THE RADIANT EDUCATION POINT
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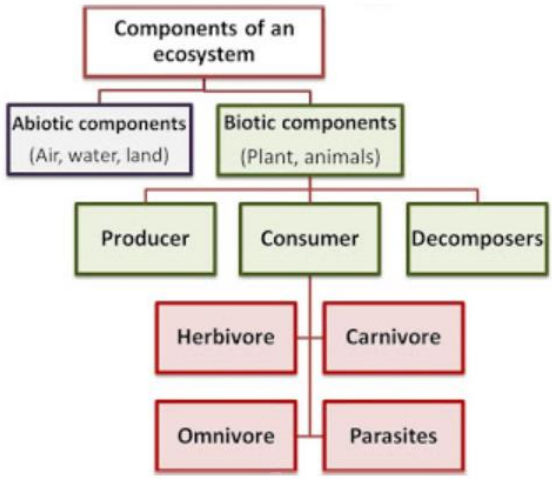
The environment includes our physical surroundings like air (or atmosphere), water bodies, soil (land) and all the organisms such as plants, animals, human beings and micro organisms like bacteria and fungi (called decomposers).
The waste materials produced by the various activities of man and animals are poisonous to some extent and can be divided into two main groups :

1. **Biodegradable wastes,** - Biodegradable substances can be further broken down by the action of bacteria e.g. paper, vegetables, clothes etc.
2. **Non-biodegradable wastes.-** On the other hand the substances which can not be further broken down by the action of bacteria are non- biodegradable substances e.g. plastics, glass etc.



ECOSYSTEM

An ecosystem is a self-contained unit of living things (plants, animals and decomposers), and their non-living environment (soil, air and water). e.g. a forest, a pond, a lake, a greenland etc.
There are two components of an ecosystem **: biotic component and abiotic component.**

TYPES OF ECOSYSTEM

It is of two types
(i) **Natural ecosystem:** The ecosystem which exist in nature on its own. Example: forest, lake, ocean.
(ii) **Artifical ecosystem**: Man-made ecosystems are called artificial ecosystem.
Example: crop field, aquarium, garden.

COMPONENTS OF ECOSYSTEM

(i) **Abiotic Components:** All the non-living components such as air, water, land, light, temperature etc. form the abiotic components.
(ii) **Biotic Components:** All the living components such as plants, animals, bacteria, fungi etc. form the biotic components.

On the basis of nutrition biotic components are further divided into:
→ **Producers:** All green plants and blue-green algae can produce their own food using abiotic components (photosynthesis), hence called producers.
→ **Consumers**: Include all animals which depend on producers directly or indirectly for their food.

Note:

Plants → **Grasshopper** → **Frog** → **Snake** → **Hawk**
(Producers) (Primary Consumer) (1st order) (Secondary) (2nd order) (Tertiary) (3rd order) (Top Consumer)

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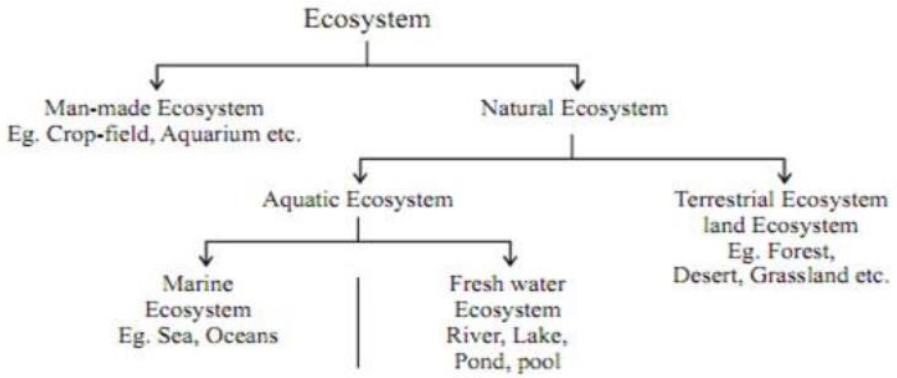
DIVISION OF CONSUMERS

