

Environmental Science

Unit –I Environment and Ecosystem

Part-II Ecosystem

(Importance of ecosystem, Bioaccumulation, Biomagnification, Biodiversity, Threats to biodiversity, Conservation of biodiversity)

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Ecosystem:

- An ecosystem is a **geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life.**

According to British ecologist *Arthur Tansley* (1935), an ecosystem is *a system that arises from the integration of all living and non-living factors of the environment.*

- An ecosystem is a self-sustained community of plants and animals existing in its own environment.
- The term ecosystem may be defined as a system resulting from the integration of all the living and non living factors of the environment. **Desert, Forest, Ocean, Grasslands, Mountains, etc.** are all ecosystems.





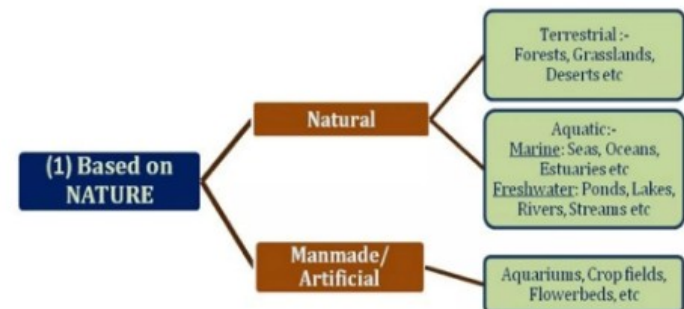
Environment: the total of our surroundings

- All the things around us with which we interact:
 - *Biotic vs. Abiotic*

Biotic factors are living things within an ecosystem; such as plants, animals, and bacteria, while abiotic are non-living components; such as water, Continents, oceans, clouds, soil, rocks and atmosphere.

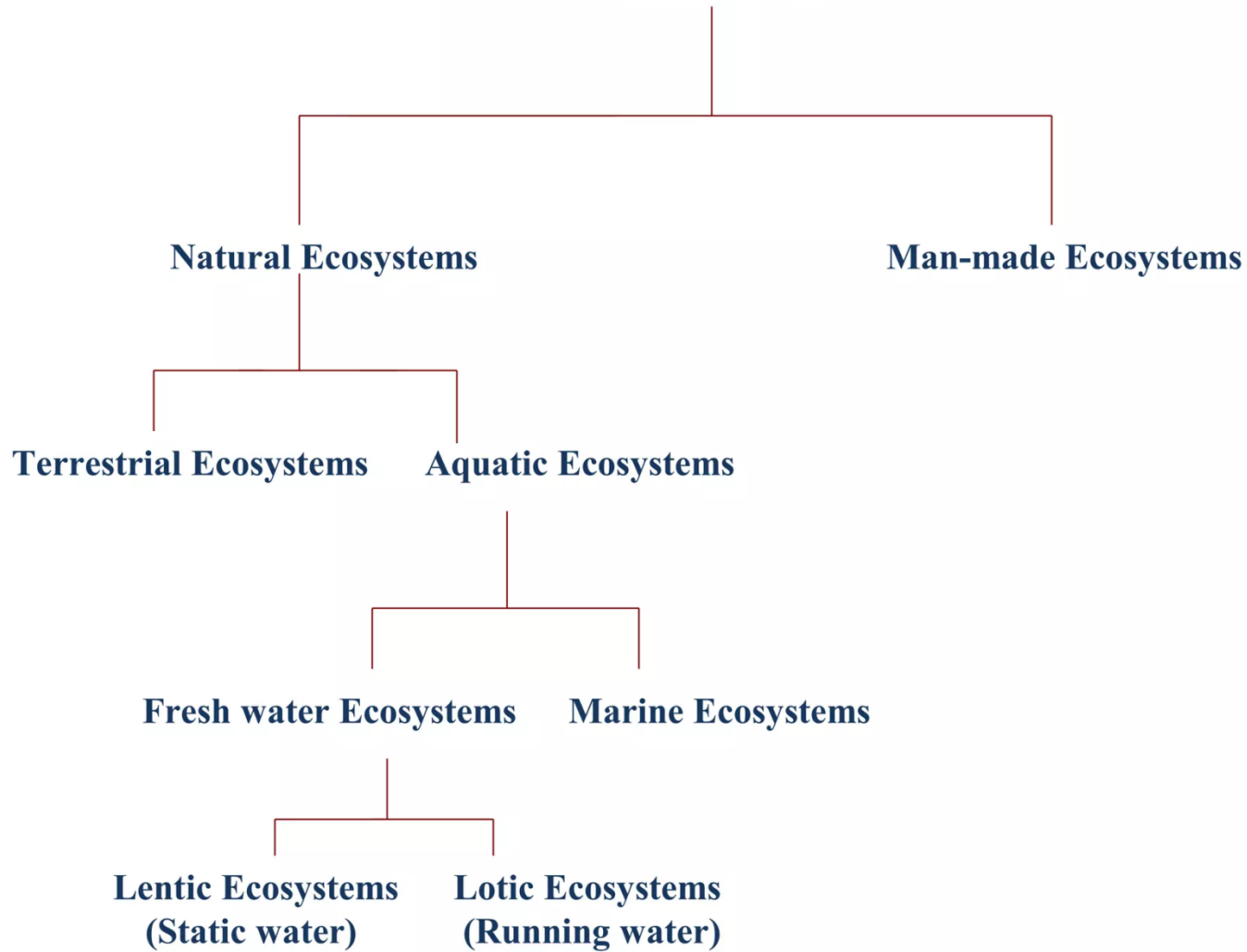
- Our built environment
- Buildings, human-created living centers
- Social relationships and institutions

