UNIT- 1

Ecosystem

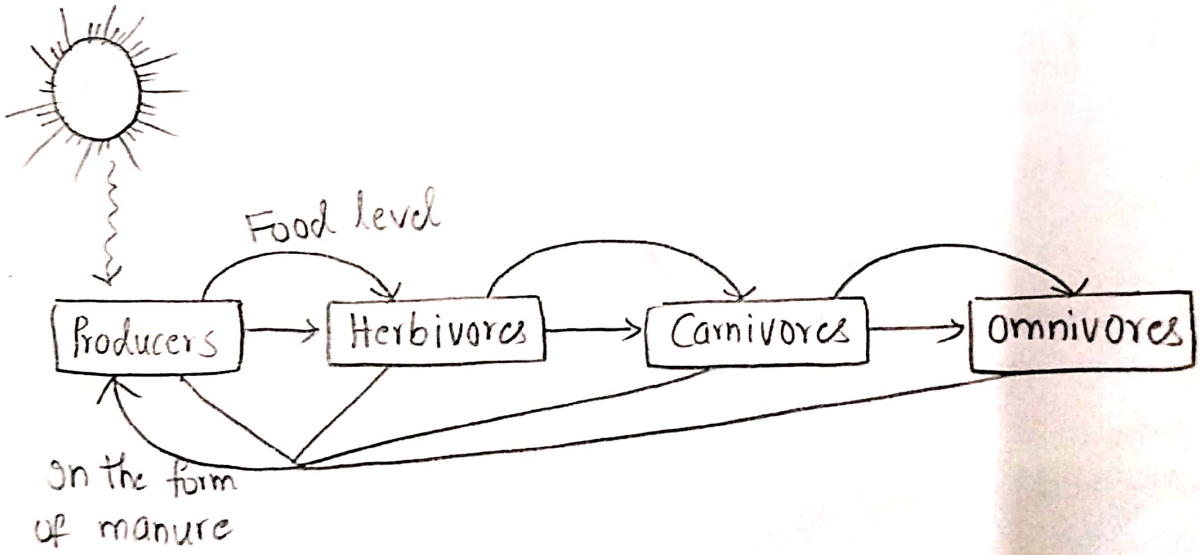
⇒ The word Ecosystem is derived from the word ecology and it is the combination of two greek words oikos + logos where oikos means living area/House/habitat and logos is study. It is given by Ernest Haeckel (1869).

⇒ The term ecosystem was given by A.G Tansley in 1935 and he defined it as the system resulting from the integration of both living and non living components

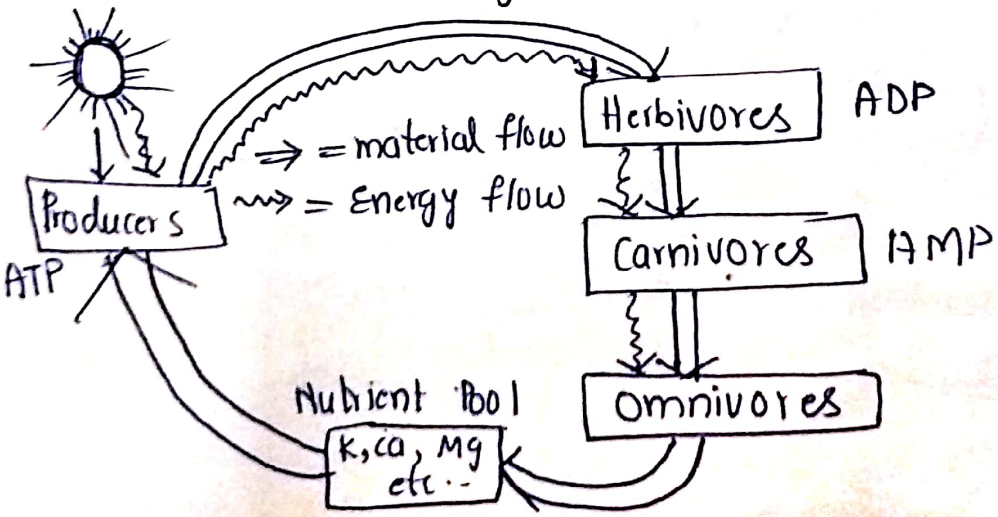
(or)

