

OUR ENVIRONMENT

KEY POINTS

"Everything which surrounds and influences the organism directly or indirectly is included in the environment."

- The environment is the sum total of all living and non-living factors that surround and influence an organism.

Biotic components

The biotic components include all kinds of living organisms with which the organism interacts (all animals, plants, micro-organisms).

Abiotic components

The abiotic components are the physical factors such as climatic factors.
(e.g. Air, Water, Temperature, Humidity, Light, Wind, Precipitation etc.).

NOTE

- Ecology is the study of interrelationships of organisms between the biotic and abiotic components of their environment.
- The **Ecology** term was coined by **Ernst Haeckel (1868)**.

Ecosystem

- Ecosystem is the basic unit of ecology and the biotic and abiotic components present in it influence each other.
- Both the components are essential for the sustenance of life.
- Ecosystem term was given by Arthur Tansley.
- Ecosystem is the structural and functional unit of biosphere.
- It is an open system with respect to energy and depend on sunlight which is the ultimate source of energy to biosphere.

- Types of ecosystem in the biosphere, ecosystem may be classified on the basis of their nature, duration and size.

Natural ecosystem

1

These ecosystem operate in the nature by themselves without any human interference. Common examples of natural ecosystem are a pond, a lake, a meadow, a desert, a grassland, a forest and an ocean, etc.

Artificial ecosystem

2

These are maintained by man and hence, are also termed as man-made ecosystem. Common examples are croplands, orchards, gardens, aquarium etc.

NOTE

On the basis of size, ecosystem may be classified as .

- (1) Small ecosystem (flowerpot, water in a dish).
- (2) Large ecosystem (forest, desert, ocean).

Components of Ecosystem

- The various components of an ecosystem may be grouped into two main types.

Abiotic (non-living)
components

01

Inorganic
Substance

02

Physical
Environment

03

Climatic
Factors

NOTE

On the basis of duration, ecosystem may be classified as:

- (1) Temporary ecosystem (short lived ecosystem, rainfed pond).
- (2) Permanent ecosystem (a lake, a forest, a desert).



(Biotic (living) components)

Producers : Those organisms which can prepare their own food from simple inorganic substances like carbon dioxide and water by using sunlight in the presence of chlorophyll, e.g., Green plants and certain blue green algae.



Consumers : These organisms which consume food or eat food prepared by producers are called consumers. The consumers depends on producers for food, directly or indirectly. All the animals are consumers.



Herbivores (primary consumers)

These animals which eat only plants are called herbivores, e.g., Buffalo, goat, sheep, horse, deer, etc.

Carnivores (secondary consumers)

These animals which eat only other animals as food are called carnivores e.g., Lion, tiger, frog, vulture, etc.

Omnivores

Those animals which eat both plants and animals are called omnivores e.g., Man, dog, crow, sparrow, bear etc.

Consumers

Decomposers : The micro-organisms which break down the complex organic compounds present in dead organisms like dead plants and animals and their products like faeces, urine into simpler substances are called decomposers, e.g., Bacteria and fungi.



Importance of decomposers

- Acts as cleaning agents of the environment.
- Help in recycling the material in biosphere thus, play a vital role in biogeochemical or nutrient cycles.
- Maintain the fertility of soil.
- If there were no decomposers, the earth would have been a heap of dead organisms.



Food Chain

- It is a sequence of organisms through which energy is transferred in the form of food by the process of one organism consuming the other.

Grass (Producer) → Deer (Herbivore) → Lion (Carnivore)



Maize

(producer)



Locust

(primary consumer)



Lizard

(secondary consumer)



Snake

(tertiary consumer)

- As the food chain goes on, the energy transferred to the next organism decreases.

NOTE

In a food chain, there is unidirectional flow of energy from sun to producers and subsequently to series of different types of consumers.

Trophic levels:

- The distinct sequential steps in the food chain where transfer of energy occurs are referred to as trophic levels.
- Plants → Men (Two trophic levels)
- Plants → Goat → Men (Three trophic levels)
- Plants → Mice → Snakes → Peacocks (Four trophic levels)
- Plants → Insects → Frogs → Snakes → Eagles (Five trophic levels)
- Plants → Grasshoppers → Frogs → Snakes → Hawks (Five trophic levels)

Characteristics of food chain

- Involves nutritive interaction.
- Proceeds in progressive in straight line.
- Usually there are 3-4 trophic levels.
- Omnivores occupy different positions.
- 80-90% energy is lost as heat at each trophic level.
- Unidirectional flow of energy.

