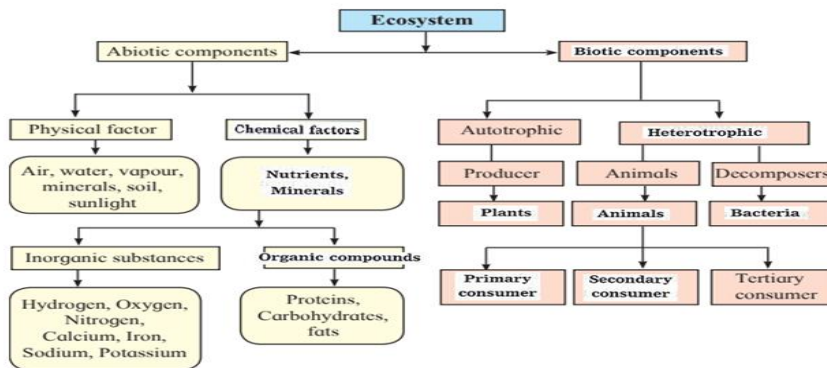


1. Write the definition of ecosystem?

Ans: The term "ecosystem" was first used in 1935 in a publication by British ecologist [Arthur Tansley](#). An ecosystem is a community of plants and animals interacting with each other in a given area, and also with their non-living environments. The non-living environments include weather, [earth](#), sun, soil, [climate](#) and atmosphere.

"An ecosystem is a community of living organisms in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows".

2. Briefly discuss the components of ecosystem?



Components of the Ecosystem

The ecosystem has two components associated with it mentioned below:

1. Abiotic component
2. Biotic component

Abiotic Component

This basically involves inorganic minerals, calcium, phosphorus & iron. It also includes soil, water, land & solar radiation. It is further divided into climatic factors and edaphic factors which include rain, light, temperature, and wind, soil, pH, minerals, and topography.

Biotic Component

The biotic component consists of all the living organisms in the ecosystem. It can be classified as Autotrophic organisms that produce their own food and heterotrophic organisms which depend on other organisms for food. This classification is based on nutritional requirements of the organism.

- **Producers:** These are the organisms in the ecosystem that generate the food and energy with the help of sunlight, oxygen, and all other abiotic components. The main producers of the ecosystem are the plants.
- **Consumers:** These are the organisms that take their nutrition from the food that is made by the producers.

- **Primary Consumers:** These organisms feed directly from the producers. They are herbivorous animals like deer, rabbit, cow, buffalo, and giraffes.
- **Secondary Consumers:** These organisms feed on the primary consumers for their nutrition. These are carnivorous and omnivorous animals like crows, dogs, cats, snakes.
- **Tertiary Consumers:** These organisms feed on secondary consumers. These are only carnivores where they only consume meat usually by preying on prey. Eg., lion, tiger, cheetah
- **Quaternary Consumers:** These organisms feed on the tertiary consumers for their nutrition. Eg; Eagle, which consumes a snake that consumes a frog that consumes a fly.

Decomposers

These organisms break down dead matter and gain their nutrition, and the decomposed material returns back to the land, which will again be utilized by the producers to produce more food.

Functions of Ecosystem:

The functions of the ecosystem are as follows:

1. It regulates the essential ecological processes, supports life systems and renders stability.
2. It is also responsible for the cycling of nutrients between biotic and abiotic components.
3. It maintains a balance among the various trophic levels in the ecosystem.
4. It cycles the minerals through the biosphere.
5. The abiotic components help in the synthesis of organic components that involve the exchange of energy.

So the functional units of an ecosystem or functional components that work together in an ecosystem are:

- **Productivity** – It refers to the rate of biomass production.
- **Energy flow** – It is the sequential process through which energy flows from one trophic level to another. The energy captured from the sun flows from producers to consumers and then to decomposers and finally back to the environment.
- **Decomposition** – It is the process of breakdown of dead organic material. The top-soil is the major site for decomposition.
- **Nutrient cycling** – In an ecosystem nutrients are consumed and recycled back in various forms for the utilisation by various organisms.