It shows the relation between living and non-living organisms

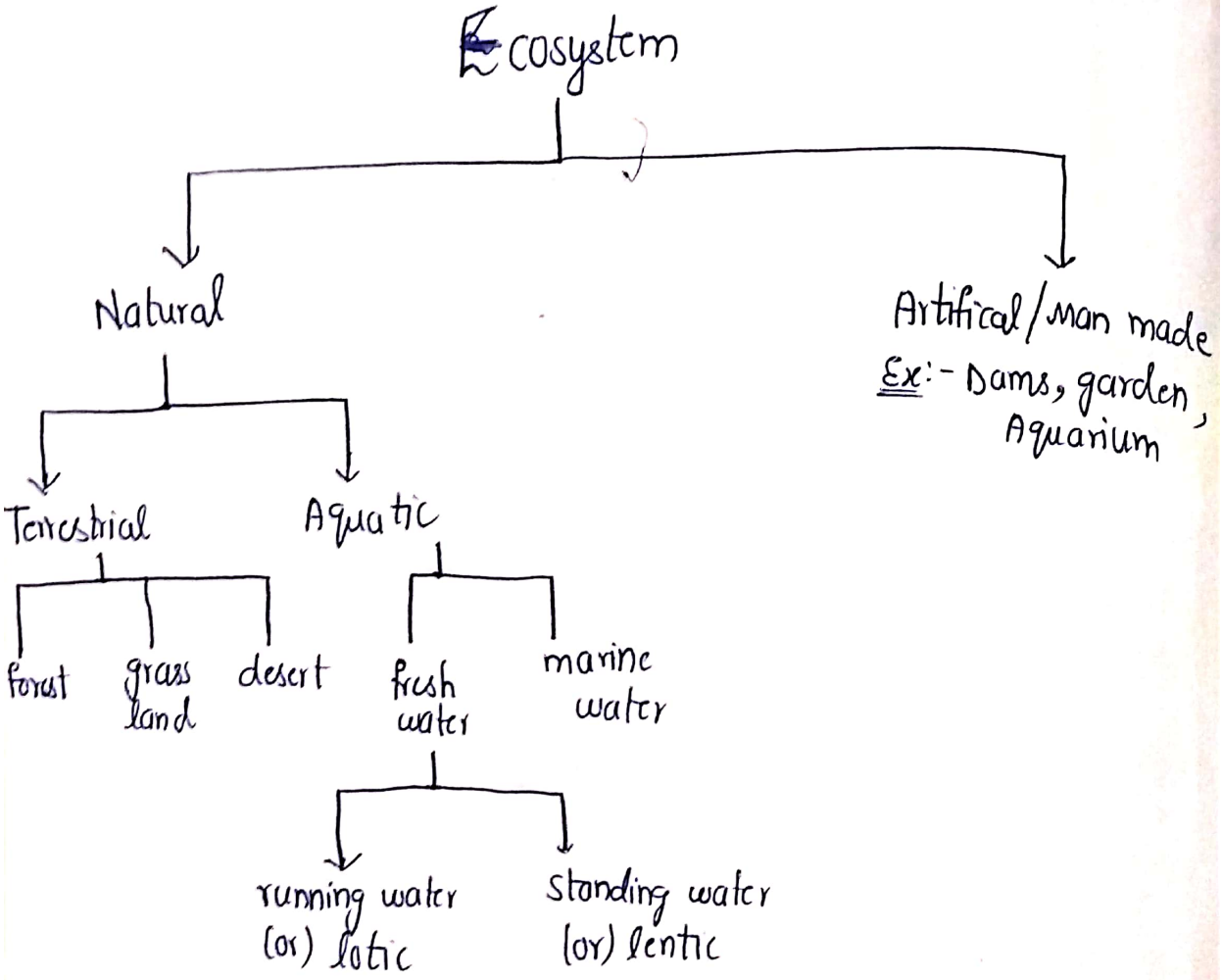
Concept of an ecosystem:-



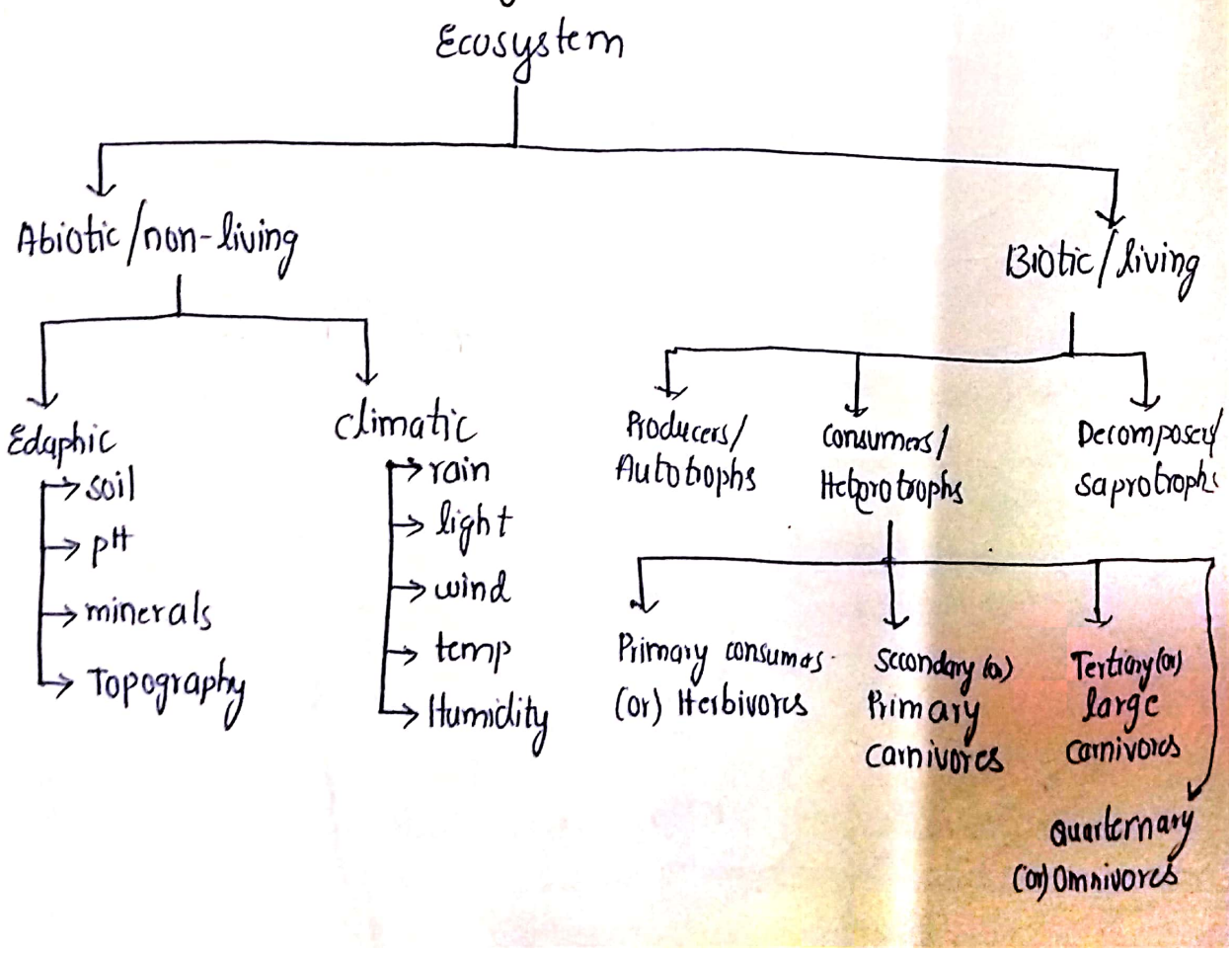
Function of an Ecosystem :-



Classification of an ecosystem:-



Structure of an ecosystem:-



Food Chain :-

⇒ The sequential transformation of food material from one level to another level. (P → H → C → O).

