Environmental studies

Environmental Science

- **The study of the environment, its living and nonliving components, and the interactions of these components**

Definitions

The term *environment* is derived from a French word *environner* which means "surrounding". It refers to an aggregate of all conditions that affect the existence, growth, and welfare of an organism or a group of organisms. The term may be defined in a number of ways:

Environment is the sum total of all social, economical, biological, physical, and chemical factors which constitute the surroundings of humans, who are both creators and moulders of the environment.

Environment is the sum total of influences which modify and determine the development of life and its associated characteristics.

Multidisciplinary Nature of Environmental Studies

Environmental Studies requires skills that encompass a range of disciplines including chemistry, biology, earth sciences, atmospheric science, statistics, mathematics, and geography.

Scope of Environmental Studies

- Ecosystem structure and function
- Natural resource conservation
- Environmental pollution control
- Environmental management
- Environmental impact assessment
- Research and development
- Social development
- Forest management
- Environmental consulting firms
- Environmental journalism
- Environmentalists

Importance of Environmental Studies

- Environmental Studies is useful in checking environmental pollution.
- It helps in maintaining ecological balance.
- It helps to gain skills to assess the environmental impact of human activities.
- It gives us basic knowledge of environment and associated problems.
- It helps to achieve sustainable development .
- It helps to educate people regarding their duties towards the protection of environment.

Need for Public Awareness

Human life is affected directly and indirectly by the changes that occur in the environment. Therefore, it is essential to be familiar with different environmental problems. For active participation of all citizens of the world, public awareness is important.

Objectives

The following are the main objectives of creating environmental public awareness:

- To identify various plants, animals, and other living and non-living components of the environment that are endangered by human activities.
- To take appropriate decisions regarding use of natural resources.
- To conserve nature and natural resources for the betterment of the society from the point of view of social, cultural, and economic development.
- To adopt appropriate measures for solving existing environmental issues.

Methods of Public Awareness

The following methods may be used for propagating public awareness regarding the environment:

Formal Method

Introducing Environmental Education in Schools and colleges

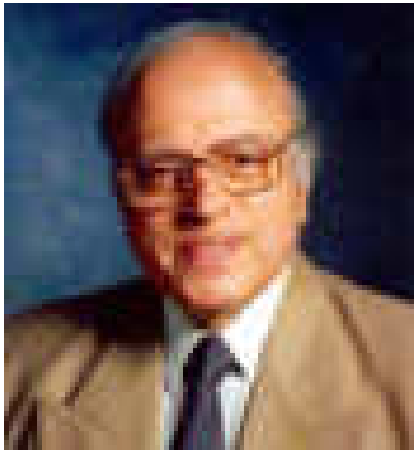
Informal Method

- Mass Media (newspapers, magazines, radio, TV, etc.)
- Seminars and conferences
- Competitions
- Entertainment (folk songs, street plays, etc.)
- Science centres
- International co-operation

Environmental study centres

- World Wide Fund (WWF)
- Centre for Science and Environment (CSE)
- Central Pollution Control Board (CPCB)
- Wildlife Institute of India (WII)
- United Nations Environment Program (UNEP)

Indian Environmentalists



Some Indian environmentalists

- Indira Gandhi - Played an important role in preserving wild life
- SP Godrej - Padma Bhusan
- MS Swaminathan - Agricultural scientist
- Madhav Gadgil - Ecologist
- MC Mehta - Environmentalist Lawyer
- Salim Ali - Orinthology
- Anil Agarwal - Journalist
- Medha patekar - Narmada dam
- Sunderlal Bahugana - Chipko Movement

Ecosystems: Basic Concepts

The term ecosystem was coined by *A.G Tansley* in 1935. According to him,ecosystem is defined as the system resulting from integration of all living and non-living factors of the environment.

STRUCTURE OF ECOSYSTEM

The components of environment are broadly classified as *abiotic* and *biotic* components.

Abiotic or non-living components of environment include all the physical and chemical factors that influence living organisms. Examples of abiotic components are air, water, soil, rocks, etc.

Biotic or living components are the living components of environment and include microbes, plants, animals, and human beings.

BIOTIC COMPONENT

- Producers ex: green plants

- Consumers

  Herbivores(feed on plants) ex:rabbit,deer,cow,grasshopper

  Carnivores (feed on animals)ex:lion,vulture,hawk

  Omnivores(feed on both plants and animals) ex:cockroach,bear

- Decomposers ex:bacteria,fungi

Function of an ecosystem

- ecosystem allows flow of energy and cycling of materials so that system remains stable and there is continuity in life.

Concept of ecosystem

- Energy flow --- food chain,food web,ecological pyramids
- Biogeochemical cycle----nitrogen cycle, oxygen cycle,phosphorus cycle,carbon cycle