Types of Ecosystem:

An ecosystem can be as small as an oasis in a desert, or as big as an ocean, spanning thousands of miles. There are two types of ecosystem:

- Terrestrial Ecosystem
- Aquatic Ecosystem

Terrestrial Ecosystem:

Terrestrial ecosystems are exclusively land-based ecosystems. There are different types of terrestrial ecosystems distributed around various geological zones. They are as follows:

1. Forest Ecosystem

2. Grassland Ecosystem
3. Tundra Ecosystem
4. Desert Ecosystem

Forest Ecosystem

A forest ecosystem consists of several plants, particularly trees, animals and microorganisms that live in coordination with the abiotic factors of the environment. Forests help in maintaining the temperature of the earth and are the major carbon sink.

Grassland Ecosystem

In a grassland ecosystem, the vegetation is dominated by grasses and herbs. Temperate grasslands and tropical or savanna grasslands are examples of grassland ecosystems.

Tundra Ecosystem

Tundra ecosystems are devoid of trees and are found in cold climates or where rainfall is scarce. These are covered with snow for most of the year. Tundra type of ecosystem is found in the Arctic or mountain tops.

Desert Ecosystem

Deserts are found throughout the world. These are regions with little rainfall and scarce vegetation. The days are hot, and the nights are cold.

Aquatic Ecosystem:

Aquatic ecosystems are ecosystems present in a body of water. These can be further divided into two types, namely:

1. Freshwater Ecosystem
2. Marine Ecosystem

Freshwater Ecosystem

The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams and wetlands. These have no salt content in contrast with the marine ecosystem.

Marine Ecosystem

The marine ecosystem includes seas and oceans. These have a more substantial salt content and greater biodiversity in comparison to the freshwater ecosystem.

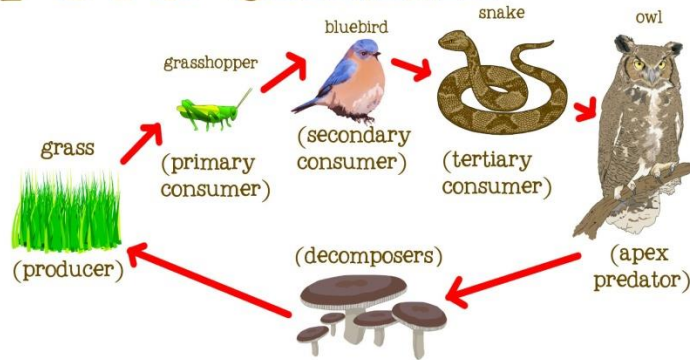
Food Chain

A food chain explains which organism eats another organism in the environment. The food chain is a linear sequence of organisms where nutrients and energy is transferred from one organism to the other. This occurs when one organism consumes another organism. It begins with the producer organism, follows the chain and ends with the decomposer organism. After understanding the food chain, we realise how one organism is dependent upon another organism for survive.

A food chain refers to the order of events in an ecosystem, where one living organism eats another organism, and later that organism is consumed by another larger organism. The flow of nutrients and energy from one organism to another at different trophic levels forms a food chain.

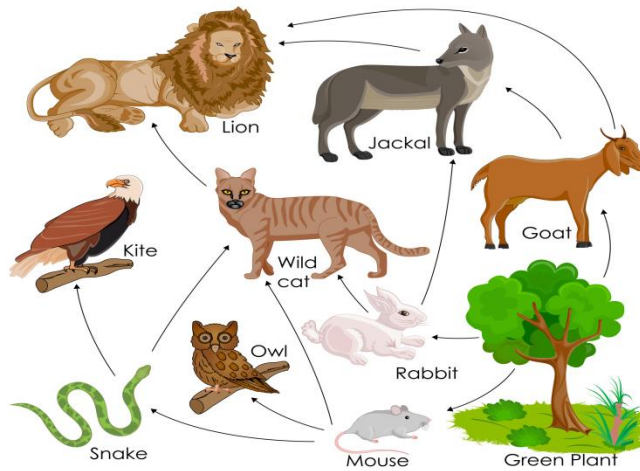
The food chain also explains the feeding pattern or relationship between living organisms. Trophic level refers to the sequential stages in a food chain, starting with producers at the bottom, followed by primary, secondary and tertiary consumers. Every level in a food chain is known as a trophic level.

