

UNIT – III

Eco System

Ecosystem

- The term ecosystem was posed by A. G. Tansley in 1935.
- “The system resulting from the integration of all living and non-living factors of the environment”
- In 1962, Odum defined ecosystem as “the structural and functional unit of ecology”.

The ecosystem includes,

- Producers
- Consumers
- Decomposers

1. Producers

- They are the primary stage of any ecosystem.
- They are mostly green plants and can produce their own food by photosynthesis.
- Example: phytoplankton, green plants.

2. Consumers

- They are animals by which they get nourishment from producers.
- They can't prepare their own food.
- They include herbivores and carnivores.
- Herbivores get energy directly from producers (plants).
- Carnivores get energy indirectly from producers (plants) and directly from herbivores (other animals).
- Example: Herbivore – goat, cow
 Carnivore – lion, tiger
 Omnivore – crow, human

3. Decomposer

- They are living organisms that breakdown dead and decaying matters.
- They do decomposition to get energy and nutrition.
- Example: bacteria, fungi.

Functions of ecosystem

- Energy creation
- Sharing of energy
- Cycling of materials between the living and nonliving components of ecosystem/
- To balance among various tropic level in the ecosystem.
- Diversity-interlinkages between organisms.

Structure of ecosystem

Ecosystem comprises of two major components. They are:

- I. **Abiotic (non-living) components:** It includes climatic factors (air, water, sunlight, rainfall, temperature and humidity), edaphic factors (soil air, soil water and pH of soil), topography (latitude, altitude), organic components (carbohydrates, proteins, lipids and humic substances) and inorganic substances (C, H, O, N and P). Abiotic components play vital role in any ecosystem and hence the total inorganic substances present in any ecosystem at a given time is called standing quality (or) standing state.
- II. **Biotic (living) components:** It includes all living organisms like plants, animals, fungi and bacteria. They form the trophic structures of any ecosystem. On the basis of nutritional relationships, trophic levels of an ecosystem has two components.
 - (1) autotrophic components and
 - (2) heterotrophic components.

(1) **Autotrophic components:** Autotrophs are organisms which can manufacture the organic compounds from simple inorganic components through a process called photosynthesis. In most of the ecosystems, green plants are the autotrophs and are also called producers.

(2) **Heterotrophic components:** Those organisms which consume the producers are called consumers and can be recognized into macro and micro consumers. Macroconsumers refer to herbivores, carnivores and omnivores (primary, secondary and tertiary consumers). Microconsumers are called decomposers. Decomposers are organisms that decompose the dead plants and animals to release organic and inorganic nutrients into the environment which are again reused by plants. Example: Bacteria, Actinomycetes and Fungi.

7.3.5 Classification of plant succession

Detailed study of Hydrosere and Lithosere are discussed below:

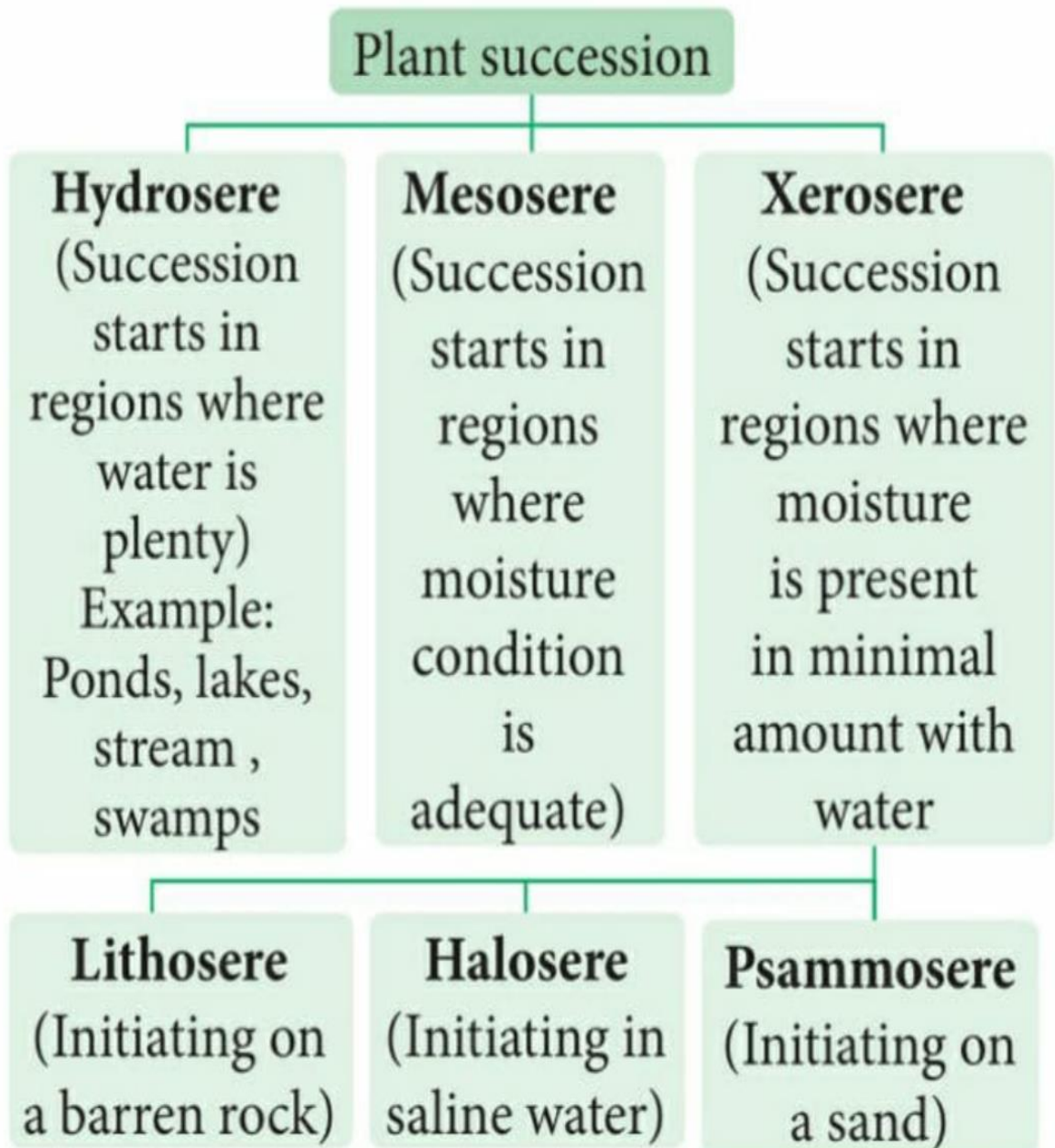


Figure 7.20: Classification of plant succession

7.3.4 Process of succession

There are a number of sequential processes in primary autotrophic succession. They are (1) Nudation, (2) Invasion (migration) (3) Ecesis, (4) Aggregation, (5) Competition, (6) Reaction (7) Stabilization (climax).

1. Nudation - This is the development of a barren area without any form of life. The barren area may be developed due to topographic (soil erosion, wind action), climatic (hails, storm, fire), and biotic (human activities, epidemics, etc.,) factors.

2. Invasion - If species invade or reach a barren area from any other area it is called invasion. When the seeds, spores or other propagules of plant species reach the barren area, by air, water and various other agent, it is known as migration.

3. Ecesis (Establishment) - After reaching a new area (invasion), the successful establishment of the species, as a result of adjustment with the conditions prevailing in the area, is known as **ecesis**. If the establishment is complete, the plant will be able to reproduce sexually in that particular area.

4. Aggregation - The successful establishment of species, as a result of reproduction and increase in population of the species than the earlier stage is called aggregation.

5. Competition - It refers to the aggregation of a particular species in an area which leads to inter specific and intraspecific competition among the individuals for water, nutrient, radiant energy, CO₂, O₂ and space, etc.

6. Reaction - The species occupying a habitat gradually modify the environmental condition, where the existing species community is displaced or replaced by another. This is called reaction. The community which is replaced by another community is called **seral community**.

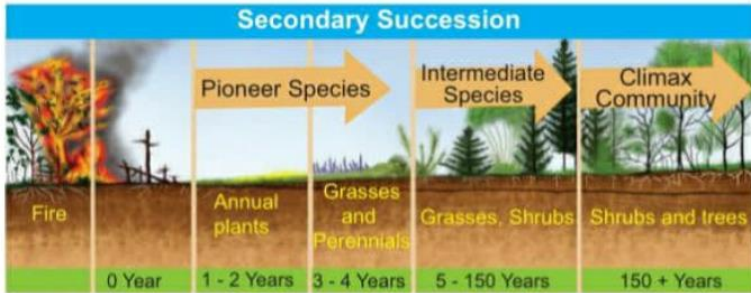


Figure 7.18: Diagrammatic representation of secondary succession

	Primary succession	Secondary succession
1	Developing in an barren area	Developing in disturbed area
2	Initiated due to a biological or any other external factors	Starts due to external factors only
3	No soil, while primary succession starts	It starts where soil covers is already present
4	Pioneer species come from outside environment	Pioneer species develop from existing environment
5	It takes more time to complete	It takes comparatively less time to complete

Table 1: Differences between primary and secondary succession

3. Autogenic succession

Autogenic succession occurs as a result of biotic factors. The vegetation reacts with its environment and modifies its own environment causing its own replacement by new communities. This is known as **autogenic succession**.

Example: In forest ecosystem, the larger trees produce broader leaves providing shade to the

forest floor area. It affects the shrubs and herbs which require more light (heliophytes) but supports the shade tolerant species (sciophytes) to grow well.

4. Allogenic succession

Allogenic succession occurs as a result of abiotic factors. The replacement of existing community is caused by other external factors (soil erosion, leaching, etc.,) and not by existing organisms.

Example: In a forest ecosystem soil erosion and leaching alter the nutrient value of the soil leading to the change of vegetation in that area.

5. Autotrophic succession

If the autotrophic organisms like green plants are dominant during the early stages of succession it is called **autotrophic succession**, this occurs in the habitat which is rich in inorganic substances. Since, green plants dominate in the beginning of this succession, there is a gradual increase in organic matter and subsequently the energy flow in the ecosystem.

6. Heterotrophic succession

If heterotrophic organisms like bacteria, fungi, actinomycetes, and animals are dominant during the early stages of succession it is called **heterotrophic succession**. Such a succession takes place in organic habitats. Since heterotrophs dominate in the beginning of such succession, there will be a gradual decrease in the energy content.