Classification of ecosystem





Kinds of Ecosystems





Structure of an Ecosystem

Living (Biotic) Components

- Producers
- Consumers
- Decomposers

Non-living (Abiotic) Components

- Physical factors
- Chemical factors
- Limiting factors





Biotic Components of Ecosystems

Producers (or autotrophs)

Green plants and some bacteria which manufacture their own food.

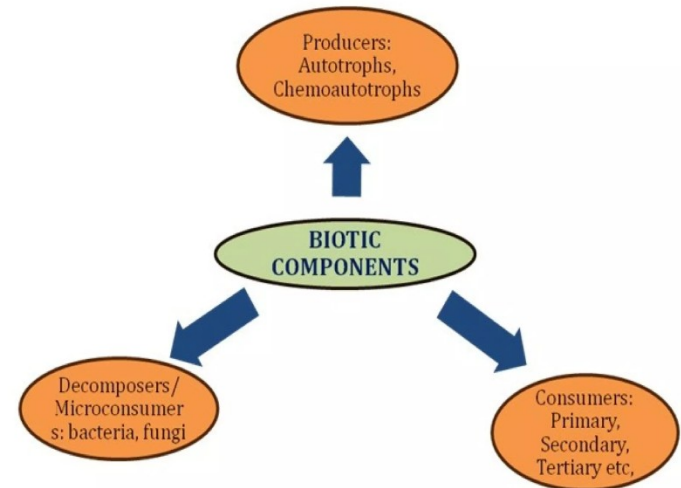
Consumers (or heterotrophs)

Animals which obtain their food from producers

- Primary consumers
- Secondary consumers
- Tertiary consumers

Decomposers

Bacteria and fungi that decompose dead organic matter and convert it into simpler parts





Abiotic Components of an Ecosystem

Physical Factors

Rainfall
Sunlight
Humidity
Temperature
Nature of soil
Water currents

Chemical Factors

Salinity of Water
Nutrients present in soil
Oxygen dissolved in water
Percentage of water and air in soil

Limiting Factors

Food, water, shelter and space are limiting factors for the growth of population of human and animals.



