BIOLOGY

Chapter 12: Ecosystem

Ecosystem

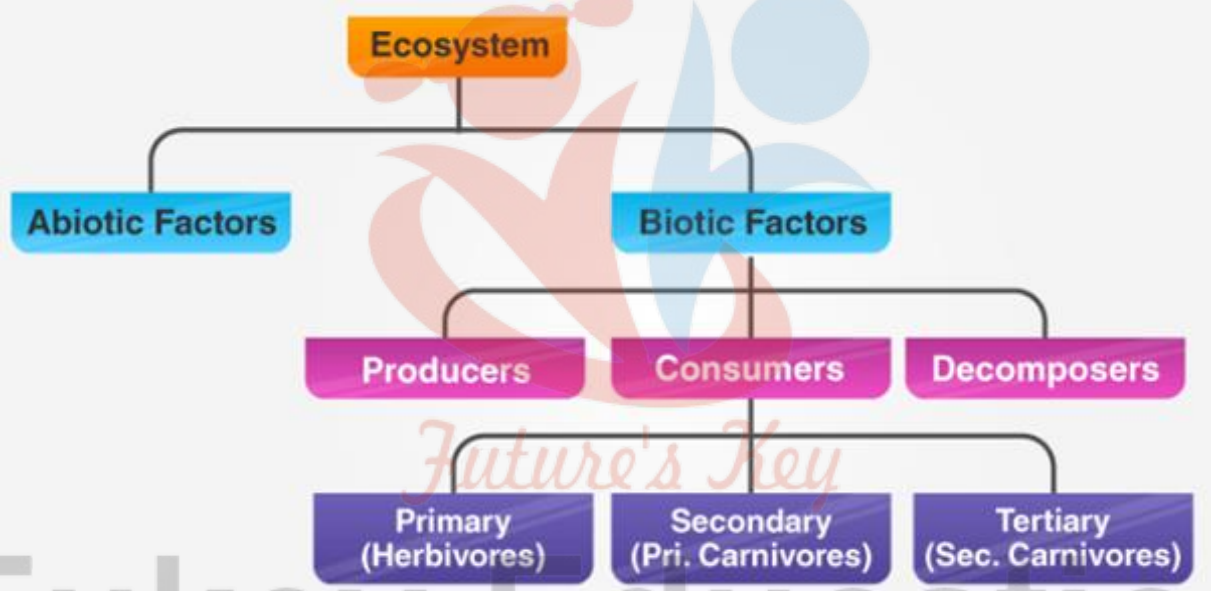
Ecosystem:

Ecosystem is a biological community where the living and non-living components interact with each other and their physical environment. It is the functional unit of nature and varies greatly in size. Let us have a look at the structure, function and components of ecosystem.

Structure of Ecosystem:

The structure of ecosystem comprises two different components:

- Biotic
- Abiotic



Biotic Components:

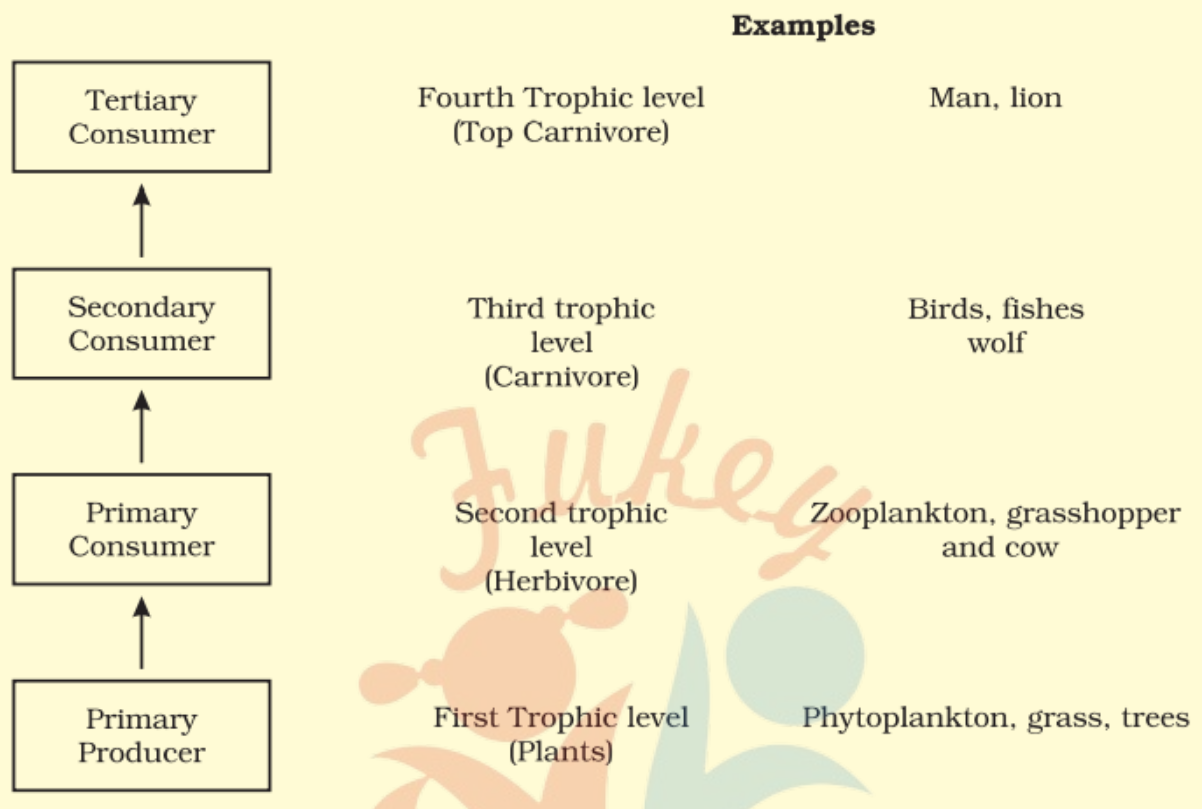
Biotic Components are the living components involved in shaping the ecosystem.

It includes biotic factors such as:

Producers: All green plant in the ecosystem are termed as the producers, as they produce their own food by making use of solar energy. All living organisms are dependent on plants for both oxygen and food.