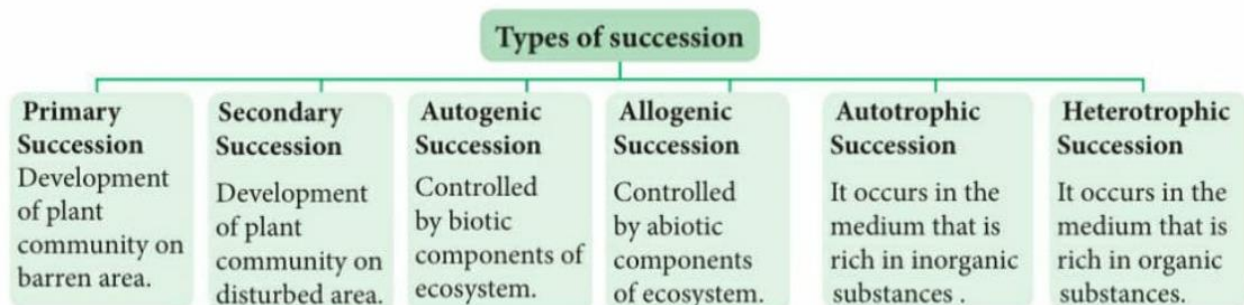


Figure 7.19: Types of succession

7.3 Plant Succession

We very often see that forests and lands in our areas are drastically affected by natural calamities (Flood, earthquake) and anthropogenic activities (Fire, over grazing, cutting of trees). Due to these reasons all plants of an area are destroyed and the areas become nude. When we observe this area, over a period of a time we can see that it will be gradually covered by plant community again and become fertile. Such successive replacement of one type of plant community by the other of the same area/ place is known as plant **succession**. The first invaded plants in a barren area are called **pioneers**. On the other hand, a series of transitional developments of plant communities one after another in a given area are called **seral communities**. At the end a final stage and a final plant community gets established which are called as climax and climax community respectively.

7.3.1 Causes of Succession

Ever since the onset of origin of life, organic evolution and ecological succession are taking place parallelly. Ecological succession is a complex process. There are three types of causes for any ecological succession. They are

a. **Initiating causes** - Activity of abiotic (light, temperature, water, fire, soil erosion and wind) and biotic factors (competition among organisms) leads to formation of a barren area or destruction of the existing community of an area, initiating primary or secondary succession respectively.

b. **Continuing causes** - The processes of migration, aggregation, competition, reaction etc, are the continuing causes which lead to change the plant communities and nature of the soil in an area.

c. **Stabilizing causes** - The stabilization of the plant community in an area is primarily controlled by climatic factors rather than other factors.

7.3.2 Characteristics of ecological succession

- It is a systematic process which causes changes in specific structure of plant community.
- It is resultant of changes of abiotic and biotic factors.
- It transforms unstable community into a stable community.
- Gradual progression in species diversity, total biomass, niche specialisation, and humus content of soil takes place.
- It progresses from simple food chain to complex food web.
- It modifies the lower and simple life form to the higher life forms.
- It creates inter-dependence of plants and animals.

7.3.3 Types of succession

The various types of succession have been classified in different ways on the basis of different aspects. These are as follows:

1. Primary succession - The development of plant community in a barren area where no community existed before is called primary succession. The plants which colonize first in a barren area is called **pioneer species** or **primary community** or **primary colonies**. Generally, Primary succession takes a very long time for the occurrence in any region.

Example: Microbes, Lichen, Mosses.

2. Secondary succession - The development of a plant community in an area where an already developed community has been destroyed by some natural disturbance (Fire, flood, human activity) is known as **secondary succession**. Generally, This succession takes less time than the time taken for primary succession.

Example: The forest destroyed by fire and excessive lumbering may be re-occupied by herbs over period of times.

How do anthropogenic activities affect ecosystem services?

Now, we all exploit the ecosystem more than that of our needs. The **Millennium Ecosystem Assessment (2005)** found that “over the past 50 years, humans have changed the ecosystem more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, medicine, timber, fiber and fuel.”

Generally the following human activities disturb or re-engineer an ecosystem every day.

- Habitat destruction
- Deforestation and over grazing
- Erosion of soils
- Introduction of non-native species
- Over harvesting of plant material
- Pollution of land, water and air
- Run off pesticides, fertilizers and animal wastes



Ecosystem resilience

Ecosystem is damaged by disturbances from fire, flood, predation, infection, drought, etc., removing a great amount of biomass. However, ecosystem is endowed with the ability to resist the damage and recover quickly. This ability of ecosystem is called ecosystem resilience or ecosystem robustness.

How to protect the ecosystem?

It is a practice of protecting ecosystem at individual, organisational and governmental levels for the benefits of both nature and humans. Threats to ecosystems are many, like adverse human activities, global warming, pollution, etc. Hence, if we change our everyday life style, we can help to protect the planet and its ecosystem.

“If we fail to protect environment, we will fail to save posterity”.

Therefore, we have to practice the following in our day today life:

- Buy and use only ecofriendly products and recycle them.
- Grow more trees
- Choose sustained farm products (vegetables, fruits, greens, etc.)
- Reduce the use of natural resources.
- Recycle the waste and reduce the amount of waste you produce.
- Reduce consumption of water and electricity.
- Reduce or eliminate the use of house-hold chemicals and pesticides.
- Maintain your cars and vehicles properly. (In order to reduce carbon emission)
- Create awareness and educate about ecosystem protection among your friends and family members and ask them to find out solution to minimise this problem.



Go green



It refers to the changing of one's lifestyle for the safety and benefits of the environments (Reduce, Reuse, Recycle)

Way to go green and save green

- Close the tap when not in use.
- Switch off the electrical gadgets when not in use.
- Never use plastics and replace them with biodegradable products
- Always use ecofriendly technology and products.

