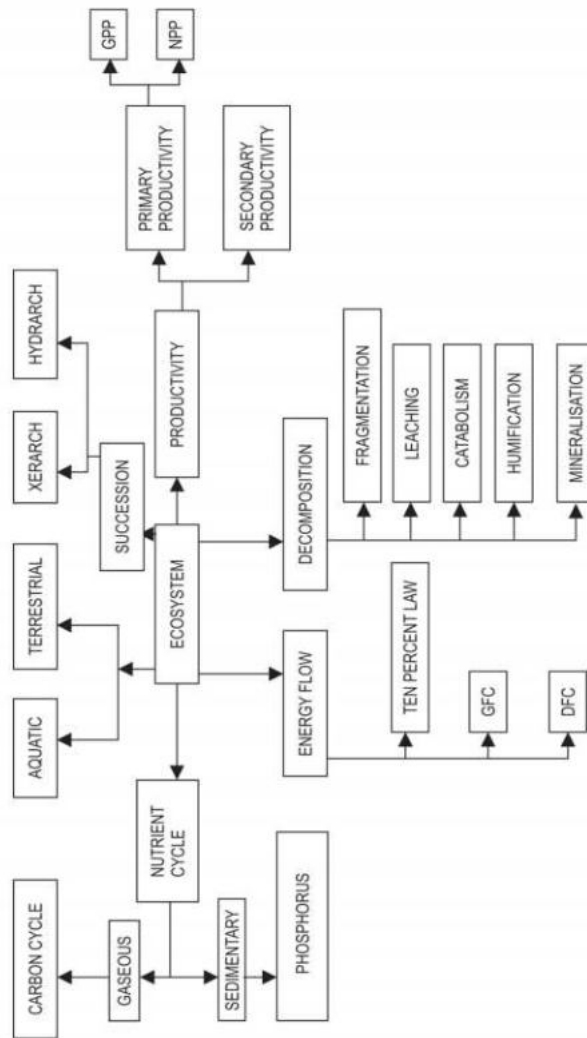


# Chapter - 12

# Ecosystem



**Ecosystem** : It is the basic functional unit of biosphere in which living organisms interact among themselves and with their surrounding physical environment.

**Stratification** : Vertical distribution of different species occupying different levels in an ecosystem. Trees occupy top vertical strata, shrubs the second layer and herbs the third layer and herbs/grasses occupy the bottom layers.

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

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

**Net Primary Productivity** :  $NPP = GPP - R$  (Gross primary productivity minus the respiration losses).

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

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

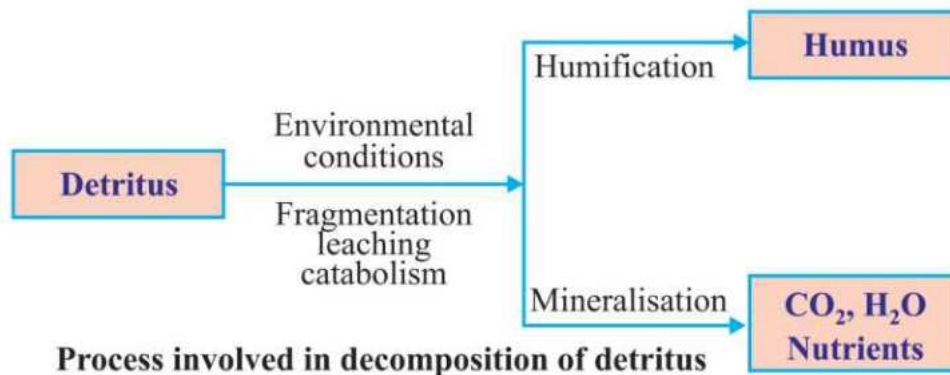
**Detrivore** : Organisms who break down detritus into smaller particles, e.g., earthworm.

