

Course: Environmental Management (DJ19ILO8029)

Prepared By

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Course Objective & Outcomes

Course Objective:

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations
4. Understand Environmental Auditing Procedures.

Course Outcomes:

1. Identify Environmental issues and get familiarized to the concept of Ecosystem and environmental management.
2. Know policies and legal aspects and understand EM system standards.
3. Understand Environment Impact assessment.
4. Understand Environment Auditing procedures.
5. Describe Environmental management Techniques.

Syllabus of Environmental Management

Environmental Management (DJ19ILO8029)		
Unit	Description	Duration
1	Principles of Environmental management (EM): Introduction of EM, Definition, Ecosystem concept, Participants in EM, Ethics and the environment, International Environmental Movement, Environmental issues relevant to India.	08
2	Policy and Legal Aspects of EM: - Introduction to various Environmental Policies, Indian and International Environmental laws and legislation. EM system Standards: - Core Elements, Benefits, Certification Body Assessment & Documentation for EMS, ISO- 14000 Standards.	10
3	Environmental Impact Assessment (EIA) :- Purpose, steps, hierarchy of EIA, Environmental Impact Statement and Impact Indicators, Evolution of IA in India and worldwide. Preliminary stages of EIA, Impact, Prediction, Evaluation and Mitigation.	10
4	Environmental Auditing (EA):- Objectives, Scope and Types of EA, Audit Methodology, Elements of Audit Process, Auditing of EMS.	06
5	Environmental Management Techniques: - Environmental Monitoring and Modelling, Environmental technology Assessment and Environmental Risk Assessment, Eco-mapping.	08

Environmental Management

The word Environment is derived from the French word 'ENVIRONNER' which means to surround. Therefore Environment includes all the living (biotic) and non-living (abiotic) components around any organism. Abiotic environment consists of air, water soil etc while biotic environment includes all living organism (Plants, animals, human beings and micro-organisms).

The Environment (Protection) Act, 1986 defines environment in section 2(a) as “Environment includes water, air, land and the interrelationship, which exists among and between air, water, land, human beings, plants, micro-organism and other living creatures and property”.

Scope Environment

SCOPE – The scope of environment is wide and it may provide the basic principles for understanding the delicate balance of nature. Following areas may be included in it:

- Natural Resources – Conservation and Management
- Ecology and Biodiversity.
- Environmental pollution and its control.
- Policy making for global environmental issues.
- Social issues related with development and environment.

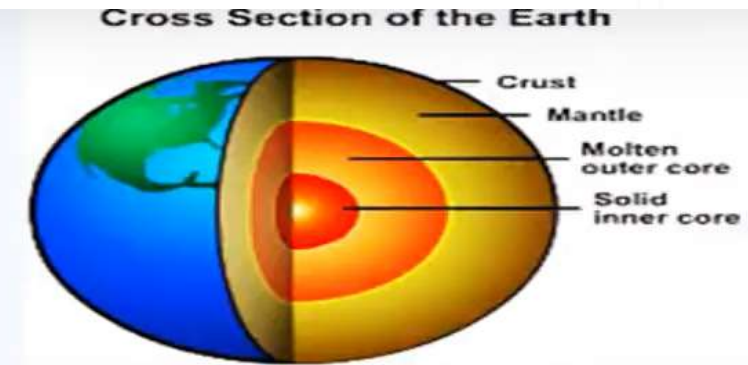
These are the basic areas of Environmental Science, which affects all the sections of the society directly. Environmental Science is centralized on the technical subjects like Environmental Biodiversity, Environmental Engineering and Environmental Management.

Scope Environment

Environment is related to everyone and it is essential to all. It is applicable to almost every living being and influences them at each moment of their life. Every person related to any age group and of any occupation is equally affected by environment. Similarly human activities also affect the environment. Today with the interference of man with nature, the environment of the earth has been changed totally and gave birth to several problems such as environmental pollution, depletion of natural resources, ozone depletion, acid rain, global warming etc., therefore, study of environment will be helpful to overcome such types of problems.

