CHAPTER 14

ECOSYSTEM

POINTS TO REMEMBER

Startification : Vertical distribution of different species occupying different levels in an ecosystem.

Primary Production : Amount of biomas or organic matter produced per unit area over a time period by plants during photosynthesis.

Productivity : Rate of biomass production. Its unit is g/m2/year.

Gross Primary Productivity : Rate of production of organic matter during photosynthesis.

Net Primary Productivity : Gross primary productivity minus the respiration losses.

Ecosystem : Relationship between living organisms and their abiotic surroundings.

Secondary Productivity : Rate of formation of new organic matter by consumers.

Detritus : Dead leaves, twigs, animal remains etc. constitute detritus.

Detrivore : Organisms who break down detritus into smaller particles. e.g., earthworm.

Ecological succession : The successive and orderly replacement of one community by the other community in an area, over a period of time.

Ecological Pyramids : The sequential graphic representation of an ecological parameter (number/ biomass/energy) depicting different trophic levels in a food chain.

Climax community : The stable and final biotic community that develops at the end of ecological succession and is in perfect harmony with its physical environment.

Pioneer species : The species that invade a bare area at the onset of ecological succession.

Process of Decomposition : The decomposers break down complex organic matter into inorganic substances like carbon dioxide, water and nutrients. This process is called decomposition. Steps of decomposition are :

(i) **Fragmentation :** Break down of detritus into smaller particles by detritivores (earthworm).

(ii) **Leaching :** Water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.

(iii) **Catabolism :** Bacterial and fungal enzymes degrade detritus into simple inorganic substances.

(iv) **Humification :** Accumulation of a dark coloured amorphous substances called humus.

(v) **Mineralisation :** The humus is further degraded by some microbes and release of inorganic nutrients occur.

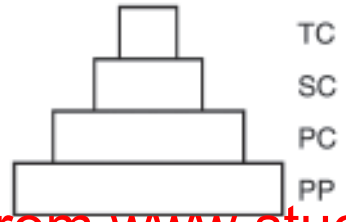
Energy Flow : Energy flow is the key function in the ecosystem. The plants (producers) capture only 2 – 10 percent of the photosynthetically active radiation (PAR). Unidirection flow of energy is taken place from the sun to producers and them to consumers. About 10% energy flows from one trophic level to another.

Grazing Food Chain : It begins with producers.

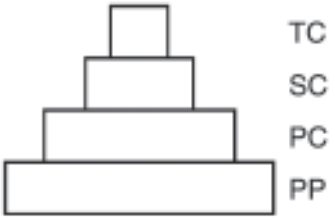
Detritus Food Chain : It begins with dead organic matter. It is made up of decomposers (Fungi, Bacteria). They meet their energy and nutrient requirements by degrading detretus. These are also known as saprotrophs.

Ecological Pyramids

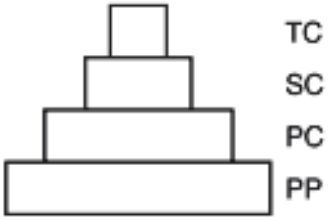
(i) Pyramid of Numbers : (Grass land system)



(ii) Pyramid of Energy : (Always upright in all Ecosystems)



(iii) Pyramid of Biomass :



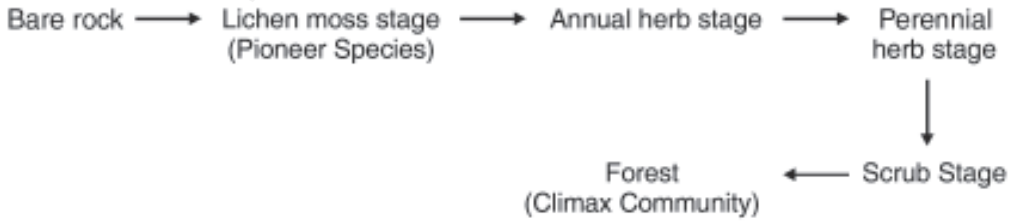
(In Terrestrual Ecosystem)

(In Aquatic Ecosystem)

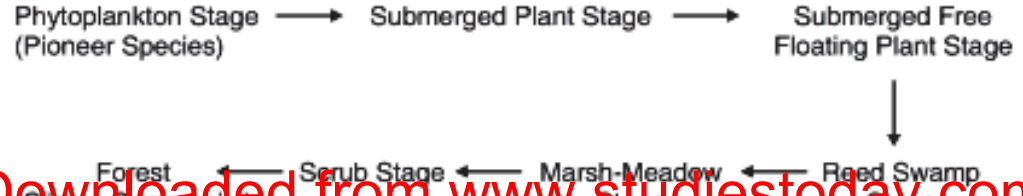
Ecological Succession : The gradual and fairly predictable change in the species composition of a given area is called ecological succession. The species that invade a bare area is called pioneer species. The final community is an ecological succeesion that is in near equilibrium with the environment is called climax community

Secondary Succession begins in the area where natural biotic communities have been destroyed (burned or cut forests, land that have been devastated by flood).