Types of food chains

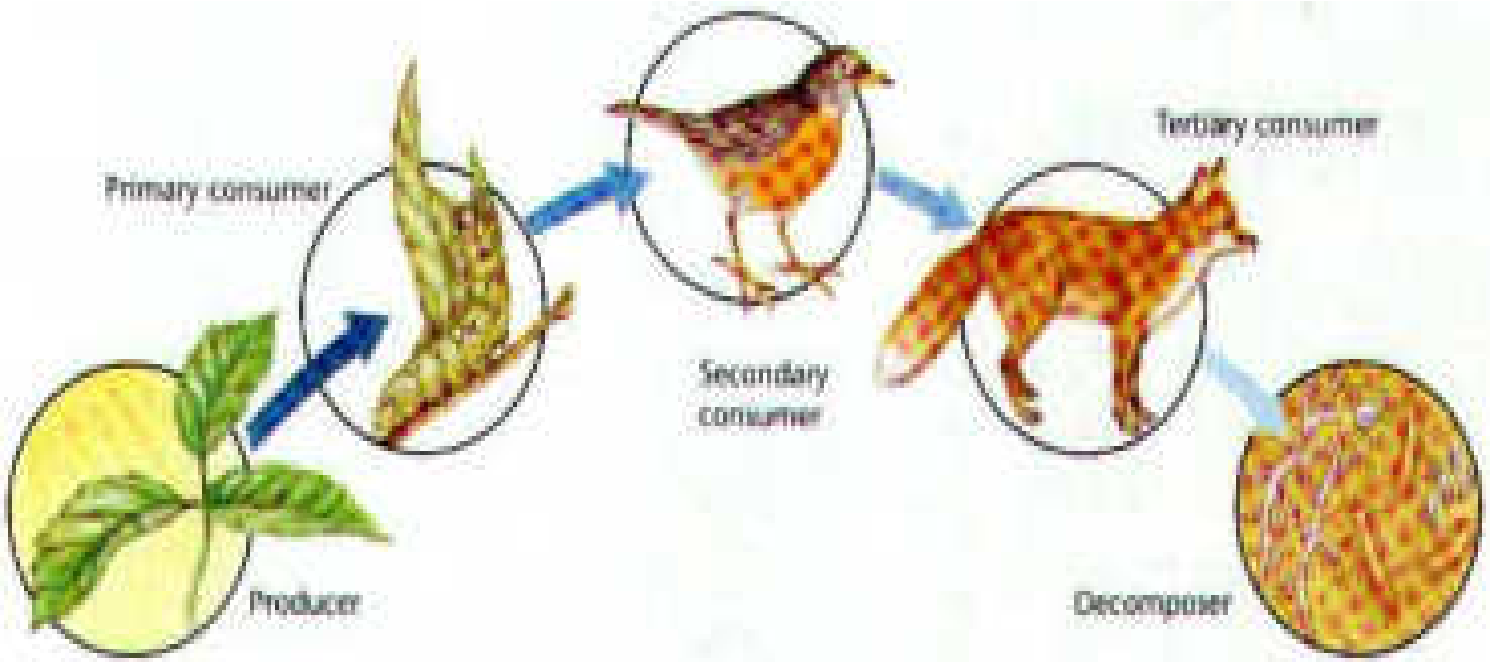
1.Grazing food chain:

50% of net primary production is grazed on by herbivores and remaining 50% goes to decomposers. Thus this food chain is herbivore based

2. Detritous food chain:

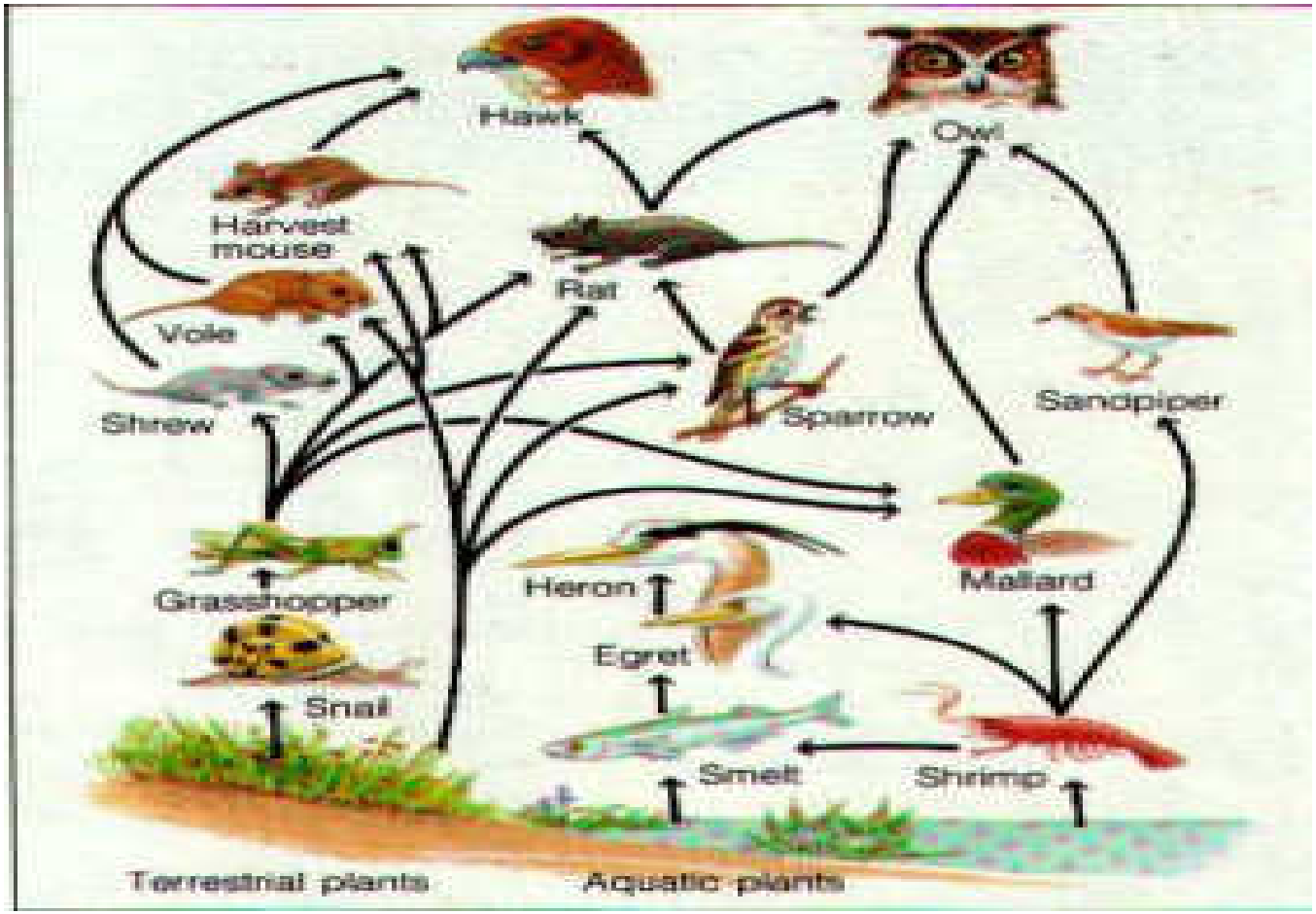
10% of net primary production is consumed by primary consumers remaining 90% enters the decomposers. So this food chain is decomposer organism based and is called detritus

Example of a Food Chain



Food Webs

- All the food chains in an area make up the **food web** of the area.