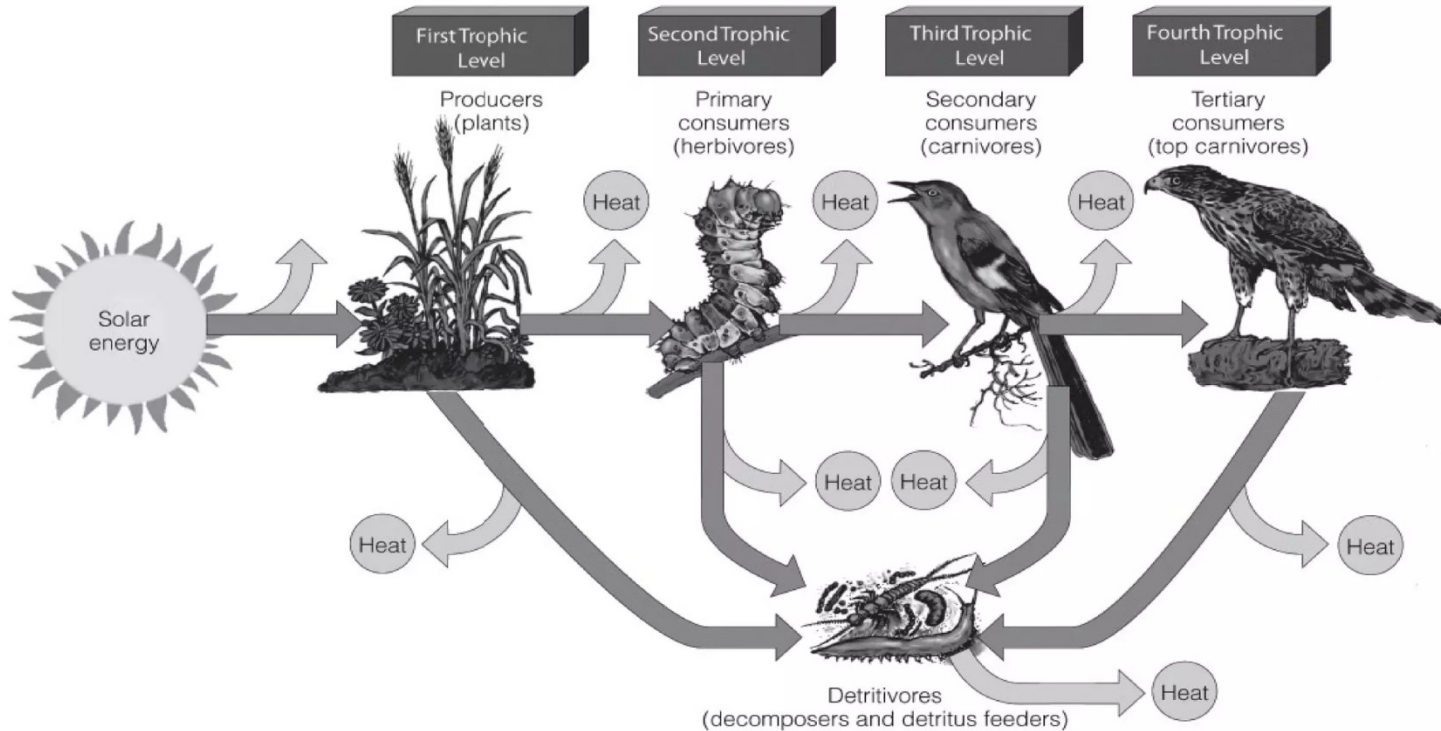


Functions of an Ecosystem

- **Food chain and food web**
- **Energy flow**
- **Ecological pyramids**

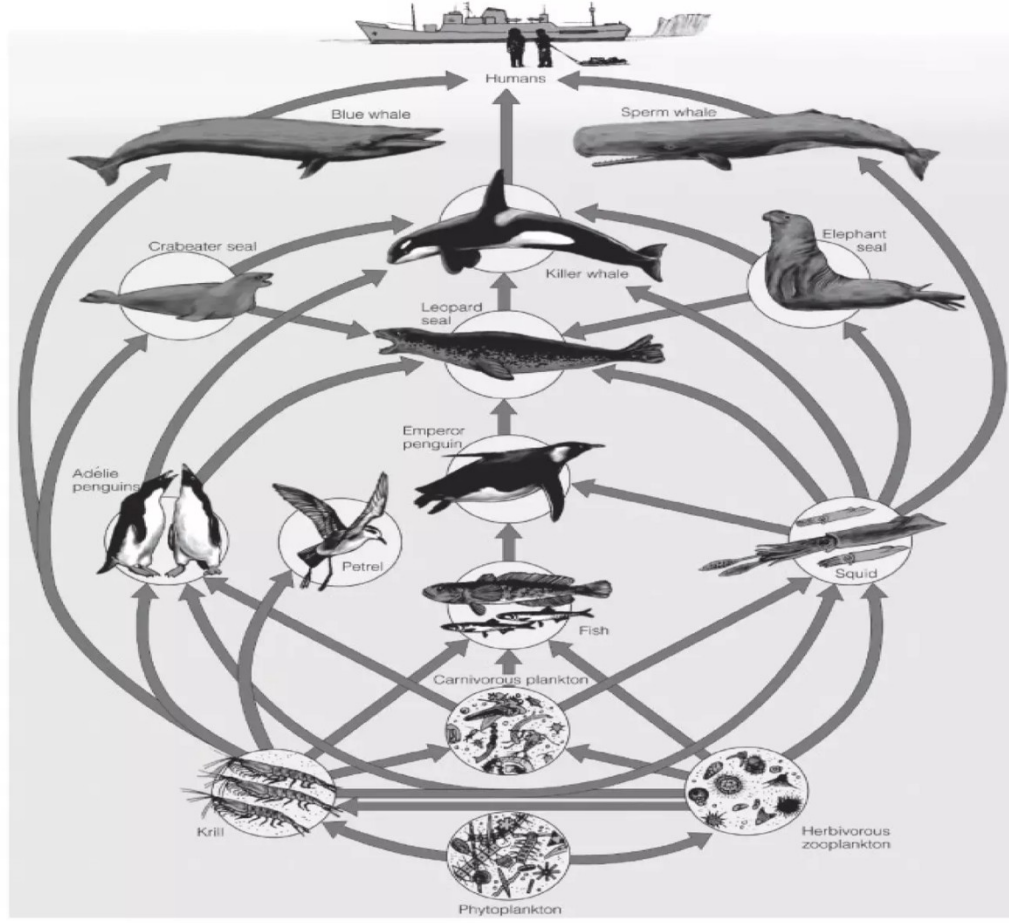


Food Chain



The transfer of food energy from the source (plants) through a series of organisms by repeated ***eating and being eaten up*** is referred to as ***food chain***.