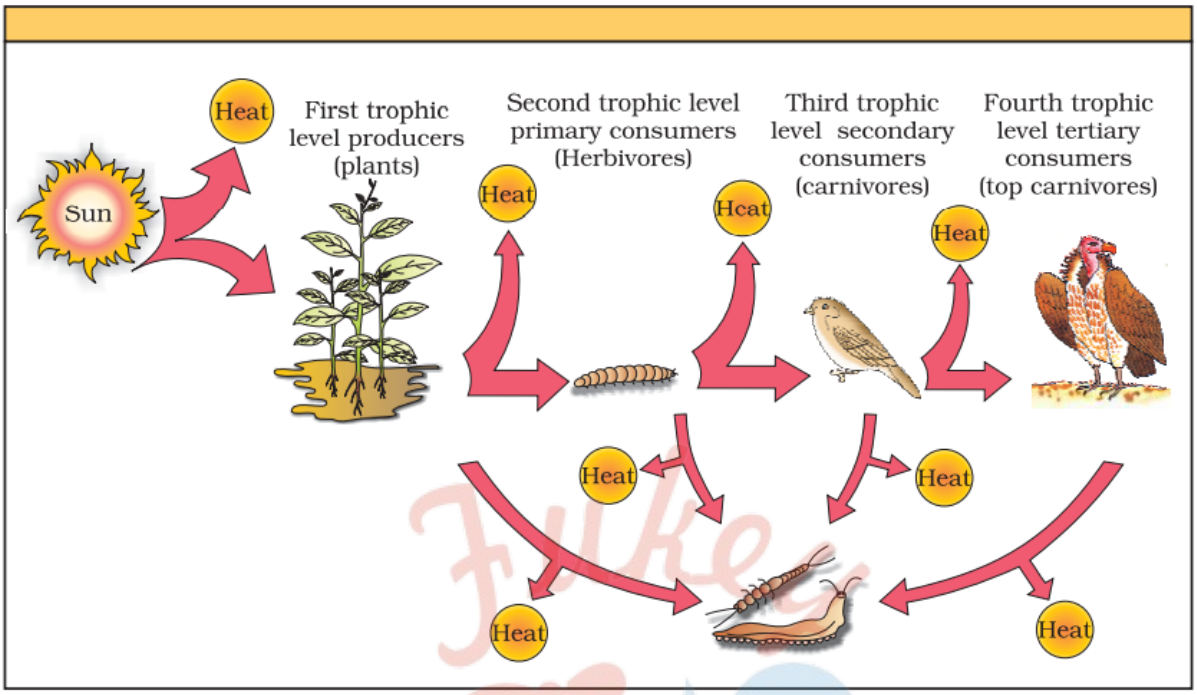
Consumers: They include both primary consumers and secondary consumers. As animals depend on plants for their food, they are called consumers. Primary consumers feed directly of Producers for their food and the secondary consumers feed on the primary consumers for their food. All herbivores animals are an example of Primary consumers.

Carnivores and apex predators make up the secondary and tertiary consumers.



Decomposers: They are the saprophytes which include fungi and bacteria. Decomposers convert the dead matter into nitrogen and carbon dioxide and the process is called decomposition.

Energy **Flow:** Energy flow is the flow of energy along the food chain, through different trophic levels. Energy is passed from the producers to the decomposers through various trophic levels.



Abiotic Components:

Abiotic components include inorganic materials like air, water, and soil.

Ecosystem Types:

There are three main types of ecosystem:

Terrestrial Ecosystem:

These are the ecosystem found only on land. The terrestrial ecosystems include:

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Mountain ecosystem
- Aquatic Ecosystem

The aquatic ecosystem is the ecosystem in the water body. It includes:

Freshwater Ecosystem:

The freshwater ecosystem can be divided into the following categories:

- **Lentic:** This includes slow-moving or still water such as lakes, ponds, pools, etc.
- **Lotic:** This includes fast-moving water bodies such as rivers and streams.
- **Wetlands:** These include the environment where soil is saturated with water for a

certain time period.

Oceanic Ecosystem: The ocean ecosystem is the largest ecosystem. It covers about 71% of the total earth's surface. This is also known as the marine ecosystem and is divided into deep water, shallow water and deep ocean surface. A large variety of corals, echinoderms, brown algae, cephalopods and dinoflagellates are found here.

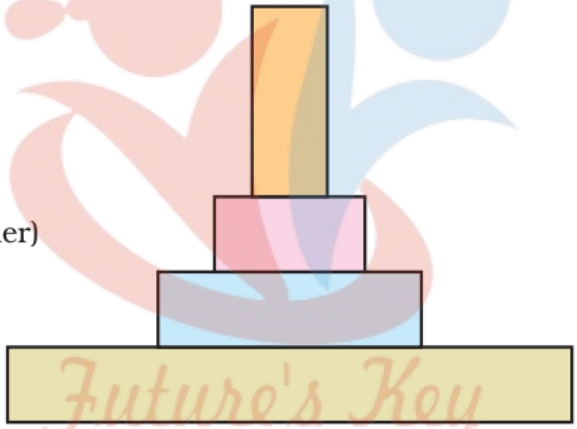
Ecological Pyramids:

An ecological pyramid is the graphical representation of the relationship between different organisms. Each bar of the pyramid represents a different trophic level.

The different types of ecological pyramids include:

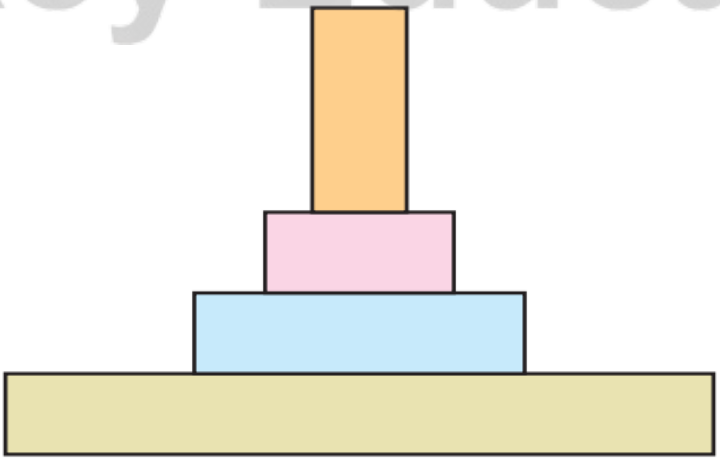
Pyramid of Numbers: This represents the number of organisms in each trophic level, irrespective of their size.

Trophic level	Number of individuals
TC (Tertiary consumer)	3
SC (Secondary consumer)	3,54,000
PC (Primary consumer)	708, 000
PP (Primary producer)	5,842,000



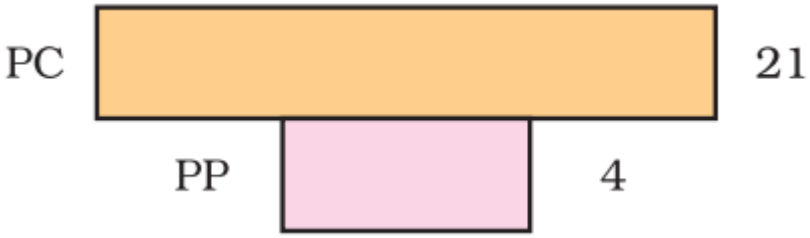
Pyramid of Biomass: This represents the total mass of organisms at each trophic level.

