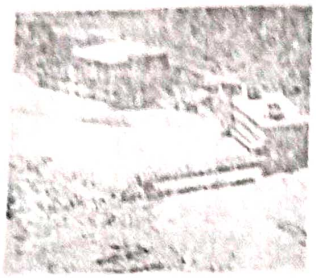
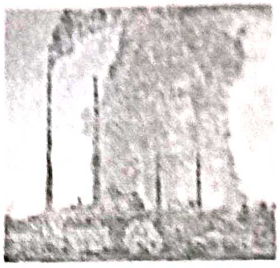
(b) Anthropogenic environment

- An anthropogenic environment includes components that have been introduced by human beings depending on their needs and requirements by the application of modern technology.

Changes which influence the organic world and are introduced into nature by human activity. In reworking nature and adapting it to their own needs, people influence the lives of animals and plants by altering their habitats. The influence may be indirect or direct.





Further classification of Environment

- Physical Environment: It includes radiation (light),temperature, humidity, rain, soil and other physical factors which directly affect the organism in a given area .For example solar energy is crucial for the plants in the preparation of food which in turn provide food to other living organisms. Similarly soil provides essential medium for the growth of plants.

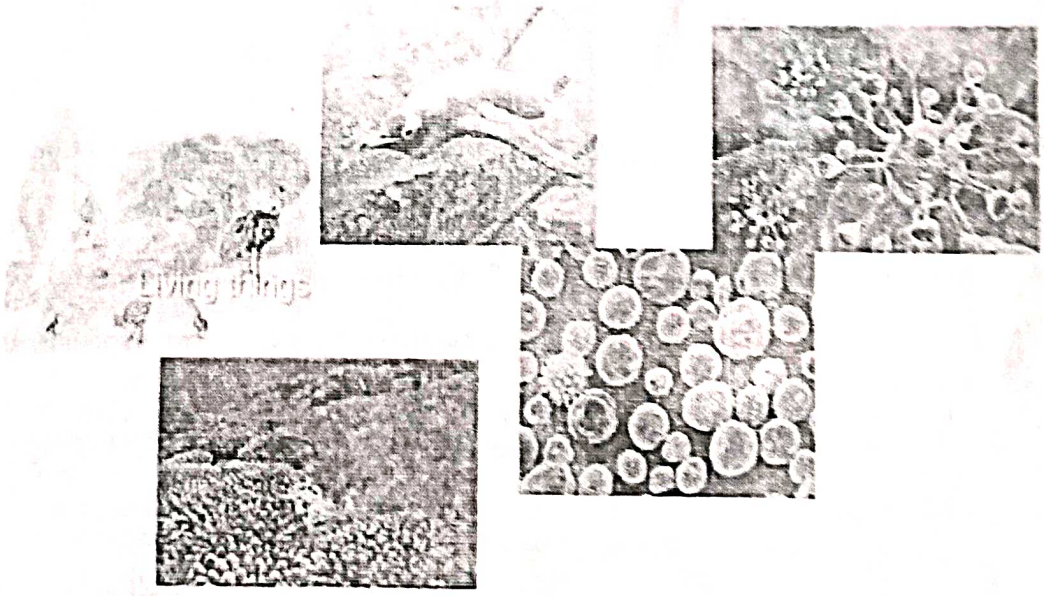

- **Chemical Environment:**

It includes all the chemical components of earth which includes gases, water, inorganic elements and organic substances. Chemical environment is different for different group of organisms eg. Chemical environment for farm livestock includes fertilizers, defoliants, insect spray etc.

For aquatic organism chemical environment means different gases, nutrients etc. dissolved in water.

- Biological Environment

It includes all life on earth. It covers all living organism on earth.These can be bacteria, viruses, alge, herbs etc. Biological environment also describes the influence of factors such as warmth, moisture and humidity on plants, and animals.



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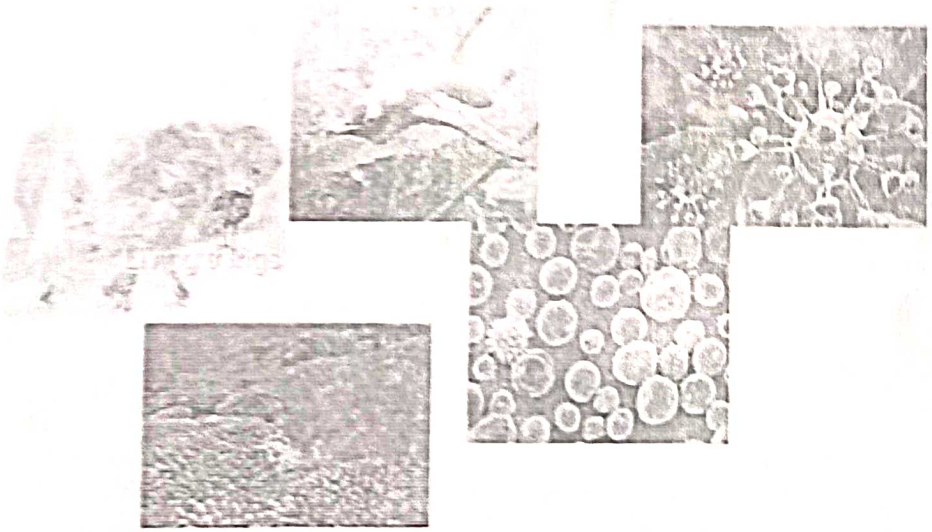
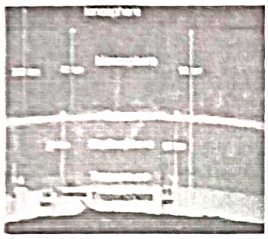