**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 in simple inorganic substances.

- (iv) **Humification** : Accumulation of a dark coloured amorphous substance called humus which is highly resistant to microbial action and rich in nutrients.
- (v) **Mineralisation** : The humus is further degraded by some microbes and release of inorganic nutrients occur.



### Factors affecting decomposition :

Decomposition is controlled by :

- (a) **Chemical composition of detritus** : The decomposition will be slower if detritus is rich in lignin and chitin and will be faster if detritus is rich in nitrogen and water soluble substance (sugar).
- (b) **Climatic factors** : In warm and moist environment, the process of decomposition increases whereas low temperature and anaerobiosis inhibit the decomposition.

**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). Unidirectional flow of energy takes place from the sun to producers and then to consumers. About 10% energy flows from one trophic level to another.

**Grazing Food Chain (GFC)** : It begins with producers.

Grass	→	deer	→	Lion
(Producer)		(Primary Consumer)		(Secondary consumer)

**Detritus Food Chain :** (DFC) It begins with dead organic matter. It includes decomposers (Fungi, Bacteria). They meet their energy and nutrient requirements by degrading detritus. Decomposers are also known as saprotrophs.

**Food Web :** A number of food chains interconnected with each other forming a web-like pattern.

**Ten Percent Law of Energy Transfer :** Proposed by Lindeman. At each step of food chain, when energy is transferred from one trophic level to the next trophic level, only 10 percent of energy is passed on to the next trophic level.

**Standing State :** Amount of all the inorganic substances present in an ecosystem per unit area at a given time.

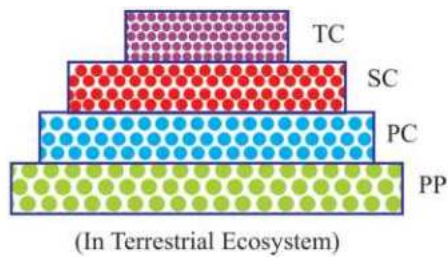
**Standing Crop :** Amount of living material present in different trophic levels at a given time. It is measured as the mass of living organisms or the number in a unit area.

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

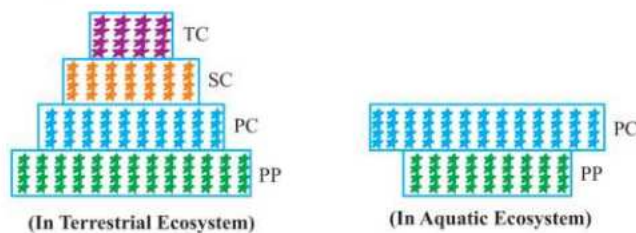
(i) Pyramid of Numbers : (Grassland Ecosystem)



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



(iii) Pyramid of Biomass



## Questions

VSA

(1 Mark)

1. If we count the number of insects on a tree and number of small birds depending on those insects and also the number of larger birds eating the smaller, what kind of pyramid of number would we get ?
2. What is the unit of measurement of productivity.
3. Out of 1,000,000 J of sunlight, how much energy will be converted by primary producers into NPP.

### Multiple choice Question:

4. Which of the following occupy top vertical strata of forest ecosystem?  
a) Shrubs    b) Herbs and grasses    c) Phytoplankton    d) Trees.
5. Decomposition is favoured by  
a) Warm and moist environment                      b) Aerobic Environment  
c) Rich enwound of nitrogen and water soluble substance like sugar in detritus.  
d) All of the above
6. If 20 J energy is available at producer level, then how much energy will be transferred to the lion in the food chain :  
Producer – Dear – Lion.  
a). 0.2 J            b) 0.02 J            c) 0.002J            d) 2J.

7. Pyramid of numbers is
- Always upright
  - Always inverted
  - Either upright or inverted
  - Neither upright nor inverted

### Assertion And Reason Question

Read the assertion and reason carefully and mark the correct option out of the options give below :

- If both the assertion and the reason are true and the reason is a correct explanation of the assertion.
- If both assertion and reason are true but reason is not a correct explanation of the assertion.
- If the assertion is true but the reason is false.
- If both the assertion and reason are false.