⇒ The concept of food chain was given by Eltan in 1927 and according to him the trophic levels in a food chain is restricted to 4 (or) 5

For example :-

1) Grass → Grasshopper → Frog/lizard → snake → Eagle

2) Trees → deers → Fox/wolf → lion/tiger

3) phyto planktons → zoo planktons → small fishes → large fishes.

Types of food Chain :-

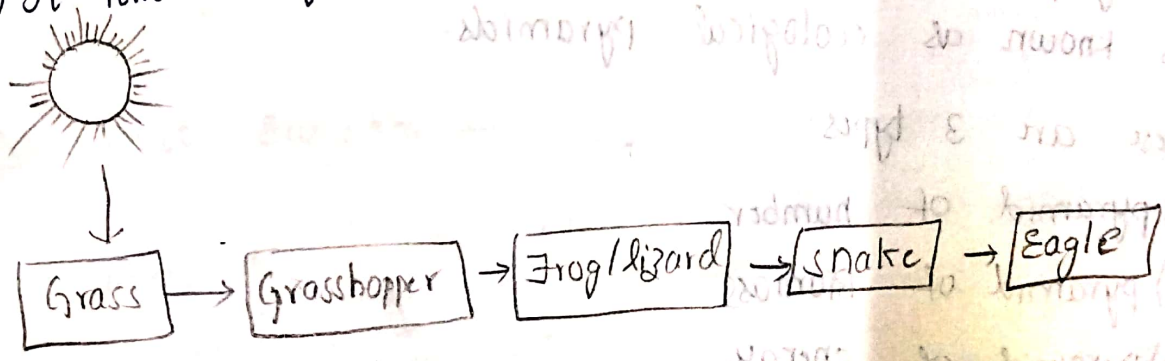
⇒ Based on starting point, these are of two types.

1) Grazing food chain :-

1) It always starts with plants

2) Solar radiation is compulsory

3) It follows sequential order

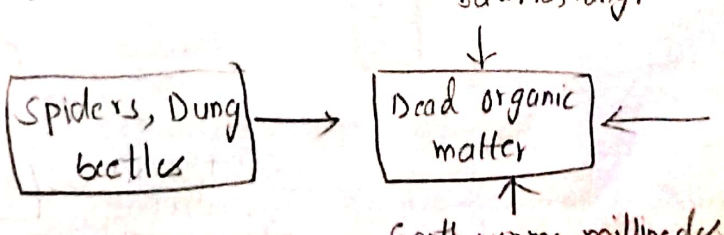


2) Detritus food chain :-

1) It starts with dead organic matter.

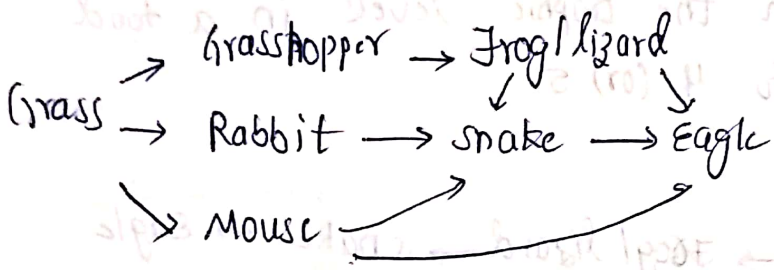
2) Solar radiation is not compulsory

3) It doesn't follows sequential order



FOOD WEB :-

⇒ The interlocking patterns of several food chains are known as food web.



(5-linear food chains)

Food chains:-

1) Grass → Grasshoppers → Frog/lizard → snake → Eagle
2) Grass → Rabbit → snake → Eagle
3) Grass → Mouse → snake → Eagle
4) Grass → Rabbit → Eagle
5) Grass → Mouse → Eagle

Ecological Pyramids :-

⇒ The graphical representation of an ecosystem or food chain is known as ecological pyramids.

⇒ These are 3 types:

i) pyramid of number
ii) pyramid of Biomass
iii) pyramid of energy

⇒ These pyramids may be upright or inverted in shape, in any type of pyramids, the producers placed at the bottom of the pyramid and remaining levels makes the apex.

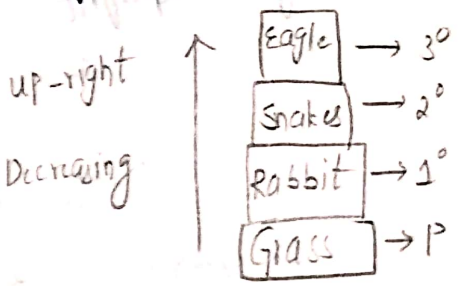
→ The pyramid of number and biomass sometimes upright or inverted but the energy pyramids are always upright in shape

1) Pyramid of number :—

→ It shows the no. of organisms for each trophic level

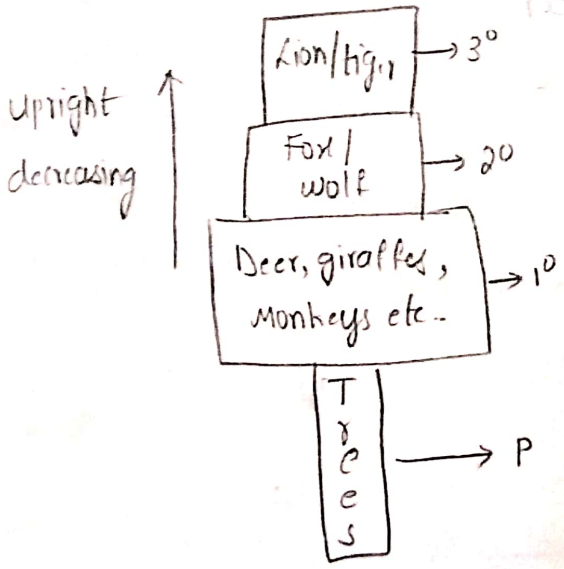
Ex:—

i) In a grass land ecosystem, the amount of grass is high



⇒ The producers which are mainly grass are always maximum in number this number then shows a decrease towards the apex. As the primary consumers like rabbit are less number than the grass. The secondary consumers such as snakes are lesser in number than rabbit, finally the top consumers like eagle are least in number. Thus the pyramid becomes upright.