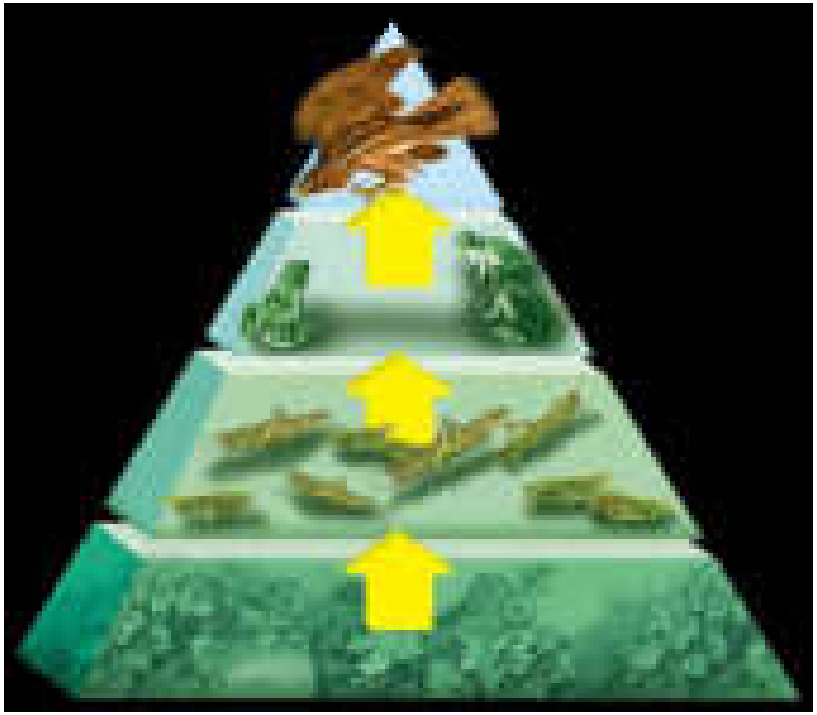
ECOLOGICAL PYRAMIDS

Three types

1. Pyramid of numbers
2. Pyramid of biomass
3. Pyramid of energy

Trophic Levels Found on an Energy Pyramid

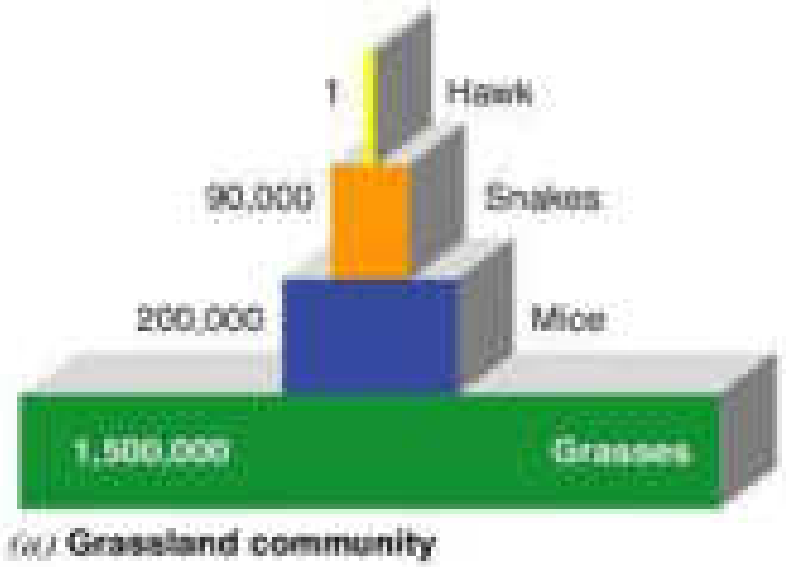
- The greatest amount of energy is found at the base of the pyramid.
- The least amount of energy is found at top of the pyramid.



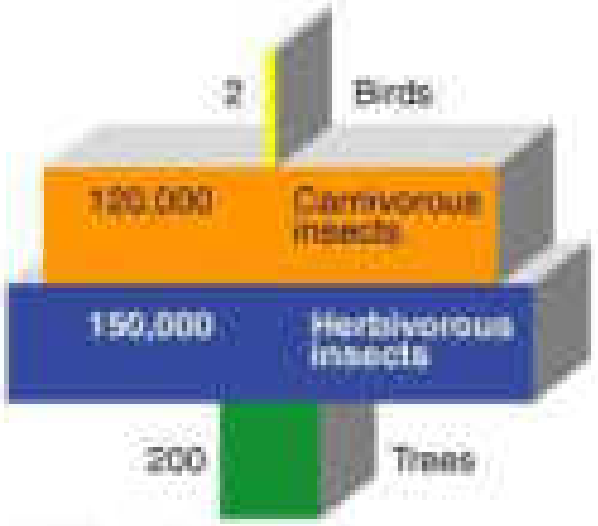
Trophic Levels

- A trophic level is the position occupied by an organism in a food chain.
- Trophic levels can be analyzed on an energy pyramid.
- **Producers** are found at the base of the pyramid and compromise the **first trophic level.**
- **Primary consumers** make up the **second trophic level.**
- **Secondary consumers** make up the **third trophic level**.
- Finally **tertiary consumers** make up the **top trophic level**.

