PLSCS 2600 Soil Science

Course Objectives:

1) To provide a better appreciation of the distribution and variability of soils and their properties across the landscape,
2) a knowledge of how these properties are created and how they effect landscape processes (both at a large and small scale),
3) a preliminary ability to investigate soil characteristics and,
4) an understanding how we manage (or not) soils and their properties for a multitude of objectives.

Professor:

Jonathan Russell-Anelli
1023 Bradfield Hall
255-2485
jmr5@cornell.edu

Teaching Assistants:

Kavya Krishnan
kk798@cornell.edu
1006 Bradfield Hall

Angela Possinger
arp264@cornell.edu
918 Bradfield Hall

Teaching Support:

Kathy Howard
G19 Bradfield Hall
255-3066
kch3@cornell.edu

There are no scheduled office hours at the moment, but meetings can be made by appointment.

Expectations:

Of you…

Cornell Code of Conduct / Academic Integrity

Cheating and Plagiarism are **NOT** acceptable behaviors!

And it will result in a failing grade in this course and other consequences as mandated by the Section, School, College and University

Of us…

Commitment to the advancement of your knowledge, skills and ability to excel.

Please make use of our knowledge and talent

– it's why we are here!

Of us all…

While we hope everyone will have an excellent experience, we expect everyone to fully contribute as well as participate in the course and attendance is mandatory!

Text: The Nature and Properties of Soil (14th Ed)
Brady N. and R. Weil

http://www.css.cornell.edu/courses/260/260.html

Week One Reading: Chapters 1, 2 and 4

For Monday and next week's Lab read:

Laboratory 1 on the web

Chapters 1, 2 and 4 in the text

Labs will be outside so wear appropriate clothing and appropriate FOOTWEAR!!!!

Labs will be at least 3 hours long so bring something to drink!

(and food if needed)

Grades:

Lecture is 65%

- Two Prelims (15% each)
- Final Assessment (30%)
  - Prelim, Take home and Practicum (10% each)
- Attendance and Participation (5 %)

Laboratory is 35%

- Reports (30%)
- Quizzes (5%)

Soils: The Foundation of Civilizations

- **" For all things come from earth, and all things end by becoming earth."**

  - Xenophanes of 580 B.C.

- **"While the farmer holds the title to the land, actually it belongs to all the people because civilization itself rests upon the soil."**

  - *Thomas Jefferson*

- **"We are part of the earth and it is part of us... What befalls the earth befalls all the sons of the earth"**