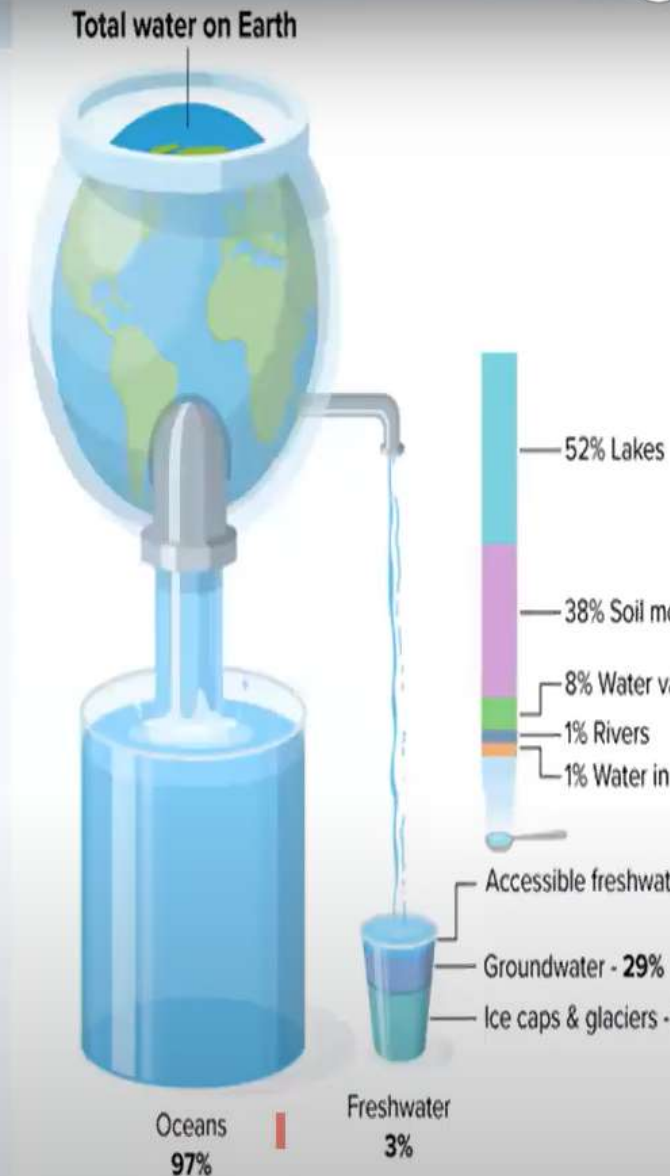
Segment of Environment

The Environment consists of various segments such as **Lithosphere, Hydrosphere, Atmosphere and Biosphere.**



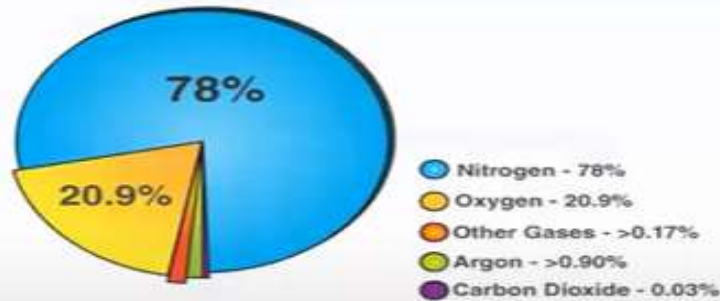
1. Lithosphere - Lithosphere is related with edaphic (related to soil) factor. The solid component of earth is known as lithosphere. Lithosphere means the mantle of rocks constituting the earth's crust. It includes the soil, which covers the rock crust. Soil plays an important role as it provides food for man and animals. A typical productive soil contains approximately 95% inorganic matter and 5% organic matter. Organic matter in the soil provides food for microorganism.

2. Hydrosphere - This includes all the surface and ground water resources such as oceans, seas, rivers, streams, lakes, ponds, reservoirs, glaciers, polar ice caps, ground water and water locked in rock and crevices and minerals laying deep below the earth's crust. Earth is called blue planet because 80 per cent of its surface is covered by water (97% of the earth's water resources is locked up in the oceans and seas, 2.4% is trapped in giant glaciers and polar ice caps). Water is universal solvent. Water is also the main medium by which chemical constituents are transported from one part of an ecosystem to others.