Ex:- Forest ecosystem :—

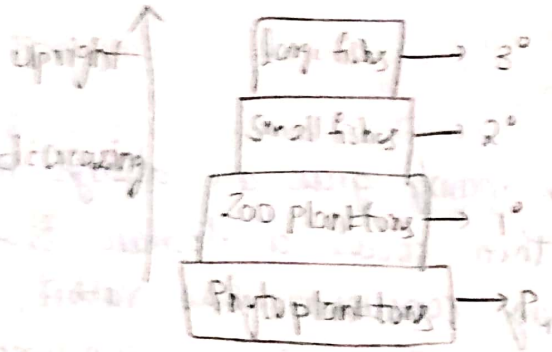


⇒ The producers which are mainly large size tree less in number and forms the base of the pyramid

⇒ The primary consumers includes fruit eating birds, elephant, deers etc.., and they are more in numbers than producers

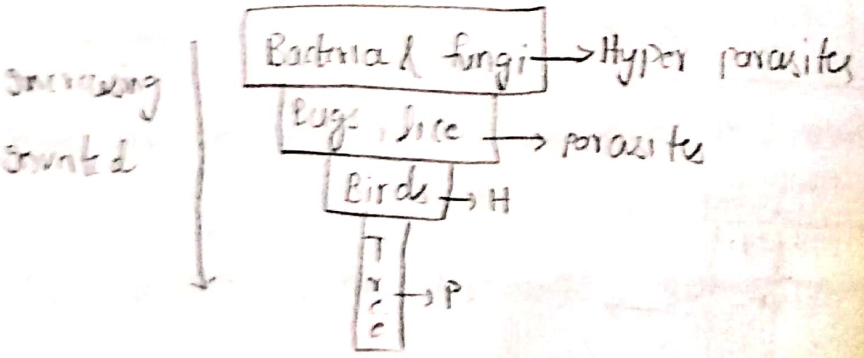
⇒ There is gradual decrease in the number of successive carnivore thus making the pyramid again upright

⇒ Aquatic Ecosystem:-



⇒ Also the pyramid is upright. The producers which are mainly phytoplankton are maximum in number. The herbivores which includes zoo planktons are lesser in numbers than the producers, secondary consumers such as small fish are lesser in number than the primary consumer. Finally the tertiary consumers are large fish are least in number.

⇒ In a parasitic food chain:-



⇒ The pyramids are always inverted in a parasitic food chain a single plant may support the growth of many

herbivores. in turns provide nutrition to several to several parasites which supports many hyper parasites.

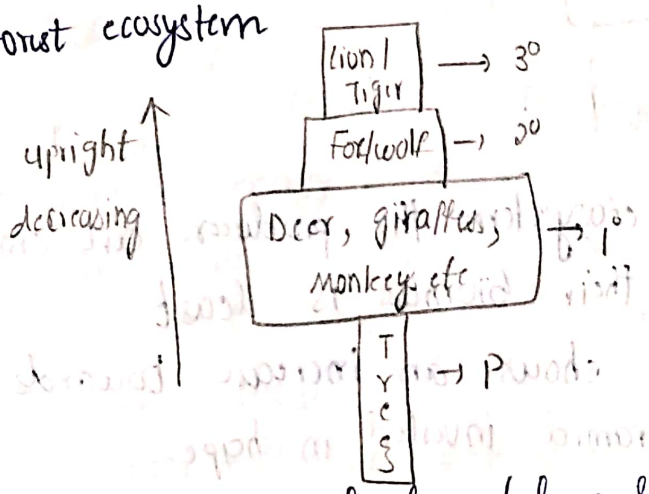
⇒ Thus from the producers towards consumers there is a reverse position. That is the number of organisms gradually shows an increase making the pyramid inverted in shape.

⇒ Pyramid of Biomass :—

⇒ It shows the living weight of organisms for each trophic level.

for example :—

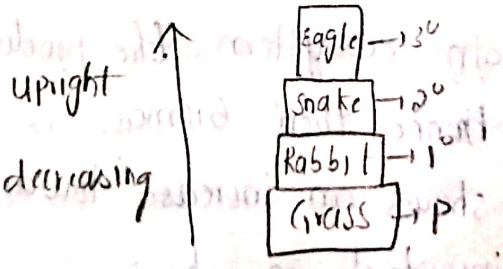
1) Forest ecosystem



⇒ They are more fundamental and show the quantitative relationships of the standing crops

⇒ For example in a forest generally there is a gradual decrease in biomass of organisms at successive levels from the producers to the top carnivores thus the pyramid a upright

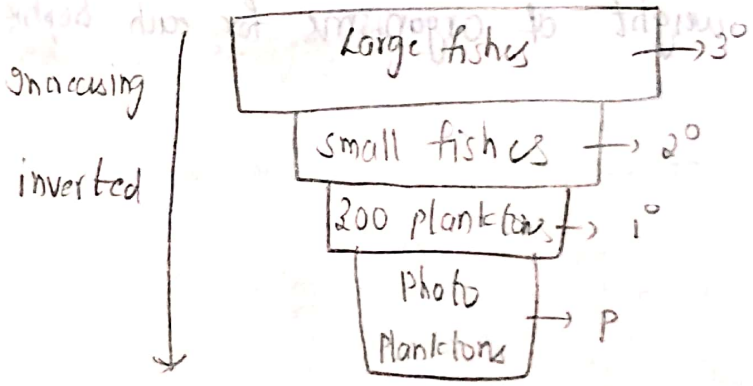
2) In a grass land :—



⇒ They are more fundamental and show the quantitative relation ships of the standing crops

⇒ For example in a grassland generally there is a gradual decrease in biomass of organisms at successive levels from the producers to the top carnivores thus the pyramid a upright

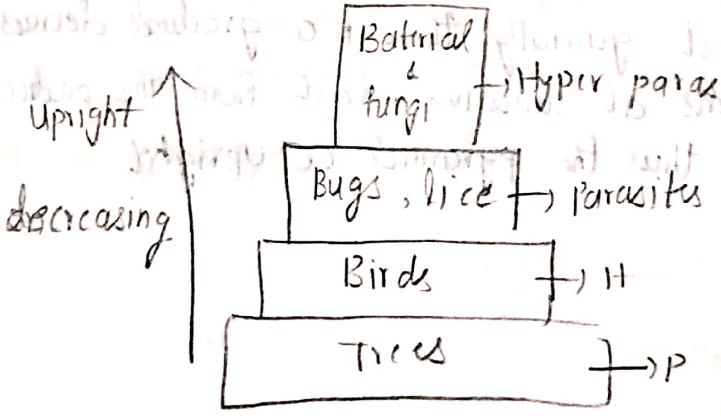
3) In a aquatic / Pond ecosystem:-



⇒ however in a pond ecosystem the producers are small organisms and hence their biomass is least.