Types of food chains

Grazing food chains

Grazing type food chains

Type of Ecosystem	Producers	Herbivores	Primary Carnivores	Secondary carnivores	Tertiary carnivores
1. Grassland ecosystem	Grass	Insects (Grasshopper), Rats and mice, Rabbits	Frog, Snakes, Foxes	Snakes, Predatory birds, Wolves	Predatory birds, Lions
2. Pond ecosystem	Phyto-planktons	Zooplanktons	Small fish	Large fish	Predatory birds

Detritus food chain

Detritus food chain

Detritus	Detritivores	Detritivores consumers	Small carnivores	Large carnivores
Fallen leaves and dead bodies of animals	Fungi, Bacteria and Protozoans	Insects, larvae, certain crustaceans and molluscs	Minnows, small game fish, etc.	Large fish, fish-eating birds

- Detritivores are heterotrophs that obtain nutrients by consuming detritus (decomposing plant and animal parts as well as faeces) e.g., invertebrates like earthworm, insects such as mites, beetles, butterflies.
- Kites and vultures feed on dead organisms and therefore, they act as scavengers.
- There are generally a greater number of individuals at the lower trophic levels of an ecosystem, the greatest number is of the producers.

Significance of food chains

- The significance of food chains can be seen with the help of following functions: -
 - It is a means of transfer of energy from one trophic level to another.
 - It provides information about the living components of an ecosystem.
 - A natural method of population control due to different nutritional habits.
 - It enables recycling of resources via decomposition.

Food Web

- The inter-connected food chains operating in an ecosystem which establish a network of feeding relationships between various species is called a food web.
- A food web provides alternative pathways of food availability.
- Unlike food chains, food webs are never straight.



Difference between Food Chain and Food Web

S.N.	Food Chain	Food web
1.	The sequence of eating and being eaten among the living organisms to transfer food energy is called food chain.	It is a system of interconnected food chains. The networks of food chains develop a relationship between various organisms.
2.	It is having 4-5 populations (trophic levels) of different species.	It is having numerous populations of different species.
3.	It is a part of food web.	It contains many food-chains.
4.	Food chains do not help in increasing population of endangered species.	Food web helps in increasing the population of endangered species.

NOTE

In an ecosystem, generally the producers are maximum in number. As we move along the chain, the number of individuals at each trophic level decreases.

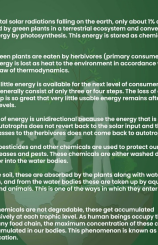
Transfer of energy in ecosystem

Ten Percent law

- It was put forth by Lindeman (1943).
- Also termed as second law of thermodynamics or law of entropy.
- According to this law, transfer of energy from one trophic level to other trophic level is never 100 percent.
- It is so because most of energy gets lost as heat in the environment during each transfer. On an average, about 10% of energy is actually available to the next trophic level.

Flow (Transfer) of energy in an ecosystem

- The ultimate source of entire energy, used by living organisms, is the Sun.
- In a community, each food chain represents stepwise transfer of food (energy).

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- Of the total solar radiations falling on the earth, only about 1% are captured by green plants in a terrestrial ecosystem and converted into food energy by photosynthesis. This energy is stored as chemical energy of food.
 - When green plants are eaten by herbivores (primary consumers), a great energy is lost as heat to the environment in accordance with the second law of thermodynamics.
 - Since so little energy is available for the next level of consumers, food chains generally consist of only three or four steps. The loss of energy at each step is so great that very little usable energy remains after four trophic levels.
 - The flow of energy is unidirectional because the energy that is captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to autotrophs.
 - Several pesticides and other chemicals are used to protect our crops from diseases and pests. These chemicals are either washed down into the soil or into the water bodies.
 - From the soil, these are absorbed by the plants along with water and minerals, and from the water bodies these are taken up by aquatic plants and animals. This is one of the ways in which they enter the food chain.
 - These chemicals are not degradable, these get accumulated progressively at each trophic level. As human beings occupy the top level in any food chain, the maximum concentration of these chemicals get accumulated in our bodies. This phenomenon is known as biological magnification.
 - The food grains such as wheat and rice, vegetables and fruits, and even meat, contain varying amounts of pesticide residues. They cannot always be removed by washing or other means.
 - The phenomenon that involves progressive increase in concentration of harmful non-biodegradable chemical at different trophic levels in a food chain is called biomagnification.