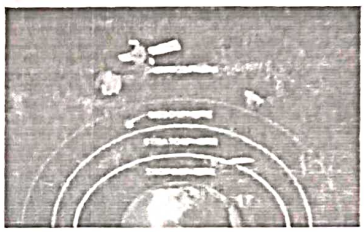
Earth's Spheres(Segments of Environment)

Natural environment on the earth is divided into four realms:

Lithosphere : Lithosphere means the mantle of rocks constituting the earth's crust. It comprises of crust and mantle of the earth surface. It includes the soil, which covers the rock crust. Soil plays an important role as it provides food for man and animals.

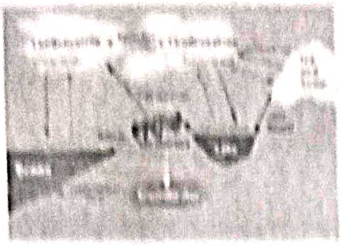
A typical productive soil contains approximately 95 per cent inorganic matter and 5 per cent organic matter. Organic matter in the soil provides food for microorganism. This matter includes amino sugars, organic sulphur, organic phosphate, and polysaccharides. Soil contains silicate minerals, which includes nearly 74 per cent Silicon and Oxygen, common elements in the soil are 46.4 per cent Oxygen, Silicon 27.7 per cent, Aluminium 8.1 per cent, Iron 5.6 per cent, Calcium 3.6 per cent, Sodium 2.8 per cent, Potassium 2.6 per cent, Magnesium 2.1 per cent. In some soils, manganese oxide and titanium oxide are also available.





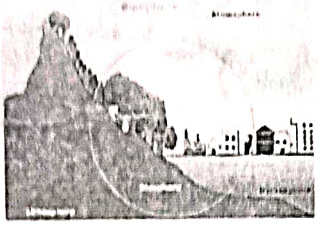
Atmosphere:

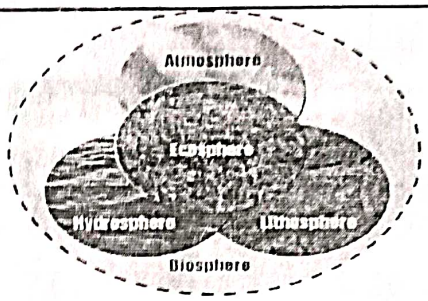
- It is the envelop of gases surrounding the earth. The gaseous envelope surrounding the earth is composed of an entire mass of air containing N_2, O_2, H_2O, CO_2 and inert gases is known as atmosphere.
- Soil contains silicate minerals, which includes nearly 74 per cent Silicon.
- The atmosphere is a reservoir of several elements essential to life and serves many purposes and functions..
- It absorbs most of the harmful radiations.
- It maintains the heat balance of the earth.
- Different cycles those are present in the atmosphere in the form of water cycle, carbon, oxygen, nitrogen cycle etc. related to the movement of matter been an organism and its environment.
- Atmosphere can be divided into several layers on the basic of temperature variations. They are troposphere, stratosphere, mesosphere and thermosphere.



Hydrosphere:

- All the water present of the earth either surface or ground water constitutes hydrosphere.
- It includes all the surface and ground water resources such as oceans, seas, rivers, streams, lakes, reservoirs, glaciers, polar ice caps, ground water and water locked in rock and crevices and minerals laying deep below the earth's crust.
- Earth is called blue planet because 80 per cent of its surface is covered by water (97 per cent of the earth's water resources is locked up in the oceans and seas, 2.4 per cent is trapped is giant glaciers and polar ice caps.)
- Water is also the main medium by which chemical constituents are transported from one part of an ecosystem to others. Water is universal solvent.
- Surface water contains a lot of organic matter and mineral nutrients, which feed large bacteria population and algae.





Biosphere:

- The portion of the earth where an organism lives is called biosphere.
- Biosphere is biological envelope that surrounds the globe, containing and able to support.
- It penetrates into and is dependent on the atmosphere, hydrosphere and lithosphere. This denotes the relating of living organism and their interactions with the environment. The biosphere is a relatively thin and incomplete envelope covering most of the world.

Components of Environment

Biotic Components

These are the living components of environment such as microbes, plants, animals and Human beings. These are classified either as producers or consumers,depending on the mode through which they obtain food.

Producers, i.e. autotrophs : e.g. plants and green alge; they convert the energy (from the sun, or other sources) into food. Bacteria utilizes the oxidation of inorganic compounds such as hydrogen sulphide, ammonium or ferrous ions as energy source (Chemosynthesis)

Consumers, i.e. heterotrophs: e.g. animals; they depend upon producers for food. Animals, fungi as well as most bacteria depend on autotrophs for both energy and raw material to make complex organic molecules.

These are further classified as herbivores (An animal that feeds on plants.), carnivores(An animal that feeds on flesh.) , omnivores (An animal or person that eats food of both plant and animal origin) and decomposers (An organism, esp. a soil bacterium, fungus, or invertebrate, that decomposes organic material) depending on their food habits.