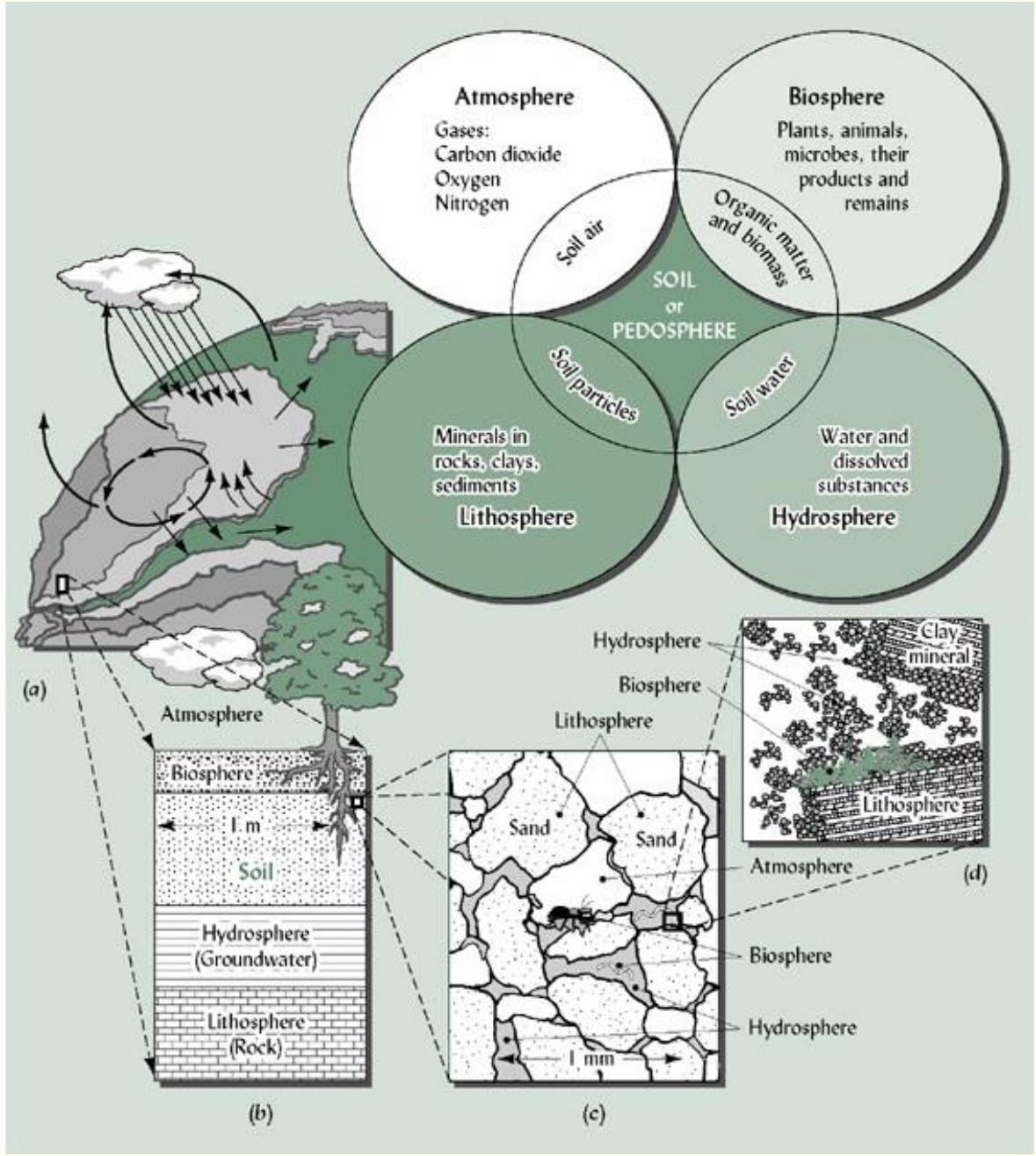
  - Chief Seattle, 1852

- **"The nation that destroys its soil, destroys itself."**

  - *Franklin Delano Roosevelt*

http://urbanext.illinois.edu/soil/quotes/quotes.htm

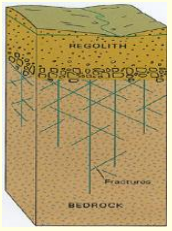
Pedosphere


Atmosphere
Gases:
Carbon dioxide
Oxygen
Nitrogen
Biosphere
Plants, animals, microbes, their products and remains
Soil air
Organic matter and biomass
SOIL
or
PEDOSPHERE
Soil particles
Soil water
Minerals in rocks, clays, sediments
Lithosphere
Water and dissolved substances
Hydrosphere
(a)
Atmosphere
Biosphere
1 m
Soil
Hydrosphere (Groundwater)
Lithosphere (Rock)
(b)
Hydrosphere
Biosphere
Lithosphere
Sand
Sand
1 mm
(c)
Clay mineral
Lithosphere
Atmosphere
(d)
Biosphere
Hydrosphere

The Concept of Soil or what is a soil?