Pyramid of Numbers

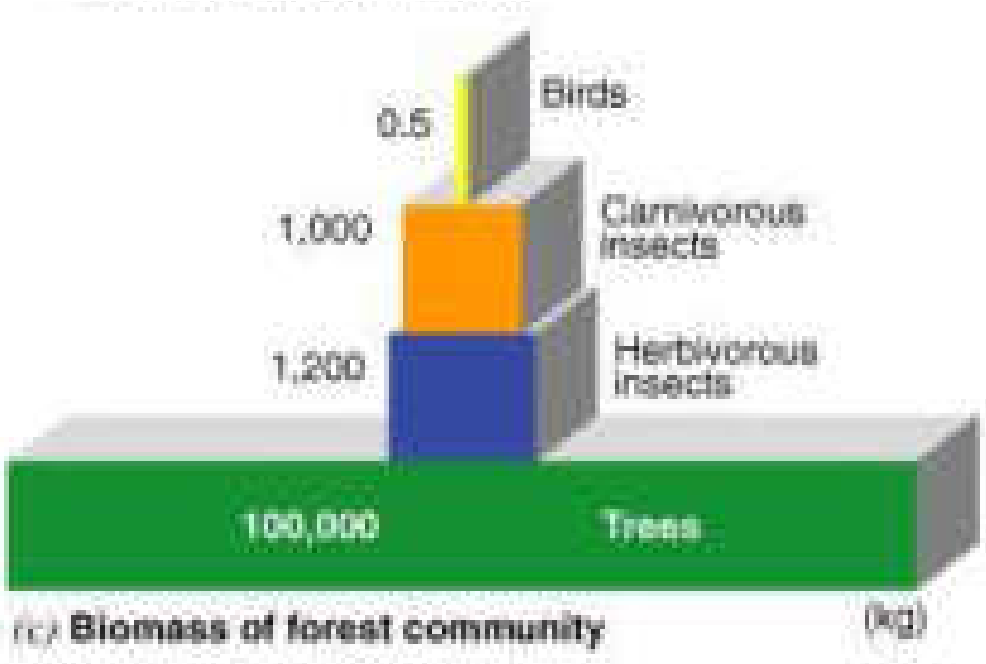


(a) Grassland community

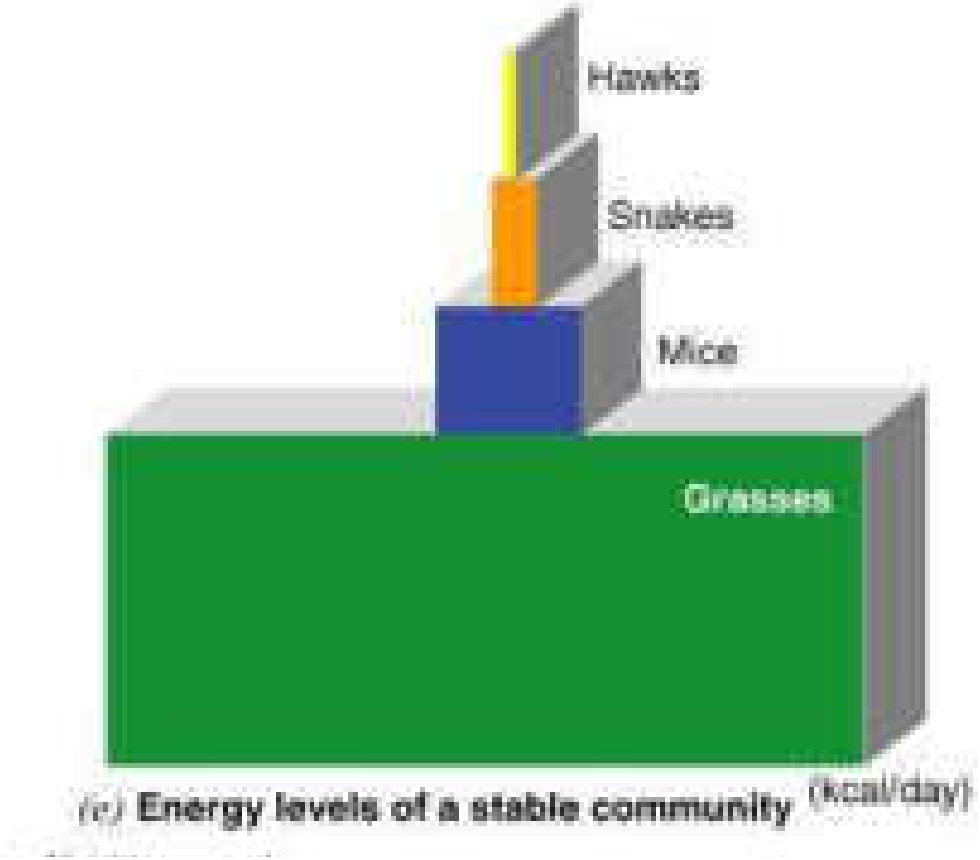


(b) Forest community

Pyramid of Biomass



Pyramid of Energy



Types of Ecosystems

1. Natural Ecosystems
    1.Terrestrial ecosystems ex:forest,grassland,desert
    2. Aquatic ecosystems
        a)Fresh water a) lentic(standing waters as lake,pond)
                b) lotic (running waters streams,rivers)
        b)marine ecosystem ex:ocean,sea
2. Artificial Ecosystems
    ex: croplands like maize, wheat, rice fields

Forest Ecosystem

Occupy roughly 40%of land. In india-1/10 of land.