Trophic level	Dry weight (kg m^{-2})
TC	1.5
SC	11
PC	37
PP	809

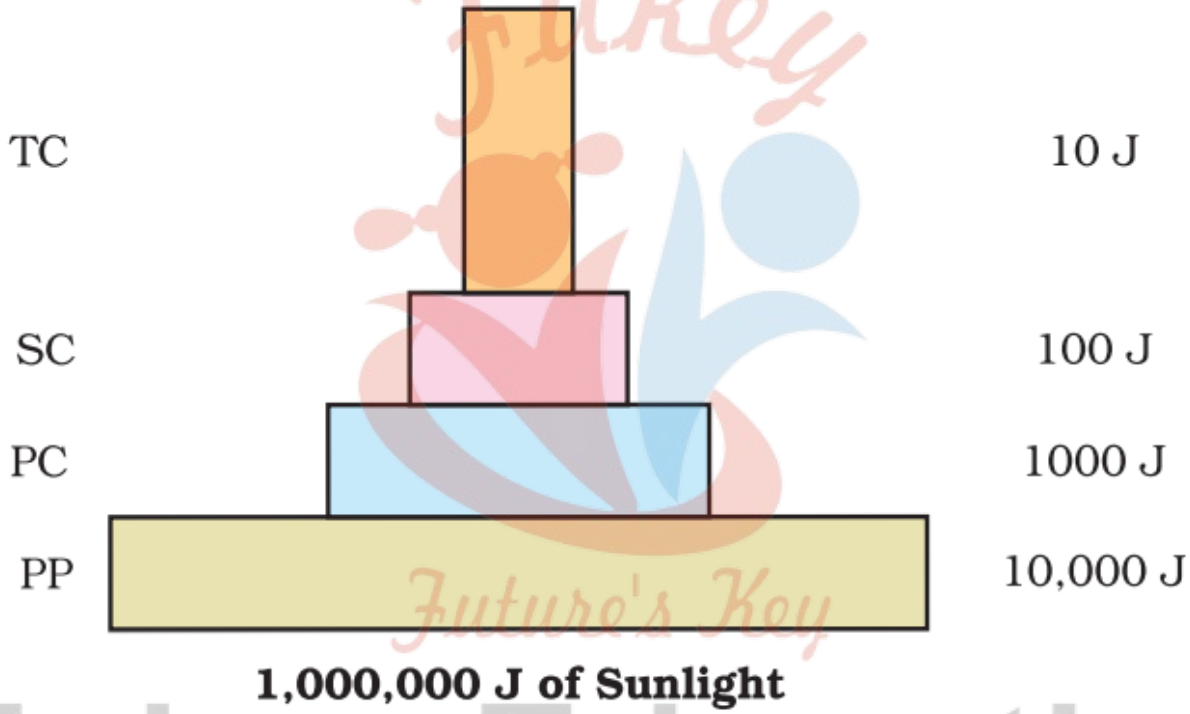


An energy pyramid: An energy pyramid (sometimes called a trophic pyramid or an ecological

pyramid) is a graphical representation, showing the flow of energy at each trophic level in an ecosystem.



Pyramid of Productivity: It is the total amount of energy present at each trophic level and the total energy lost between each trophic level.



Ecological Succession: Ecological succession refers to the change in the structure of species of an ecological community over time. These are of two types:

Primary Succession: This is a type of succession in which plants and animals first colonize a barren piece of land.

Secondary Succession: This is the type of succession in which an ecosystem that is destroyed, revives itself.

Function of Ecosystem:

- The level of organisms regulates the flow of energy.
- The autotrophs are the producers that produce energy which is transferred through various trophic levels.
- The minerals of the biosphere are cycled through the biosphere.

- It supports life systems and provides stability.

Decomposition:

It is the process of break down complex organic matter into simpler inorganic substances such as carbon dioxide, water, and nutrients by the action of decomposers.

- **Detritus:** Dead remains of plants and animals such as leaves, barks, flowers, faecal matter of animals, etc. constitute detritus.
- **Detritivores:** Organisms that feed on detritus are called detritivores. Earthworms, fungi, etc. are examples of detritivores.

Steps in Decomposition:

- **Fragmentation:** It is the breakdown of detritus into smaller particles by the action of detritivores.
- **Leaching:** It's the phenomenon by which water-soluble nutrients sink to the soil horizon and precipitate as salts that aren't available.
- **Catabolism:** It is the breakdown of detritus into simple inorganic nutrients by the action of bacterial and fungal enzymes.
- **Humification:** It is the formation and continuous deposition of a dark-coloured organic amorphous substance called humus. Humus is extremely resistant to microbial action and decomposes at a very slow rate. Because it is colloidal, it acts as a nutrient reservoir.
- **Mineralization:** It is the process by which some microorganisms further break down humus to form simple inorganic nutrients.

Ecological Succession:

Ecological succession is the process of change in the structure of species that belongs to an ecological community over time. After a mass extinction, the time scale can be decades or even millions of years. This change occurs orderly and sequential, parallel with the changes in the physical environment.

- **Pioneer Species:** The species that invade a bare area are called pioneer species.
- **Pioneer Community:** The community that is capable to invade a bare area is known as the pioneer community.
- **Climax Community:** A community that is almost near to equilibrium with the

environment is called the climax community.

- **Sere:** A sequence of ecological communities arising in an area from the initial pioneer community to the final climax community.
- **Primary Succession:** Primary succession is a type of biological and ecological succession of plant life. It occurs in an environment in which a new substrate is deposited. This new substrate is not having any kind of vegetation and other organisms. It also usually lacks soil and organic matter. It occurs in places such as land after a lava flow or area left from the retreated glacier.
- **Secondary Succession:** Secondary succession is a type of biological and ecological succession of plant life which takes place in a habitat that has been previously populated but has since been disturbed or damaged. For instance, regions where existing vegetation has been removed (due to tree-felling in a woodland or destructive events such as fires).