Food Web



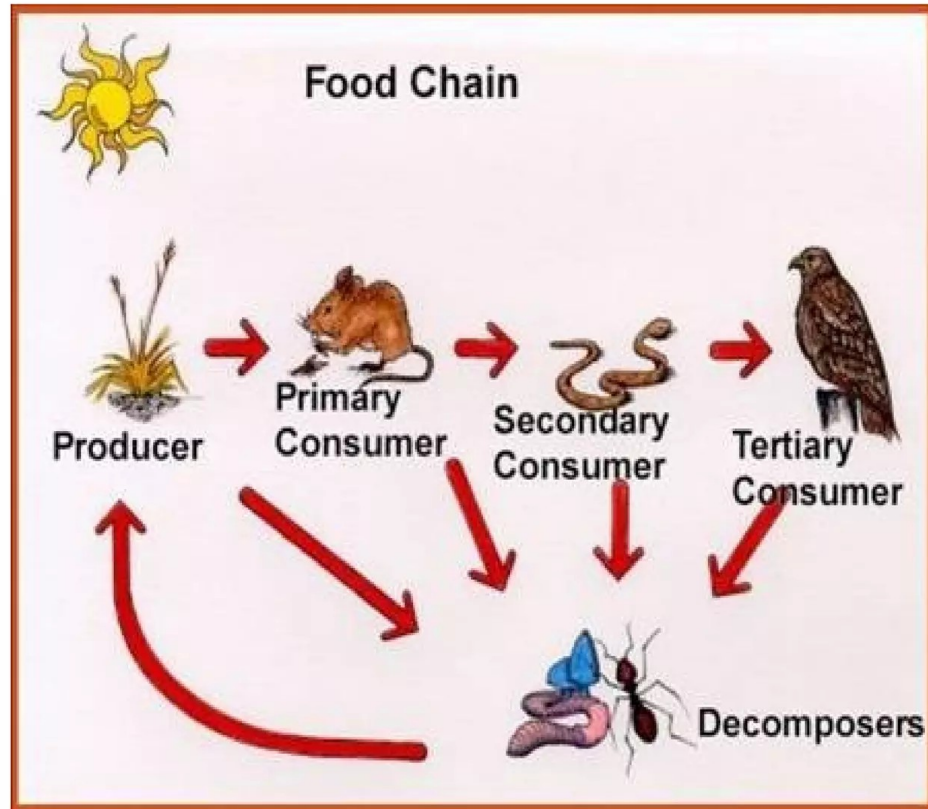
The interlocking pattern formed by several food chains that are linked together is called a *food web*.

Food Chain

- A series of organism by repeated **eating and being eaten up** is referred as **food chain**.

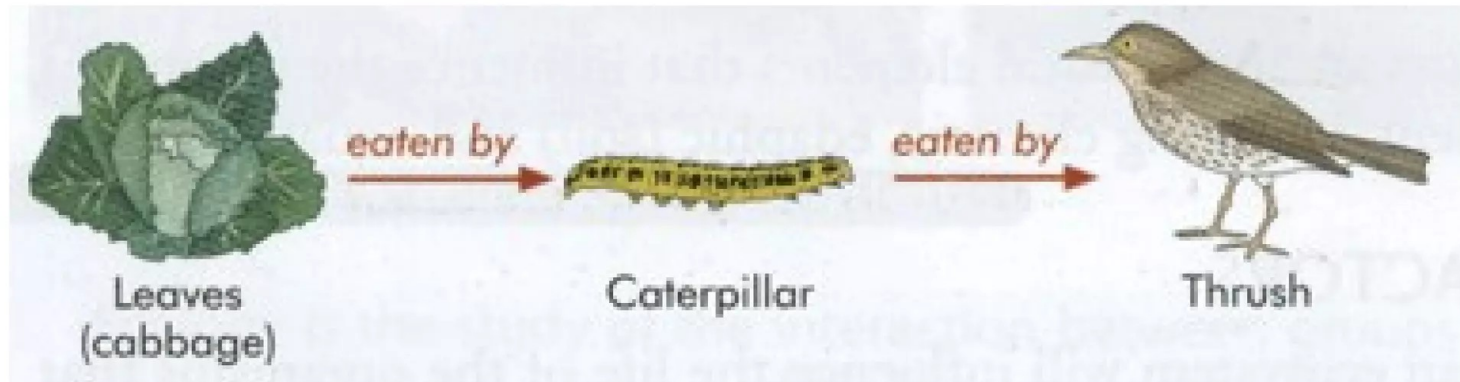
Types:

- **Grazing food chain**-a common chain
- **Detritus food chain**-chain derived by the organic wastes and dead matter from grazing food chains

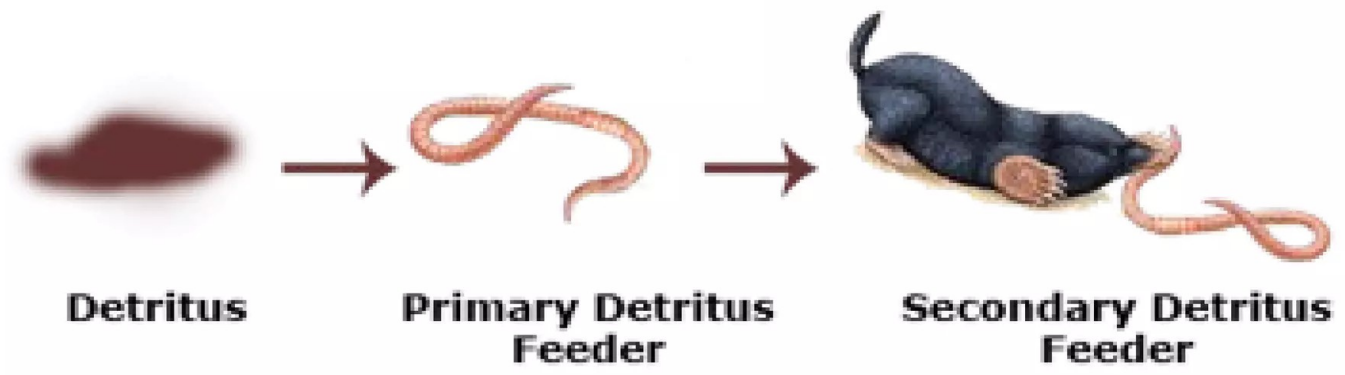


The process of eating and being eaten

Grazing and Detritus Food Chain



Grazing Food Chain



Detritus (**Dead organic matter**) Food Chain



You will see the terms **food chains** and **food webs**. They describe the same series of events that happen **when one organism consumes another to survive**.



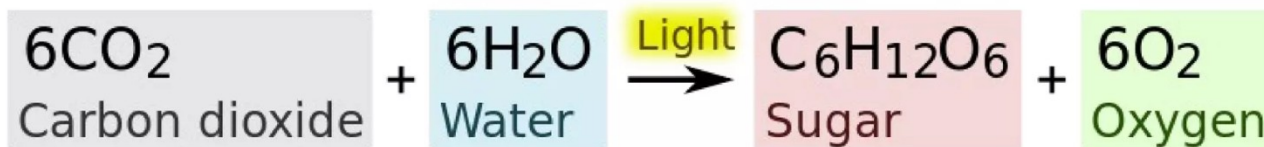
THE PRODUCERS

Producers are the beginning of a simple food chain. Producers are plants and vegetables.



THE PRODUCERS

- All energy comes from the Sun and plants are the ones who make food with that energy. They use the process of photosynthesis.
- Plants also make nutrients for other organisms to eat.





Consumers are the next link in a food chain. There are three levels of consumers.





FEEDING RELATIONSHIPS

A food chain shows a simple feeding relationship.

Sun → **grass** → **rabbit** → **fox**

Note: All food chains start with the sun





Sun with Large Solar Eruption
www.webshots.com

All food chains start with ENERGY from the sun



Ecosystem

- The meaning of the word ecology was given by German Biologist Haeckel in 1869.
- The word ecology is derived from Greek words 'Oikos' meaning house, habitat or place of living and 'Logos' meaning to study.

The term Ecosystem was first proposed by A.G. Tansley in 1935. An ecosystem consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living environment. There are many examples of ecosystems - a pond, a desert, a forest, an estuary, an ocean.