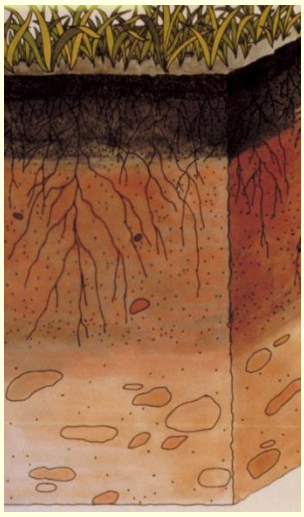
- **Geologic definition:**

  Loose surface of the earth as distinguished from solid bedrock.
  (support of plant life not required)



- **Traditional definition**:

  Loose, altered surface material of the earth which nourishes and supports growing plants.
  (includes rocks, water, snow, air)



What is *A* Soil?

- **Soil Taxonomy definition:** Collection of natural bodies of the earth's surface
  - modified or even made by man or earthy materials,
  - characterized by one or both of the following:
    - horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment
    - containing living matter and supporting or capable of supporting rooted plants, out of doors, in a natural environment
  - *upper limit*: air, shallow water, live plants or loose plant material that has not begun to decompose
  - *lower limit*: the depth to which soil weathering has been effective

What is *A* Soil?

- **SSSA Taxonomy definition:**
  - The layer(s) of generally loose mineral and/or organic material that are affected by physical, chemical, and/or biological processes at or near the planetary surface and usually hold liquids, gases, and biota and support plants.

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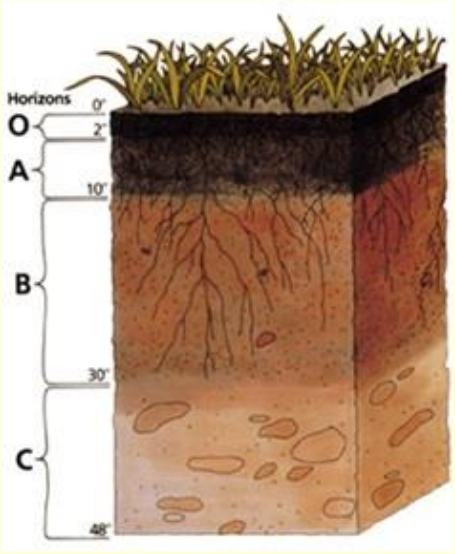
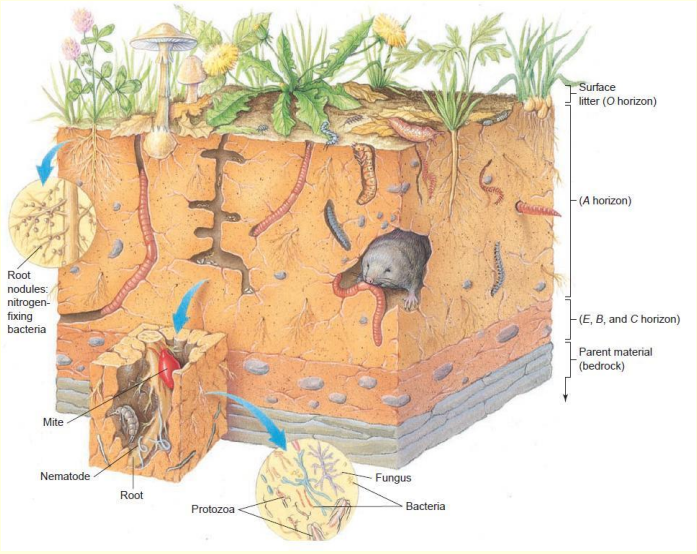
Layers…	Horizons
Materials …	Components
Processes …	Processes
Planetary surface …	Landscape Position