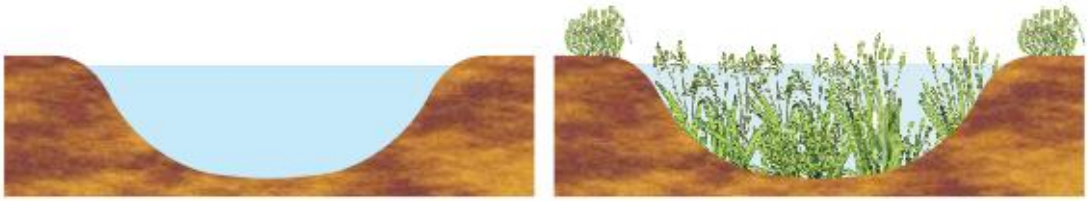
Succession of Plants:

Hydrarch: A succession that begins in a water body or aquatic environment is called Hydrosere or Hydrarch Succession.

Xerarch: Xerosere is a succession of plants that are limited in the availability of water availability. It includes the different stages in xerarch succession. Xerosere originates in extremely dry situations such as sand deserts, dunes, salt deserts, rock deserts, etc.

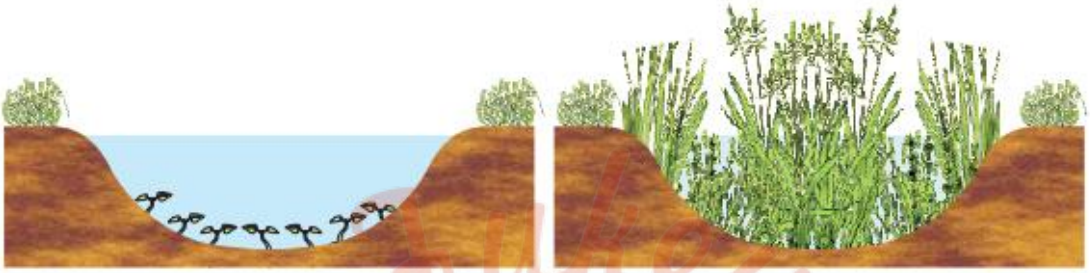
In secondary succession, the invasion of species depends on the availability of water, conditions of the soil, and the environment. It also depends on whether any seeds or other propagules are present. Because soil is already existent, the pace of succession is substantially faster, and the climax community is reached much sooner.

Succession always proceeds towards the mesic community.



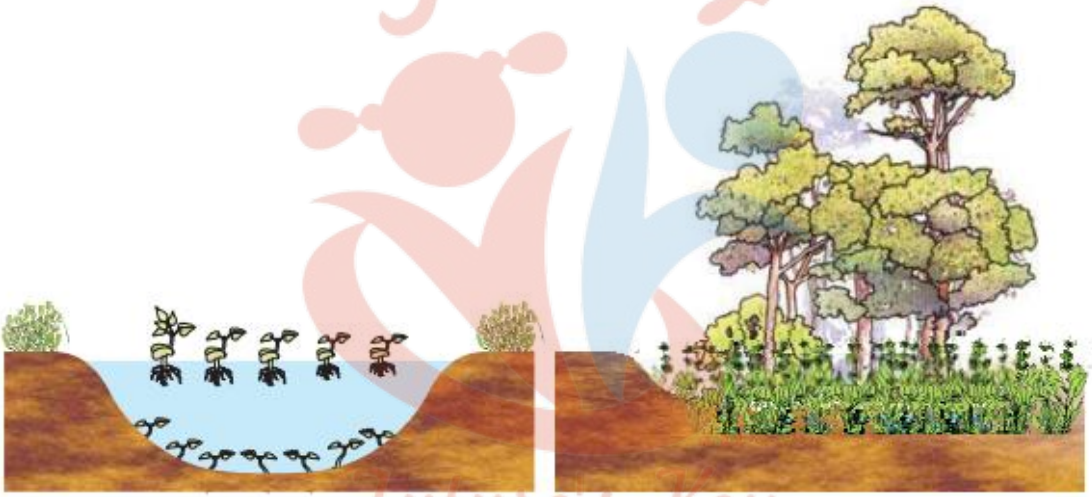
Phytoplankton

Reed-swamp stage



Submerged plant stage

Marsh-meadow stage



Submerged free floating plant stage

Scrub stage

Forest

Nutrient Cycling:

The movement of nutrients through the various components that belong to an ecosystem is called nutrient cycling. It is also called biogeochemical cycles (bio: living organism, geo: rocks, air, and water).

Types of Nutrient Cycles:

- Gaseous.
- Sedimentary.

Standing State: The total amount of various nutrients like nitrogen, carbon, phosphorus, calcium, etc., present in the soil at any given time, is referred to as the standing state. It differs in different kinds of ecosystems and also on the basis of season.

The atmosphere serves as a reservoir for gaseous nutrient cycles (carbon and nitrogen).

The reservoir for the sedimentary nutrient cycle (sulfur, phosphorus, etc.) exists in the earth's crust.

The rate of release of nutrients into the atmosphere is regulated by environmental factors.

The reservoir functions to meet with the deficit occurring due to an imbalance between influx and efflux.

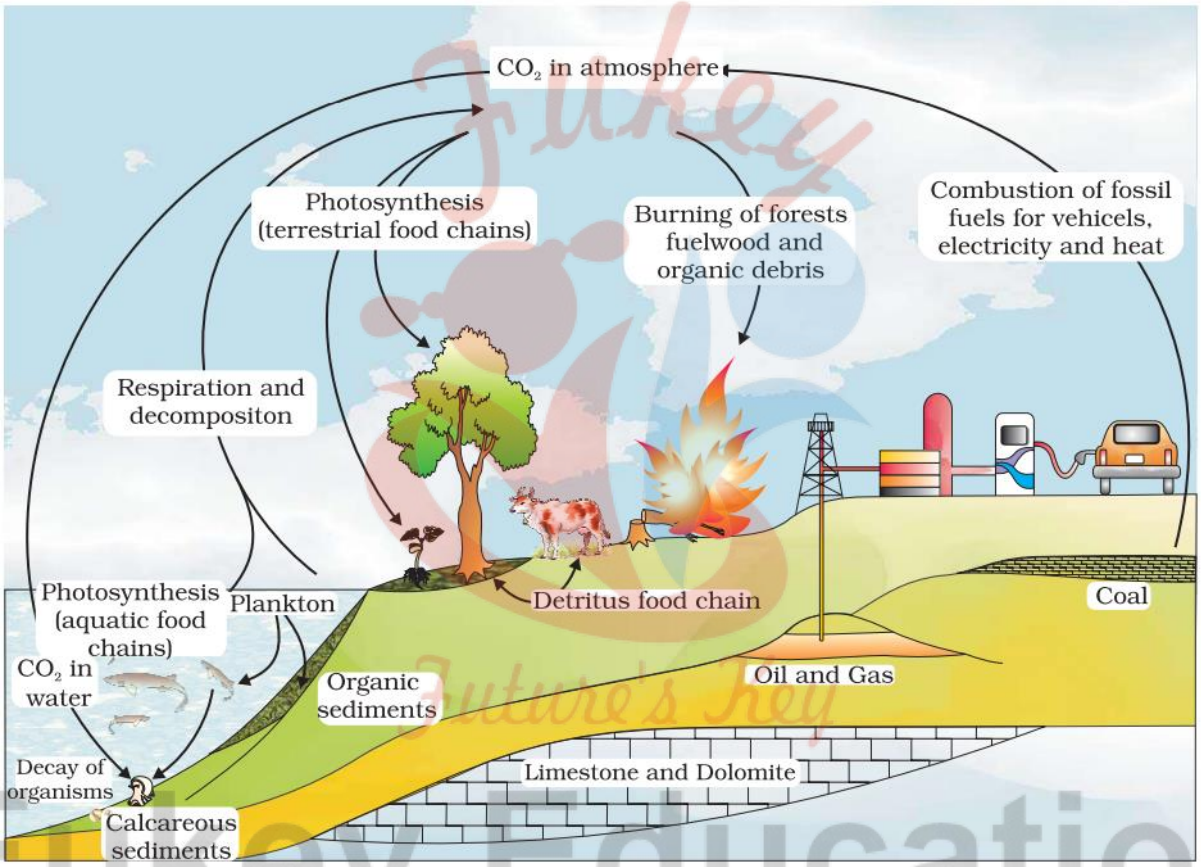
Ecosystem Carbon Cycle:

Carbon is contained by most of the chemicals that make up living tissue. When the organisms die the carbon contained by them is recycled to be used by future generations. The movement of carbon through the various components of the ecosystem is called the carbon cycle.

- As a result of respiration and combustion, carbon is released into the environment as CO_2.
- Carbon dioxide is absorbed by producers during the process of photosynthesis to produce carbohydrates.
- Animals feed on the producers. The food chain causes carbon to move along various trophic levels. During breathing, the majority of the carbon eaten is exhaled as CO_2. The animals and plants eventually die.
- Decomposers eat the dead organisms and break them down. This causes the carbon in their bodies to be returned to the atmosphere as carbon dioxide. In some extraordinary conditions, decomposition is blocked. The plant and animal material may then be turned into fossil fuel for use in the future for combustion.
- Marine animals may convert some of the carbon in their diet to calcium carbonate

which is then used to make the shells for their bodies. Over time these shells of dead organisms get collected on the seabed and form or converted into limestone. Due to various activities and movements of the earth, this limestone may eventually become exposed to the air where it is subjected to weathering. This results in the back release of carbon into the atmosphere as carbon dioxide. Carbon dioxide is also released through volcanic action.

- Human activities have significantly influenced the carbon cycle. Rapid deforestation and massive burning of fossil fuels have increased the rate of release of carbon dioxide into the atmosphere.



Phosphorus Cycle:

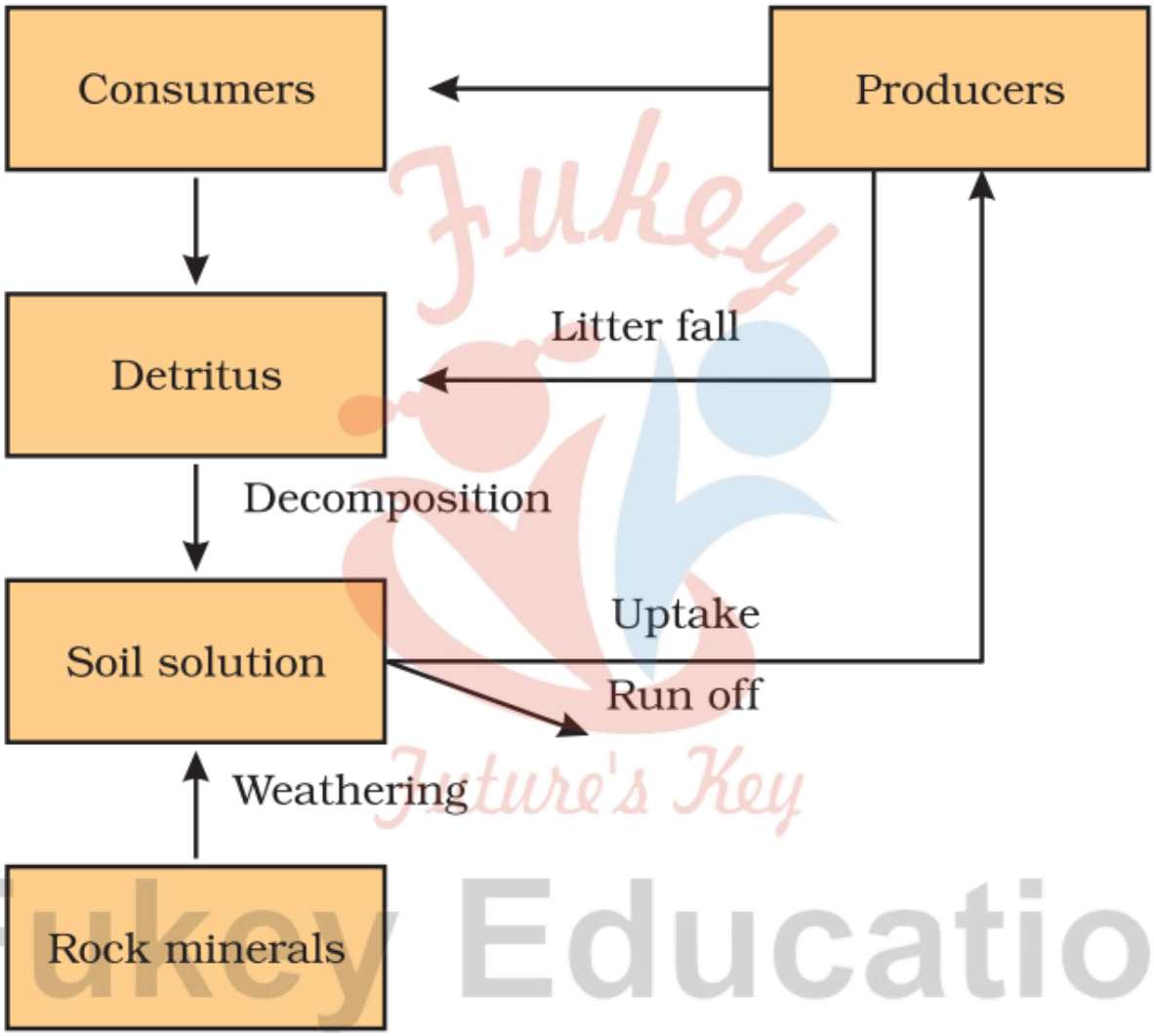
The phosphorus cycle is the process by which phosphorus moves through the different layers of the atmosphere that is the lithosphere, hydrosphere, and biosphere.