Abiotic- Inorganic and organic substances , soil, atmosphere**.**

Biotic-

1) **Producers**- Trees,climbers,epiphytes,shrubs.

2)Consumers-

- Primary consumers ex:ants,flies,bugs,spiders which feed on leaves
- Secondary consumers ex:snakes,birds,lizards
- Tertiary consumers ex:lion,tiger

3)**Decomposers** –

Fungi ex:aspergillus,trichoderma
Bacteria ex:bacillus,clostridium,pseudomonas
Actinomycetes ex:streptomyces

Grass land Ecosystem

Occupy roughly 17%of land.

Abiotic- C,H,O,S,N,P which are present in soil and air.

Biotic-

1) **Producers-**grasses ex:Dichanthium,digitaria,setaria.
2) **Consumers-**
   - primary consumers ex:cows,buffalows,deers,sheep,rabbit which feed on leaves
   - Secondary consumers ex:snakes,birds,lizards
   - Tertiary consumers ex:lion,tiger

3) **Decomposers** –
   fungi ex:aspergillus,trichoderma
   Bacteria ex:bacillus,clostridium,pseudomonas
   Actinomycetes ex:streptomyces

Desert Ecosystem

Occupy roughly 17%of land.

Abiotic- C,H,O,S,N,P which are present in soil and air.

Biotic-

1) **Producers**- shrubs,bushes,grasses, and few trees,succulents like cacti,Lichens, xerophytic mosses.

2)**Consumers-** reptiles,insects,rodents birds, ship of desert,*camel.*

3)**Decomposers** – fungi and bacteria

Aquatic Ecosystem

Pond ecosystem(lentic)

Abiotic: C,H,O,S,N,P which are present in soil and air.

Biotic:

1) Producers

a)macrophytes- floating and submerged ex:saggitaria, eichhornia
b)phytoplanktons- floating or suspended lower plantsex:algae.

2)Consumers

primary consumers

a) benthos-ex:fish,insect larvae molluscs
b)zooplanktons ex: euglena

Secondary consumers ex:fish
Tertiary consumers ex:large fish

3)Decomposers

fungi, bacteria ,Actinomycetes

Aquatic Ecosystem

Riverine and stream ecosystem (lotic)

Abiotic: C,H,O,S,N,P which are present in soil and air.
Biotic:
1) **Producers-** cladophora, aquatic mosses
2) **Consumers-**snails, flatworms, fish

3)**Decomposers** – fungi, bacteria

Aquatic Ecosystem

Marine ecosystem

Major oceans of the world cover appr.70% of earth's surface.
Sea water is a solution of 0.5%Nacl and 0.05%$Mgso_4$

Abiotic- C,H,O,S,N,P which are present in soil and air.

Biotic-

1) Producers- ex: brown , red algae

2)Consumers-

primary consumers- molluscs, fish
Secondary consumers ex:fish
Tertiary consumers ex:large fish

3)Decomposers – fungi, bacteria ,Actinomycetes

Aquatic Ecosystem

Estuarine ecosystem

An estuary is a semi enclosed coastal body of water which has free connection with open sea, thus strongly affected by tidal action and sea water is mixed with fresh water.

Abiotic- C,H,O,S,N,P which are present in soil and air.

Biotic-

1) Producers- macrophytes
2)Consumers-Zooplanktons,crabs
3)Decomposers – fungi, bacteria

Biogeochemical cycles

‘Fundamentals’ of biogeochemical cycles

• Biogeochemicals (bio=living organisms,geo=soil,rock, chemicos=elements)

•All matter cycles...it is neither created nor destroyed...

• As the Earth is essentially a closed system with respect to matter, we can say that *all matter on Earth cycles* .

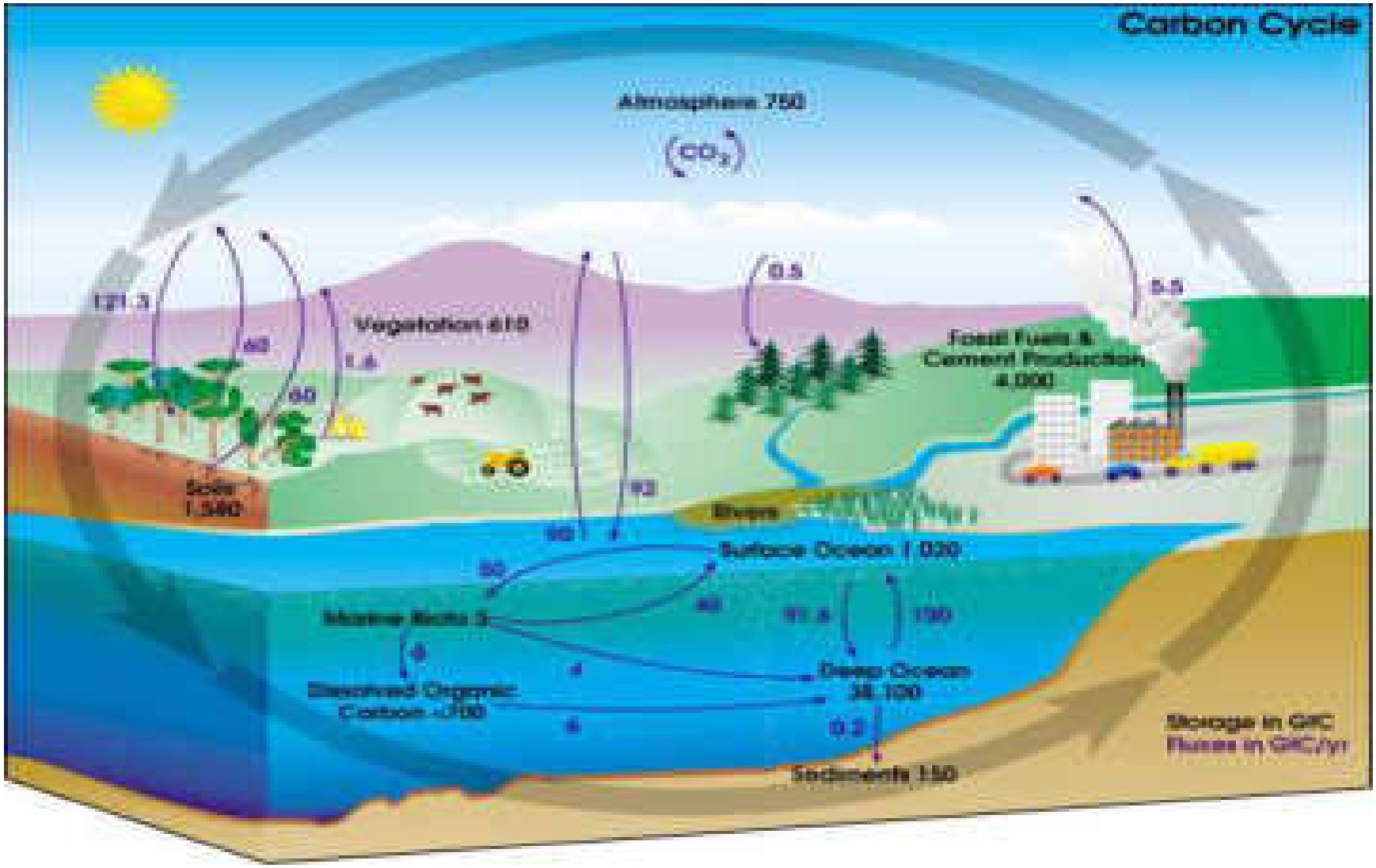
• Biogeochemical cycles: the movement (or cycling) of matter through a system