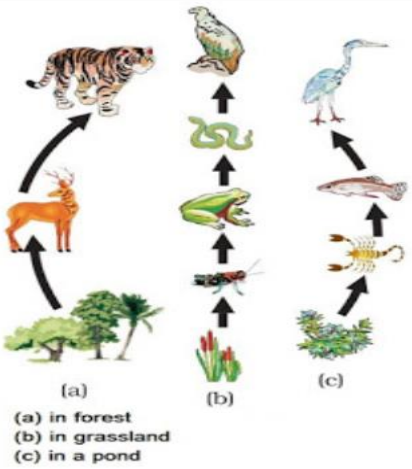
(i) **Herbivores:** Plant eaters. Example: goat, deer.
(ii) **Carnivores:** Flash eaters. Example: tiger, crocodile.
(iii) **Omnivores**: Eats both plants and animals. Example: human.
(iv) **Parasites:** Live on the body of host and take food from it. Example: lice, cascuta.



Decomposers: Include organisms which decompose the dead plants and animals. Example: bacteria, fungi. These help in the replenishment of natural resources.

FOOD CHAIN

Food Chain is defined as series of organisms in order in which organisms feeds on another organism. There are various steps in food chain in which energy is transferred, each level is known as trophic level. Energy is always transferred unidirectionally.

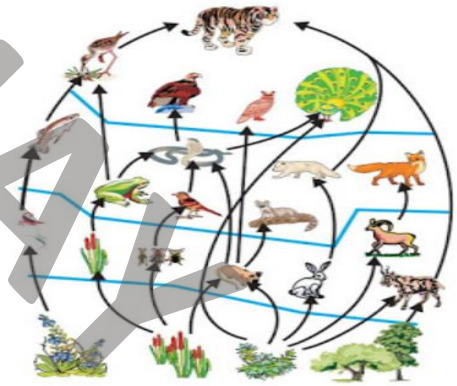


Characteristics of food chain

There is a unidirectional flow of energy from producers to consumers.
There are generally 3 to 4 trophic levels.
It is always straight
Organism can occupy different trophic levels in different food chain.

FOOD WEB

Interconnection of food chain is known as **Food Web**. It shows how food chains are interdependent.



Characteristic of Food Web

Food webs are never straight as they are formed by interlinking of food chains.
Food web provides alternative pathways of food availability. If a particular species is destroyed, the predator can feed on an alternative species.
Food webs increase ecosystem stability.

Flow of energy between trophic levels

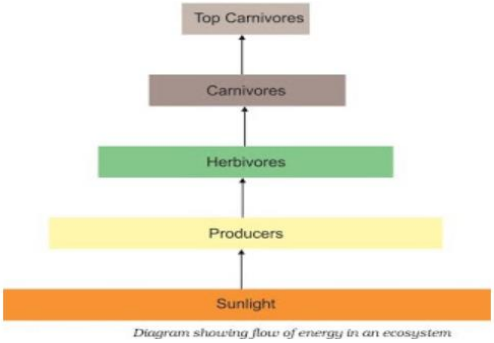


Diagram showing flow of energy in an ecosystem

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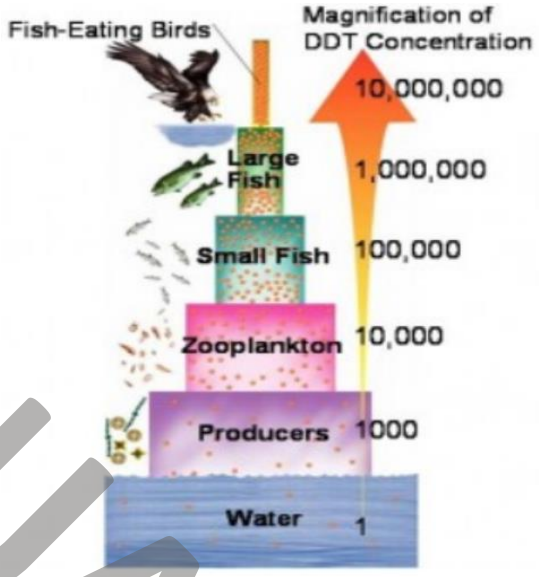
Sun is ultimate source of energy. Only 1% of solar energy coming to earth is absorbed by plants. Plants convert this energy to chemical energy by the process of photosynthesis. Some of this energy is lost by plants to surrounding. Rest is stored in body of plants. Almost 9O% of this energy is utilized for its own need and rest 10% is left for the organism of the next trophic level. So, very little energy is left for the organism which is at the tertiary level. Flow of energy is unidirectional.