Food Chains



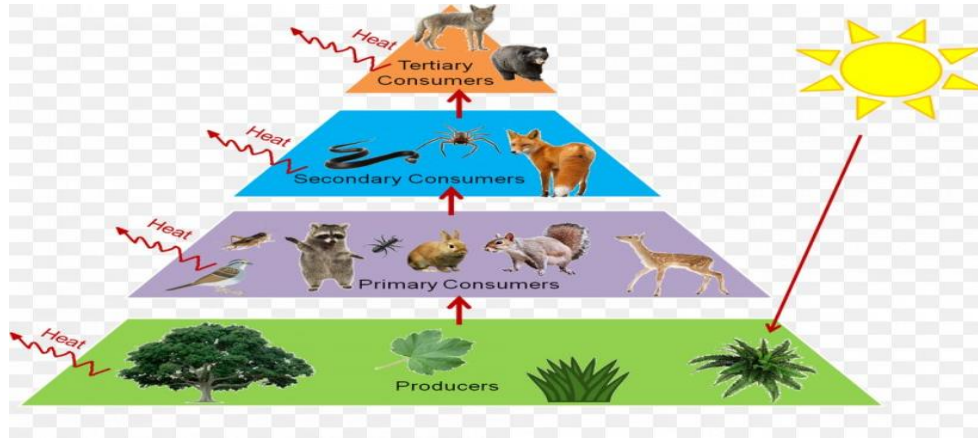
Food Web:

Several interconnected food chains form a food web. A food web is similar to a food chain but the food web is comparatively larger than a food chain. Occasionally, a single organism is consumed by many predators or it consumes several other organisms. Due to this, many trophic levels get interconnected. The food chain fails to showcase the flow of energy in the right way. But, the food web is able to show the proper representation of energy flow, as it displays the interactions between different organisms.



Ecological Pyramid

An ecological pyramid is a graphical representation of the relationship between different organisms in an *ecosystem*. Each of the bars that make up the pyramid represents a different *trophic level*, and their order, which is based on who eats whom, represents the flow of energy. Energy moves up the pyramid, starting with the *primary producers*, or *autotrophs*, such as plants and algae at the very bottom, followed by the *primary consumers*, which feed on these plants, then *secondary consumers*, which feed on the primary consumers, and so on. The height of the bars should all be the same, but the width of each bar is based on the quantity of the aspect being measured.



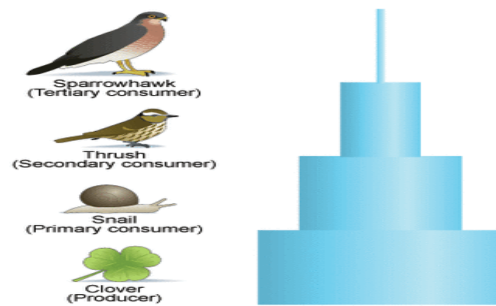
Types :

- Pyramids of numbers
- Pyramids of biomass
- Pyramids of energy

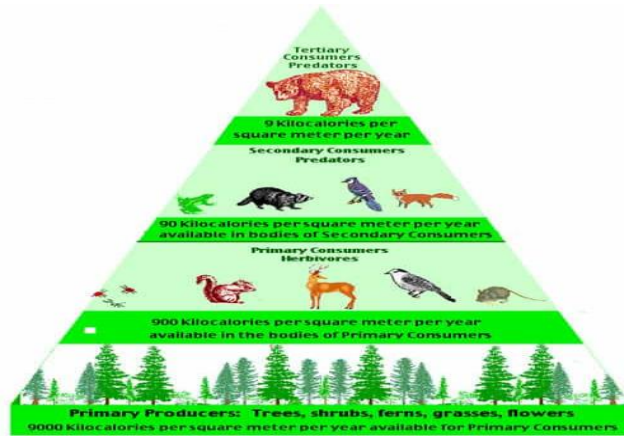
Pyramids of numbers: A pyramid of numbers shows the *relative number of organisms at each stage of a food chain*.