Steps in Phosphorus Cycle:

- **Weathering:** Weathering of uplifted rocks adds phosphates to the land. Eventually, some phosphates reach the ocean again.
- **Fertilizers:** Phosphate fertilizers from fields might run off straight into the streams. These may later become part of a soil pool or can be absorbed by the plants.
- **Excretion and Decomposition:** Animal excretion (on land or in the ocean) and animal

and plant decomposition both produce phosphates on land and in water.

- **Dissolved Phosphates:** Dissolved phosphates plays important role in forming ocean sediments by precipitation. The process of conversion of these sediments into phosphate rocks is a very slow and gradual process.
- **Geological Uplift:** Geologic forces can lift up the phosphate rocks very slowly from the ocean floor or the rocks thick with phosphate in them to form the huge mountains.



Ecosystem Services:

The results or outcome of ecosystem processes is called ecosystem services.

Services of Healthy Forest Ecosystems:

Purification of air and water.

Mitigation of droughts and floods.

- Cycling of nutrients.

- Generation of fertile soils.
- Providing habitats to wildlife.
- Maintenance of biodiversity.
- Pollination of crops.
- To provide storage site for carbon.
- Providing aesthetic, cultural, and spiritual values.
- The average price tag of these ecosystem services is estimated to be US $ 33 trillion annually.
- This is near twice the value of the global gross national product GNP (the US $ 18 trillion).

The Calculation, Out of the Total Cost of Various Ecosystem Services:

- Soil formation accounts for about 50% of the ecosystem services.
- Recreation for about 10% of these services.
- Nutrient cycling about 10% of them.
- The cost of climate regulation and habitat dark approximate 6% each.

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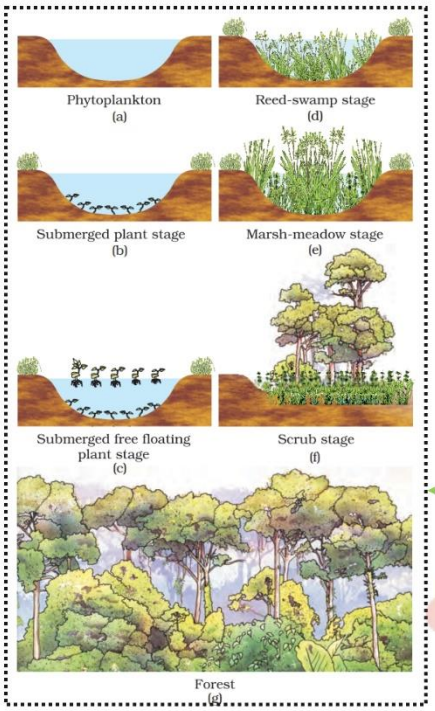
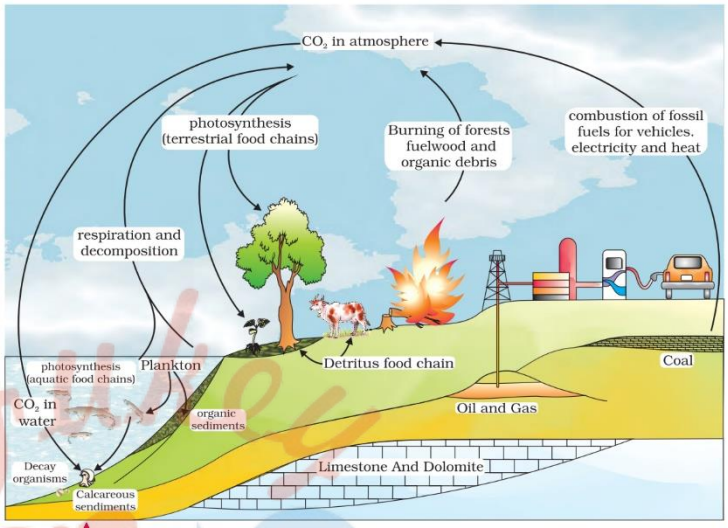




Primary Succession

Carbon Cycling

Nutrient Cycling

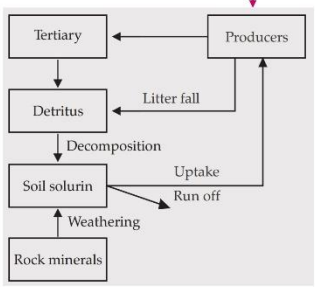
Phosphorus Cycling

Ecological Services

Ecosystem

- Purify air and water.
- Mitigate droughts and flood.
- Cycle nutrients.
- Generates fertile soil.
- Provide wildlife habitat.
- Maintain biodiversity.
- Pollinate crops.
- Provide storage site for carbon
- Provide aesthetic, cultural and spiritual values.

Microbes as biocontrol



Structure and function Ecosystem

Functional Components of Ecosystem

Comprises

Biotic

Autotrophs, Herbivores and carnivores

Abiotic

Pond, lake, river, estuary

Distribution of different species at different levels

Stratification

(i) Tall emergent trees
(ii) Canopy trees
(iii) Understoreys trees
Top most layers
(iv) Shrubs
(v) Herbs
(vi) Grasses
Bottom layers

Energy Flow

Food chain shows energy pathways. Energy passes from producer (plants) to Plant-eaters, to Animal-eaters and to tertiary consumer

Process of Decomposition

- Fragmentation
- Leaching
- Catabolism
- Humification
- Mineralisation

Productivity

Primary

NPP= GPP-R

Secondary

Rate of formation of new organic matter by consumers

Nutrient cycling

Ten Percent Law

During transfer of energy from one trophic level to another, only about 10% is stored at higher levels; remaining 90% is lost in respiration (heat).

Trophic level

Specific place occupied by an organism in the food chain in an ecosystem

Food Chain

Detritus food chain

Begins with detritus such as dead bodies of animals or fallen leaves.

Grazing food chain

Begins with producers, present at the first trophic level.

Ecological Pyramid

Pyramid of Energy

Always upright because energy is lost at each step

Pyramid of Biomass

- Upright e.g. in grassland
- Inverted e.g. in pond

Pyramid of No.

- Upright e.g. in grassland
- Inverted e.g. in tree ecosystem

Important Questions

➢ Multiple Choice Questions:

1. An inverted pyramid of biomass can be found in which ecosystem?

(a) Forest
(b) Marine
(c) Grassland
(d) Tundra.