⇒ This value gradually shows an increase towards the apex of the pyramid inverted in shape.

4) In a parasitic food chain:-

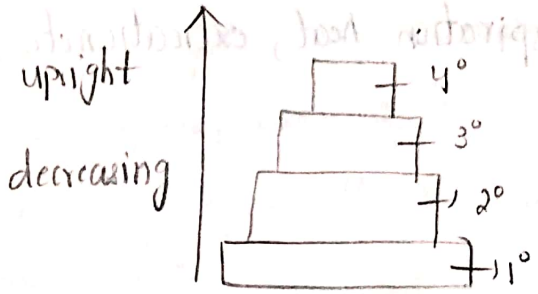


⇒ However in parasitic food chain ecosystem the producers are small organisms and hence their biomass is least. This value gradually shows an increase towards the apex of the pyramid inverted in shape.

⇒ The energy pyramid reflects the best picture of overall nature of ecosystem. On this pyramid the number and weight of organisms at any trophic level depends on the rate at which food is being produced but not on the amount of fixed.

3) Pyramid of energy :—

⇒ It shows the flow of energy from 1 level to the another level.



⇒ Flow of energy: —

⇒ The energy is defined as the ability to do work the behaviour of energy is described by following laws.

⇒ The first law of thermodynamics states that energy is transformed from one type into another type but it never created or destroyed

Eg:- solar radiation → chemical energy

⇒ The second law known as entropy law explains that the transformation of material and energy is irreversible ? Process transformation of useful material into waste

Eg:- Respiration and coal rise to ash.

Types of Energy Flow:-

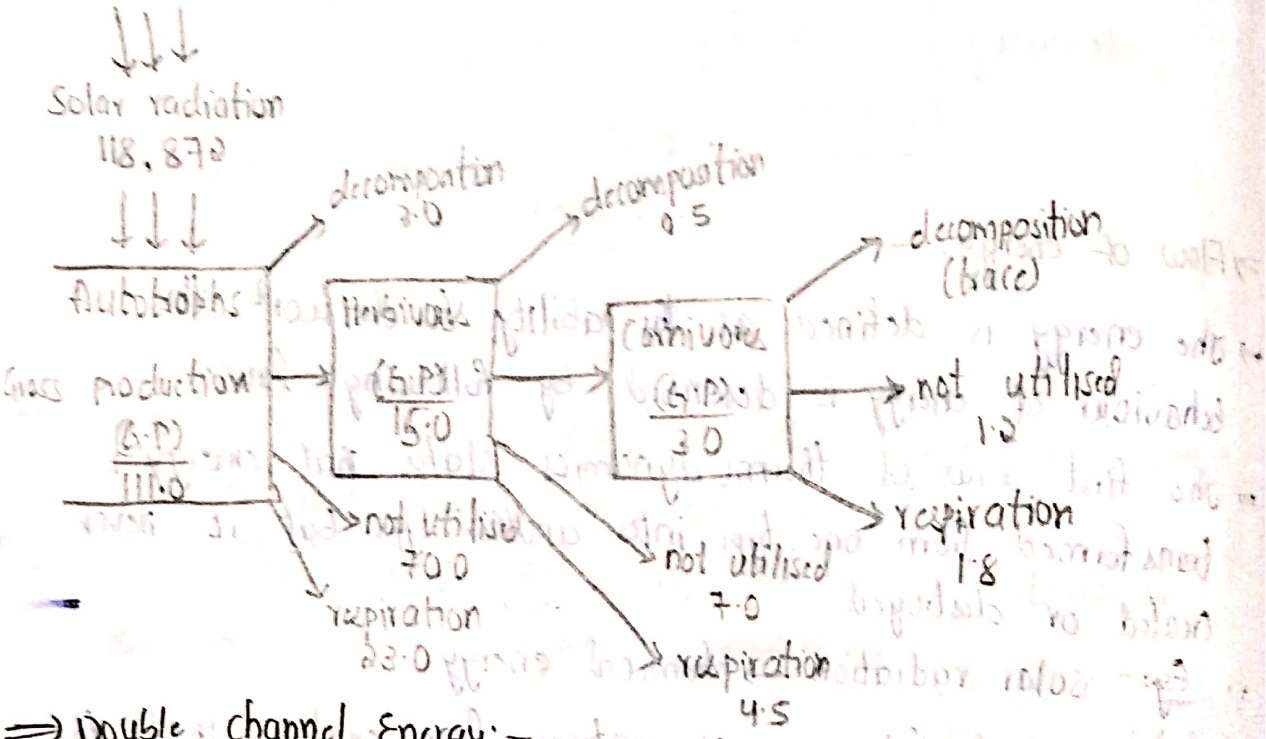
⇒ Single channel Energy model:—

The behavior of energy in an ecosystem can be termed as single channel flow due to unidirectional flow of energy in an ecosystem. The following aspects are essential in understanding the ecological energy.

→ The efficiency of the producers in observation and conversion and conversion of solar energy the use of this converted form of chemical by the consumers.