8. Assertion : Despite occupying about 70% of surface the productivity of oceans is only 55 billion tons.

Reason : Light and minerals are limiting factor for productivity of ocean.

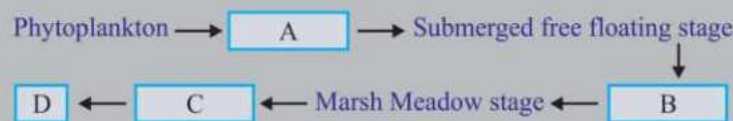
9. Assertion : Amount of nutrient present in soil at any given time, in an ecosystem is rafferred as standing state.

Reason : Each tropic level has a certain mass of living material at a particular time, known as standing crop.

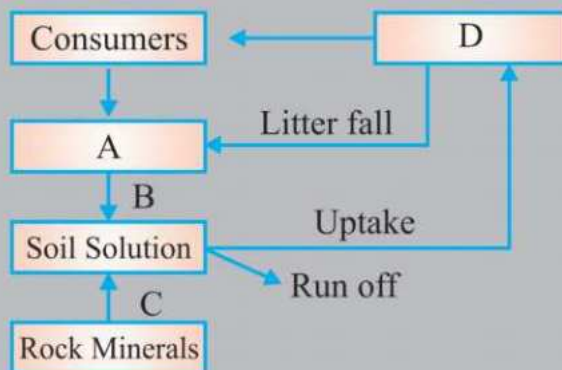
SA-I

(2 Marks)

10. What is the shape of pyramid of biomass in sea ? Why so ?
11. Give an example of an ecological pyramid which is always upright. Justify your answer.
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. What is the effect on decomposition rate if :

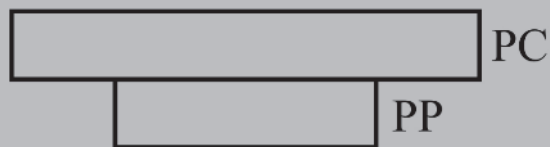
- (a) Detritus is rich in lignin and chitin
- (b) Detritus is rich in nitrogen and sugars

SA-II

(3 Marks)

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

16. 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 pyramid found.



LA

(5 Marks)

17. 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. Inverted Pyramid of Number.

**Answer**

2.  $\text{g}^2\text{yr}^{-1}$  or  $(\text{Kcal m}^{-2})\text{yr}^{-1}$

3. 10,000 J

4. d) 5. d) 6. a) 7. c) 8. a) 9. b)

SA-I

(2 Marks)

10. Inverted, because biomass of fishes far exceeds that of phytoplankton.

11. 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.

12. A = Submerged plant stage

B = Reed-Swamp Stage

C = Scrub stage

D = Forest stage

13. A = Detritus

11. (a) Decomposition rate is slower.

(b) Decomposition rate is faster.

14.

SA-II

(3 Marks)

(i) Forest (ecosystem) purify water and air

(ii) Mitigate Droughts and floods

15. (iii) Nutrient cycling

(iv) Generate fertile soil

(v) Provide habitat for wildlife



- (vi) Pollinate flowers
- (vii) Maintain Biodiversity
- (viii) Provide aesthetic, cultural and spiritual values

- Robert Constanza and his colleagues gave price tags to ecosystem services.
- Most important ecosystem services provider : Soil formation.

16. (i) Supported trophic level is formed by zooplanktons  
(ii) Supporting trophic level is formed by phytoplanktons ecosystem.  
It is found in aquatic ecosystem.

LA

(5 Marks)

17. The dead remains of plants and animals called detritus undergo decomposition and are converted into simpler substances. The steps of this process are fragmentation, leaching, catabolism, humification, mineralisation.

**Steps involved** : Refer content in chapter.