Example 1: clover → snail → thrush → hawk

Clover is a plant and it is the producer in this food chain. Its bar goes at the bottom of the pyramid:



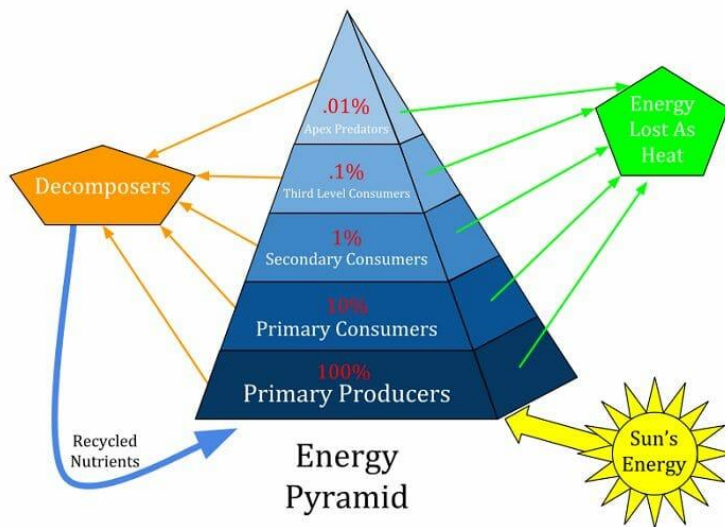
Pyramids of biomass: A pyramid of biomass is a graphical representation of biomass present in a unit area of various trophic levels. It shows the relationship between biomass and trophic level quantifying the biomass available in each trophic level of an energy community at a given time.



Pyramids of energy:

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.

The width of each bar represents the units of energy available within each trophic level; the height is always the same. The flow of energy moves through the layers of the energy pyramid from the bottom-up, and is gradually reduced as energy is used up by the organisms at each level



Discuss the different stages of energy flow :

The energy flow of the ecosystem occurs in three steps. Such as

- Absorption of energy.
- Use of energy.
- Transference of energy.

1. Absorption or source of energy

The sun is the main source of energy in the ecosystem. About 30% of the sunlight is radiated from the sun to the earth. Only 0.02% of it is bound as potential energy in the body of the green plant. Green plants convert solar energy (0.02%) into potential energy with the help of chlorophyll and in the presence of sunlight.

The amount of energy stored in the food produced during photosynthesis is called gross primary production or GPP. From this gross primary production, the green plant uses some amount of energy for its own needs. The amount of energy that remains after the use of green plants for their own needs is called net primary production or NPP. Energy is transferred from the producer level to the consumer level of the food chain for gross primary production.

2. Use of energy

Only the primary consumer accepts the gross primary production energy of green plants or producers. Thus the energy (GPP) of the primary consumer is absorbed by the secondary consumer and the energy (GPP) of the secondary consumer is confined to the tertiary consumer. This process involves the use of energy between various types of consumers from the producer. The transfer of energy from the ecosystem never happens completely. Most of the energy that an organism absorbs is used to produce body heat and for various physiological functions.

3. Transference of energy

From the gross primary production, some energy comes out of the organism in the form of excretory substances. The remaining energy is then periodically transferred from the producer to the various consumers in the ecosystem. This type of energy transfer can be observed in the food chain of any type of ecosystem

Laws of energy exchange in energy flow

In order to maintain the ecological balance in the environment, the laws of thermodynamics must be followed. The energy flow of the ecosystem is actually controlled by thermodynamic formulas. The formulas for thermodynamics are

1. First laws

The first law of thermodynamics states that energy is transformed but that energy cannot be created or destroyed.

For example, green plants convert solar energy into potential energy by making food with the help of sunlight in the process of photosynthesis. This energy then flows through the ecosystem and is stored in the animal body or exits the ecosystem .

2. Second laws

The second law of thermodynamics states that heat energy is lost during the transfer of energy from one level to another in an ecosystem. The flow of this energy stops after it has flowed up to a certain level.

There is no 100% conversion of energy in the food pyramid. There is always some amount of energy loss. *In 1942, scientist Raymond Lindeman explained this feature of the energy flow of the ecosystem by his famous 10% law. He said that as the trophic level rises, its supply decreases with the transfer of energy. And 10% of the energy in the food chain is used to build the body at every level.*

For example, if a rabbit eats 1000 gm of green plants, then 100 gm of that food is used for its various physiological functions and body heat production. If a hawk eats that rabbit as food, only 10 gm of energy is transferred to the hawk's body, according to Lindeman's 10% law.