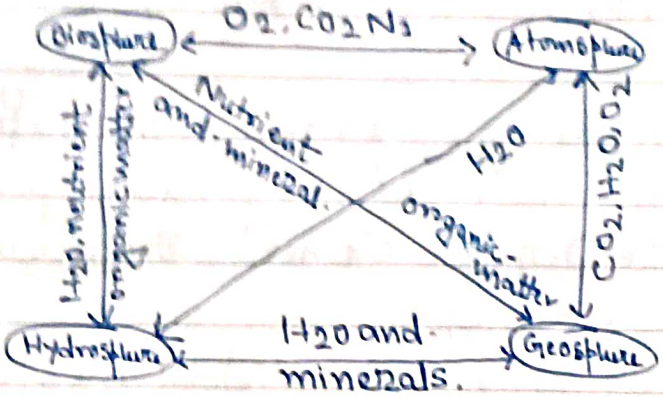
Abiotic Components

These are the non living physical and chemical components that influence living organisms. For example, air, water, soil, rocks, etc. All basic inorganic elements and components such as soil, water, calcium, oxygen and a variety of organic components such as humus and different climatic conditions such as light, temperature ,wind and precipitation all are abiotic components of environment.

These components are very essential as life can not exist without these. Each a biotic component differ in characteristics such as turbidity, alkalinity, pH, conductivity and amount of oxygen. Changes in the abiotic environment can affect the conditions of living organisms and vice versa. Human activities are currently resulting in considerable changes in abiotic environment of earth including changes in global cycles hance causing harmful environmental effects such as global warming.

Biosphere

Biosphere refers to living organisms of the earth. Biosphere is the common interface for the interactions with the abiotic component i.e hydrosphere, geosphere and atmosphere. The biotic component biosphere allows the flow of matter and energy in the total environment. This flow of energy and matter is very much important to run the biogeochemical cycle.



Interchange of matter among the different segment of environment

The biotic and abiotic components

The different ecosystem such as freshwater ecosystem, marine ecosystem, grassland ecosystem, desert ecosystem etc. are constituent of biosphere.

Biogeochemical cycles:- Biogeochemical cycles outline the pathways of interchange of nutrients among the both biotic and abiotic community of the environment. The word bio refers to the biotic community while the word geo refers to abiotic community. In this cycles, the nutrient element like C, O, N, P, N, S etc. are experiencing transition from one station to another station regularly to complete the cycles.

Depending upon the nature of the main abiotic reservoir of the nutrient element the biogeochemical cycle are classified into two groups. one is known as gaseous cycles and another is known as sedimentary cycles.

(i) Gaseous cycles:- In gaseous cycles atomsphere acts as the main reservoir.
e.g:- Nitrogen cycle, oxygen cycle. etc.

(ii) Sedimentary cycles:- In sedimentary cycles the earth's soil and sedimentary rocks are main reservoirs.
e.g:- Sulfur cycles, and phosphorus cycles).

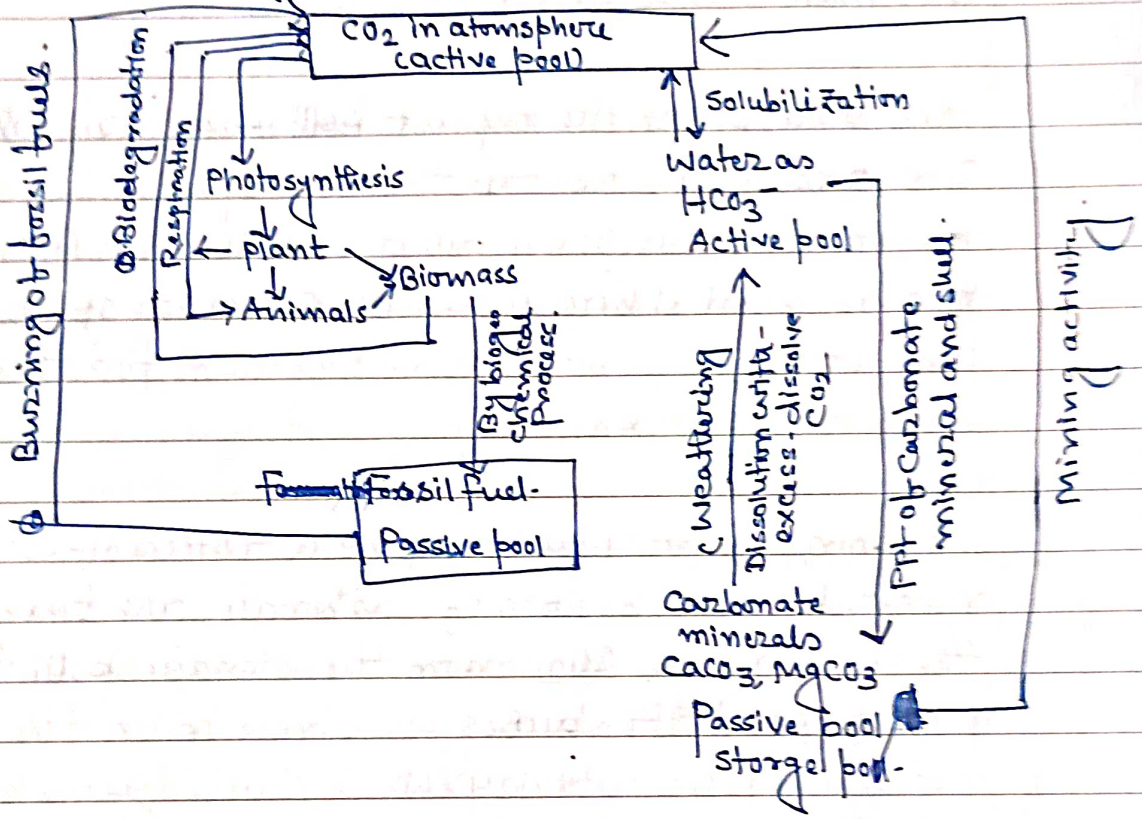
In a biogeochemical cycle the word "pools" refers to the natural abiotic store houses (e.g hydrosphere, atomsphere, soil etc) of the element Consideration. These pools are of two types.