Components of an ECOSYSTEM

The components of an ecosystem are

- ❖ Biotic (living) components
- ❖ Abiotic (non living) components

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

Ex: Plants, Animals, Microorganisms





Classification of biotic components

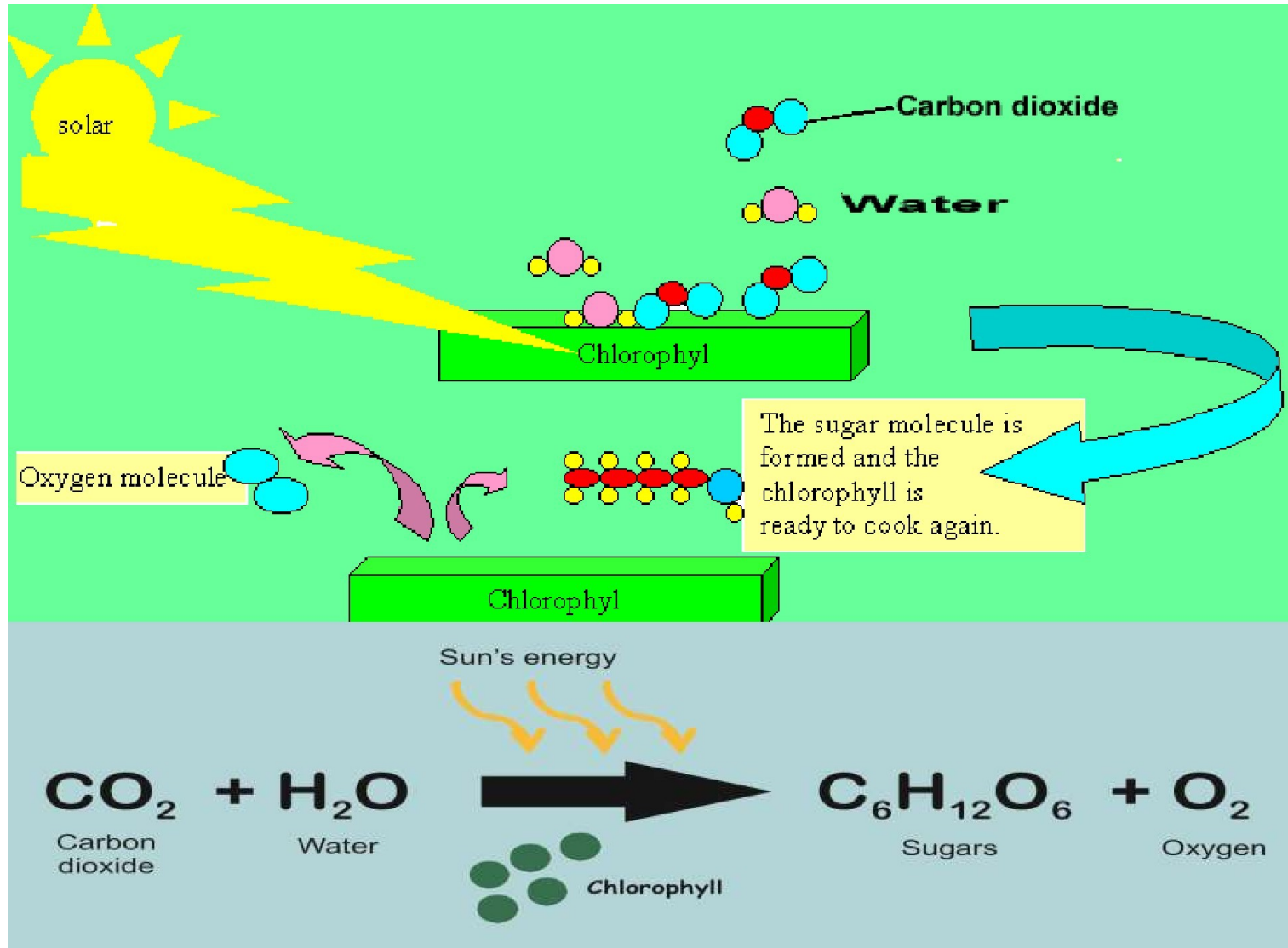
The members of biotic components of an ecosystem are grouped in to three based on how they get food.

- ❖ Producer (Plants)
- ❖ Consumer (Animals)
- ❖ Decomposers (Micro-organisms)





Producer





Classification of consumers

Primary consumers or Herbivores or Plant eaters:

- Primary consumers are also called herbivores, they directly depend on the plants for their food. So they are called plant eaters.
- **Ex : Insects, rat, goat, deer, cow etc.**



OAK TREE LEAVES



PRODUCER

CATERPILLAR



PRIMARY
CONSUMER

TREECREEPER
(SMALL BIRD)



SECONDARY
CONSUMER

HAWK



TERTIARY
CONSUMER





Types Of Ecosystem

- **Natural ecosystem:** These operate themselves under natural conditions. Based on habitat types, it can be further classified into three types.
- **Terrestrial ecosystem:** This ecosystem is related to land.
 - Ex: Grassland ecosystem, forest ecosystem, desert ecosystem, etc.,
- **Aquatic ecosystem:** This ecosystem is related to water. It is further sub classified into two types based on salt content.
 - Fresh water ecosystem
 - (a) Running water ecosystems. Ex: Rivers, Streams...
 - (b) Standing water ecosystems Ex: Pond, lake...
 - Marine ecosystem Ex: Seas and sea shores...
- **3. Man – made (or) Artificial ecosystems:** Artificial ecosystem is operated (or) maintained by man himself.
 - Ex: Croplands, gardens...