3. Atmosphere

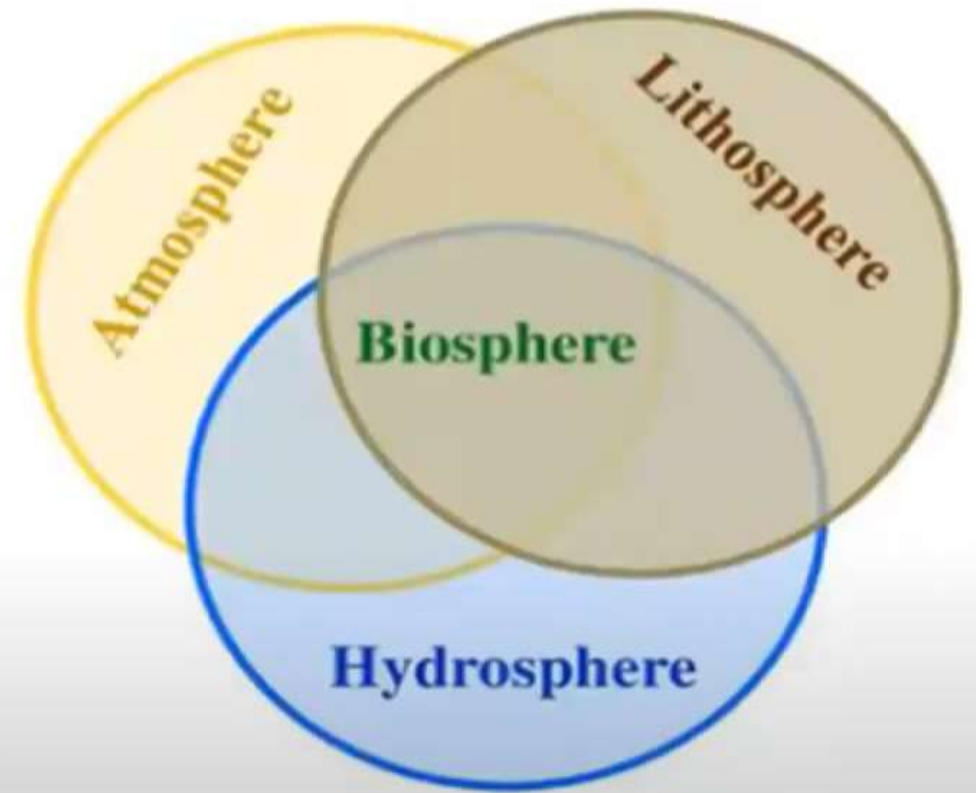
3. Atmosphere - The gaseous envelope surrounding the earth is composed of an entire mass of air containing N_2 , O_2 , H_2O , CO_2 and inert gases is known as atmosphere. The atmosphere is a reservoir of several elements essential to life and serves many purposes and functions. Atmosphere serves many purposes and functions. It absorbs most of the harmful radiations. It maintains the heat balance of the earth.



Different cycles those are present in the atmosphere in the form of water cycle, carbon, oxygen, nitrogen cycle etc. related to the movement of matter between an organism and its environment. On the basis of temperature variation, atmosphere is divided into four major layers – Troposphere.

4. Biosphere

4. Biosphere - The biosphere is the part of the earth in which life exists. Biosphere is biological envelope that surrounds the globe, containing and able to support. It is dependent on the atmosphere, hydrosphere and lithosphere. This denotes the relating of living organism and their interactions with the environment.