“USE ECOSYSTEM BUT DON'T LOSE ECOSYSTEM; MAKE IT SUSTAINABLE”

species. The limnetic zone refers the open water of the pond with an effective penetration of light and domination of planktons. The deeper region of a pond below the limnetic zone is called profundal zone with no effective light penetration and predominance of heterotrophs. The bottom zone of a pond is termed benthic and is occupied by a community of organisms called benthos (usually decomposers). The primary productivity through photosynthesis of littoral and limnetic zone is more due to greater penetration of light than the profundal zone.

7.2.11 Ecosystem services (Benefits)

Ecosystem services are defined as the benefits that people derive from nature. Robert Constanza et al (1997) stated “Ecosystem services are the benefits provided to human, through the transformation of resources (or Environmental assets including land, water, vegetation and atmosphere) into a flow of essential goods and services”.

Study on ecosystem services acts as an effective tool for gaining knowledge on ecosystem benefits and their sustained use. Without such knowledge gain, the fate of any ecosystem will be at stake and the benefits they provide to us in future will become bleak.



Robert Constanza and his colleagues estimated the value of global ecosystem services based on various parameters. According to them in 1997, the average global value of ecosystems services estimated was US \$ 33 trillion a year. The updated estimate for the total global ecosystem services in 2011 is US \$ 125 trillion / year, indicating a four-fold increase in ecosystem services from 1997 to 2011.

Mangrove ecosystem services

- Offers habitat and act as nursery for aquatic plants and animals
- Provides medicine, fuel wood and timber.
- Act as bridge between sea and rivers by balancing sedimentation and soil erosion.
- Help to reduce water force during cyclones, tsunamis and high tide periods.
- Help in wind break, O₂ production, carbon sequestration and prevents salt spray from waves.



The varieties of benefits obtained from the ecosystem are generally categorized into the following four types

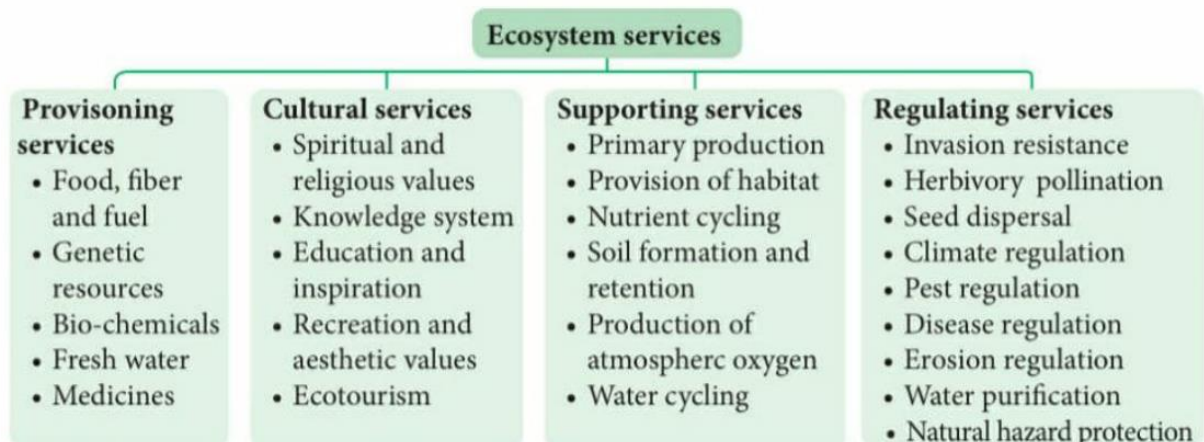


Figure 7.17: Types of Ecosystem services

Abiotic components

A pond ecosystem consists of dissolved inorganic (CO_2 , O_2 , Ca, N, Phosphate) and organic substances (amino acids and humic acid) formed from the dead organic matter. The function of pond ecosystem is regulated by few factors like the amount of light, temperature, pH value of water and other climatic conditions.

Biotic components

They constitute the producers, variety of consumers and decomposers (microorganisms).

a. Producers

A variety of phytoplanktons like *Oscillatoria*, *Anabaena*, *Eudorina*, *Volvox* and *Diatoms*. Filamentous algae such as *Ulothrix*, *Spirogyra*, *Cladophora* and *Oedogonium*; floating plants *Azolla*, *Salvia*, *Pistia*, *Wolffia* and *Eichhornia*; sub-merged plants *Potamogeton* and *Phragmites*; rooted floating plants *Nymphaea* and *Nelumbo*; macrophytes like *Typha* and *Ipomoea*, constitute the major producers of a pond ecosystem.

b. Consumers

The animals represent the consumers of a pond ecosystem include zooplanktons like *Paramecium* and *Daphnia* (primary consumers); benthos (bottom living animals) like molluscs and annelids; secondary consumers like water beetles and frogs; and tertiary consumers (carnivores) like duck, crane and some top carnivores which include large fish, hawk, man, etc.



Sea grasses and mangroves of Estuarine and coastal ecosystems are the most efficient in carbon sequestration. Hence, these ecosystems are called as “**Blue carbon ecosystems**”. They are not properly utilized and maintained all over the world although they have rich bioresources potential.

c. Decomposers

They are also called as microconsumers. They help to recycle the nutrients in the ecosystem. These are present in mud water and bottom of the ponds. Example: Bacteria and Fungi. Decomposers perform the process of decomposition in order to enrich the nutrients in the pond ecosystem.

