

# Ecology and Ecosystems

## Unit -1

# Ecology and Ecosystems

**Ecology Definition:** The scientific study of interactions between different organisms and between organisms and their environment or surroundings.



# Ecology and Ecosystems

- The meaning of word ecology was given by German biologist Hackle in 1869.
- The word ecology is derived from Greek word, “Oilkos” meaning house.

## **Classification of ecology:**

1. Autecology
2. Synecology

### **Autecology:**

The study of the interactions of an individual organism or a single species with the living and nonliving factors of its environment.

### **Synecology:**

Study of a group or community of organisms and their relationships to each other and to their common environment.



# Ecology and Ecosystems

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## ECOLOGICAL ORGANISATION

- SPECIES
- POPULATION
- COMMUNITY
- ECOSYSTEM
- BIOME
- BIOSPHERE

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## **SPECIES**

- THE MOST FUNDAMENTAL UNIT OF BIOLOGICAL ORGANISATION
- IT IS DEFINED AS
- A group of organisms that are capable of breeding with each other under natural conditions

## **POPULATION**

- A group of organisms of the same species that occupy a particular area over a given interval of time.
- The size and extent of populations is described in terms of density i. e. no of individuals per unit area

## **COMMUNITY**

- Populations of various species living in the same area, representing a large no. of connections and needs are referred as community.
- Within a community, each organism is found in a specific location.
- Communities can change over long periods of time

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## **ECOSYSTEMS**

- It is a self sustaining structural and functional unit of the biosphere.
- The biotic community and abiotic elements of a particular area interacting and functioning as a unit is called the ecosystem.

## **BIOME**

- Biome is a large community of vegetation and wild life adapted specific climate

## **BIOSPHERE**

- The portion of earth that supports life is called the biosphere.
- The biosphere extends several km up in the atmosphere to the deepest parts of the oceans.



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## ECOSYSTEMS

# Ecology and Ecosystems

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**Ecosystem** is the basic functional unit of ecology.

The term ecosystem is coined from a Greek word meaning study of home.

**Definition:** Ecosystem is a community of living organism.

Interacting with each other and their non living and living organisms.

- **Living organisms Ex:** Plants, Animals & Micro Organisms.
- **Non living organisms Ex:** Sun, Rocks & Soil.