Types of Biogeochemical Cycles

Four of the most important are:

- The nitrogen cycle
- The oxygen cycle
- The phosphorus cycle
- The carbon cycle

The carbon cycle



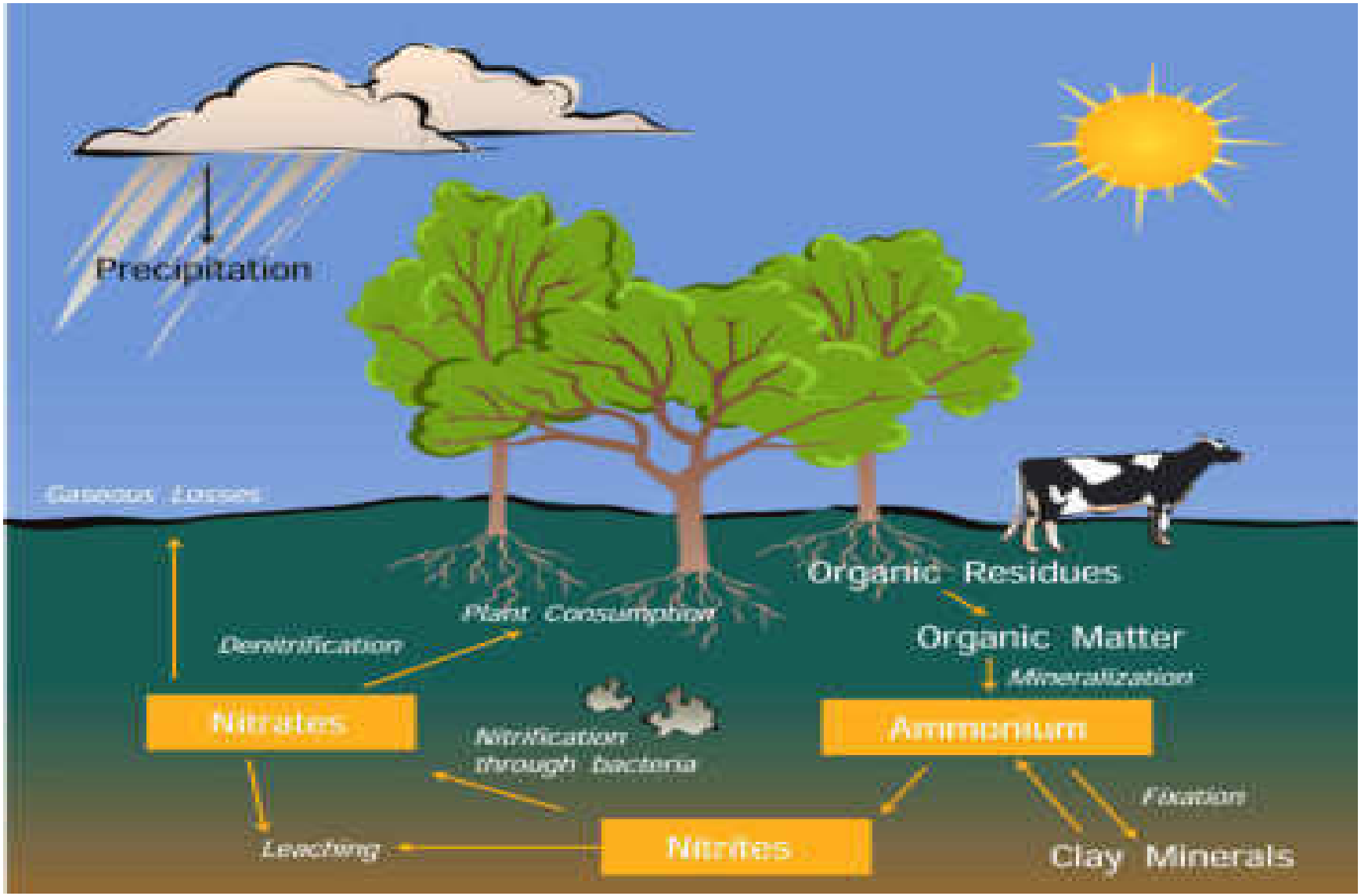
- **Photosynthesis**

$$6CO_2 + 6H_2O + \text{energy} \rightarrow \underset{\text{glucose}}{C_6H_{12}O_6} + 6O_2$$