The cycling of nutrients between abiotic and biotic components is evident in the pond ecosystem, making itself self sufficient and self regulating.



Limnology

It is the study of biological, chemical, physical and geological components of inland fresh water aquatic ecosystems (ponds, lakes, etc.).

Oceanography – It is the study of biological, chemical, physical and geological components of ocean.

Stratification of pond ecosystem

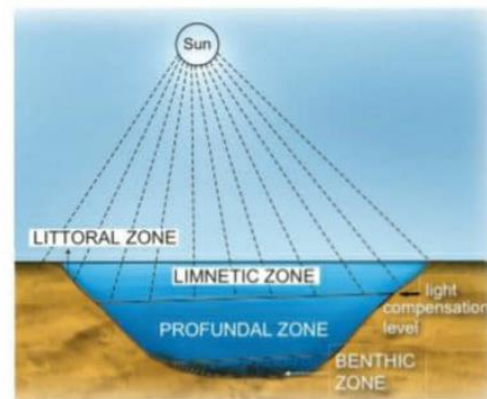
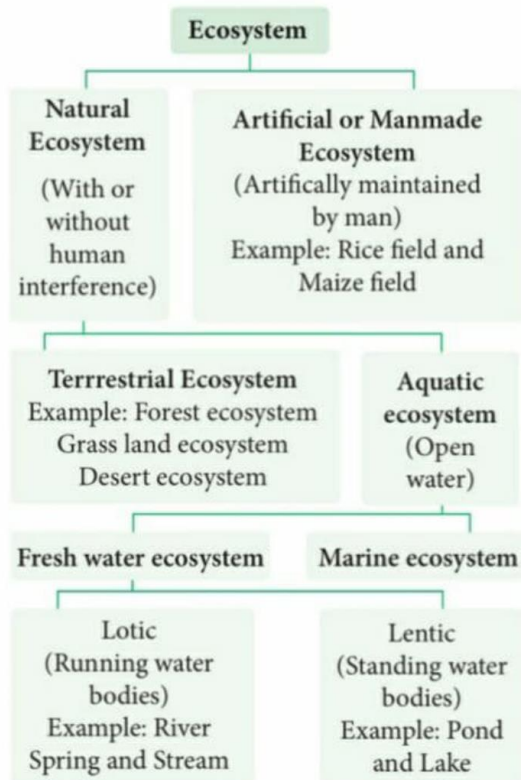


Figure 7.16: Diagrammatic sketch shows stratification of Pond ecosystem

Based on the factors like distance from the shore, penetration of light, depth of water, types of plants and animals, there may be three zones, littoral, limnetic and profundal. The littoral zone, which is closest to the shore with shallow water region, allows easy penetration of light. It is warm and occupied by rooted plant

7.2.10 Types of ecosystem

Biosphere consists of different types of ecosystems, which are as follows:



Structure of Pond ecosystem

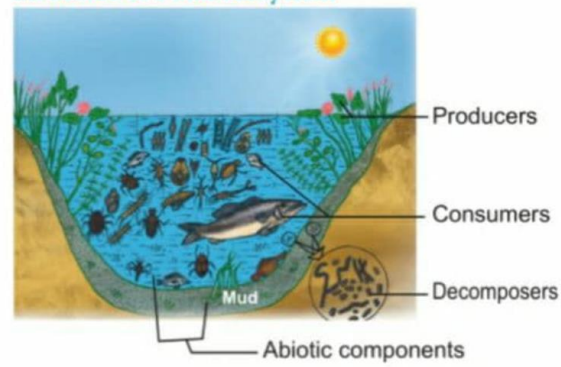


Figure 7.15: Diagram shows structure of pond ecosystem with abiotic and biotic components.

It is a classical example for natural, aquatic, freshwater, lentic type of ecosystem. It helps us to understand the structure and function of an ecosystem. When rain water gathers in a shallow area, gradually over a period of time, different kinds of organisms (microbes, plants, animals) become part of this ecosystem. This pond ecosystem is a self sustaining and self regulatory fresh water ecosystem, which shows a complex interaction between the abiotic and biotic components in it.