## **COMPONENTS OF ECOSYSTEM:**

An ecosystem has two major components

1. **Biotic components**
2. **Abiotic components**

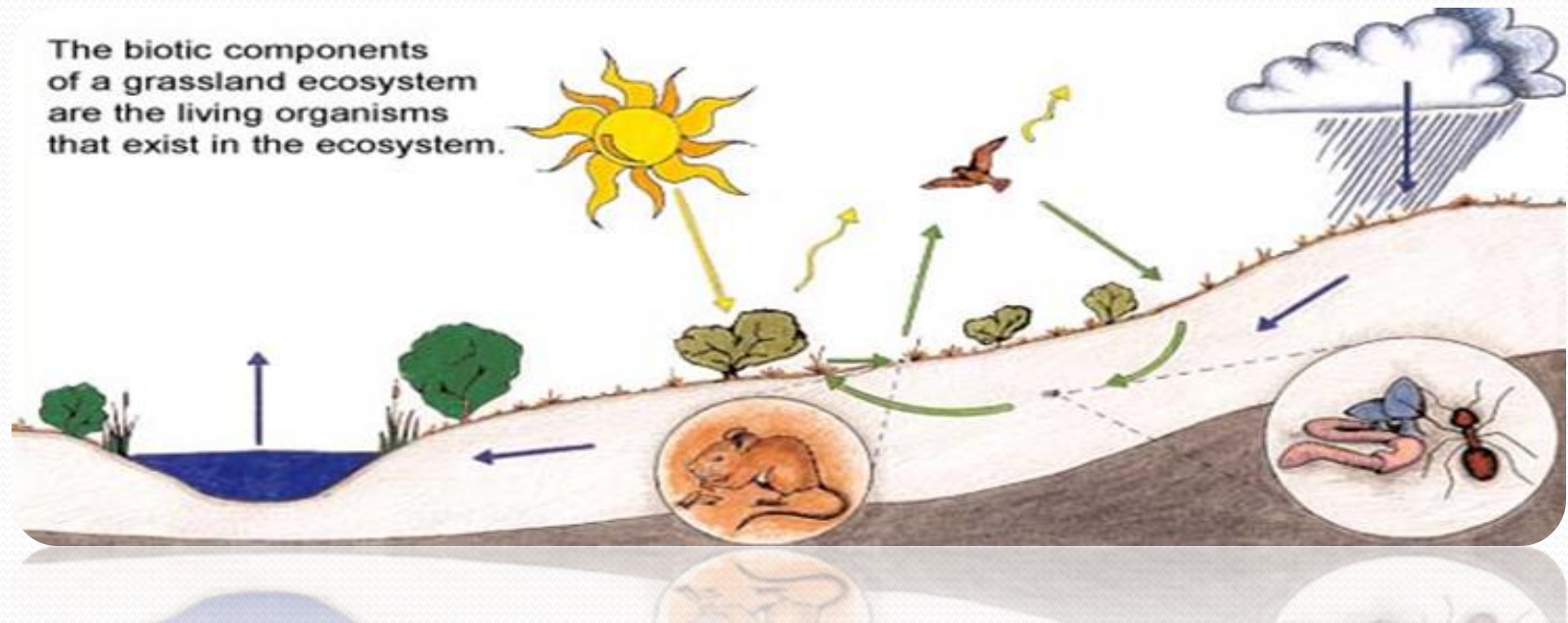


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## BIOTIC COMPONENTS

The living organisms (or) living members in an ecosystem collectively form its community called biotic components.

**Examples:** Plants (producers), Animals (consumers)  
Microorganisms (decomposers).

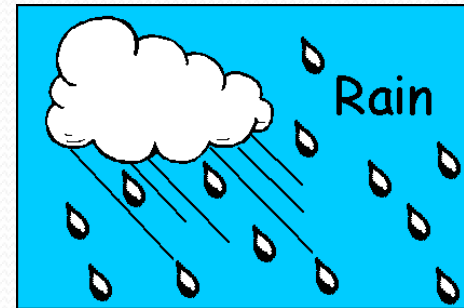


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## ABIOTIC COMPONENTS

The non-living surroundings

Examples: Sun, Rain



### Classification of Biotic Components

The members of biotic components of an ecosystem are grouped in to three based on how they get food.

- (1) Producer (plants)
- (2) Consumer (Animals)
- (3) Decomposers (Micro-organisms)

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## Producers

A. Sunlight is the main energy source for life on earth

B. Also called autotrophs

C. Use light or chemical energy to make food

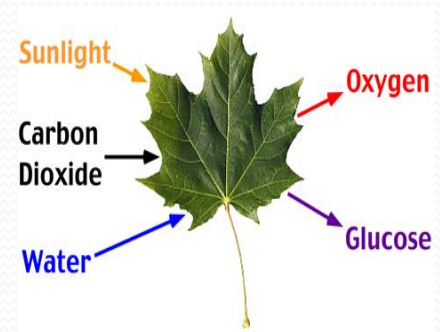
1. Plants
2. plant-like protists (algae)
3. Bacteria

D. Photosynthesis—use light energy to convert carbon dioxide and water into oxygen and carbohydrates

(Remember:  $6\text{CO}_2 + 6\text{H}_2\text{O}$

$6\text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6$ )

E. Chemosynthesis—performed by bacteria, use chemical energy to produce carbohydrates



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## Consumers (heterotrophs)

Organisms that rely on other organisms for their energy and food supply. Also called heterotrophs.

Consumers are further classified as

### (i) **Primary consumers (Herbivores) (Plant eaters)**

Primary consumers are also called herbivores, they directly depend on the plants for their food. So they are called plant eaters.

**Examples :** Goat, deer, cow, horse, etc.,

### (ii) **Secondary consumers (primary carnivores)** **(meat eater)**

Secondary consumers are primary carnivores, they feed on primary consumers.

They directly depend on the herbivores for their food.

