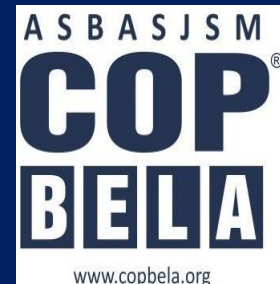




**Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial**  
**COLLEGE OF PHARMACY**  
**(An Autonomous College)**  
**BELA (Ropar) Punjab**



Name of Unit	Ecosystem
Subject Name	Environmental Science
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**Learning Outcomes Module 03**

<b>LO</b>	<b>Learning Outcome (LO)</b>	<b>Course Outcome Code</b>
LO1	To learn about various concepts of environment.	BP206T.2
LO2	To learn about various components of ecosystem.	BP206T.2
LO3	To learn about concept of food chain and food	BP206T.2
LO4	To learn about various ecological concepts.	BP206T.2

**Content Table**

<b>Topic</b>
<ul style="list-style-type: none"><li>• Concepts of environment</li><li>• Introduction to Ecosystem</li><li>• Various components of ecosystem</li><li>• Food chain and food web</li><li>• Ecological concepts</li></ul>

## ECOSYSTEM

### What is an Ecosystem?

The ecosystem is the structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. In other words, an ecosystem is a chain of interaction between organisms and their environment. The term “Ecosystem” was first coined by A.G.Tansley, an English botanist, in 1935.

### 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

#### 1. Terrestrial Ecosystems

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 Ecosystems
- 2) Grassland Ecosystems
- 3) Tundra Ecosystems
- 4) Desert Ecosystem

#### *Forest Ecosystem*

A forest ecosystem consists of several plants, 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, savanna grasslands are some of the 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. The ecosystem in the Arctic or mountain tops is tundra type.

## ***Desert Ecosystem***

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

## **2. 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.

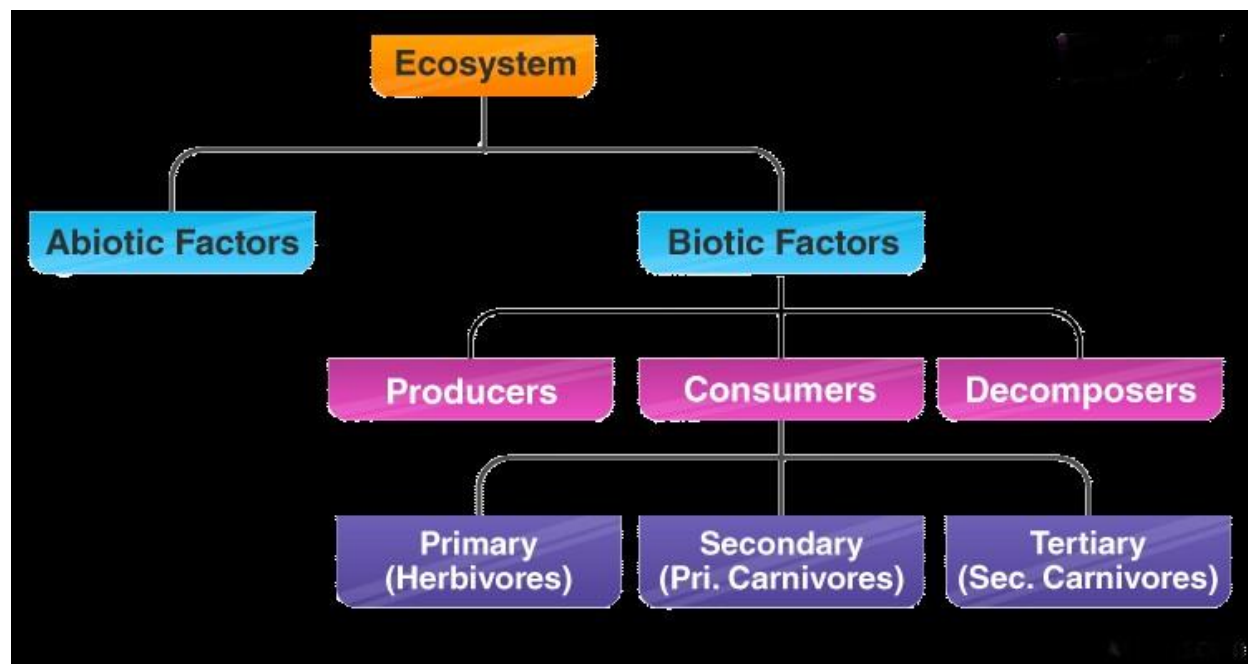
## **Structure of the Ecosystem**

The structure of an ecosystem is characterized by the organization of both biotic and abiotic components. This includes the distribution of energy in our environment. It also includes the climatic conditions prevailing in that particular environment.