2. Which of the following is not a producer?

(a) Spirogyra
(b) Agaricus
(c) Volvox
(d) Nostoc.

3. Which of the following ecosystems is most productive in terms of net primary production?

(a) Deserts
(b) Tropical rainforests
(c) Oceans
(d) Estuaries.

4. Pyramid of numbers is:

(a) Always upright
(b) Always inverted
(c) Either upright or inverted
(d) Neither upright nor inverted.

5. Approximately how much of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis?

(a) Less than 1%
(b) 2-10%
(c) 30%
(d) 50%.

6. Among the following, where do you think the process of decomposition would be the fastest?

(a) Tropical rainforest
(b) Antarctic
(c) Dry arid region
(d) Alpine region.

7. How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?

(a) 1%
(b) 10%
(c) 40%
(d) 90%.

8. During the process of ecological succession the changes that take place in communities are:

(a) Orderly and sequential
(b) Random
(c) Very quick.
(d) Not influenced by the physical environment

9. Climax community is in a state of:

(a) non-equilibrium
(b) equilibrium
(c) disorder
(d) constant change.

10. Among the following biogeochemical cycles which one does not have losses due to respiration?

(a) Phosphorus
(b) Nitrogen
(c) Sulphur
(d) All of the above.

11. The sequence of communities of primary succession in water is:

(a) phytoplankton, sedges, free-floating hydrophytes, rooted hydrophytes, grasses and trees.
(b) phytoplankton, free-floating hydrophytes, rooted hydrophytes, sedges, grasses and trees.
(c) free-floating hydrophytes, sedges, phytoplankton, rooted hydrophytes, grasses and trees.
(d) phytoplankton, rooted submerged hydrophytes, floating hydrophytes, reed swamp, sedges, meadow and trees.

12. The reservoir for the gaseous type of bio-geochemical cycle exists in

(a) stratosphere
(b) atmosphere
(c) ionosphere
(d) lithosphere.

13. If the carbon atoms fixed by producers already have passed through three species, the trophic level of the last species would be

(a) scavenger
(b) tertiary producer
(c) tertiary consumer
(d) secondary consumer.

14. Which of the following types of ecosystem is expected in an area where evaporation exceeds precipitation, and mean annual rainfall is below 100 mm.

(a) Grassland
(b) Shrubby forest
(c) Desert
(d) Mangrove.

15. The zone at the edge of a lake or ocean which is alternatively exposed to air and immersed in water is called:

(a) Pelagic zone
(b) Benthic zone
(c) Lentic one
(d) Littoral zone.

➢ Very Short Question:

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 photosyntheticallyactive radiation is captured by plants?
7. Name the pioners of primary succession in water.
8. Name any two man – made ecosystem?
9. Define stratification?
10. Name the ecological pyramid that is always upright?

➢ Short Questions:

1. What is the shape of pyramid of biomass in sea? Why?
2. Give an example of an ecological pyramid which is always upright. Justify your Answer.
3. Differentiate between primary succession and secondary succession. Which one occurs faster?
4. Gaseous nutrient cycle and sedimentary nutrient cycles have their reservoir. Name them. Why is a reservoir necessary?
5. Differentiate between Hydrarch and a Xerarch succession.
6. Why is secondary sucession faster than primary sucession?
7. Distinguish between upright & inverted pyramids?
8. Explain with an example, why is the length of a food chain in an ecosystem generally limited to 3-4 tropic level?

➢ Long Questions:

1. Briefly describe the biotic components of an ecosystem.
2. Give an account of factors affecting the rate of decomposition.
3. Sometimes due to biotic/abiotic factors, the climax remains in a particular serai stage (pre-climax) without reaching climax. Do you agree with this statement? If yes give a suitable example.

➢ Assertion & Reason Questions:

1. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

   a. Both assertion and reason are true, and reason is the correct explanation of assertion.
   b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c. Assertion is true, but reason is false.
   d. Both assertion and reason are false.

   Assertion: Ecosystem is the structural and functional unit of biosphere consisting of abiotic and biotic components which interact with each other and maintain a balance in nature.

   Reason: In an ecosystem, energy and matter are continuously exchanged between living and non-living components.

2. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

   a. Both assertion and reason are true, and reason is the correct explanation of assertion.
   b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c. Assertion is true, but reason is false.

d. Both assertion and reason are false.

Assertion: Different ecosystems have different species composition.

Reason: The type of species that can thrive in an ecosystem is dependent upon its geography, topography and climate.

➢ Case Study Questions:

1. Read the following and answer any four questions from (i) to (v) given below:

Except for the deep sea hydro-thermal ecosystem, sun is the only source of energy for all ecosystems on Earth. Of the incident solar radiation less than 50 per cent of it is photosynthetically active radiation (PAR). We know that plants and photosynthetic bacteria (autotrophs), fix Sun's radiant energy to make food from simple inorganic materials. Plants capture only 2-10 per cent of the PAR and this small amount of energy sustains the entire living world. So, it is very important to know how the solar energy captured by plants flows through different organisms of an ecosystem. All organisms are dependent for their food on producers, either directly or indirectly. The green plant in the ecosystem are called producers. In a terrestrial ecosystem, major producers are herbaceous and woody plants. Likewise, producers in an aquatic ecosystem are various species like phytoplankton, algae and higher plants. You have read about the food chains and webs that exist in nature. Starting from the plants (or producers) food chains or rather webs are formed such that an animal feeds on a plant or on another animal and in turn is food for another. The chain or web is formed because of this interdependency. No energy that is trapped into an organism remains in it for ever. The energy trapped by the producer, hence, is either passed on to a consumer or the organism dies. Death of organism is the beginning of the detritus food chain/web. All animals depend on plants (directly or indirectly) for their food needs.

They are hence called consumers and also heterotrophs. If they feed on the producers, the plants, they are called primary consumers, and if the animals eat other animals which in turn eat the plants (or their produce) they are called secondary consumers. Likewise, you could have tertiary consumers too. Obviously the primary consumers will be herbivores. Some common herbivores are insects, birds and mammals in terrestrial ecosystem and molluscs in aquatic ecosystem.

1) …… Is an herbivore organism in the aquatic ecosystem.

(a) Molluscs
(b) Insects
(c) Mammals
(d) Birds

2) In the ecosystem, green plants are

(a) Consumers
(b) Decomposers
(c) Producers

(d) All of them

3) PAR is a …….

(a) Powerful Atomic Radiation.
(b) Photosynthetically Atomic Radiation.
(c) Photosynthetically Active Radiation.
(d) Powerful Active Radiation.

4) Which ecosystem on earth does not require sun as an energy source?

5) Name any two producers from aquatic ecosystem.