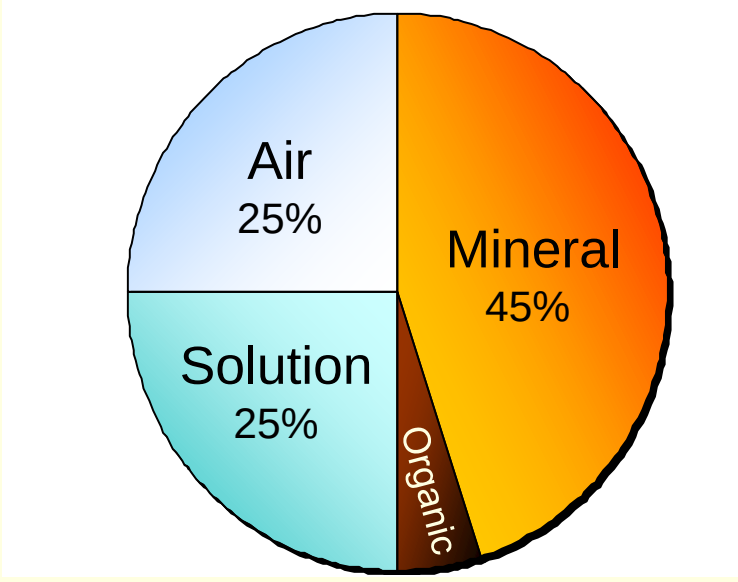
Soil Horizons



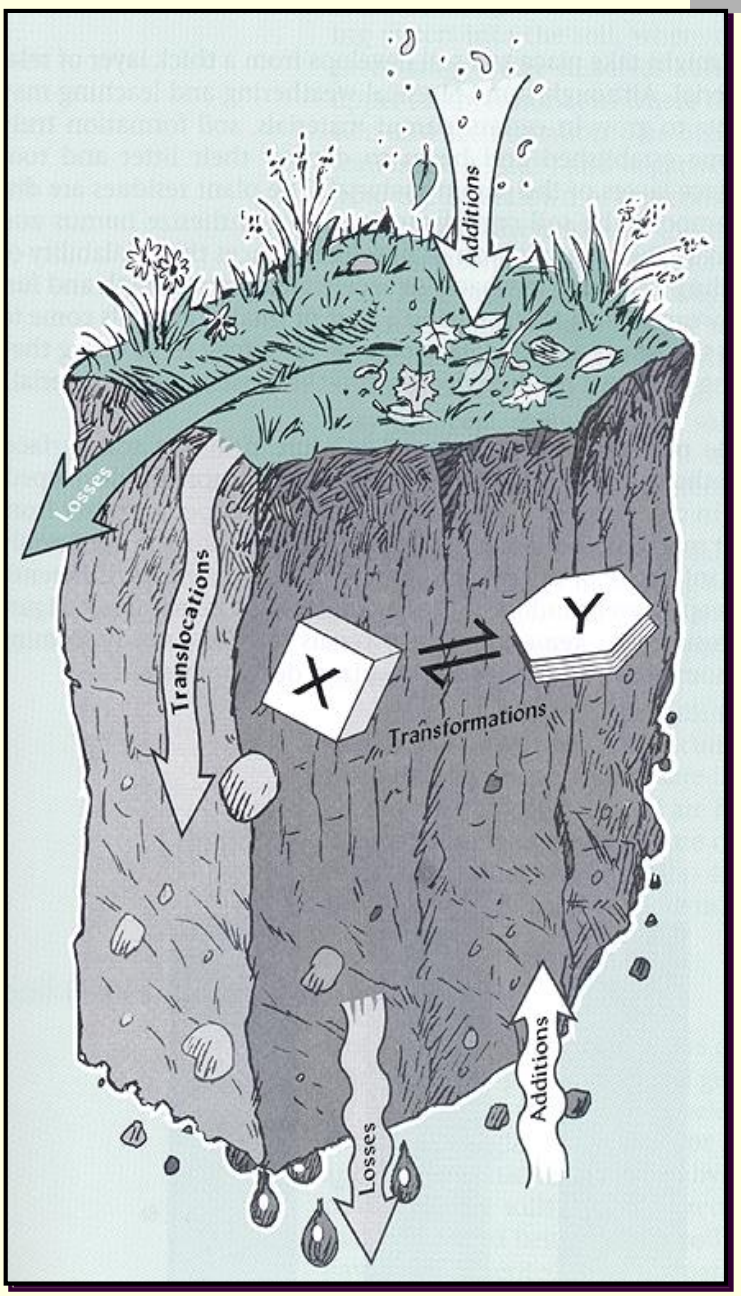


Soil Components

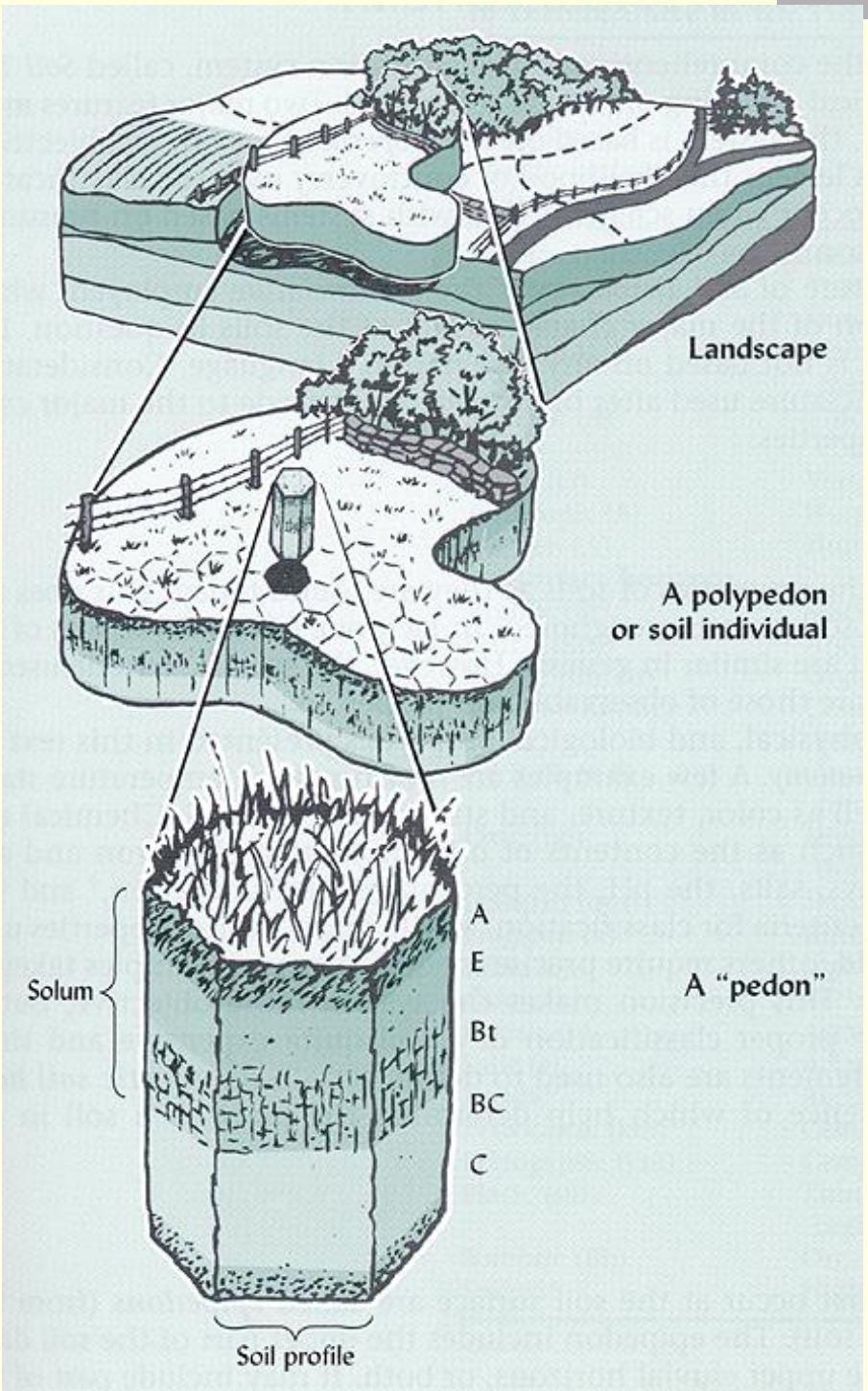
- **Solids**
  - Mineral
  - Organic
- **Solution**
- **Air**
- **Biota**
  - Microorganisms
  - Macrofauna
  - Plant roots



Alteration processes



Portion of the landscape



What is *A* Soil?

