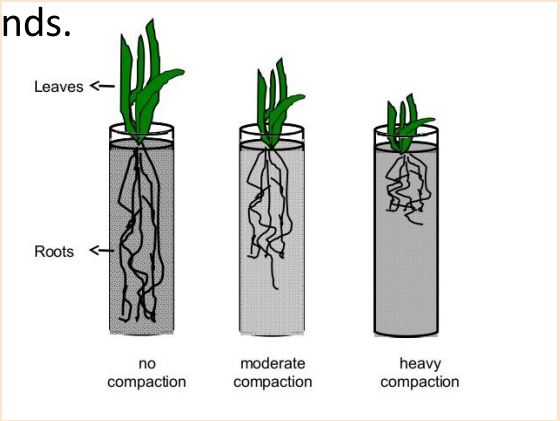
- Soil that is not predominantly sand, silt, or clay is called "loam".
- Loam is considered ideal for gardening and agricultural uses because it retains nutrients well and retains water while still allowing excess water to drain away.



Loam soils generally contain more nutrients, moisture, and humus than sandy soils, have better drainage and infiltration of water and air than silt and clay-rich soils, and are easier to till than clay soils.

Soil Porosity

- **soil porosity** - the available air spaces within the soil that are filled with either air, other gases, or water - everything but the solid phase that contains mainly minerals of varying sizes as well as organic compounds.



Macropores or fractures play a major role in infiltration rates in many soils as well as preferential flow patterns, hydraulic conductivity and evapotranspiration. Cracks are also very influential in gas exchange, influencing respiration within soils.

Desertification

- **Desertification** is a type of land degradation in which relatively dry area of land becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife.

- It is caused by a variety of factors, such as through climate change and through the overexploitation of soil through human activity.

Fig. 18.10

When deserts appear automatically over the natural course of a planet's life cycle, then it can be called a natural phenomenon; however, when deserts emerge due to the rampant and unchecked depletion of nutrients in soil that are essential for it to remain arable, then a virtual "soil death" can be spoken of,[4] which traces its cause back to human overexploitation.