Bioaccumulation

- The increase in concentration of a substance in an organism over time (taken in and stored faster than they are broken down).
- Examples: Metals, pesticides etc.





Biomagnification

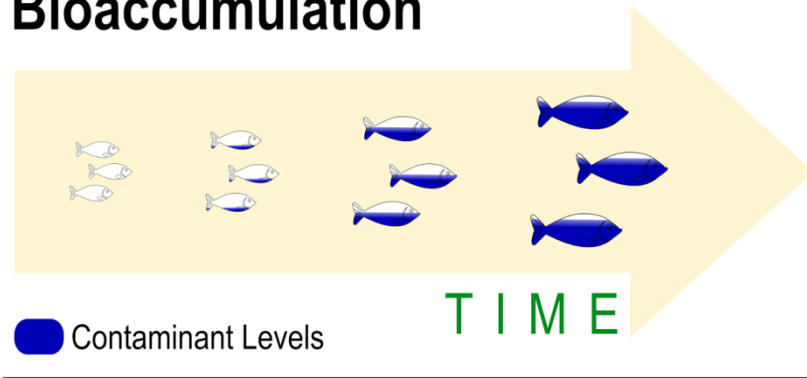
- Bio-magnification is increasing concentration of the non – biodegradable materials, on passing from one trophic level to another. At each successive trophic level, the concentration keep on increasing.

Ex- When chemicals or pesticides are let into rivers or lakes they are consumed by aquatic organisms like fish, which in turn are consumed by large birds, animals or humans. These harmful substances become concentrated in tissues, internal organs as it moves up the food chain.



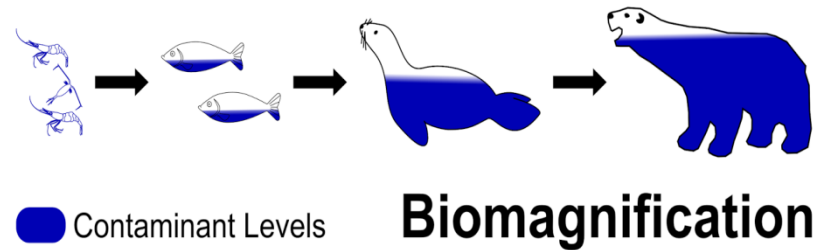
Difference between Bioaccumulation and Biomagnification

Bioaccumulation



- **Bioaccumulation** is the concentration of pollutant from the environment which occurs **within a trophic level**, i.e. one level of a food chain, usually the first organism in the food chain

- Where as **biomagnification** is the **concentration of pollutant across the food chain**



Biomagnification



Biodiversity

- The term “biodiversity” was first introduced by Walter G. Rosen in 1986.
- The word Biodiversity originates from the Greek word BIOS and Latin word DIVERSITAS

BIOS = LIFE + DIVERSITAS = VARIETY or DIFFERENCE

BIO DIVERSITY = VARIETY OF LIFE

Biodiversity is the degree of variation of life. It is a measure of the variety of organisms present in different ecosystems.



Types of Biodiversity

Diversity of Species

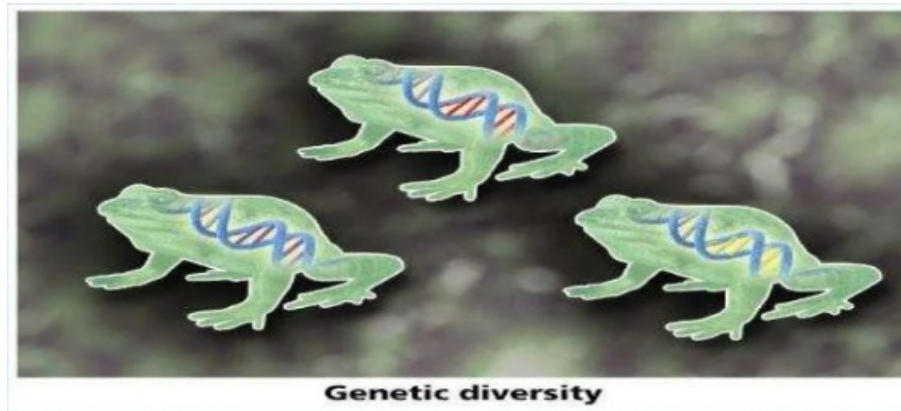
- It refers to the variety of species within a region.
- Species diversity is an index that incorporates the number of species in an area and also their relative abundance.



Types of Biodiversity

Diversity of Genetics

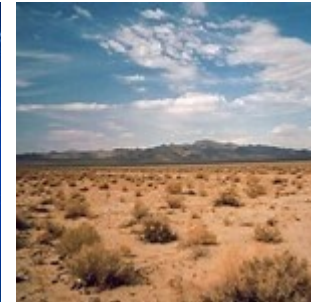
- It is a level of biodiversity that refers to the total number of genetic characteristics in the genetic makeup of a species.