- **As a portion of the landscape**
  Collection of natural bodies occupying portions of the earth's surface

  How does this happen?

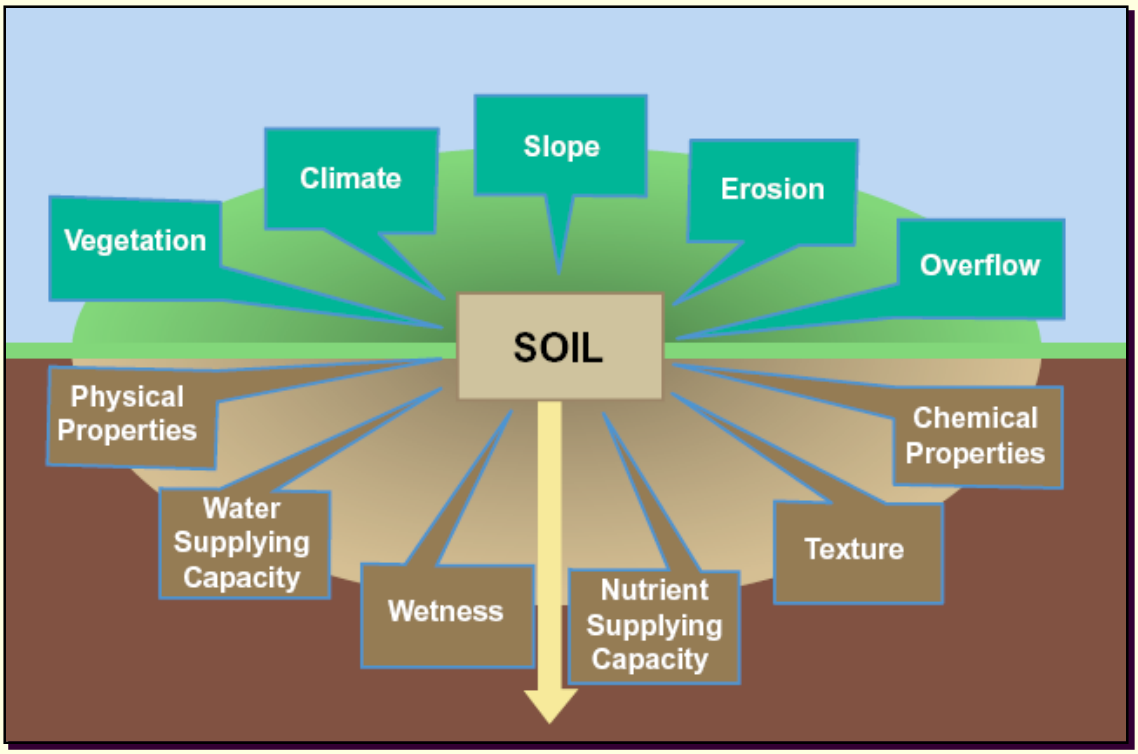
  What controls its distribution?