- **Respiration**

- O_2 + carbohydrates $\rightarrow$ $CO_2 + H_2O$ + energy

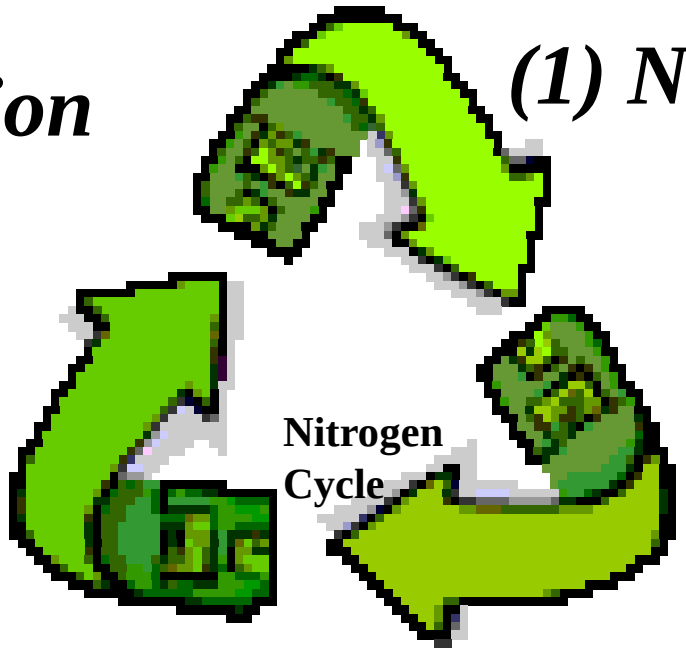
The N cycle over land



Various Stages in nitrogen cycle

(4) Denitrification

(1) Nitrogen Fixation



(3) Nitrification

(2) Ammonification

Nitrogen Fixation

Occurs in three ways

- Atmospheric N-fixation

$$N_2 + O_2 \rightarrow 2NO$$
$$2NO + O_2 \rightarrow 2NO_2$$
$$2NO_2 + H_2O \rightarrow HNO_2 + HNO_3$$