Ecosystem

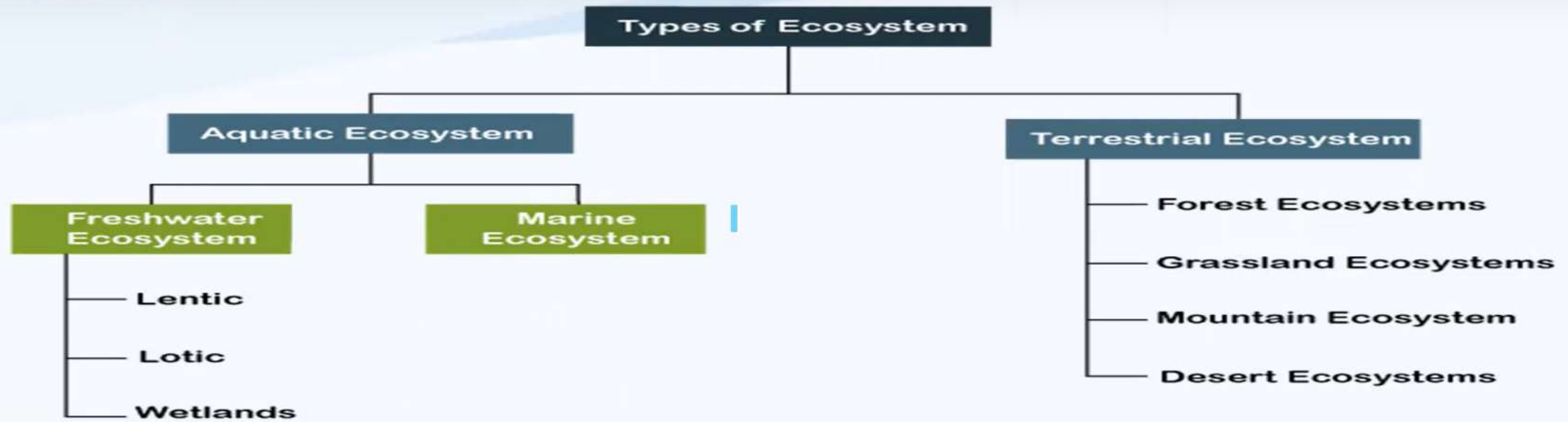
ECOSYSTEM - A biotic community cannot live in isolation. It lives and flourishes in an environment which supplies and fulfills its material and energy requirements and provides other living conditions. The biotic community and its physical (non-living) environment in which **matter (chemical elements) cycles and energy flows** is called ECOSYSTEM.

The term 'ECOSYSTEM' was first given by **A.G.Tansley in 1935**. He defined ecosystem as 'the system resulting from the integration of all the living and non-living factors of the environment'.

ECOLOGY - A branch of science concerned with the interrelationship of organisms and their environments.

Father of Modern Ecology – **Eugene Odum** (1913 - 2002)

Types of Ecosystem



Ecosystem are of two types –

(A) Natural Ecosystems – These operate by themselves under natural conditions without any major interference by man. These are further divided as-

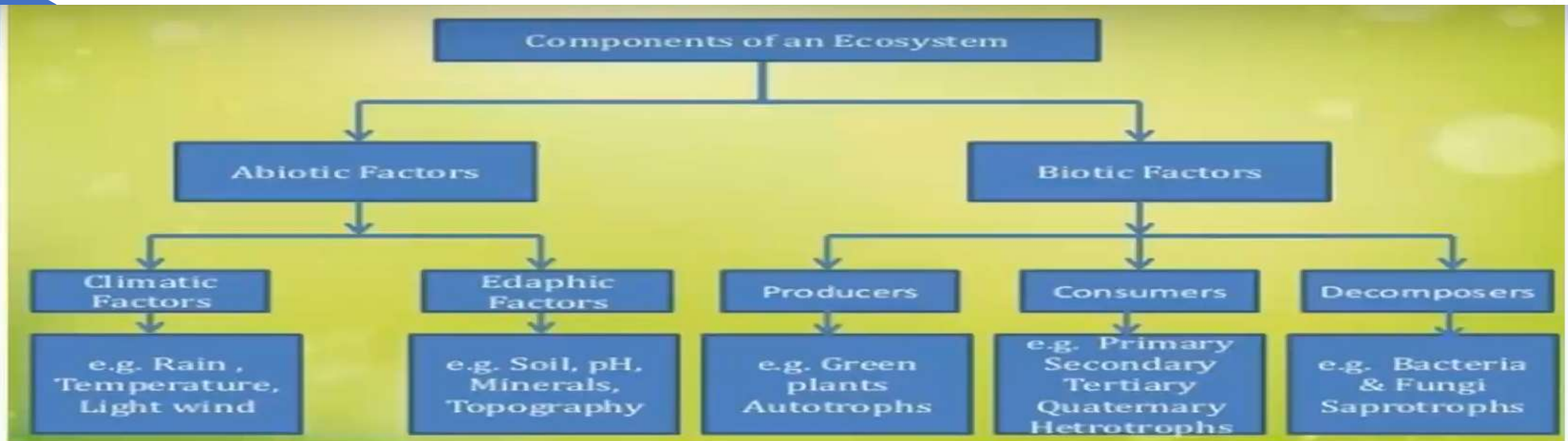
a) Terrestrial Ecosystem – Found on Land. Forest, Grassland, Desert ecosystem

b) Aquatic Ecosystem – It is divided into -

- (i) Fresh Water** – It may be **Lotic** (Running water as spring, stream or rivers) or **Lentic** (Standing water as lake, ponds, pools, swamp etc).
- (ii) Marine Water** – Like Ocean and seas.