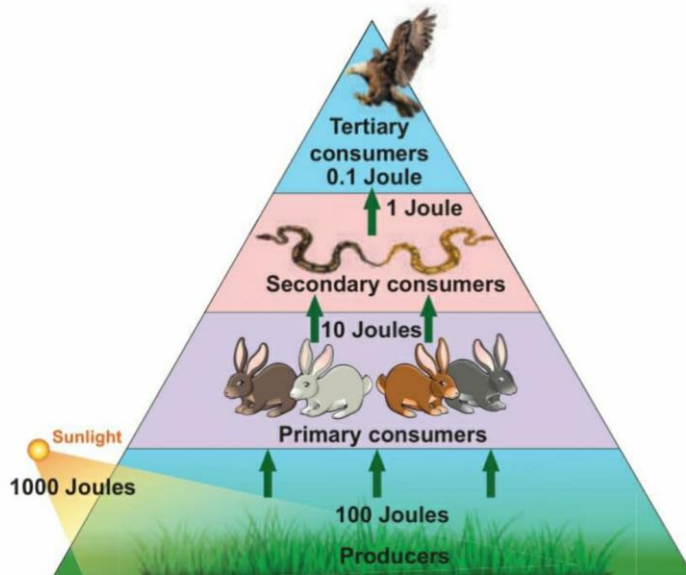
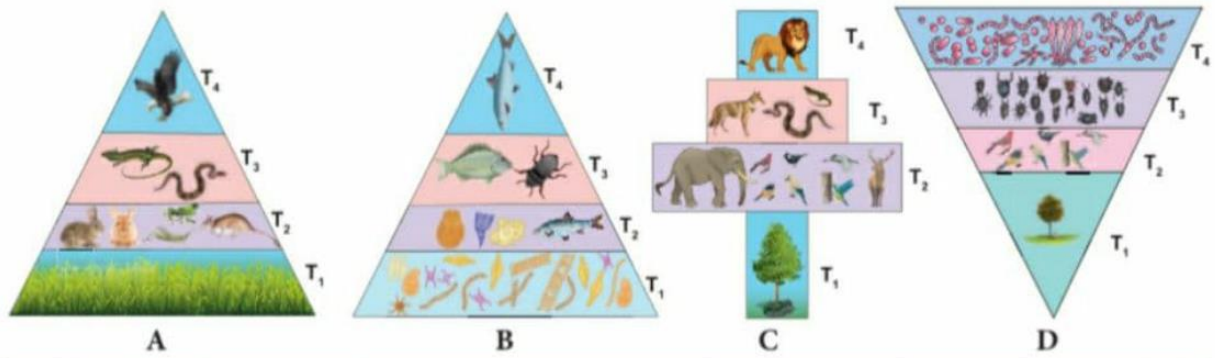


Figure 7.10: Pyramids of energy(Kcal/unit area/unit time) in any ecosystem



T₁ - Producers | T₂ - Herbivores | T₃ - Secondary consumers | T₄ - Tertiary consumers

Figure 7.8: Pyramids of numbers (individuals per unit area) in different types of ecosystems.

Upright-A) Grassland ecosystem B) Pond ecosystem , **Spindle shaped -**C) Forest ecosystem, **Inverted-**D) Parasite ecosystem

starts with a single tree. Therefore there is gradual increase in the number of organisms in successive trophic levels from producer to tertiary consumers.

2 Pyramid of biomass

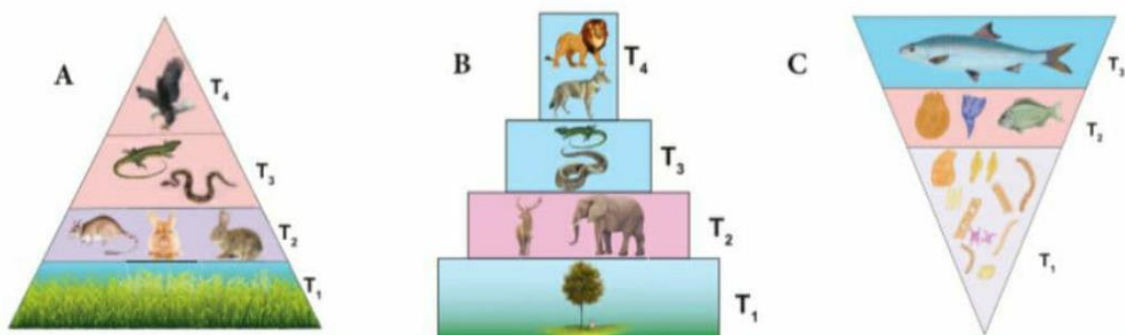
A graphical representation of the amount of organic material (biomass) present at each successive trophic level in an ecosystem is called **pyramid of biomass**.

In **grassland** and **forest ecosystems**, there is a gradual decrease in biomass of organisms at successive trophic levels from producers to top carnivores (Tertiary consumer). Therefore, these two ecosystems show pyramids as **upright** pyramids of biomass.

However, in **pond ecosystem**, the bottom of the pyramid is occupied by the producers, which comprise very small organisms possessing the least biomass and so, the value gradually increases towards the tip of the pyramid. Therefore, the pyramid of biomass is always **inverted** in shape.

3. Pyramid of energy

A graphical representation of energy flow at each successive trophic level in an ecosystem is called **pyramids of energy**. The bottom of the pyramid of energy is occupied by the producers. There is a gradual decrease in energy transfer at successive trophic levels from producers to the upper levels. Therefore, the pyramid of energy is **always upright**.



T₁ - Producers | T₂ - Herbivores | T₃ - Secondary consumers | T₄ - Tertiary consumers

Figure 7.9: Pyramids of biomass (dry weight per unit area)in different types of ecosystems.

Upright-A) Grassland ecosystem B) Forest ecosystem, **Inverted-** C)Pond ecosystem

The transfer of energy from the dead organic matter, is transferred through a series of organisms called detritus consumers (detritivores)- small carnivores - large (top) carnivores with repeated eating and being eaten respectively. This is called the detritus food chain.



Figure 7.6: Diagrammatic representation of Detritus food chain.

7.2.6 Food Web

The inter-locking pattern of a number of food chain form a web like arrangement called **food web**. It is the basic unit of an ecosystem, to maintain its stability in nature. It is called homeostasis.

Example: In a grazing food chain of a grass land, in the absence of a rabbit, a mouse may also eat food grains. The mouse in turn may be eaten directly by a hawk or by a snake and the snake may be directly eaten by hawks.