10 Percent Law : The energy available at each successive trophic levelis 10% of the previous level.
So only 10% of Energy is transferred to next trophic level while 90% of energy is used by present trophic level in its life processes.

Plants → Grasshopper → Frog → Snake → Hawk
10000 J → 1000J → 100 J → 10 J
Only 10% of the energy is transfer to the next trophic level

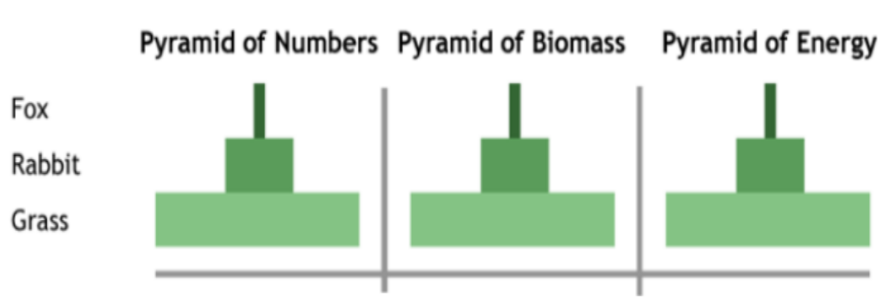


Biological Magnification

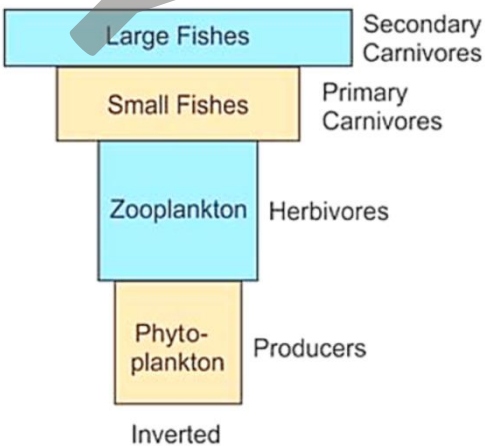
The concentration of harmful substances increases with every trophic level. This is known as **Biomagnification**. Addition of pesticides in one trophic level increases the concentration of pesticides in other trophic level.Maximum concentration of such chemicals get accumulated in human bodies. Since humans occupy the top level in any food chain.

Ecological Pyramids

Ecological Pyramid is a graphical representation to show biomass or bioproductivity. There are different ecological pyramids such as pyramid of biomass, pyramid of number and pyramid of energy. Pyramid of number indicates number of individuals at different trophic levels. Pyramid of biomass indicates biomass of the members of the food chain present at different trophic levels. Pyramid of energy indicates energy at different trophic levels.



Pyramid of number and pyramid of biomass can be inverted also. In aquatic ecosystem pyramid of biomass is inverted.



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Ozone layer

→ Ozone layer is a protective blanket around the earth which absorbs most of the harmful UV (ultraviolet) radiations of the sunlight, thus protecting living beings from many health hazards such as skin cancer, cataract, destruction of plants etc.
→ Ozone (O_3) layer is present at higher levels of atmosphere (i.e. stratosphere). It is a deadly poison at ground level.

Formation of ozone molecule

(i) The high energy UV radiations break down the O_2 molecules into free oxygen (O) atoms.

$$O \xrightarrow{(UV)} O + O \text{ (atoms)}$$

(ii) These oxygen atoms then combine with oxygen (O_2) molecule to form the ozone molecule.

$$O_2 + O \rightarrow O_3 \text{ (ozone)}$$

Depletion of ozone layer

→ The decrease in the thickness of ozone layer over Antarctica was first observed in 1985 and was termed as ozone hole.
→ This decrease was linked to excessive use of synthetic chemicals like chlorofluorocarbons (CFCs) which are used in refrigerators, ACs, fire-extinguishers, aerosols sprays etc.
→ United Nations Environment Programme (UNEP) succeeded in forging an agreement to stop CFC production at 1986 levels (KYOTO PROTOCOL) by all countries.
Ozone-depleting substances: Chlorofluorocarbons (CFCs), oxides of nitrogen, methane, carbon tetrachloride and chlorine are the ozone-depleting substances.

Garbage disposal

→ Improvements in lifestyle have resulted in accumulation of large amounts of waste materials.