(B) Artificial Ecosystem – It is the ecosystem in which conditions are modified by man. E.g. Aquarium, Zoo, Cultivated land, Fish farms, Canals, Gardens and Industrial & Urban area.

Components of Ecosystem



An ecosystem may be divided into two components.

Abiotic Components (Non Living) – The abiotic components of an ecosystem includes both physical and chemical features. Physical features includes wind, soil, moisture, temperature, light etc while chemical features includes water, gases as oxygen, minerals as iron, sulfur, carbon, nitrogen etc. The kind of chemicals which are present in any ecosystem may regulate

Biotic Components (Living) – The biotic components of an ecosystem may be divided as

(A) Autotrophic Components (Producers) – Autotrophic Components of an ecosystem mainly comprises of green plants which fixes the radiant energy of the sun to form food during the process of photosynthesis. They are also known as producers.

(B) Heterotrophic Components (Consumers) – These are organisms which feed upon green plants (autotrophs). They are divided as herbivores, carnivores and omnivores.

(i) Herbivores – Those organisms which feed on green plants only are called herbivores. They are also called as primary consumers. Examples are Cow, Buffalo, Goat, Deer, Camel etc.

(ii) Carnivores - Those organisms which feed on flesh or meat are called carnivores. They are also called as secondary consumers. Examples are Lion, Tiger, Wolf etc.

(iii) Omnivores - Those organisms which feed on green plants as well as flesh or meat are called omnivores. Examples are human beings and dog.

(C) Decomposers – Those organisms which feed on dead and decaying organic matter and break complex organic compounds into simple organic compounds and make them available for autotrophs. They include mainly bacteria and fungi

Example

- ▶ Biotic components refer to all living components in an ecosystem. Based on nutrition, biotic components can be categorised 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

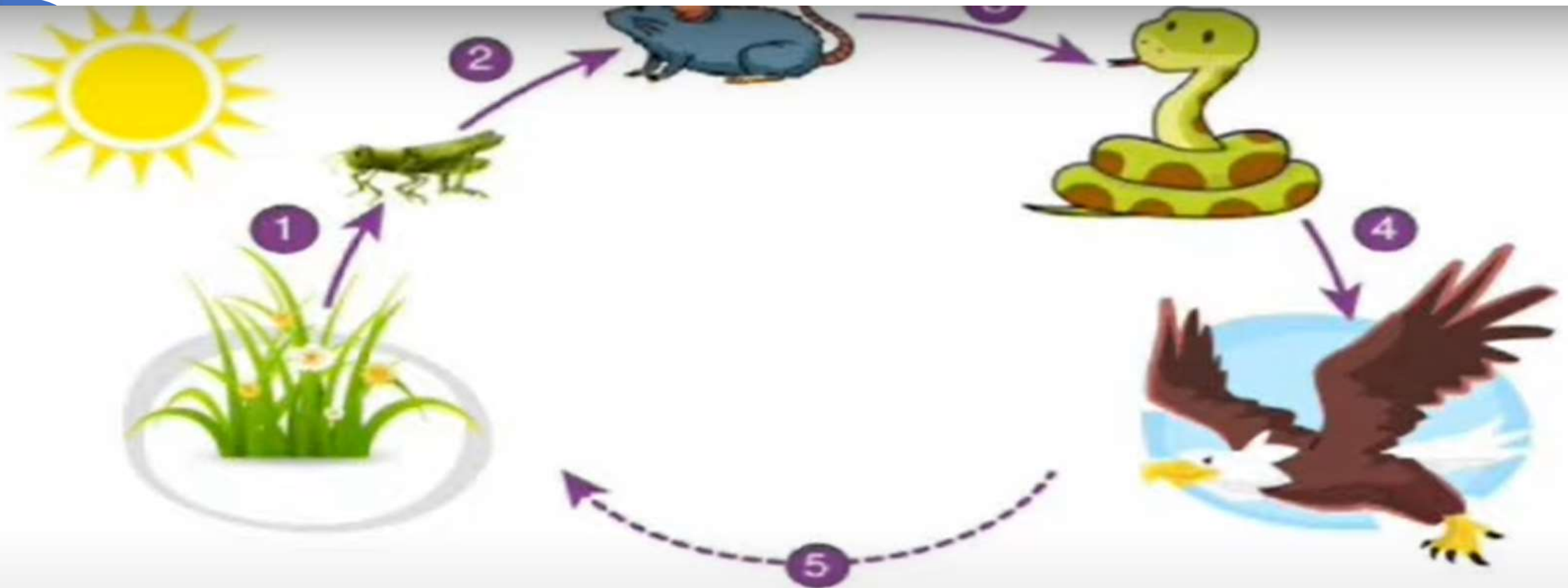
- ▶ **Primary consumers** are always herbivores as they rely on producers for food.
- ▶ **Secondary consumers** depend on primary consumers for energy. They can either be carnivores or omnivores.
- ▶ **Tertiary consumers** are organisms that depend on secondary consumers for food. Tertiary consumers can also be carnivores or omnivores.
- ▶ **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