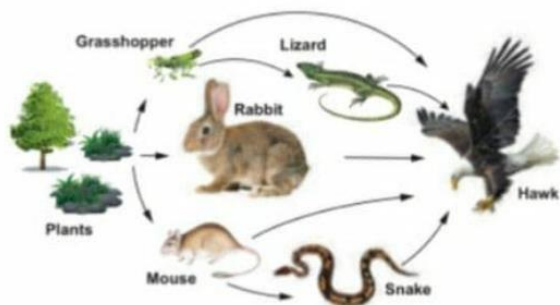


Figure 7.7: Diagrammatic representation of Food web in a grassland ecosystem

Hence, this interlocking pattern of food chains is the food web and the species of an ecosystem may remain balanced to each other by some sort of natural check.

Significance of food web

- Food web is constructed to describe species interaction called direct interaction.

- It can be used to illustrate indirect interactions among different species.
- It can be used to study bottom-up or top-down control of community structure.
- It can be used to reveal different patterns of energy transfer in terrestrial and aquatic ecosystems.

7.2.7 Ecological pyramids

Graphic representation of the trophic structure and function at successive trophic levels of an ecosystem is called **ecological pyramids**. The concept of ecological pyramids was introduced by **Charles Elton (1927)**. Thus they are also called as **Eltonian pyramids**.

There are three types: (1) pyramid of number (2) pyramid of biomass (3) pyramid of energy.

1. Pyramid of number

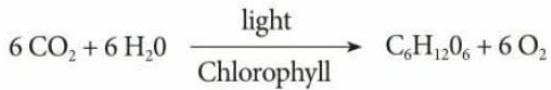
A graphical representation of the number of organisms present at each successive trophic level in an ecosystem is called **pyramids of number**. There are three different shapes of pyramids upright, spindle and inverted.

There is a gradual decrease in the number of organisms in each trophic level from producers to primary consumers and then to secondary consumers, and finally to tertiary consumers. Therefore, pyramids of number in **grassland** and **pond ecosystem** are always **upright**.

In a **forest ecosystem** the pyramid of number is somewhat different in shape, it is because the base (T_1) of the pyramid occupies large sized trees (Producer) which are lesser in number. Herbivores (T_2) (Fruit eating birds, elephant, deer) occupying second trophic level, are more in number than the producers. In final trophic level (T_4), tertiary consumers (lion) are lesser in number than the secondary consumer (T_3) (fox and snake). Therefore, the pyramid of number in forest ecosystem looks **spindle shaped**.

The pyramid of number in a **parasite ecosystem** is always **inverted**, because it

no gain or loss in total energy. Here light energy is converted into chemical energy.



Light energy \longrightarrow chemical energy

ii. Second law of thermodynamics

It states that energy transformation results in the reduction of the free energy of the system. Usually energy transformation cannot be 100% efficient. As energy is transferred from one organism to another in the form of food, a portion of it is stored as energy in living tissue, whereas a large part of energy is dissipated as heat through respiration. The transfer of energy is irreversible natural process. Example: Ten percent law

Ten percent law

This law was proposed by Lindeman (1942). It states that during transfer of food energy from one trophic level to other, only about 10% stored at every level and rest of them (90%) is lost in respiration, decomposition and in the form of heat. Hence, the law is called **ten percent law**.

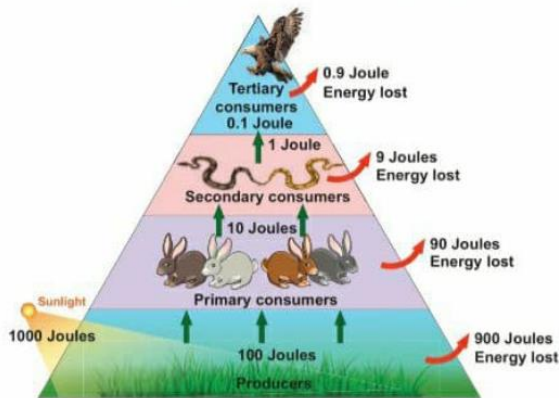


Figure 7.4: Ten percent law

Example: It is shown that of the 1000 Joules of Solar energy trapped by producers. 100 Joules of energy is stored as chemical energy through photosynthesis. The remaining 900 Joules would be lost in the environment. In the next trophic level herbivores, which feed on producers get only 10 Joules of energy and the remaining 90 Joules is lost in the environment. Likewise, in the next trophic level, carnivores, which eat

herbivores store only 1 Joule of energy and the remaining 9 Joules is dissipated. Finally, the carnivores are eaten by tertiary consumers which store only 0.1 Joule of energy and the remaining 0.9 Joule is lost in the environment. Thus, at the successive trophic level, only ten percent energy is stored.

7.2.5 Food chain

The movement of energy from producers upto top carnivores is known as **food chain**, i.e., in any food chain, energy flows from producers to primary consumers, then from primary consumers to secondary consumers, and finally secondary consumers to tertiary consumers. Hence, it shows linear network links. Generally, there are two types of food chain, (1) Grazing food chain and (2) Detritus food chain.

1. Grazing food chain

Main source of energy for the grazing food chain is the **Sun**. It begins with the first link, producers (plants). The second link in the food chain is primary consumers (mouse) which get their food from producers. The third link in the food chain is secondary consumers (snake) which get their food from primary consumers. Fourth link in the food chain is tertiary consumers (eagle) which get their food from secondary consumers.