(i) Active pools:- In active pool the stored materials are easily accessible to the biotic community.
eg:- In the carbon cycle the atomspheric CO_2 is easily available for plant photosynthesis and the released CO_2 used for respiration of living bodies is also directly stored in the atomsphere. Thus atomsphere acts as active poll of carbon-cycle.

(ii) Storage pools or passive pools:- Storage pool or passive pools where the materials stored are not easily accessible to the biotic community.
eg:- Oceans can store a large amount of carbon in the sediment lying on the sea-bed. To release carbon from this source it requires uplifting of $CaCO_3$ enrich sediments from sea bed followed by decomposition. Which required a very long period of time. Thus the oceans acts as the passive pool of the carbon-cycle.

Carbon cycle (C-cycle)

In the carbon cycle the atomsphere is the active pool that receives CO_2 from the respiration of living bodies, burning of fossil fuel and biodegradation of organic matter. The atomspheric CO_2 is fixed by the ~~photosynthesis~~ photosynthetic plant including the phytoplankton of the oceans. From the photosynthetic plant carbon enters into the food chain. Decomposition of carbonate mineral slowly released CO_2. Weathering of rocks are slowly consumes CO_2 from the atomsphere.



The Carbon-cycle.

Approximate budget of CO_2 in atomsphere.

Process	Accumulation of CO_2 in atomsphere in crore ton/year.
(i) From ocean.	10,000
(ii) Respiration and biodegradation	6,000
(iii) ~~hot spring~~ volcano eruption.	10
(iv) Burning of fossil fuel.	600
(v) ~~Earth~~ Enhancement of aggricultural activity	200
Total.	= 16810

	Process.	Removal of CO_2 from atomsp in crore ton/year.
(I)	To the oceans.	10,000
(II)	photosynthesis	6.000
(IV)	Weathering of rocks	10
	Total	16010

It is evident that the atomsphere is receiving about 800 crore ton of CO_2 excess due to the man made activity.

The oceans are the biggest ~~pollut~~ pool of CO_2. The ocean can absorb the atomspheric CO_2 in different ways. like (I) direct solubilisation (II) through algal photosynthesis (III) conversion of CO_2 to lime stone by some marine organism for their shell formation *

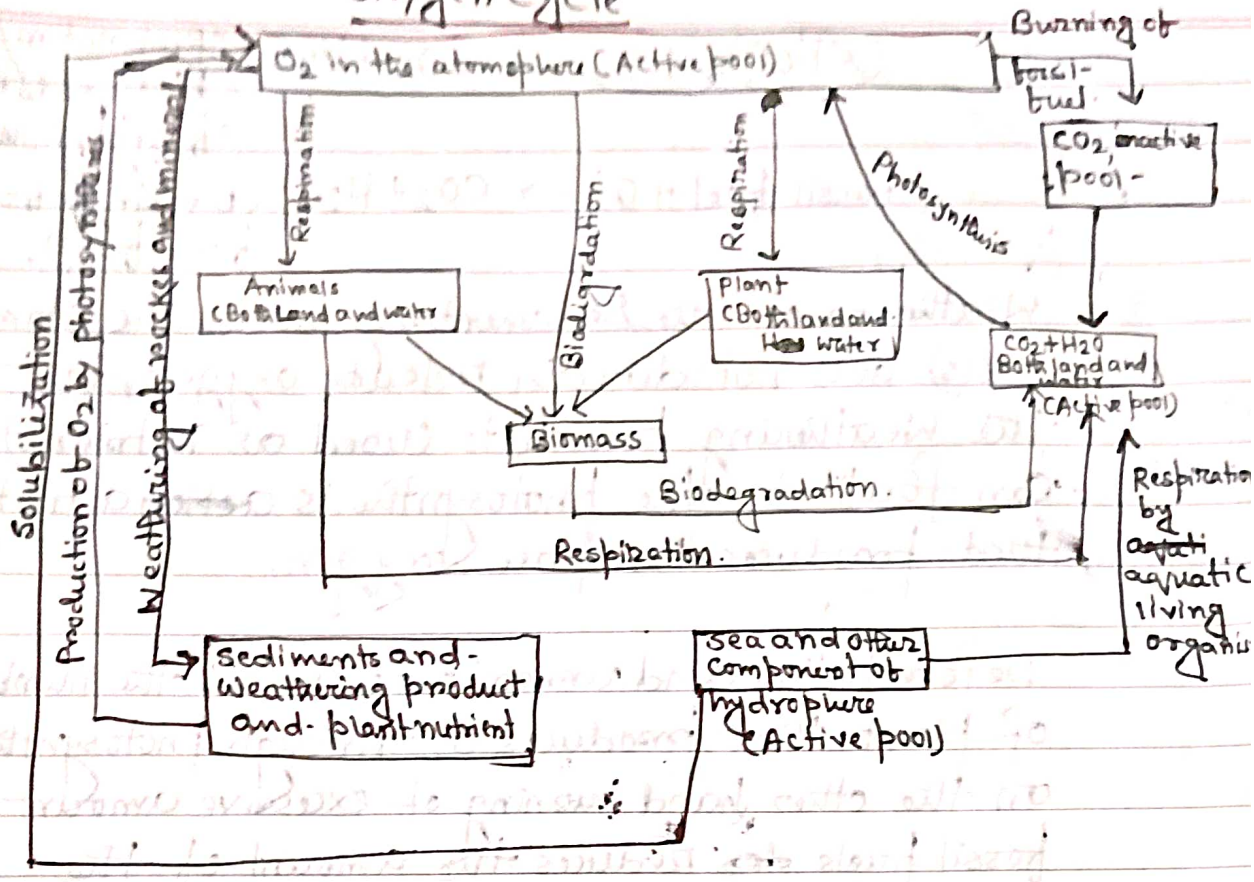
Burning of fossil fuel, mining activities of carbonate minerals, decomposition of carbonate, are transferring the element as CO_2 from the storage pool to active pool. It causes an stress on the natural cyclic pathway. Which cause green house effect leading to global warming.