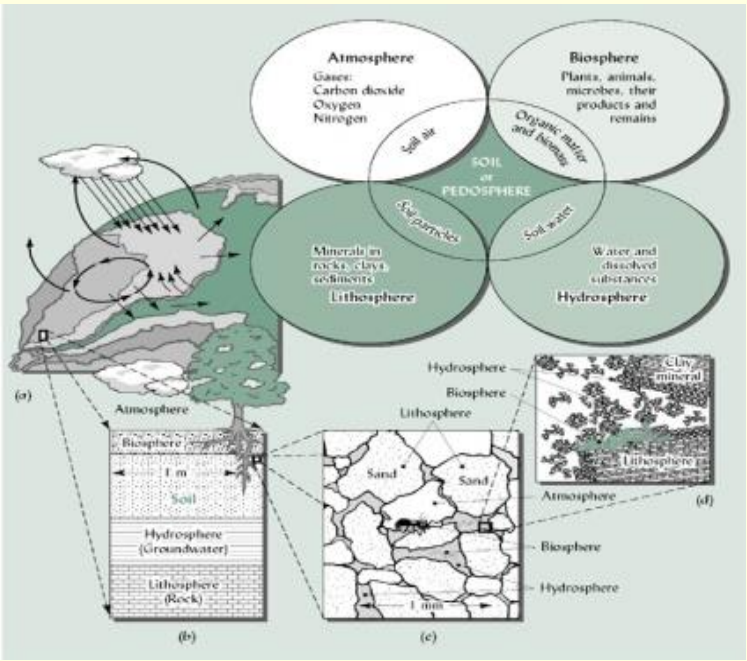
Soil as an Integrator
(soil forming factors)

Soil = *f* (P.M., Relief, Climate, Biota, Time)

- Parent material
  - Rock
  - Alluvium
  - Glacial Till
  - Loess
- Relief or Topography
  - Slope (angle)
  - Shape (form)
- Climate
  - Temperature
  - Moisture
  - Seasonality
- Biota
  - Animals
  - Microbes
  - Plants
  - Humans
    - management
- Time

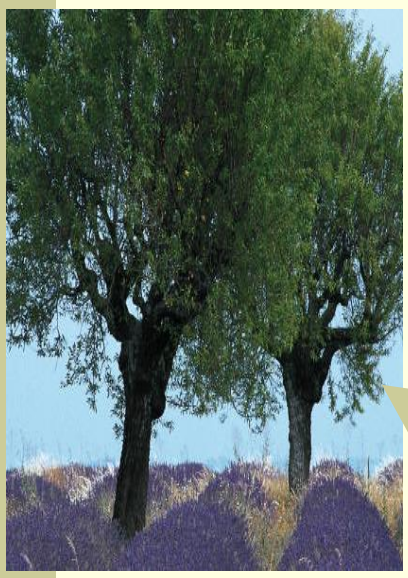
What is Soil?


Climate
Slope
Erosion
Vegetation
Overflow
SOIL
Physical Properties
Chemical Properties
Water Supplying Capacity
Texture
Wetness
Nutrient Supplying Capacity


Atmosphere
Gases: Carbon dioxide Oxygen Nitrogen
Biosphere
Plants, animals, microbes, their products and remains
Soil air
Organic matter and humus
SOIL or PEDOSPHERE
Soil particles
Soil water
Minerals in rocks, clays, sediments
Lithosphere
Water and dissolved substances
Hydrosphere
(a)
Atmosphere
Biosphere
1 m
Soil
Hydrosphere (Groundwater)
Lithosphere (Rock)
(b)
Hydrosphere
Biosphere
Lithosphere
Sand
Sand
1 mm
(c)
Clay mineral
Lithosphere
Atmosphere
(d)
Biosphere
Hydrosphere

The functions of soil

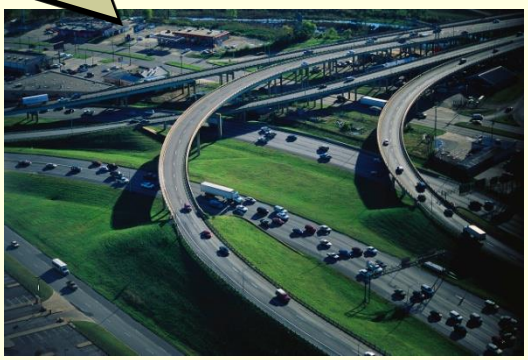
Recycling system for nutrients and organic wastes



Medium for plant growth

Habitat for soil organisms

Water supply and purification



Engineering medium