**Example :** Frog, cat, snakes, foxes, etc.,



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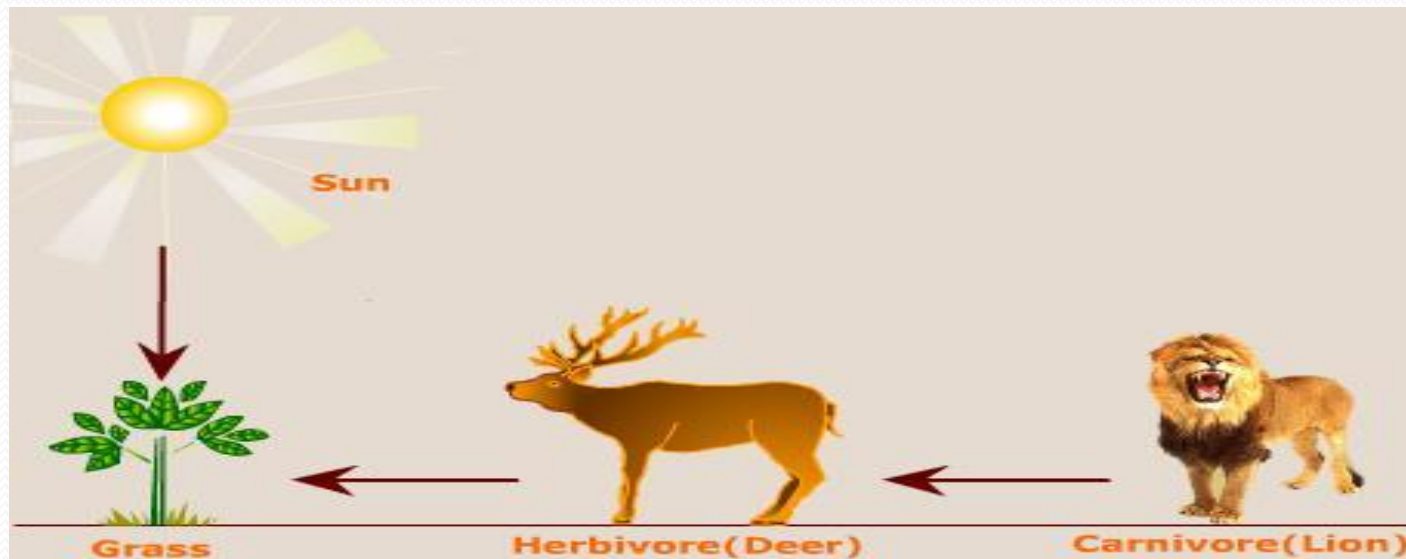
## Classification of consumers

### (iii) Tertiary consumers (Secondary carnivores) (Meat-eaters)

Tertiary consumers are secondary carnivores, they feed on secondary consumers.

They depend on the primary carnivores for their food.

**Examples:** Tigers, lions, etc.,



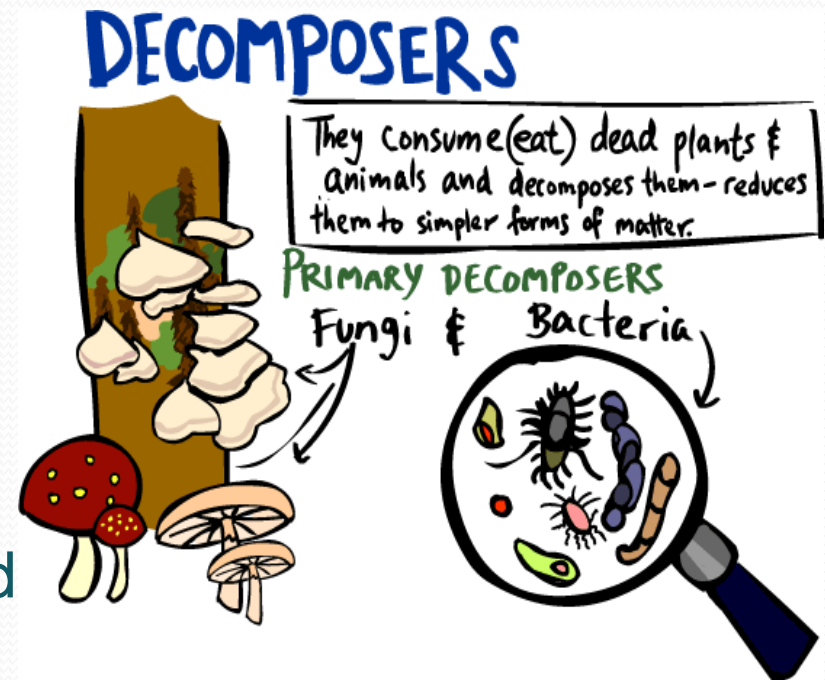


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## Decomposers

Decomposers are a group of organisms consisting of small animals like worms, insects, bacteria and fungi, which break down dead organic material into smaller particles and finally into simpler substances that are used by plants as nutrition.