The structure of an ecosystem can be split into two main components, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interrelated in an ecosystem. It is an open system where the energy and components can flow throughout the boundaries.



## Biotic Components

Biotic components refer to all life in an ecosystem. Based on nutrition, biotic components can be categorized into autotrophs, heterotrophs and saprotrophs (or decomposers).

🌱 **Producers** include all autotrophs such as plants. They are called autotrophs as they can produce food through the process of photosynthesis. Consequently, all other organisms higher up on the food chain rely on producers for food.

🌱 **Consumers** or heterotrophs are organisms that depend on other organisms for food. Consumers are further classified into primary consumers, secondary consumers and tertiary consumers.

✚ **Primary consumers** are always herbivores that they rely on producers for food.

✚ **Secondary consumers** depend on primary consumers for energy. They can either be a carnivore or an omnivore.

✚ **Tertiary consumers** are organisms that depend on secondary consumers for food. Tertiary consumers can also be an omnivore.

✚ **Quaternary consumers** are present in some food chains. These organisms prey on tertiary consumers for energy. Furthermore, they are usually at the top of a food chain as they have no natural predators.

🍄 **Decomposers** include saprophytes such as fungi and bacteria. They directly thrive on the dead and decaying organic matter. Decomposers are essential for the ecosystem as they help in recycling nutrients to be reused by plants.

## Abiotic Components

Abiotic components are the non-living component of an ecosystem. It includes air, water, soil, minerals, sunlight, temperature, nutrients, wind, altitude, turbidity, etc.

## Functions of Ecosystem

The functions of the ecosystem are as follows:

- i. It regulates the essential ecological processes, supports life systems and renders stability.
- ii. It is also responsible for the cycling of nutrients between biotic and abiotic components.
- iii. It maintains a balance among the various trophic levels in the ecosystem.
- iv. It cycles the minerals through the biosphere.
- v. The abiotic components help in the synthesis of organic components that involves the exchange of energy.
- vi.

## Important Ecological Concepts

**Food Chain** The sun is the ultimate source of energy on earth. It provides the energy required for all plant life. The plants utilize this energy for the process of photosynthesis, which is used to synthesize their food.

During this biological process, light energy is converted into chemical energy and is passed on through successive levels. The flow of energy from a producer, to a consumer and eventually, to an apex predator or a detritivore is called the food chain.

Dead and decaying matter, along with organic debris, is broken down into its constituents by

scavengers. The reducers then absorb these constituents. After gaining the energy, the reducers liberate molecules to the environment, which can be utilized again by the producers.



## 2. Ecological Pyramids

An ecological pyramid is the graphical representation of the number, energy, and biomass of the successive trophic levels of an ecosystem. Charles Elton was the first ecologist to describe the ecological pyramid and its principals in 1927.

The biomass, number, and energy of organisms ranging from the producer level to the consumer level are represented in the form of a pyramid; hence, it is known as the ecological pyramid.

The base of the ecological pyramid comprises the producers, followed by primary and secondary consumers. The tertiary consumers hold the apex. In some food chains, the quaternary consumers are at the very apex of the food chain.

The producers generally outnumber the primary consumers and similarly, the primary consumers outnumber the secondary consumers. And lastly, apex predators also follow the same trend as the other consumers; wherein, their numbers are considerably lower than the secondary consumers.

For example, Grasshoppers feed on crops such as cotton and wheat, which are plentiful. These grasshoppers are then preyed upon by common mice, which are comparatively less in number. The mice are preyed upon by snakes such as cobras. Snakes are ultimately preyed on by apex predators such as the brown snake eagle.

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GRASSHOPPER → MICE → COBRA → BROWN SNAKE EAGLE

### 3. Food Web

Food web is a network of interconnected food chains. It comprises all the food chains within a single ecosystem. It helps in understanding that plants lay the foundation of all the food chains. In a marine environment, phytoplankton forms the primary producer.