Succession on a Bare Rock (Xerarch)



Succession in Aquatic environment (Hydrarch)

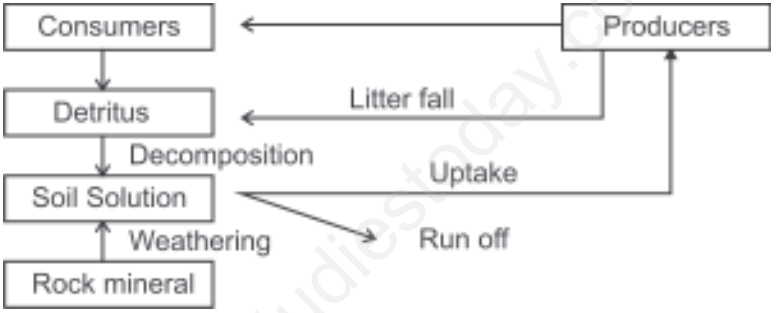


Nutrient Cycling – Movement of nutrient elements through the various components of an ecosystem also called Biogeochemical cycles.

Nutrient cycle
- Gaseous – Reservoir in atmosphere
- Sedimentary – Reservoir eg. earth's crust

Carbon cycle – occurs through atmosphere, ocean, and though living and dead organisms. Considerable amount of carbon returns to atmosphere as CO_2 through respiratory activities, decomposers also contribute to Carbon di-oxide pool, burning of wood, forest fire and combustion of organic matter, fossil fuels, volcanic activity also release CO_2 is atmosphere.

Phosphorous cycle – Sedimentary cycle Rocks contain phosphorous in the form of phosphates



Carbon Cycle	***Phosphorous Cycle***
1. Amount of atmospheric inputs more in amount	1. Amount of atmospheric inputs less in amounts
2. Degree of exchanges between organism and environment high	2. Degree of exchange between organism and environment negligible.

ABBREVIATIONS

PAR : Photosynthetically Active Radiation

GAP : Gross Primary Productivity

NPP : Net Primary Productivity

DFC : Detritus Food Chain

GFC : Grazing Food chain

QUESTIONS

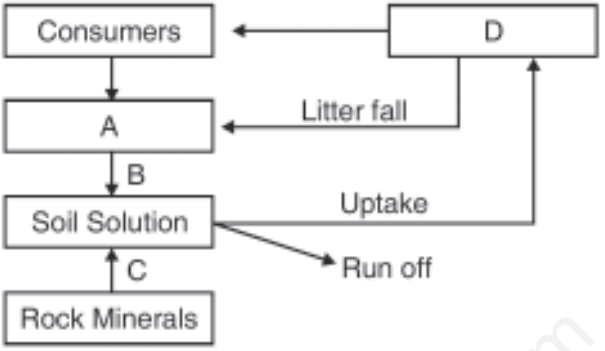
VSA (1 MARK)

1. Decomposition is faster if deteritus is rich in nitrogen and water soluble substance like sugars. When is the decomposition process slower?
2. If we count the number of insects on a tree and number of small birds depending on those insects as also the number of larger birds eating the smaller, what kind of pyramid of number would we get?
3. Differentiate between Sere and Seral communities.
4. Who are generally the pioneer species in a Xerarch succession and in a Hyararch succession?
5. Which metabolic process causes a reduction in the Gross Primary Productivity?
6. What percentage of photosynthetically active radiation is captured by plants?
7. Name the pioners of primary succession in water.

SA-II (2 MARKS)

8. What is the shape of pyramid of biomass in sea? Why?
9. Give an example of an ecological pyramid which is always upright. Justify your answer.
10. Differentiate between primary succession and secondary succession. Which one occurs faster?
11. Gaseous nutrient cycle and sedimentary nutrient cycles have their reservoir. Name them. Why is a reservoir necessary?
12. Fill up the missing links depicted as A, B, C and D in the given model of primary succession.