► **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,

Example



Food Chain

1 The grasshopper eats the plants

2 The mouse eats the grasshopper

3 The snake eats the mouse

4 The eagle eats the snake

5 When the eagle dies, fungi break down the body and turn them into

FOOD CHAIN

The transfer of food energy from the source in plants (producers) through a series of organisms (herbivores to carnivores to decomposers) with repeated stages of eating and being eaten is known as the food chain.

In any food chain, energy (in the form of food) flow from producers to primary consumers (herbivores), from primary consumers to secondary consumers (carnivores), from secondary consumers to tertiary consumers (carnivores/omnivores) and so on. The transfer of energy from one trophic level to the next trophic level is called food chain.

- There are three types of food chain:

(A) Grazing Food Chain – This type of food chain starts from the living green plants goes to grazing herbivores, and on to carnivores. Ecosystems with such type of food chain are directly dependent on an influx of solar radiation. For e.g in forest ecosystem food chain, the primary consumers are the ungulates like deer which are eaten by tiger.

- Green plants → Deer → Tiger
- Grasses → Grasshopper → Frog → Snake → Hawk

(B) **Detritus Food Chain** – It starts from dead organic matter and goes to detritus feeding organisms (detritivores) and on their predators. Detritivores are consumer of dead organic matter. Examples are

Dead organic matter \longrightarrow Detritivores \longrightarrow Predators

Mangrove leaves \longrightarrow Detritus \longrightarrow Microorganism \longrightarrow Crabs \longrightarrow Small fishes \longrightarrow large fishes

(C) **Parasitic Food Chain** – In such type of food chain, parasite may consume a portion of food available to host. It involves host-parasite links. In the whole process the parasite gets nutritonally benefited and host is harmed.