NOTE

Biodegradable waste can also be used in biogas plants to generate biogas and manure. Biogas is a cheap source of fuel, and manure, a cheap fertilizer.



How do our activities affect the environment?

There are two major environmental problems:

- (a) Solid waste and their disposal
- (b) Depletion of ozone layer.

Solid waste and their disposal

- ➔ Solid waste generally comes from residences, cattle sheds, industries, agricultural fields and many other places.
- ➔ There are two types of solid wastes:

S.N.	Biodegradable waste	Non-biodegradable waste
1	They can be broken down into simpler substances by the activity of biological catalysts called enzymes (present in microorganisms like bacteria or other saprophytes). Physical processes like heat and temperature help in the functioning of enzymes.	They can't be broken down into simpler and harmless products because the biological catalysts called enzymes can't act upon them. They can be acted upon only by some physical processes like heat and pressure.
2	They can enter the biogeochemical cycles.	They cannot enter the biogeochemical cycles.
3	They become pollutants only when they accumulate in large quantities and not degraded at the right time.	They always act as pollutants whether present in small or large quantity.
4	All the biodegradable wastes should be treated properly before discharging them into water or soil.	Should not be discharged into water or soil. Instead, they can be either recycled or reused.
5	They do not persist in the environment for a long time.	They persist in the environment for a long time.
6	Examples: Urine and faecal matter, Sewage, Paper, vegetable and fruit peels, Agricultural residues, Wood and Cloth.	Examples: Heavy metals like Mercury, Lead, Arsenic, Radioactive wastes like Uranium, Plutonium, Insecticides and Pesticides like DDT and BHC.

NOTE

- The use of a lot of clay for making millions of kulhads daily led to the loss of fertile top soil from fields. So, the practice of using kulhads has been discontinued.

Modes of waste disposal

- Some prominent methods of waste disposal are:

Land fills

- In urban areas, majority of the solid wastes are buried in low lying areas to level the uneven surface of land. This method of waste disposal is commonly called land fills.

Recycling of wastes

- Number of solid wastes can be recycled by sending them to respective recycling units.
- Paper is sent for recycling into special paper mills; broken plastic (e.g., plastic bags, buckets, bowls, dishes, mugs, discs, etc.) are sent to plastic processing factories.

Preparation of compost

- Kitchen waste can be converted into compost and used as manure.

Incineration

- It is the process of burning of substances at high temperature (usually more than 1000°C) and ultimately converting them into ashes. This ash can be disposed off by land fills.

Ozone layer Depletion

- Ozone (O_3) is a molecule formed by three atoms of oxygen. Ozone, is a deadly poison. It is formed in atmosphere by the action of ultraviolet radiation on oxygen gas.
- The high energy ultraviolet radiation (UV radiation) coming from the sun splits oxygen gas into free oxygen atoms.

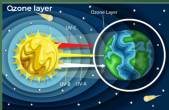


- The free oxygen atoms are highly reactive. One oxygen atom reacts with an oxygen molecule to form an ozone molecule.



Ozone layer

- The amount of ozone in the atmosphere began to drop sharply in the 1980s. The thinning of ozone layer is commonly called ozone-depletion.
- The ozone layer is very important for the existence of life on earth because it absorbs most of the harmful ultraviolet radiation coming from the sun and prevents them from reaching the earth. It shields the surface of the earth from ultraviolet (UV) radiation from the Sun.
- Ozone is being depleted by air pollutants. Chlorofluorocarbons (CFCs) are air pollutants that are mainly responsible for the depletion of ozone layer in the stratosphere.
- Chlorofluorocarbons (CFCs) which are used as refrigerants and in fire extinguishers. Besides, methane (CH_4) and oxides of nitrogen (NO_x) also cause destruction of ozone.
- In 1987, the United Nations Environment Programme (UNEP) succeeded in forging an agreement to freeze CFC production at 1986 levels. It is now mandatory for all the manufacturing companies to make CFC-free refrigerators throughout the world.



Effect of ozone depletion

- Ultraviolet radiation is highly damaging to organisms. It cause skin cancer in human beings.
- These cause damage to eyes and also cause increased incidence of cataract disease in eyes.
- These cause damage to immune system by lowering the body's resistance to diseases.

Steps to be taken to prevent depletion of ozone layer are

- Reduce the use of chlorofluorocarbon in refrigerators, air conditioners, etc.
- Avoid using CFCs in aerosols, sprays, etc.
- Complete freeze on large scale CFC production.