Module 3 Ecosystems 10 hours

- Structure and function of ecosystem:

  Ecosystem components- abiotic and biotic, Productivity – primary and secondary-gross and net productivity.

  Decomposition in nature, homeostasis in ecosystem

- Ecological energetics:

  energy flow, trophic levels, food chain and food web, ecological pyramids

- Nutrient cycles:

  Biogeochemical cycles of C, N and S.

Abiotic components

- Can be divided into
  - Climatic factors
  - Edaphic factors

- Temperature, water, light, Humidity, Wind, Soil pH, Mineral elements, Topography (Surface configuration or physical features of an area),

Decomposition

What are decomposers?

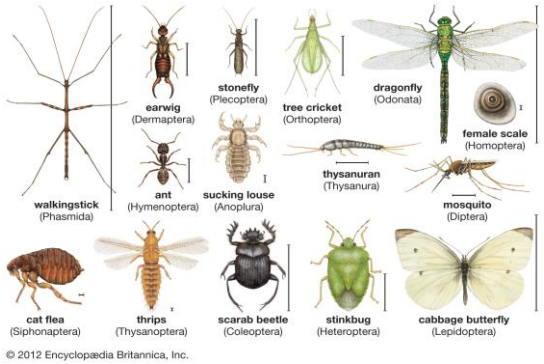
- The non green organism like fungi and bacteria, which are incapable of producing their food, live on dead and decaying plants or animal parts (Detritus) and are consumers of special kinds. They are called decomposers.
- They are also known as saprotrophs.
- They play an important role in maintaining dynamic nature of ecosystems.
- Decomposers carry out **decomposition process** by which complex organic materials of dead remains are broken into simpler compounds that can again be utilized by green plants (Producers).

- Some organic material such as simple carbohydrates, fats and proteins are decomposed rapidly, where as others such as cellulose, ligin, Cutin, hairs, bones and chitin are decomposed very slowly.
- Decomposers release different enzymes from their body into the dead plant and animal remains.
- The **extra cellular digestion** of dead remains lead to the release of simpler inorganic substances.
- It is essentially a vital function in the ecosystem because if it is not happening, all nutrients would have been **tied up in the dead bodies** and no new life could be produced.

- Decomposition process

1. **Formation of particulate detritus** – by physical and biological action coupled with release of dissolved organic matter.
2. **Humification** – Rapid production of humus accompanied by release of additional dissolved organic matter.
3. **Mineralization** – Slower mineralization of humus.

- Decomposition is a complex process.
- No single type of organism performs complete decomposition.
- Bacteria, Fungi and moulds may work together in breakdown process.
- Protozoa, mites, Snails, Earthworms, Millipedes, insects, nematodes



Common examples

- Fungus –*Aspergillus, Rhizopus, Peziza, Mucor, Agaricus, Polyporous, Coprinus, Saprolegnia*,
- Bacteria – *Bacillus, Pseudomonas, Clostridium, Streptococcus, staphylococuss*
- Actinomycetes – *Streptomyces.*