* $CO_2(air) + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^- \rightleftharpoons 2H^+ + CO_3^{2-}$

Thus CO_3^{2-} ppt down as $CaCO_3$ or $MgCO_3$.

Some marine organism use $CaCO_3$ for the construction of their protective shell.

Oxygen cycle



~~Oxygen cycle.~~

Oxygen is required for the respiration of all living organism including the plant. Thus for the servival of living Community, the presence of free O_2 is very much essential. The atomsphere and dissolve oxygen in sea water are the active pools of oxygen cycle while the chemically trapped oxygen in the mineral (e.g silicate, oxide, carbonate, sulfate etc) constitutes the passive pools (storage pools) of the cycle.

At the early stage of the earth there is no free oxygen in atomsphere and it was stored later through by photosynthesis activity.

$$CO_2 + H_2O \xrightarrow{h\nu} (CH_2O)_x + O_2$$

Oxygen is mainly consumed in the respiration, burning of fossil fuel, and biodegradation of organic waste and oxidative weathering of minerals.

$(CH_2O)_x + O_2 \longrightarrow CO_2 + H_2O$ (Respiration/ biodegradation of organic mass).

Fossil fuel $+ O_2 \rightarrow CO_2 + H_2O$ (burning of fossil fuel).

- Weathering of the sedimentary rocks (i.e storage pools) does not directly release oxygen, but the weathering products (used as nutrient) can facilitate the photosynthesis ~~action~~ activity that produces the free oxygen.

Deforestation and urbanization reduce the number of plant that produces O_2 through photosynthesis. on the other hand burning of excessive amount of fossil fuels ~~do~~ reduces the amount of the atmospheric oxygen.

Nitrogen cycle

In nitrogen cycle there is contineous interchange of nitrogen between the biosphere and atomsphere. Atomspheric N_2 is chemically inert. So the ~~accu~~ storage of N_2 as nitrogeneous compound in biosphere is called nitrogen fixation. The N_2 present as nitrogenous compounds in the sediment are not easily ~~avala~~ ~~available for plant growth~~ available for biosphere. The inorganic nitrogen present as NH_4^+, NO_2^-, NO_3^- are easily available for plant growth.

In biosphere some bacteria like Azotobactor, Rhizobium, and blue-green algee convert N_2 into nitrogenious compound by using nitrogenease enzyme.

$$2N_2 + 6H_2O \xrightarrow{\text{Nitrogenease}} 4NH_3 + 3O_2$$

The produced further converted to NO_3^- by some specified bacteria. This proces is called nitrification.

$$N_2 \xrightarrow{\text{Nitrogenease}} NH_3 \xrightarrow[+O_2]{\text{Nitrosomonous}} NO_2^- \xrightarrow{\text{Nitrobactor}/O_2} NO_3^-$$

(NO_3^- Available for plant).