Green plants \longrightarrow Sheep \longrightarrow Liver Fluke

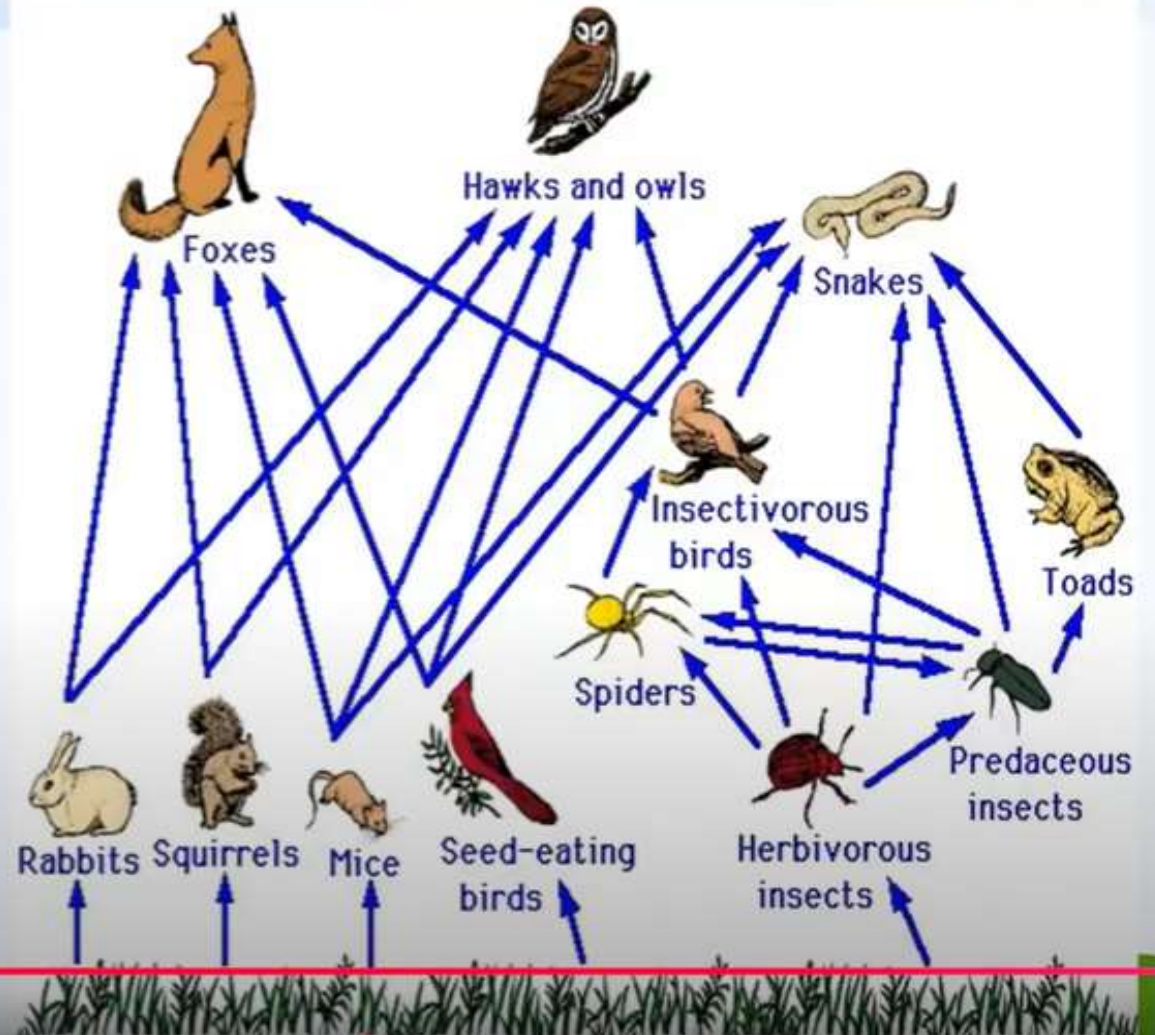


FOOD WEB

A food web is a tool that illustrates the feeding relationship among species within a specific habitat. Species may occupy a single trophic level in an ecosystem. Example a single plant may be eaten by more than one species for their nourishment i.e. herbivores feed on different kinds of plants. Similarly carnivores may feed on different kinds of herbivores and so on. Therefore we can say that food chains are interconnected to each other in various ways. Such types of interconnected food chains forms a web called as food web.

FOOD WEB

A network of food chains which are interconnected at various trophic levels, so as to form a number of feeding connections amongst different organisms of a biotic community is called food web.



Significance of food chain:

1. The studies of food chain **help understand the feeding relationship** and the interaction between organisms in any ecosystem.
2. They also help us to appreciate **the energy flow mechanism and matter circulation** in ecosystem and understand the movement of toxic substances in the ecosystem.
3. The study of food chain helps us to **understand the problems of bio-magnifications**.

ENERGY FLOW IN AN ECOSYSTEM

Energy flow is the movement of energy through an ecosystem through a series of organisms and back to the external environment. It is one of the most fundamental processes that is common to all the ecosystems.

The unidirectional flow of energy in an ecosystem can be well demonstrated by the two laws of thermodynamics. Therefore it is necessary to know properly about an ecosystem which includes fixing of radiant energy of sun by producers and transformation of this energy to consumers and decomposers and the loss of energy during the whole process.

According to first law of thermodynamics, energy can neither be created nor destroyed; energy can simply change its form. In an ecosystem, autotrophs i.e green plants fix the radiant energy of the sun and converted it into chemical energy. This chemical energy is transferred to hetrotrophs i.e. consumers when they feed upon autotrophs and finally when hetrotrophs die this energy is transferred to decomposers which feed upon them. Hence in this process of energy flow we can see the first law of thermodynamics operating in living organisms.