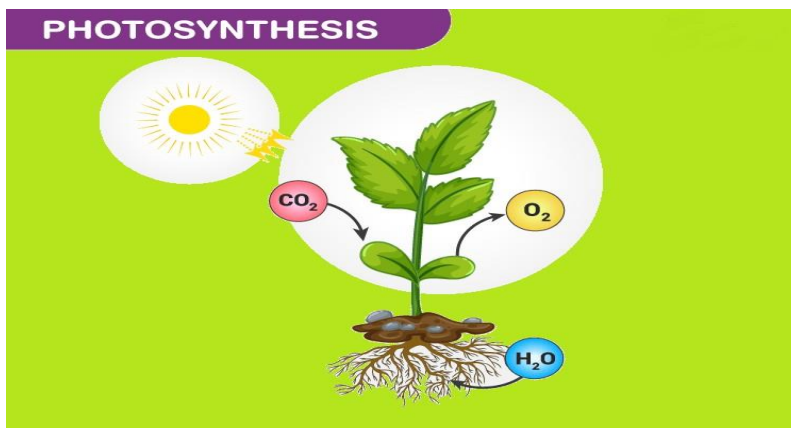
### Energy Flow

The chemical energy of food is the main source of energy required by all living organisms. This energy is transmitted to different trophic levels along the food chain. This energy flow is based on two different laws of thermodynamics:

- ✚ First law of thermodynamics, that states that energy can neither be created nor destroyed, it can only change from one form to another.
- ✚ Second law of thermodynamics, that states that as energy is transferred more and more of it is wasted.

### Energy Flow in Ecosystem

The energy flow in the ecosystem is one of the major factors that support the survival of such a great number of organisms. For almost all organisms on earth, the primary source of energy is solar energy. It is amusing to find that we receive less than 50 per cent of the sun's effective radiation on earth. When we say effective radiation, we mean the radiation, which can be used by plants to carry out photosynthesis.



Most of the sun's radiation that falls on the earth is usually reflected back into space by the earth's atmosphere. This effective radiation is termed as the Photosynthetically Active Radiation



(PAR).

Overall, we receive about 40 to 50 percent of the energy having Photosynthetically Active Radiation and only around 2-10 percent of it is used by plants for the process of photosynthesis. Thus, this percent of PAR supports the entire world as plants are the producers in the ecosystem and all the other organisms are either directly or indirectly dependent on them for their survival.

The energy flow takes place via the food chain and food web. During the process of energy flow in the ecosystem, plants being the producers absorb sunlight with the help of the chloroplasts and a part of it is transformed into chemical energy in the process of photosynthesis.

This energy is stored in various organic products in the plants and passed on to the primary consumers in the food chain when the herbivores consume (primary consumers) the plants as food. Then conversion of chemical energy stored in plant products into kinetic energy occurs, degradation of energy will occur through its conversion into heat.

Then followed by the secondary consumers. When these herbivores are ingested by carnivores of the first order (secondary consumers) further degradation will occur. Finally, when tertiary consumers consume the carnivores, energy will again be degraded. Thus, the energy flow is unidirectional in nature.

Moreover, in a food chain, the energy flow follows the 10 percent law. According to this law, only 10 percent of energy is transferred from one trophic level to the other; rest is lost into the atmosphere. This is clearly explained in the following figure and is represented as an energy pyramid.

## **Trophic level**

The producers and consumers in the ecosystem can be arranged into different feeding groups and are known as trophic level or the feeding level.

- 1) The producers (plants) represent the first trophic level.
- 2) Herbivores (primary consumers) present the second trophic level.
- 3) Primary carnivores (secondary consumers) represent the third trophic level
- 4) Top carnivores (tertiary consumers) represent the last level.

**Very short answer questions (2 marks)**

1. What is the ecosystem?
2. What is food web?
3. What is grassland ecosystem?
4. Write the two components of ecosystem.
5. What is the role of producer in ecosystem?

**Short answer questions (5 marks)**

1. What are the different types of ecosystems?
2. Which ecosystem do we live in?

**Long answer questions (10 marks)**

1. What is the structure of the ecosystem? Explain in detail.
2. What is forest ecosystem? Explain its importance.