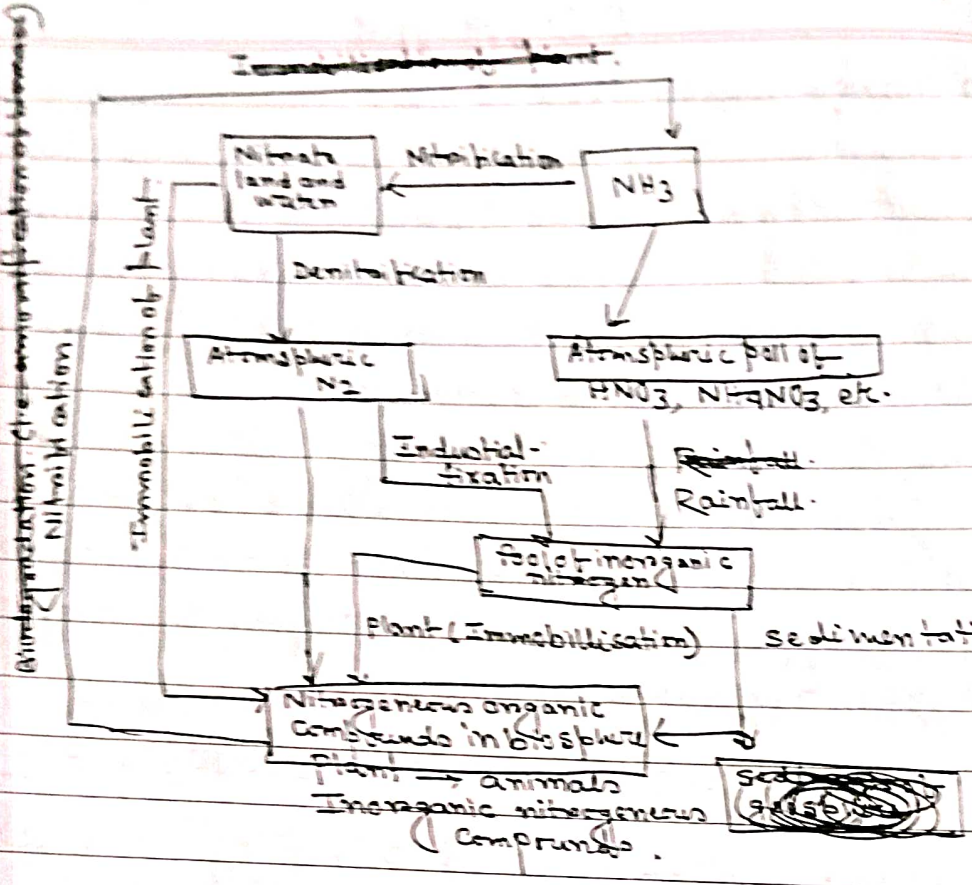
Denitrifying bacteria Reduces NO_3^- to N_2 or NH_3 and N_2 is released to environment. ~~and NH_3 comes back to soil~~

$$NO_3^- \xrightarrow{\text{Nitrite Reductase}} HNO_2 \xrightarrow{\text{nitrite Reductase}} H_2N_2O_2 \xrightarrow{\text{Hyponitrite Reductase}} N_2O, N_2, NH_3$$

The important step in N-cycle is.

Free N_2 ⟶ Ammonification ⟶ Nitrification

Denitrification.



Several man made activities put a problem in N-cycle. To increase agricultural production a large amount of N-based fertilised is being used. It make soil acidic and destroy the balance in the distribution in soil organism. Thus acidification of soil disturb the natural nitrogen cycle. Combustion of fossil fuels produces a huge amount of NO_x in atmosphere and it produces acid rain.

Phosphorus cycle

Phosphorus is very important in life process several important biomolecules like nucleic acid, phospholipids, sugar, phosphate, & ATP, ADP etc required phosphorus as phosphate. Phosphate required in constructing skeleton of many living bodies. In soil organic phosphases are easily avaiable but these can not be taken by the plant. ~~For~~ plant only ~~recive~~ take inorganic phosphate ~~for~~ ($H_2PO_4^-$) for their growth. The microorganism present in soil slowly convert organic phosphate to inorganic phosphate.

P-Containing organic compound $\xrightarrow[\text{Microorganism}]{\text{mineralisation}}$ P-Containing inorganic Compound

Hydrological cycles :-

The hydrological cycle is a continuous natural process leading to exchange of water between atomsphere and earth. It is ~~interlinked~~ maintain by five interlinked natural process.

(i) Evaporation (ii) transpiration (iii) precipitation (iv) surface run off (v) ground water movement.

1. Evaporation :- Evaporation occurs from the surface of natural water bodies (oceans, river, lakes etc) is driven by solar energy. 1/3rd of the solar energy absorbed by earth surface is ~~(i)~~ utilize to natural process of evaporation. The rate of evaporaion depends on the relative humidity and salinity of the water from which evaporation occurs. Fresh water evaporates faster than the ocean's saline water.