- Biological N-fixation

- Industrial N-fixation

- Ammonification

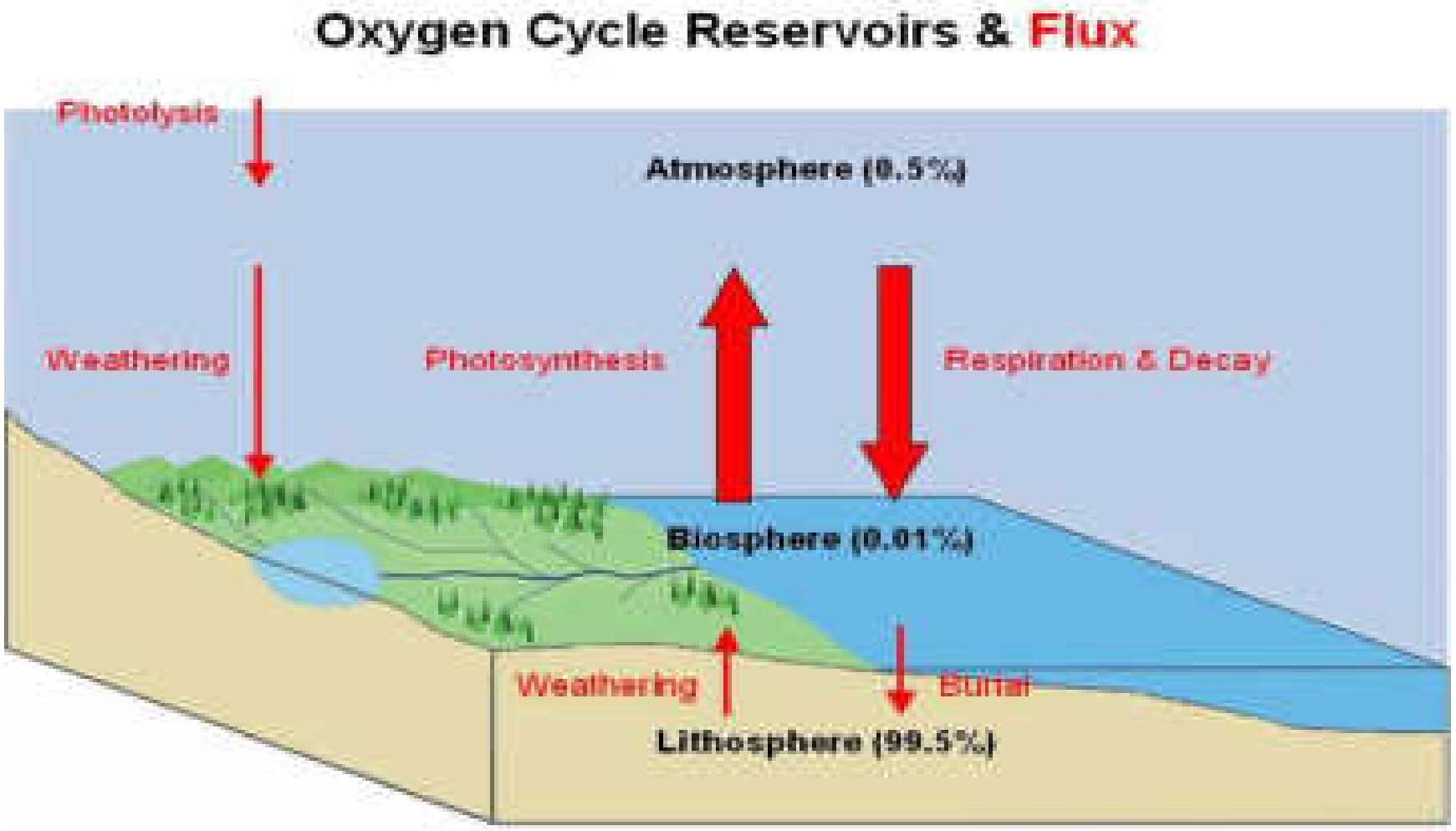
- Nitrification

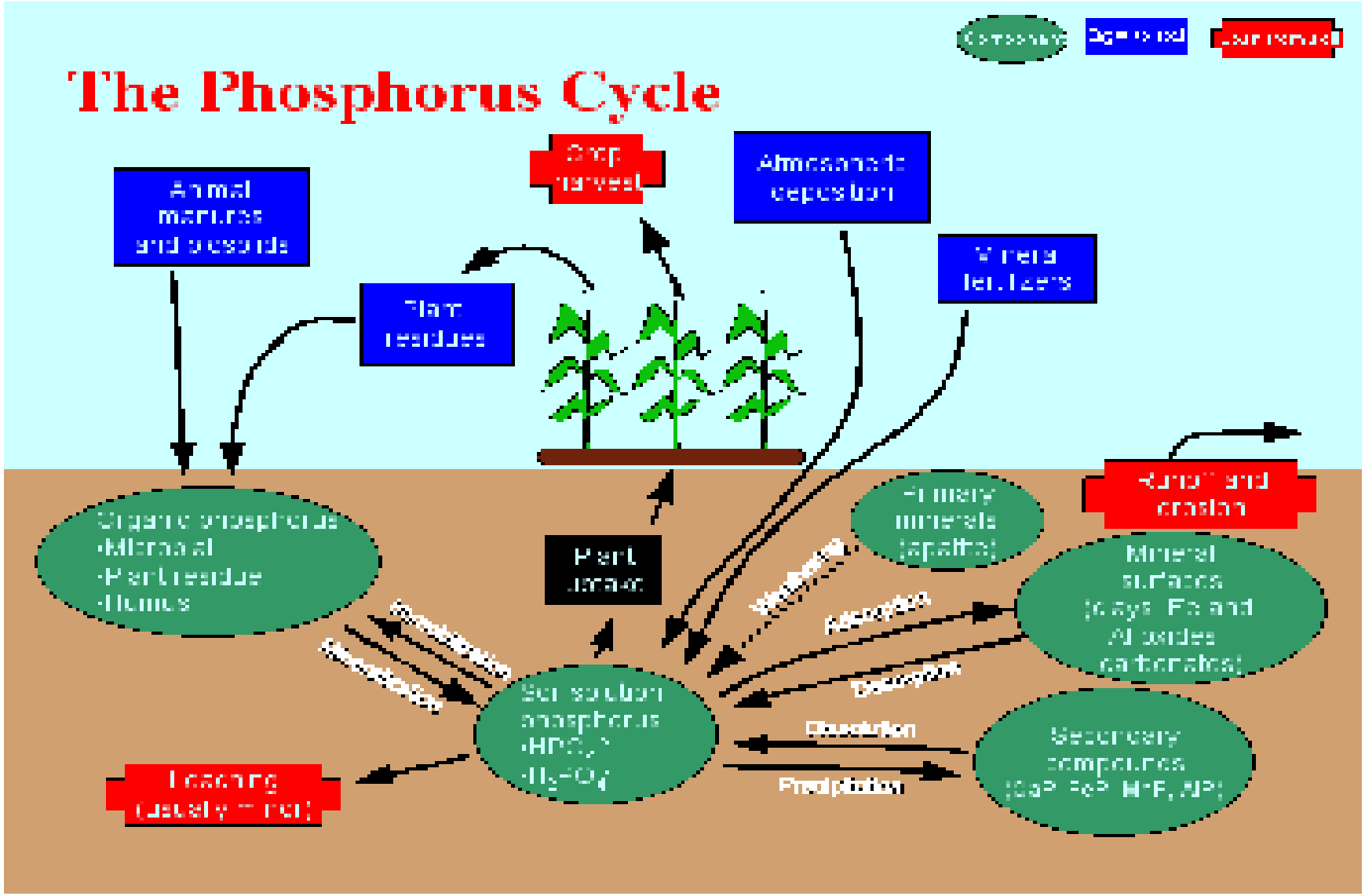
  $2NH_3 + 3O_2$ **Nitrosomonas** $\rightarrow 2NO^-_2 + 2H^+ + 2H_2O$

  $2NO^-_2 + O_2$ **Nitrobacter** $\rightarrow 2NO^-_3$ + energy

- Dentrification

The Oxygen cycle




The Phosphorus Cycle
Crop harvest
Atmospheric deposition
Animal manures and biosolids
Plant residues
Mineral fertilizers
Organic phosphorus
•Microbial
•Plant residue
•Humus
Plant uptake
Soil solution phosphorus
•HPO_4^{2-}
•$H_2PO_4^-$
Leaching (usually small)
Runoff and erosion
Primary minerals (apatite)
Mineral surfaces (oxyd. Fe and Al oxides carbonates)
Secondary compounds (Ca-P, Fe-P, Al-P)
Weathering
Adsorption
Desorption
Dissolution
Precipitation
Immobilization
Mineralization