13. In the model of phosphorus cycle given below, what does A, B, C and D refer to?



14. Differentiate between Hydrarch and a Xerarch succession.

15. What is the effect on decomposition rate if :–
    a) Detritus is rich in lignin and chitin
    b) Detritus is rich is nitrogen and sugars

16. What are the limitations of ecological pyramids?

17. Name any four ecosystem services. Who gave the price tags on nature's life support services? Which is the most important ecosystem service provider?

18. Study the table given below and fill the blanks from 'A' to 'F'.

S.No	***Component of the Ecosystem***	***Position of the trophic level***	***Organism present in the Food chain***
1.	E	Fourth trophic level	F
2.	Secondary consumer	D	Bird, fish, wolf.
3.	B	Second trophic level	C
4.	Primary producer	A	Phytoplankton, grass, tree.

19. In the pyramid of biomass drawn below, name the two crops (i) one which is supported (ii) one which supports in which ecosystem is such a phyramid found?

LA (5 MARKS)

20. Detrivores like earthworm are involved in the process of decomposition of dead plants and animals. Describe the different steps involved in the process of decomposition.

ANSWERS

VSA (1 MARK)

1. Its slower if detritus is rich in lignin and chitin.
2. Inverted Pyramid of Number.
3. **Sere :** Entire sequence of communities that successively change in a given area.

   Seral community : Individual transitional community.
4. Pioneer species in Hydrarch succession are usually the small phytoplanktons and that in Xerarch succession are usually lichens.
5. Respiration.
6. 2 – 10%
7. Phytoplanktons

SA-II (2 MARKS)

8. Inverted, because biomass of fishes far exceeds that of phytoplankton.
9. Pyramid of energy is always upright and can never be inverted, because when energy flows from a trophic level to the next trophic level some energy is always lost as heat at each step.
10. **Primary Succession :** A process that starts where no living organisms are there.

    Secondary succession : A process that starts in areas which have lost all the living organisms that existed there.
11. Reservoir for Gaseous nutrient cycle : Atmosphere; for sedimentary nutrient cycle : Earth's crust. Reservoir is needed to meet with the deficit which occurs due to imbalance in the rate of influx and efflux.

12. A = Submerged plant stage B = Reed Swamp Stage
    C = Scrub stage D = Forest stage
13. A = Detritus B = Decomposition
    C = Weathering D = Producers.
14. **Hydrarch Succession :** Starts in water proceeds from hydric (aquatic) to mesic (neither dry nor wet) situations.

    Xerarch succession : Starts on barren rock Proceeds from Xeric (dry) conditons.
15. a) Decomposition rate is slower
    b) Decomposition rate is faster.
16. (i) Does not take into account same species belonging to two or more trophic levels.
    (ii) Assumes simple food chain, does not accomodate food web.
    (iii) Saprophytes have not been given any place in ecological pyramids.
17. ❑ Forest (ecosystem) purify water and air
    ❑ Mitigate Droughts and floods
    ❑ Nutrient cycling
    ❑ Generate fertile soil
    ❑ Provide habitat for wildlife
    ❑ Pollinate flower
    ❑ Maintain Biodiversity
    ❑ Provide aesthetic, cultural & spiritual values
    ❑ Robert Constanza gave price tags to ecosystem services.
    ❑ Most important ecosystem services provider : Soil formation.
18. A = First trophic level
    B = Primary consumer
    C = Zooplankton, Cow, Grass hopper
    D = Third trophic level
    E = Tertiary consumer
    F = Man, Lion

19. (i) Supported trophic level is founded by zooplanktons

    (ii) Supporting trophic level is formed by phytoplanktons ecosystem

    It is found in aquatic ecosystem.

20. The dead remains of plants and aminals called detritus undergo decomposition and are converted into simpler substances. The steps of this process are :

    (i) **Fragmentation :** Breakdown of detritus into smaller pieces by detrivoures like earthworm.

    (ii) **Leaching :** Water soluble inorganic nutrients go down into soil horizon and get precipitated as unavailable salts.

    (iii) **Catabolism :** Bacterial and fungal enzymes degrade detritus into simpler inorganic substances.

    (iv) **Humification :** It leads to accumulation of dark coloured amorphous substance called humus which is highly resistant to microbial action so decomposes at slow rate and is rich in nutrients.

    (v) **Mineralisation :** Humus is further degraded by some microbes and release of inorganic nutrients occurs.