**Example:** Microorganisms like bacteria and fungi.



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## Classification of Abiotic Components

### **Abiotic (non-living) components**

The non-living components (physical and chemical) of ecosystem collectively form a community called abiotic components (or) abiotic community.

**Examples:** Climate, soil, water , air, energy, nutrients, etc.,

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## 1. Physical components

They include the energy, climate, raw materials and living space that the biological community needs. They are useful for the growth and maintenance of its member.

**Example:** Air, water, soil, sunlight, etc.,

## 2. Chemical Components

They are the sources of essential nutrients.

**Examples:**

**Organic substances :** Protein, lipids, carbohydrates, etc.,

**Inorganic substances:** All micro (Al, Co, Zu, Cu) and macro elements (C,H, O, P, N, P, K) and few other elements.



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## FUNCTION OF AN ECOSYSTEM

The function of an ecosystem is to allow flow of energy and cycling of nutrients.

**Types of Functions:** Functions of an ecosystem are of three types

- 1. Primary function:** The primary function of all ecosystem is manufacture of starch (photosynthesis).
- 2. Secondary function** The secondary function of all ecosystem is distribution energy in the form of food to all consumers
- 3. Tertiary Function** All living systems diet at a particular stage. These dead systems are decomposed to initiate third function of ecosystems namely “cycling”.

The functioning of an ecosystems may be understood studying the following terms. Food chains, Food webs & Food pyramids

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**FOOD CHAIN:** All living organisms need energy for doing any biological work such as growing, moving, reproduction. That energy comes from food. The only way is one organism eat another organism.

**Examples :** An insect is eaten by frog, frog become food for snake and snake is eaten by eagle.

Every living organisms are mutually depended on other organisms is called as food chain.

**FOOD WEB:** Food web is a network of food chain which become inter-connected at various tropic levels so as to form a number of feeding connections amongst different organisms of a biotic community.

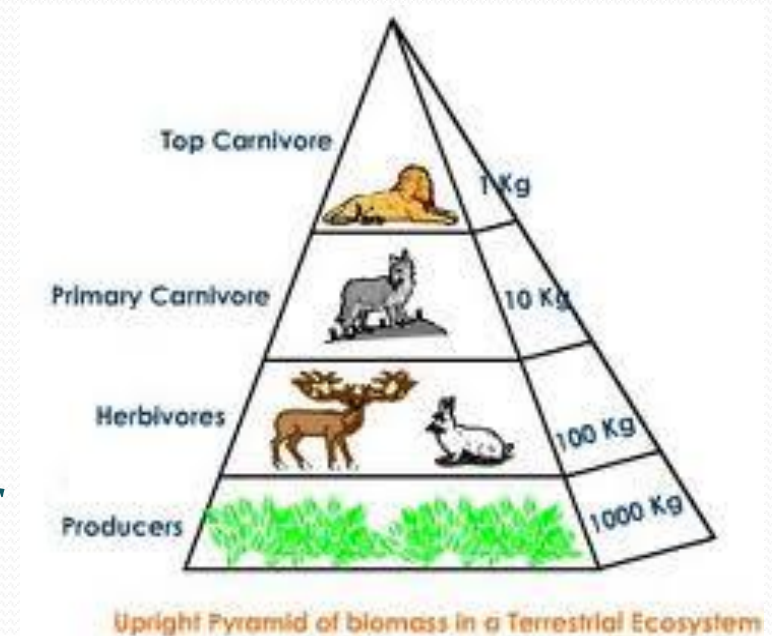
## **CHARACTERISTICS OF FOOD WEB:**

1. Food webs are never straight.
2. Food webs is formed by interlinking of food chains.
3. Food web provides alternative ways of food availability.
4. Food webs help in checking the overpopulation of organism .

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## ENERGY PYRAMIDS

- A graphical representation of the trophic levels by which the incoming solar energy is transferred into an ecosystem.
- The consumers are at the top of the food pyramid whereas producers are at the bottom of the pyramid.