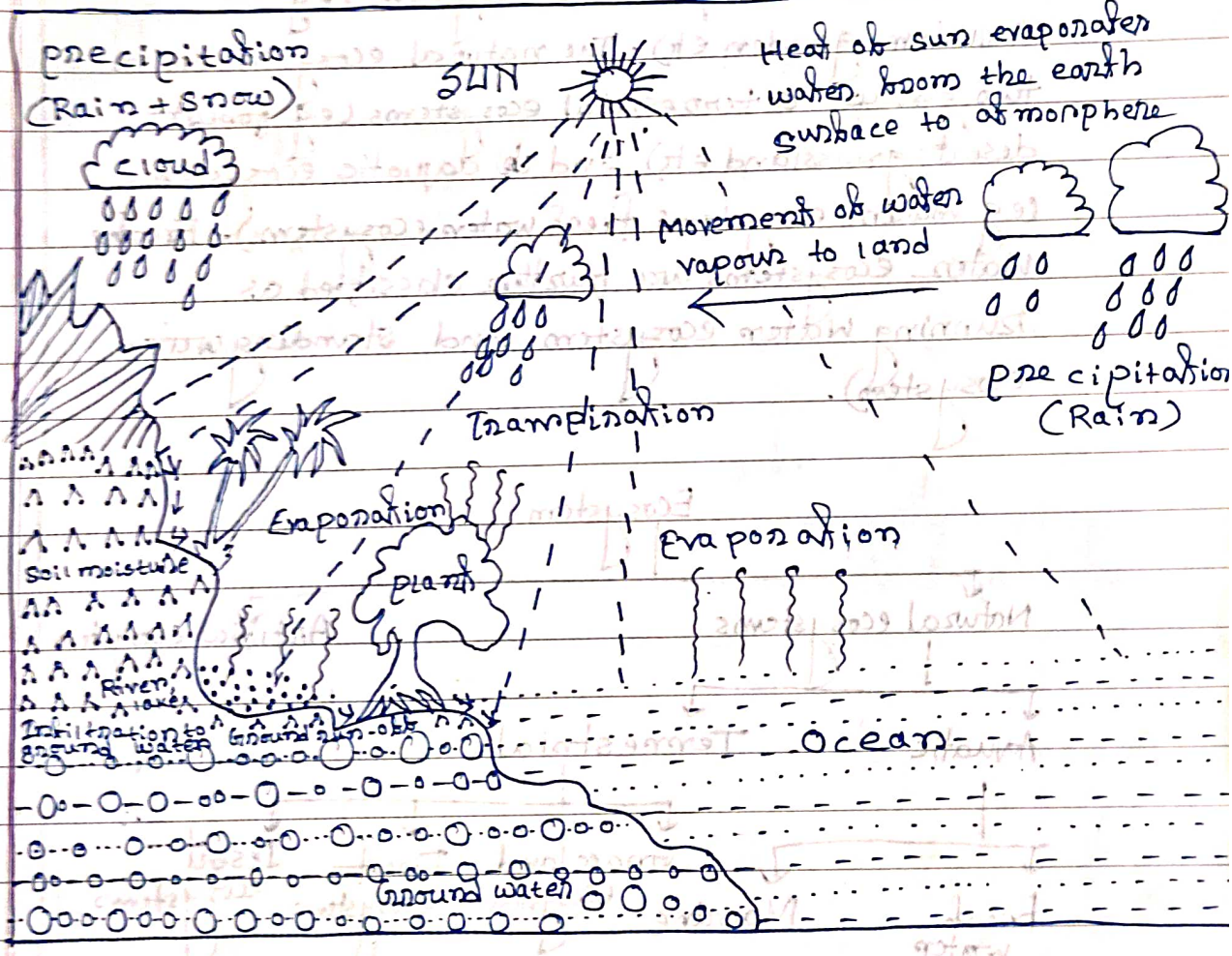
(ii) Transpiration :- Soil water is absorbed by the plants. The ~~movement~~ excess water taken by plant is lost as water vapour through the leaves in day time. The process of release of water vapour ~~through~~ to the atomsphere through the plant leaves known as transpiration.

(iii) Precipitation :- Water vapour on cooling at higher altitudes undergoes condensation arround the suspended particles. The droplets of condense water vapour remain as cloud which ultimately precipitate as rainfall on the earth surface. The precipitation of water vapour also happen through snow fall.

(iv) Surface run-off :- A part of the rainfall on the earth's land surface ~~it~~ is utilized by the plants and animals. Another part of the rainfall makes the run-off flow into the stream, rivers and other reservoirs. The reminder

Part sinks into soils due to gravity. This ~~produces~~ infiltration gives ~~ground~~ ground water.

⑤ Ground water movement:- The ground water circulated in different direction through capilary action. In a plant takes ground water through capilary action and a part of ground water lost through transpiration to the atomsphere as water vapours. Thus ground water is interlinked with the atomspheric water vapour through the plant. The water remain stored above the impermeable rock and known as aquifers. From the aquifers, water can be extracted to the surface by pumping.



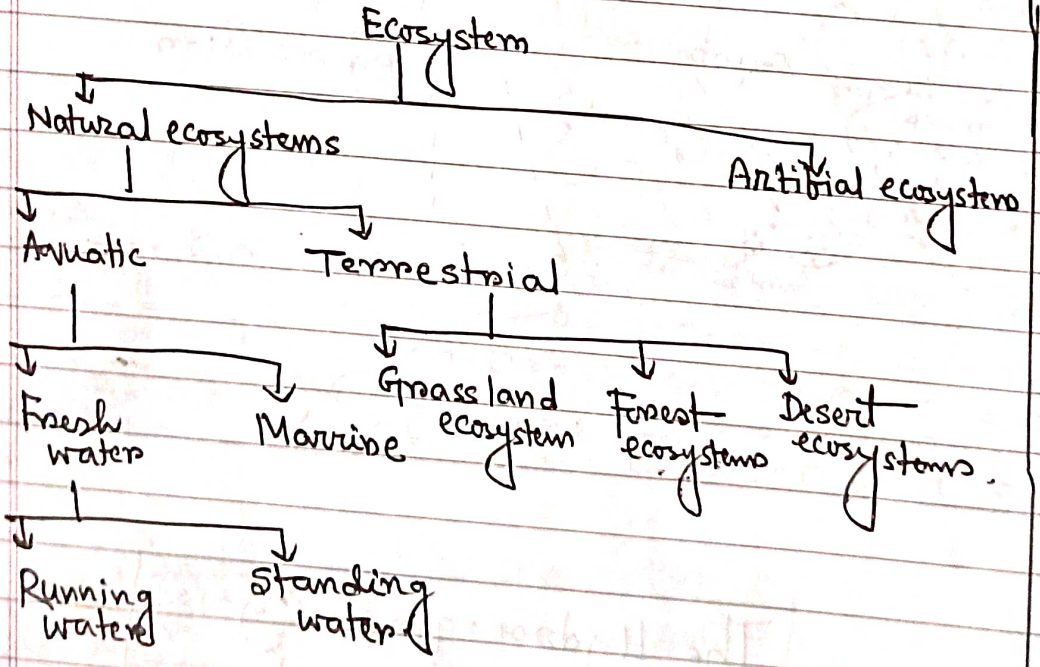
The Hydrological Cycle.