Ecosystem homeostasis

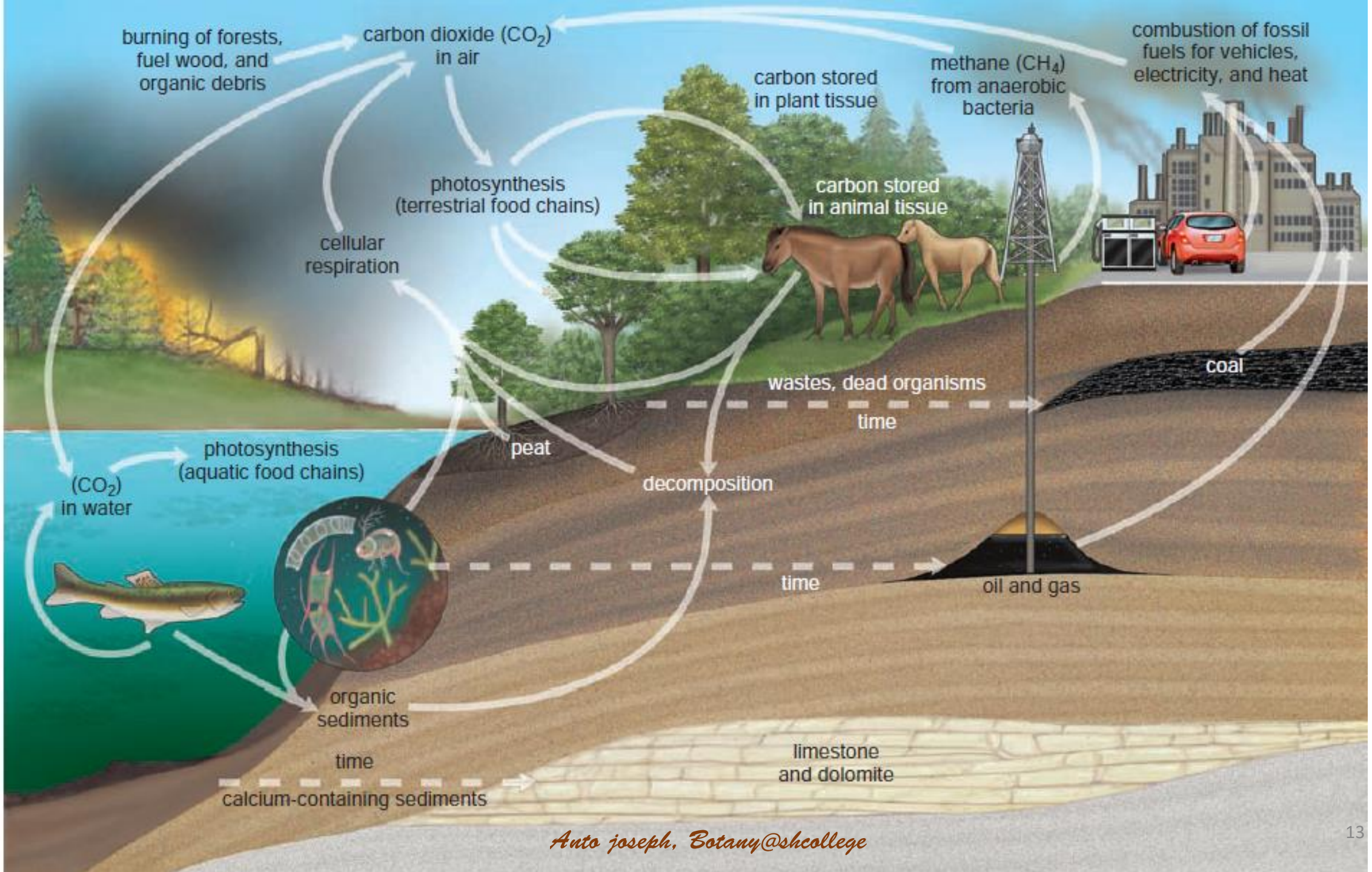
- Natural ecosystems are capable of self regulation and self maintenance, as they are able to maintain a stable steady state.
- Odum defined homeostasis as the tendency of natural ecosystems to resist change and to remain in a steady state of equilibrium.
- There would be a balance between production, consumption and decomposition as well as between all species with in the system.

Biogeochemical Cycles

- Include biological organisms
- Earth and other paths
- Chemical reactions are involved in it.
- Hence the name – “Bio” “Geo” “Chemical” Cycle

- Reservoir ?

- Based on reservoir pool biogeochemical cycles are divided into
- Gaseous cycle – Reservoir is atmosphere
  - Eg – Nitrogen cycle, Carbon cyle
- Sedimentary cycle – Reservoir in earth crust or lithosphere.
  - Eg – Sulphur cycle, Phosphorus cycle


burning of forests, fuel wood, and organic debris
carbon dioxide (CO_2) in air
carbon stored in plant tissue
methane (CH_4) from anaerobic bacteria
combustion of fossil fuels for vehicles, electricity, and heat
photosynthesis (terrestrial food chains)
carbon stored in animal tissue
cellular respiration
coal
wastes, dead organisms
time
peat
photosynthesis (aquatic food chains)
(CO_2) in water
decomposition
time
oil and gas
organic sediments
time
limestone and dolomite
calcium-containing sediments