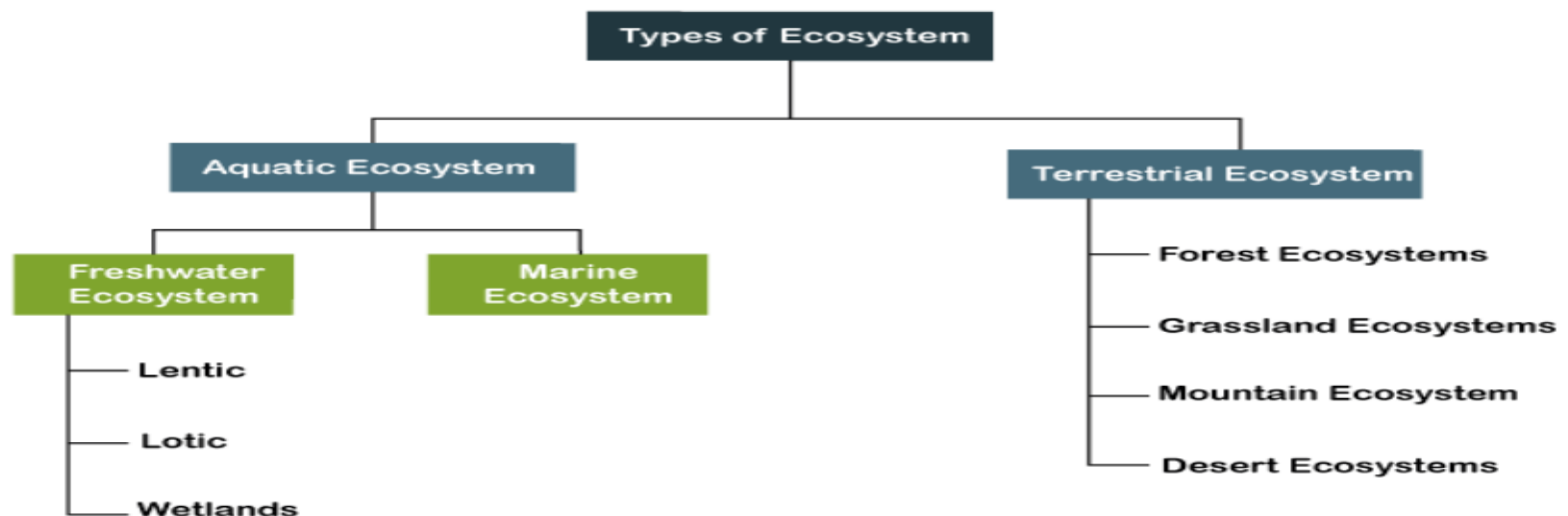


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## Types of Ecosystem

There are different types of ecosystems based on different climates, habitats, and life forms. This means that ecosystems can typically be divided into hundreds and thousands of smaller systems. However, all such types generally fall into one of the following two categories:

- Aquatic Ecosystem
- Terrestrial Ecosystem



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## Freshwater Ecosystem

- The freshwater ecosystem is one of the essential ecosystems for humans and other organisms living on land. This is because this ecosystem is a source of drinking water. Additionally, it also helps in providing the necessary energy and water for transportation, recreation, etc.
- The freshwater ecosystem is the smallest type of ecosystem among the major types of ecosystems. There is usually no salt content in the freshwater ecosystem. Besides, it consists of many insects, small fish, amphibians, and various plant species. Plants help provide oxygen through photosynthesis and also provide food for the organisms living in this ecosystem.

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## Freshwater Ecosystem-Lentic, Lotic & Wetland

Freshwater ecosystems mainly include lentic, lotic, and wetlands.

- **Lentic:** Water bodies that are moving slowly or are still in some places come under lentic. For example, ponds, lakes, pools, etc. Lakes are known as large water bodies and are surrounded by land.
- **Lotic:** Water bodies that are moving at a fast pace fall under a lotic. For example, streams and rivers.
- **Wetlands:** Environments characterized by soils saturated with water for a long time fall under wetlands.