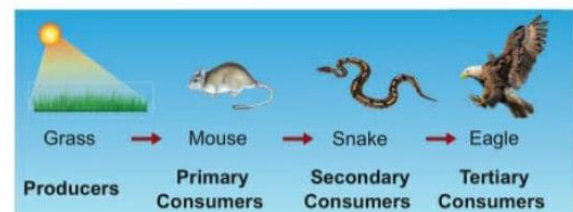


Figure 7.5: Diagrammatic representation of Grazing food chain

2. Detritus food chain:

This type of food chain begins with **dead organic matter** which is an important source of energy. A large amount of organic matter is derived from the dead plants, animals and their excreta. This type of food chain is present in all ecosystems.

Generally, the average world net primary productivities of open ocean and tropical rain forest are the maximum among aquatic and terrestrial ecosystems respectively.

The following graph represents net primary productivity of various ecosystems.

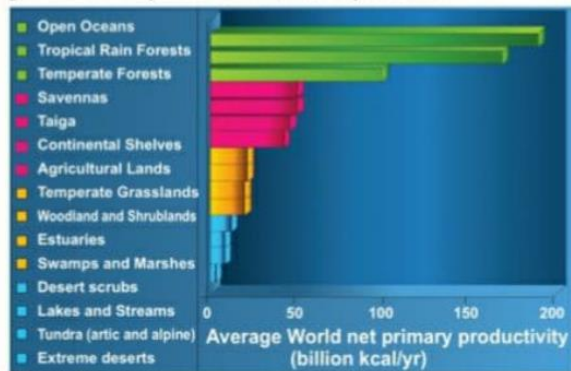


Figure 7.1: Average world net primary production of various ecosystems.

7.2.3 Concept of trophic level in an ecosystem

(Greek word ' trophic ' = to food or feeding)

A trophic level refers to the position of an organism in the food chain. The number of trophic levels is equal to the number of steps in the food chain. The green plants (producers) occupying the first trophic level (T_1) are called **producers**. The energy produced by the producers is utilized by the plant eaters (herbivores) they are called **primary consumers** and occupies the second trophic level (T_2).

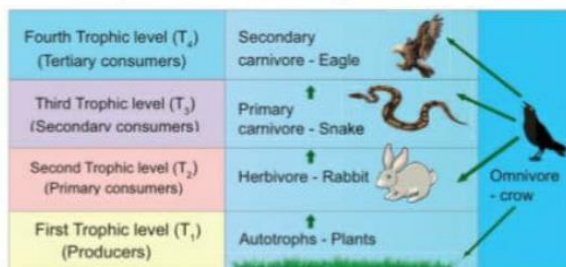


Figure 7.2: Diagrammatic representation of trophic levels

Herbivores are eaten by carnivores, which occupy the third trophic level (T_3). They are also called **secondary consumers** or **primary carnivores**. Carnivores are eaten by the other carnivores, which occupy the fourth trophic level (T_4). They are called the **tertiary consumers** or **secondary**

carnivores. Some organisms which eat both plants and animals are called as **omnivores** (Crow). Such organisms may occupy more than one trophic level in the food chain.

7.2.4 Energy flow

The transfer of energy in an ecosystem between trophic levels can be termed as energy flow. It is the key function in an ecosystem. Part of the energy obtained from the sun by producer is transferred to consumers and decomposers through the each trophic level, while some amount of energy is dissipated in the form of heat. Energy flow is always unidirectional in an ecosystem.

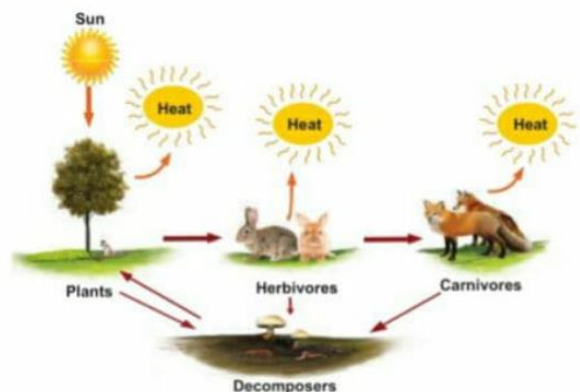


Figure 7.3: Diagrammatic representation of energy flow

Laws of thermodynamics

The storage and loss of energy in an ecosystem is based on two basic laws of thermo-dynamics.

i. First law of thermodynamics

It states that energy can be transmitted from one system to another in various forms. Energy cannot be destroyed or created. But it can be transformed from one form to another. As a result, the quantity of energy present in the universe is constant.

Example:

In photosynthesis, the product of starch (chemical energy) is formed by the combination of reactants (chlorophyll, H_2O , CO_2). The energy stored in starch is acquired from the external sources (light energy) and so there is

7.3.6 Significance of Plant Succession

- Succession is a dynamic process. Hence an ecologist can access and study the seral stages of a plant community found in a particular area.
- The knowledge of ecological succession helps to understand the controlled growth of one or more species in a forest.
- Utilizing the knowledge of succession, even dams can be protected by preventing siltation.
- It gives information about the techniques to be used during reforestation and afforestation.
- It helps in the maintenance of pastures.
- Plant succession helps to maintain species diversity in an ecosystem.
- Patterns of diversity during succession are influenced by resource availability and disturbance by various factors.
- Primary succession involves the colonization of habitat of an area devoid of life.
- Secondary succession involves the reestablishment of a plant community in disturbed area or habitat.
 - Forests and vegetation that we come across all over the world are the result of plant succession.