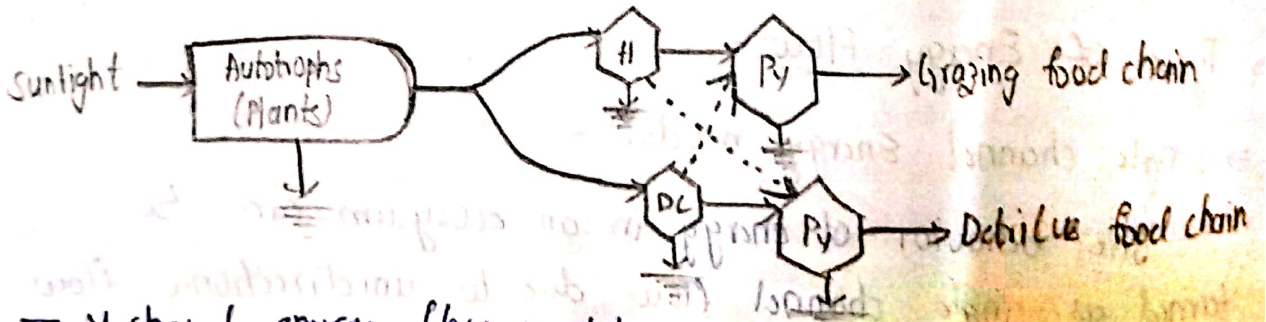
→ The total input of energy has food and its efficiency of absorption.

→ The energy loss through respiration heat, excreationcte at trophic level.



⟹ Double channel Energy:-

P. ODUM (1983) given a generalised model of Y-shape or 2 channel energy flow model applicable to both grazing and debites food chain in the ecosystem as shown in figure.



→ Y-shaped energy flow model, it shows linkage between gracing and debitus food chain (H = herbivores; DC = debitus consumers, Py = predators).

Bio-Geo chemical cycles:-

→ The constant recycling of essential chemicals in the atmosphere are known as bio-geo chemical cycles

→ These are of two types:

1) Gaseous
2) Sedimentary

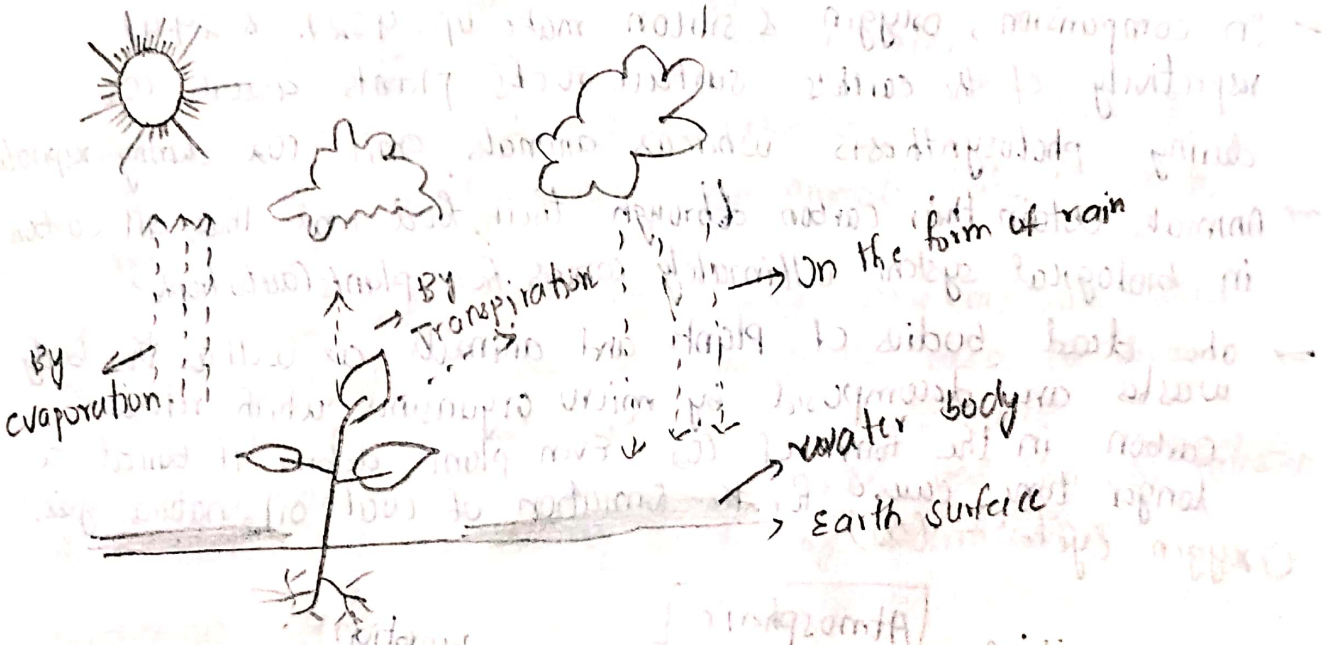
⇒ In gaseous cycles the reservior or sink is atmosphere

Ex:- O_2, CO_2, N_2, water cycle.

→ In sedimentary cycles the reservior or sink is soil & and sedimentary rocks

Ex:- P, S.