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## Marine Ecosystem

- Marine ecosystems are usually characterized by the presence of salt content. These ecosystems have a higher salt content than the freshwater ecosystem. Moreover, they are known as the largest type of ecosystem on Earth. It usually includes all the oceans and their parts. Besides, marine ecosystems have a distinctive flora and fauna, which support greater biodiversity than freshwater ecosystems. This type of ecosystem is essential for both marine and terrestrial environments.
- In particular, this ecosystem includes salt marshes, lagoons, coral reefs, estuaries, intertidal zones, mangroves, seafloor, and deep seas. Salt marshes, mangrove forests, and sea-grass meadows are said to be among the most productive ecosystems. Coral reefs are known to provide adequate quantities of food and shelter to most marine inhabitants worldwide



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## Forest Ecosystems

- A forest ecosystem is an ecosystem where many organisms live together with the environment's abiotic components. There are much different flora and fauna in this ecosystem. This usually means that the forest ecosystem has a high density of living organisms that live with non-living abiotic elements. The forest ecosystem usually includes various plants, microorganisms, animals, and other species.
- Forests are significant carbon sinks and participate in controlling and balancing the overall temperature of the Earth. Changes in the forest ecosystem affect the entire ecological balance, and severe changes or destruction of forests can also kill the whole ecosystem. Forests are generally classified into tropical deciduous forests, tropical evergreen forests, temperate deciduous forests, temperate forests, and Taiga.



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## Grassland Ecosystems

- Grassland ecosystems are referred to as those ecosystems where the number of trees is low. These ecosystems mainly consist of grasses, shrubs, and herbs. That means grasses are the primary vegetation in these ecosystems, along with legumes that typically belong to the composite family.
- Grassland ecosystems are commonly situated in both the tropical and temperate regions globally; however, they have distinct variations. Examples of these ecosystems include the savanna grasslands and temperate grasslands. They are home to various grazing animals, insectivores, and herbivores.

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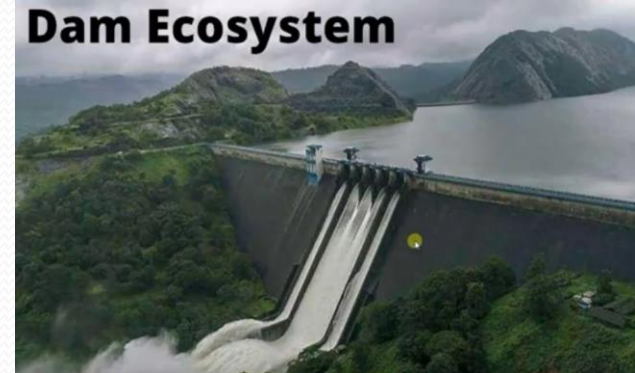
## Desert Ecosystems

- Desert ecosystems exist worldwide and cover about 17 percent of desert areas. These are areas where annual rainfall is usually measured less than 25 mm. Due to fewer trees and land of sand, sunlight intensifies in these ecosystems. This is why these ecosystems have incredibly high temperatures and low availability of water. However, the nights are quite cold.
- The Desert ecosystem has unique flora and fauna. Plants grow with small amounts of water and conserve water's possible amount in their leaves and stems. For example, the spiny-leafed cactus is a type of desert plant that has the characteristic of storing water using a stem. Similarly, animals are also adopted to the condition of desert ecosystems. Some common animals are camels, reptiles, a diverse range of insects and birds.

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## Artificial Ecosystem

An artificial ecosystem is a human-made system of plants, animals, and people living in an area together with their surroundings. Deserts, forests, and oceans are a few examples of naturally occurring ecosystems. Examples of artificial ecosystems are-Aquariums, crop fields, dams, gardens, zoo, green house, park, etc.



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Natural ecosystem	Artificial ecosystem
It consists of many species of plants and animals.	Here Species diversity is low.
Genetic diversity is very high.	Genetic diversity is very low.
Sunlight is the energy source for plants and this energy drives all biological cycles.	Sunlight is the ultimate energy source for plants but artificial fertilizers and other nutrients are externally supplied to the soil.
Food chains are long and complex.	Food chains are simple and often incomplete as other species are killed as pests or weeds.
Ecological succession takes place over time.	No ecological succession.
Natural nutrient cycling takes place.	Incomplete nutrient cycling occurs.
It is naturally sustainable.	It is unsustainable as most fertilizers are made from non-renewable fossil fuels, and they add to water pollution, biomagnification, and other ecological disturbances.

THANK YOU