2. Read the following and answer any four questions from (i) to (v) given below:

The consumers that feed on these herbivores are carnivores, or more correctly primary carnivores (though secondary consumers). Those animals that depend on the primary carnivores for food are labelled secondary carnivores. A simple grazing food chain (GFC) is depicted below:

Grass	Goat	Man
Producer	Primary consumer	Secondary consumer

The detritus food chain (DFC) begins with dead organic matter. It is made up of decomposers which are heterotrophic organisms, mainly fungi and bacteria. They meet their energy and nutrient requirements by degrading dead organic matter or detritus. These are also known as saprotrophs (sapro: to decompose). Decomposers secrete digestive enzymes that breakdown dead and waste materials into simple, inorganic materials, which are subsequently absorbed by them. In an aquatic ecosystem, GFC is the major conduit for energy flow. As against this, in a terrestrial ecosystem, a much larger fraction of energy flows through the detritus food chain than through the GFC. Detritus food chain may be connected with the grazing food chain at some levels: some of the organisms of DFC are prey to the GFC animals, and in a natural ecosystem, some animals like cockroaches, crows, etc., are omnivores. These natural interconnection of food chains make it a food web. How would you classify human beings!

1) …….. is a beginning of Detritus food chain.

(a) Living organic matter
(b) Producers
(c) Dead organic matter
(d) Consumers

2) The meaning of sapro word in the saprotrophs is …….

(a) To produce
(b) To divide
(c) To consume
(d) To decompose

3) GFC is a ……..

(a) Global food chain
(b) Grazing food chain
(c) Global food consumers
(d) Grazing form chain

4) Write a short note on Grazing food chain.

5) What is ‘Food web’.

✓ Answer Key-

➢ Multiple Choice Answers:

1. (b) Marine
2. (b) Agaricus
3. (b) Tropical rainforests
4. (c) Either upright or inverted
5. (b) 2-10%
6. (a) Tropical rainforest
7. (b) 10%
8. (a) Orderly and sequential
9. (b) equilibrium
10. (d) All of the above.
11. (b) phytoplankton, free-floating hydrophytes, rooted hydrophytes, sedges, grasses and trees.
12. (b) atmosphere
13. (c) tertiary consumer
14. (c) Desert
15. (d) Littoral zone.

➢ Very Short Answers:

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.Serial 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
8. Aquarium & Garden.
9. Stratification in an ecosystem refers to the vertical distribution of different species occupying different levels.

10. Pyramid of energy.

➢ Short Answer:

1. Inverted, because biomass of fishes far exceeds that of phytoplankton.
2. 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.
3. Primary Succession: Aprocess that starts where no living organisms are there. Secondary succession: Aprocess that starts in areas which have lost all the living organisms that existed there.
4. 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.
5. HydrarchSuccession: Starts in water proceeds from hydric (aquatic) to mesic (neither dry nor wet) situations. Xerarchsuccession: Starts on barren rock Proceeds from Xeric (dry) conditons.
6. Secondary succession refers to community development on sites previously occupied by welldeveloped communities where the environment is both organic & inorganic. Since these bare areaspossesses suitable soil for proper growth so, secondary successes is more rapid them primarysuccession.
7. In upright pyramid the number of producers or its biome is maximum in an ecosystem & it decreases progressively at each trophic level. Whereas in inverted pyramid at producer level is minimum & is increasing progressively at each trophic level in a food chain.
8. In a food chain at each trophic level about 90% of energy is degraded into heat & only 10% energy is transferred to next tropic level thus of trophic levels in the food chain the amount energy to be transferred to next trophic level will be approximately negligible thus a food chain is generally limited to 3-4 trophic levels.

➢ Long Answer:

1. Biotic components: Of an ecosystem's biotic components, the plants are producers as they introduce food materials and energy into the living world. The animals are consumers because they get food and energy by consuming plants directly thus called primary consumers (herbivores); secondary/ tertiary consumers (carnivores) obtain energy and food indirectly from plants, and microorganisms are decomposers for they flourish by breaking dead organic matter to simple substances that are returned to environment for reuse by plants.

   In an ecosystem, nutrients are used again and again in a cyclic manner, whereas energy trapped from sunlight is lost as heat.

2. Factors affecting decomposition:

i. The upper layer of soil is the main site of decomposition processes in the ecosystem.

ii. The rate of decomposition of detritus is affected by climatic factors and the chemical quality of detritus.

iii. Temperature and soil moisture affect the activities of root microbes.

iv. The chemical quality of detritus is determined by the relative proportion of water-soluble substances, polyphenols, lignin, and nitrogen.

3. Sometimes pre-climax stage remains in a particular serai stage without reaching the climax because during ecological succession any change in abiotic and biotic components may affect the particular serai stage, leading to the pre-climax stage before the climax is achieved.

This type of condition occurs in the presence of seeds and other propagules. This secondarily based area may be invaded by moss or exotic weeds thus exhibiting succession seriously and the climax community is never regenerated.

➢ Assertion and Reason Answers:

1) a) Both assertion and reason are true, and reason is the correct explanation of assertion.

Explanation:

Ecosystems include living organisms, the dead organic matter produced by them, the abiotic environment within which the organisms live and exchange elements and the interactions between these components. Ecosystems include the concept that living organisms continually interact with each other and with the environment to produce complex systems with emergent properties, such that "the whole is greater than the sum of its parts" and "everything is connected". The idea of the ecosystem relates to the idea that all organisms in the environment are engaged in relationships with every other aspect (like resources and other organisms) in that environment. Ecosystems deal with energy and nutrient flow through a system/community.

2) a) Both assertion and reason are true, and reason is the correct explanation of assertion.

Explanation:

A Each ecosystem has different kinds of species. This is because the type of species that can thrive in an ecosystem is dependent upon its geography, topography and climate. For example, the desert biomes have species that are well adapted to life in the sand with limited access to water, such as camels and cacti. The species in tundras have adaptations to keep the body warm, such as the polar bear that has fur and fat layers under its skin.

➢ Case Study:

1.

1. (a) Molluscs.
2. (c) Producers.

3. (c) Photosynthetically Active Radiation.
4. The deep sea hydro-thermal ecosystem is the ecosystem on earth that does not require sun as an energy source.
5. Algae and phytoplankton both are producers in an aquatic ecosystem.

2.

1. (c) Dead organic matter.
2. (d) To decompose.
3. (b) Grazing food chain.
4. The producers are present in beginning of grazing food chain. Grass is taken as producer in this chain. Then goat is primary consumer because it eats or consume grass. Man are secondary consumers in the chain because man consume goat which consumes grass.
5. The normal interconnection of food chain is known as Food web.