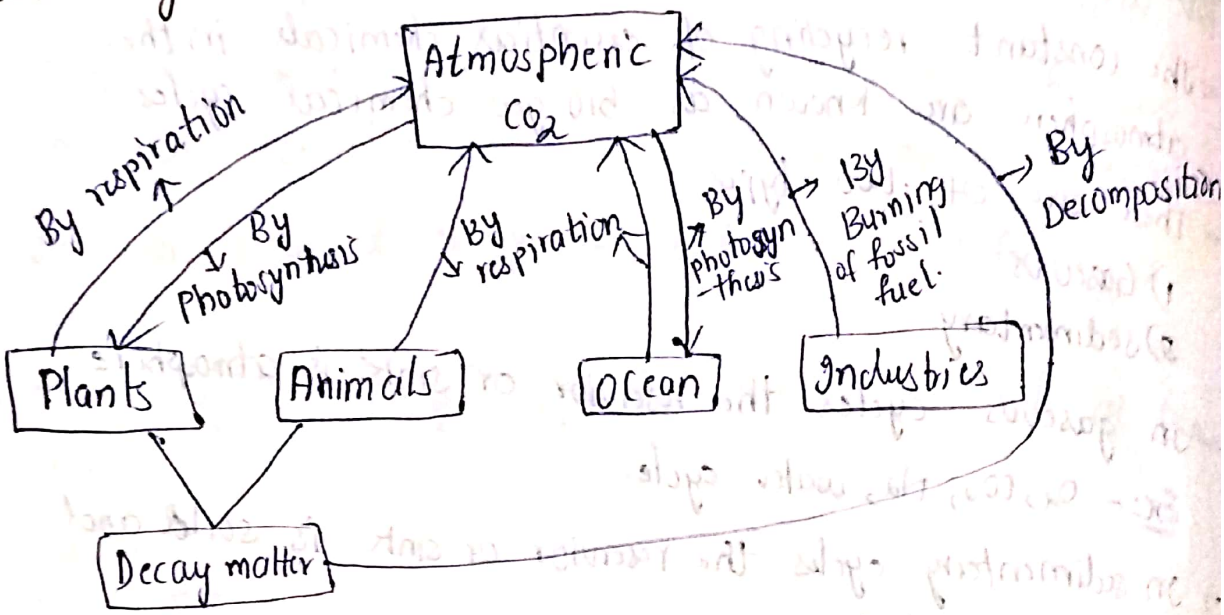
water cycle (or) hydrological cycle:-



⇒ Due to the solar heat, water evaporates or water is lost to the atmosphere as vapour from the seas/oceans which is then precipitated back in the form of rain, snow, frost etc... The evaporation and precipitation continues for ever, and thereby a balance is maintained b/w the two

⇒ This process is known as Hydrologic cycle.

Carbon cycle:—



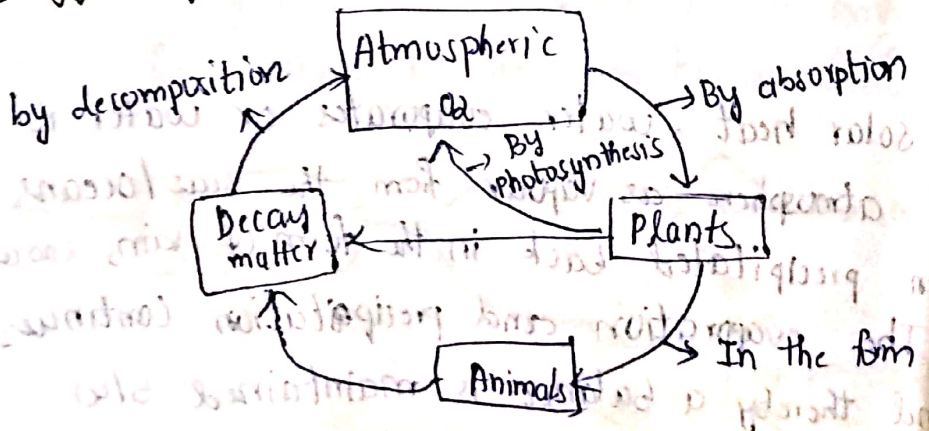
⇒ Carbon may present in most organic matter from fossil fuels to the complex molecules (DNA & RNA). In fact, the lithosphere is only 0.032% carbon by weight.

⇒ In comparision, oxygen & silicon make up 45.2% & 29.4% respectively of the earth's surface rocks. plants absorb CO_2 during photosynthesis whereas animals emit CO_2 during respiration

⇒ Animals obtain their carbon through their food and thus, all carbon in biological system ultimately comes from plants (autotrophs).

⇒ The dead bodies of plants and animals as well as the body wastes are decomposed by micro organisms which release carbon in the form of CO_2. Even plant debris if buried a longer time cause for the formation of coal, oil, natural gas.

Oxygen cycle:— (O_2)



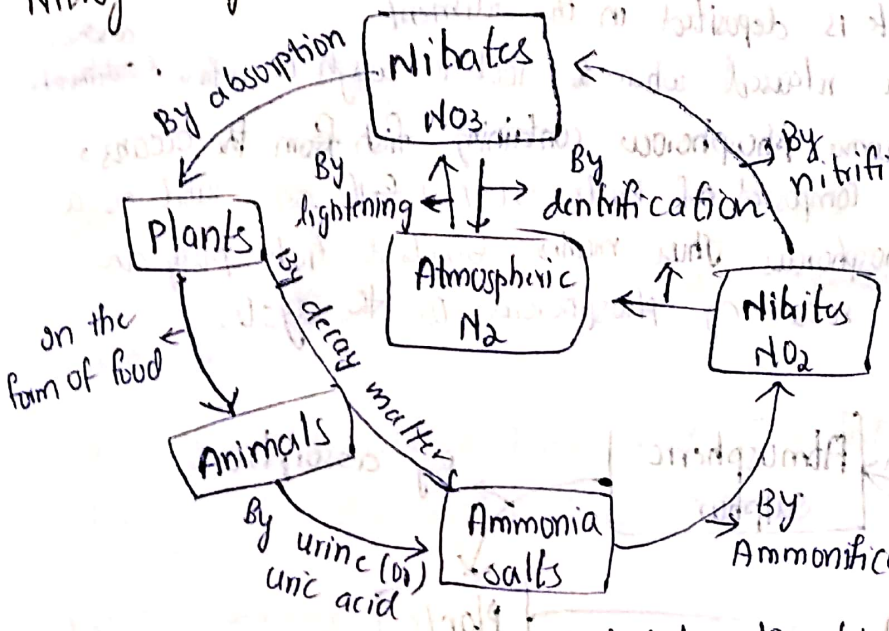
⇒ Oxygen is present in CO_2, CH_2O (carbohydrates) and H_2O. Oxygen is released into the atmosphere by plants during Photosynthesis and taken up both autotrophs and heterotrophs

during respiration.

→ All the oxygen in the atmosphere is biogenic i.e, it was released from water through the process of photosynthesis.

⇒ Because of the vast amounts of oxygen in the atmosphere, even if all photosynthesis cease it would take 5000 million years to strip out more or less all oxygen.