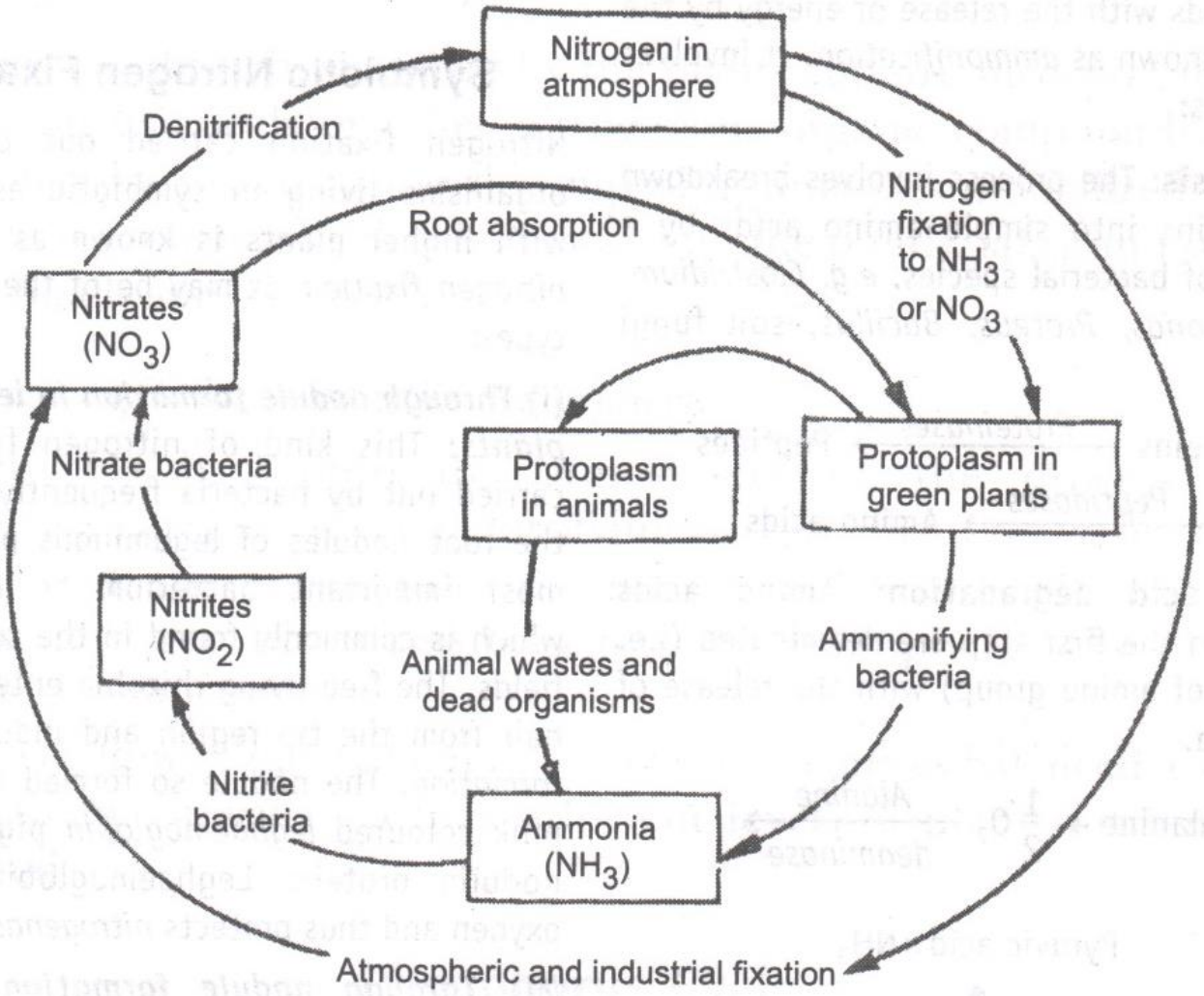
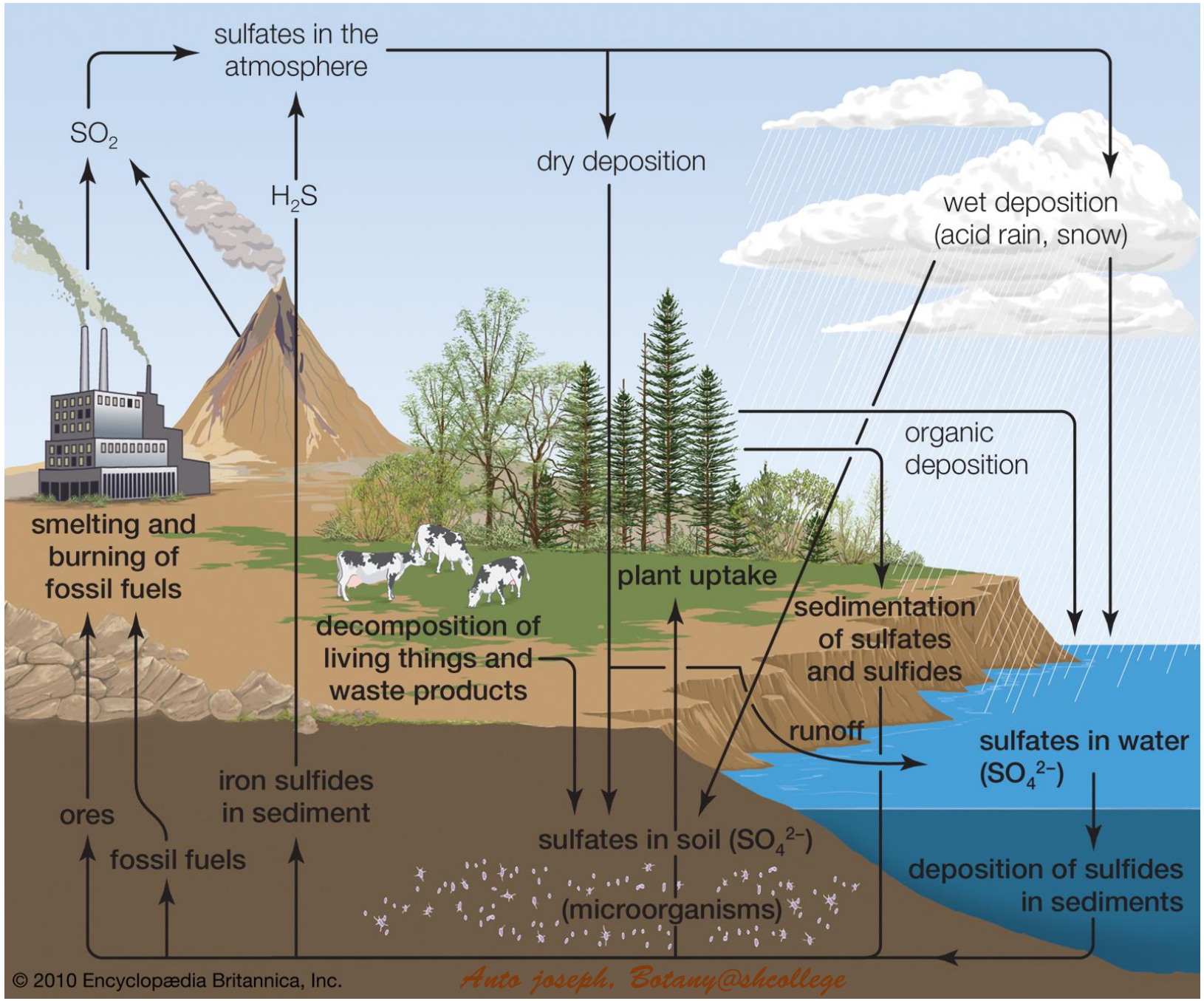