Ecosystems

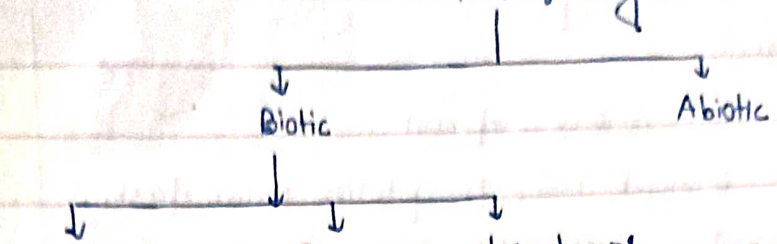
The ecosystem refers to a system formed by a group of biotic community interacting with the surrounding abiotic community and physical environment. The biotic and abiotic component in ecosystem are regarded as linked together through nutrient cycle and energy flow. So ecosystem is the network of interactions among organism and their environment.

classification of Ecosystem:-

Ecosystem may be classified as ~~natur~~ (i) natural ecosystem (eg desert ecosystem, marine ecosystem,) and (ii) Man made/artificial ecosystem. (e.g. aquarium, garden etc). The natural ecosystem are in two groups (a) terrestrial ecosystems (eg forest desert, grassland etc) and (b) aquatic ecosystems. (eg marine ecosystems, fresh water ecosystems). Fresh water ecosystems are further classified as running water ecosystem and standing water ecosystem).



Structure of ecosystem



The living organisms (i.e. biotic components) of an ecosystems are of three types (i) producers (ii) Consumers of different classess (iii) decomposers.

(a) Producers:- The ~~autotrophic~~ photosynthetic plant, algae, phytoplanktons belonging to this group. In the terrestrial ecosystem the grasses and green plants are the main producers while in aqatic ecosystem the floating or submerged algae and phytophanktons etc are the main producers. Through photosynthesis solar energy is trapped in ~~producing th~~ Chemical energy and ultimately produced the product carbohydrate. The solar energy is main source of energy in an ecosystem.

(b) Consumers:- The consumers can not manufacture their food by using solar energy and they are generally describe as heterotrophs. Consumers hunt, gather and store food because they can not make their own. The consumers are classified in three different types. (i) Herbivores (ii) carnivores (iii) omnivores.

(i) Herbivores:- Harbivores directly eat producers. e.g in terrestrial ecosystems cattle, deer, elephants etc. are the primary consumers.

(ii) Carnivores :- The primary consumers are taken as food by the secondary Consumers. ~~or The e.g~~ known as carnivores. eg tiger, lion are the example of carnivores.

(iii) omnivores:- Animal who eat both plant and animals are known as omnivores. e.g :- human, bears etc.

(iv) Decomposers:- are Microorganism that are able to break down large molecules into smaller parts. Decomposers return the nutrient that are in a living organism, to the soil. eg :- Bacteria, Fungi, etc.

Functioning of ecosystems: Several types of biological process takes place in an ecosystem. The function of ecosystem can be studied in following forms.

(i) Food chain and food web

(ii) Energy flow

(iii) Mineral nutrient cycle.

(i) Food chain: In an ecosystems food flow i.e energy flow occurs from one level to another level.

Producers → Primary Consumers → Secondary Consumers → Tertiary Consumers

Decomposers ←

This chain is called food chain. The sequence of organism in a food chain indicates that the organism of a particular trophic level use the organism trophic level as a source of a food.

The food chain differs from one ecosystem to another. In marine ecosystems the food chain is:

Phytoplanktons (Producers) → Zooplanktons (Primary Consumers) → Small fishes (Secondary Consumers) → Big fishes, Seal (Tertiary Consumers)

Fungi, Bacteria, etc. (Decomposers) ← Big fishes, Seal (Tertiary Consumers)

Fungi, Bacteria, etc. → Phytoplanktons (Producers)

Food chain in a grass-land ecosystems is

Grass (Producers) → Grasshopper (1st trophic Primary Consumers) → Toad Secondary Consumers → Snake (Tertiary Consumers)

Snake (Tertiary Consumers) → Hawk (Quarternary Consumers) → Bacteria, fungi and other organism Decomposers → Grass (Producers)

There are two types of food chain

(i) Grazing food chain

(ii) Detritus food chain.

(i) Grazing food chain:- Grazing food chains are common in nature and are more frequently discussed, they are directly depends on solar radiation.

(ii) Plant → deer (Herbivores) → tiger (Carnivores) → Bacteria (Decomposers)
(Producers)

Detritus food chain:- The organic waste and dead matter derived from grazing food chains are termed as detritus. In this food chain energy flow starts from the decomposition of detritus. Detritus is produced through the partial decomposition of dead organic matter. The decomposers are bacteria and fungi

Detritus → Small organism → Small fish → Big fish.

Significance of food chain:- Food chain are important for