Nitrogen cycle :- (N_2)

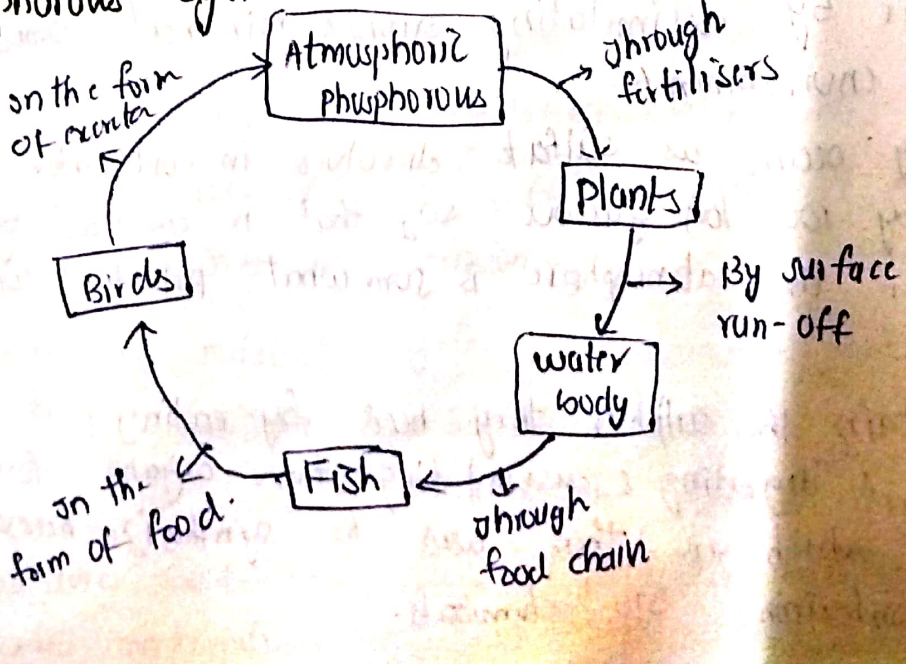


⇒ Atmospheric N_2 is converted into NO_3 by lightening. This NO_3 is absorbed by plants. Then Animals take it in the form of food.

→ These animals excrete it in the form of urine (or) uric acid or gets converted into Ammonia salts. In few cases the decay matter of plants is also converted into Ammonia salts

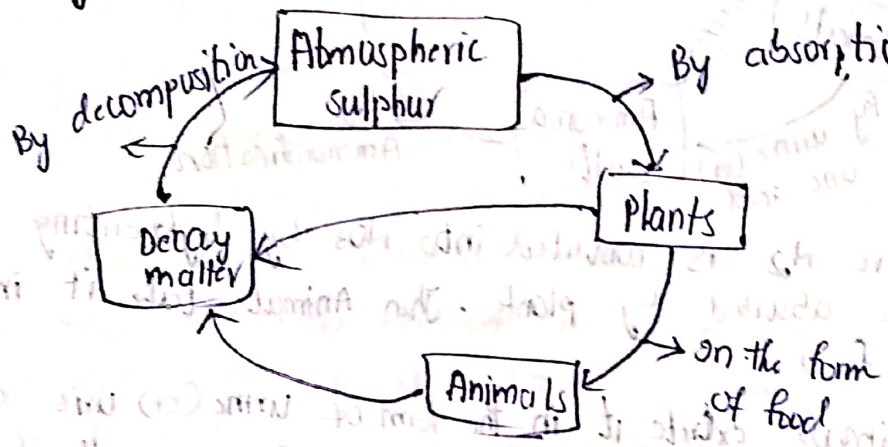
⇒ By Ammonification it is converted into NO_2 and then by nitration NO_3 is obtained and again Atmo. N_2 can be by denitrification.

Phosphorous cycle :-



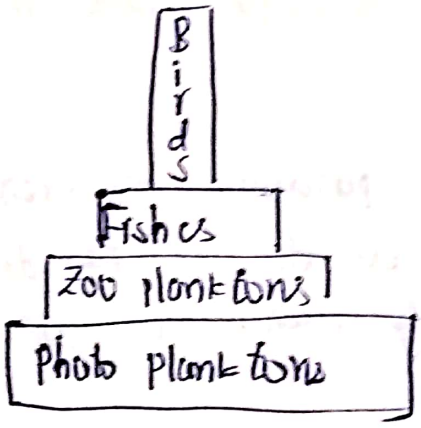
- when rocks containing phosphorus are exposed to water, the phosphate goes into solution. Plants & fungi have symbiotic relationship. they get from fungi and give sugar.
- Animals obtain phosphorus from plant through food. when animals & plants die, the phosphates are returned to the soil or water by decomposers.
- Most of the phosphates escape into the sea through the water, where part of phosphate is deposited in the sediments
- this phosphorus will be released when the rock is bought to surface & added.
- Marine birds consume phosphorous containing fish from the oceans, their guano (manure composed of birds excreta) falls on land as a high content of phosphorous. Thus marine birds & fish play an important role in returning phosphorous to the cycle

Sulphur cycle :-



- ⇒ sulfur is an important nutrient for organisms being a key constituent of certain amino acids, lipids, and other biochemicals. Plant satisfy their nutritional needs for sulfur by assimilating simple mineral compounds from the environment.
- ⇒ This mostly occurs as sulfate dissolved in soil water that is taken up by roots low gaseous SO_2 that is absorbed by leaves when the atmosphere is somewhat polluted with this gas.
- Animals obtain the sulphur they need by eating plant or other animals & digesting & assimilating their organic forms of sulphur which are then used to synthesize necessary sulphur-containing bio chemicals.

Biomagnification (or) Bio accumulation (or) Bio amplification



⇒ The increasing concentration of pesticide or pollutant from lower level to the higher level and causes damage to the higher level organisms.

⇒ All the pesticides & heavy water are fat soluble and causes damage to the higher level organisms.

Carrying Capacity:-

→ It is the capacity of ecosystem to sustain ~~with init~~. The Population within it

Ecosystem services values:-

⇒ performing photosynthesis by which solar energy is captured by the primary producers & converted into chemical energy

⇒ Absorbing CO_2 from atmosphere

⇒ purifying the air by releasing O_2

⇒ Providing clean water, regulating water cycle.

⇒ creating & conserving soil, building up soil organic matter & preventing soil erosion

→ maintaining nutrient cycles & sustaining growth

→ Providing habitat to biodiversity

→ Renewal of grass lands & forests by self-regeneration.

→ Providing food, medicine, fuel, fodder, fertilizer, industrial raw materials.

→ control of climate
→ control of population
→ control of pests
→ For all these functions performed by ecosystem, known as ecosystem services. we do not pay directly, However we often pay indirectly, when we suffer from their absence