Fig. 12.4. Schematic representation of nitrogen cycle (after Southwick, 1976).


sulfates in the atmosphere
SO_2
H_2S
dry deposition
wet deposition (acid rain, snow)
organic deposition
smelting and burning of fossil fuels
plant uptake
sedimentation of sulfates and sulfides
decomposition of living things and waste products
runoff
sulfates in water (SO_4^{2-})
iron sulfides in sediment
ores
fossil fuels
sulfates in soil (SO_4^{2-})
(microorganisms)
deposition of sulfides in sediments
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Anto joseph, Botany@shcollege

Ecological succession

- Coined by Hult 1885
- The natural process by which the same locality become successively colonised by different groups or communities.
- Characteristics of Ecological succession
  - It is an orderly process of change in the species structure and community, and is predictable.
  - It is a physical environment based biological process
  - It ends in a stabilized ecosystem – Maximum biomass and symbiotic functions between the organisms are maintained
  - Climax community maintains dynamic equilibrium with the environment

- Causes of ecological succession
  - Climatic causes
  - Topographic causes
  - Biotic causes
- Types of ecological succession
  - Primary succession
  - Secondary succession
  - Autogenic succession
  - Allogenic Succession
  - Induced Succession
  - Autotrophic succession
  - Heterotrophic Succession
  - Retrogressive succession


Thank you