Types of Biodiversity

Diversity of Ecosystem

- It refers to the diversity of a place at the level of ecosystems.





Value of Biodiversity

Consumptive use:

- **Drugs:** Many plants are used in primary health care. 70% of modern medicines are derived from plant and plant extracts.
 - ❖ Penicillin – fungus is the source – Antibiotic
 - ❖ Quinine – Chincona bark - Malaria treatment
 - ❖ Morphine – Poppy bark – Analgesic
- **Fuels:** Fire woods are directly consumed by villagers.
- **Food:** A large number of wild plants and wild animals are consumed by human beings as food.





Value of Biodiversity

Productive use:

Biodiversity products have commercial value. These products are marketed and sold. These are derived from animals and plants.

- **Animal products:** Silk from silk worm, Wool from sheep, Musk from musk deer, Leather from animals
- **Plant Products:** Wood for paper and Plywood, Cotton for textile industry, Pearl for pearl industry





Value of Biodiversity

Non-Consumptive use:

- **Recreation**
- **Education and Research**
- **Traditional value**



Threats to Biodiversity

Natural causes:

- Low population
- Low breeding rate
- Natural disasters

Anthropogenic causes:

- Climate change –Global warming
- Habitat modification
- Pollution
- Invasive species
- Overexploitation of selected species
- Hunting
- Agriculture
- Domino effect



1. CLIMATE CHANGE

Increase in the temperature of the atmosphere has major effects on the environment such as the seasons, rising of the sea levels, and glacial retreats.



2. HABITAT LOSS & DEGRADATION

Habitat loss may either be caused by natural events like natural calamities and geological events or anthropogenic activities like deforestation and man-induced climate change.



3. POLLUTION

Be it water, air, or land pollution, all forms of pollution appear to be a threat to all life forms on Earth.



4. INVASIVE SPECIES

An exotic or unnatural species can be any kind of organism that has been introduced to a foreign habitat. This introduction can cause major threats to the native species.



5. OVEREXPLOITATION

Overexploitation refers to the act of over-harvesting species and natural resources at rates faster than they can actually sustain themselves in the wild.



6. OTHER POTENTIAL THREATS

Epidemics and infectious diseases of wildlife such as Ebola virus disease, infectious bursal disease, and flu affect wildlife and biodiversity.

Source: <https://www.bioexplorer.net/threats-to-biodiversity.html/>



Recent Issues on Biodiversity

- Some 75% of the genetic diversity of crop plants been lost in the past century.
- Some scientists estimate that as many as 3 species per hour are going extinct and 20,000 extinctions occur each year.
- Roughly one-third of the world's coral reef systems have been destroyed or highly degraded.
- About 24 per cent of mammals and 12 per cent of bird species are currently considered to be globally threatened.
- More than 50 per cent of the world's wetlands have been drained, and populations of inland water and wetland species have declined by 50% between 1970 and 1999.



Conservation of biodiversity

- Biodiversity inventories
- Seed Bank, Gene Bank, Pollen Bank, DNA Bank.
- Conserving Biodiversity in protected Habitats-
 - In situ conservation
 - Ex situ conservation



National Park



Gene Bank



Zoo



In-situ conservation:

- Conservation of species in its natural habitat, in place where the species normally occurs
- The strategy involves establishing small or large protected areas.
- Today in world, there are 9800 protected areas and 1500 national parks

Methods:

- Nature or biosphere reserves. Examples: Nilgiri bio reserve
- National parks and sanctuaries. Examples: Mudumalai, Vedanthangal
- On farm and home garden conservation for plants, vegetables, and fruits to maintain traditional crop varieties.





Ex- situ conservation:

- It involves maintenance and breeding of endangered plant and animal species under partially or wholly controlled conditions in zoos, gardens and laboratories
- The crucial issue for conservation is to identify those species which are more at risk of extinction.

Methods:

1. Long term captive breeding
2. Shortage term propagation and release
3. Animal translocation and re introductions





National Biodiversity Act

Objective:

- To ensure the conservation of biological diversity,
- Sustainable use of its components and
- Fair usage of its resources in order to prevent overuse or eventual destruction of biodiversity.

The salient features of the Biological Diversity Act are as follows:

- Regulation of access to biological resources of the country
- Conservation and sustainability of biological diversity
- Protecting the knowledge of local communities regarding biodiversity
- Secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources
- Protection and rehabilitation of threatened species
- Involvement of institutions of state governments in the broad scheme of the implementations of the Biological Diversity Act through the establishment of dedicated committees.