Types of materials in Garbage

(i) *Biodegradable*: Substances which can be decomposed by the action of micro-organisms are called biodegradable wastes.
Example: fruit and vegetable peels, cotton, jute, dung, paper, etc.
(ii) *Non-biodegradable wastes*: Substances which cannot be decomposed by the action of micro-organisms are called non-biodegradable wastes.
Example: plastic, polythenes, metals, synthetic fibres, radioactive wastes, pesticides etc.
→ Micro-organisms release enzymes which decompose the materials but these enzymes are specific in their action that's why enzymes cannot decompose all the materials.

Methods of waste disposal

(i) Biogas plant: Biodegradable waste can be used in biogas plant to produce biogas and manure.
(ii) Sewage treatment plant: The drain water can be cleaned in sewage treatment plant before adding it to rivers.
(iii) Land fillings: The wastes are buried in low lying areas and are compacted by rolling with bulldozers.
(iv) Composting: Organic wastes are filled in a compost pit and covered with a layer of soil, after about three months garbage changes to manure.
(v) Recycling: Non-biodegradable wastes are recycled to make new items.
(vi) Reuse: It is a conventional technique to use an item again. Example: newspaper for making envelops.

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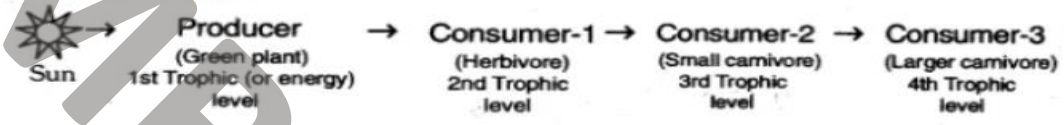
Food chain	Food web
1. Food chain is a straight sequence of organisms.	1. Food web is a complex network formed of many food chains.
2. Food chain do not have any cross linkages.	2. Food web has many cross linkages.
3. The entire food chain gets affected if any organism dies in it.	3. There is no effect on other organisms in the food web if any organism dies in it.
4. It has maximum of 5-6 populations of different species.	4. It has many populations of different species.

10. A generalised food chain:



Biodegradable Wastes	Non-Biodegradable Wastes
1. Those waste materials which can be broken down to non-poisonous substances in nature by the action of microorganisms (like bacteria) are called biodegradable wastes.	1. Those waste materials which cannot be broken down to non-poisonous substances in nature are called non-biodegradable wastes.
2. They get recycled and,therefore, do not require dumping sites.	2. They cannot be recycled easily and, therefore, are to be dumped which requires a lot of space. This causes wastage of land.
3. They do not cause any pollution to the soil. **Examples are :** Paper, wood, animal excreta, compost, animal bones, leather, plant waste, wool and hay.	3. The harmful chemicals leach out of these wastes when they are dumped in soil. This leads to soil pollution. **Examples are :** DDT, plastics, polythene bags, glass objects, synthetic fibres, aluminium cans, other metal foils, radioactive elements and their wastes, pens and their refills.

ECOSYSTEM

Abiotic Components
[Non-living components]

These include :

(*i*) **Physical environment**
[Soil, water and air]

(*ii*) **Inorganic substances**
[Carbon dioxide, nitrogen, water, oxygen, sulphur, phosphorus, calcium, potassium, etc.]

(*iii*) **Climatic factors**
[light, temperature, pressure, humidity, etc.]

Biotic Components
[Living components]

These include all plants and animals which may be any of the following types :

(*i*) **Producer organisms** (or **Autotrophs**)
All the green plants which synthesise their own food are producers.

(*ii*) **Consumer organisms** (or **Heterotrophs**)
All the animals which depend on others for food are consumers.

(*iii*) **Decomposer organisms** (or **Saprotrophs**)
Certain bacteria and fungi which consume the dead remains of other organisms are decomposers.

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Environment: The physical, chemical and 'biological conditions of the region in which an organism lives is called its Environment. It includes air, light, soil, temperature, water and the presence or absence of other organisms, i.e., the conditions for development or growth.
The environment has three main components

- Physical surroundings [soil, air and water bodies]
- Living organisms [plants, animals, decomposers (bacteria and fungi)]
- Meteorological factors (or climatic factors). [Sunlight, temperature, rainfall, humidity, pressure and wind speed].

***Ten percent law*:** Ten percent law states that only 10 percent of the energy entering a particular trophic level of organisms is available for transfer to the next higher trophic level.
For example, suppose 1000 J of solar energy is received by green plants, then only 1% of solar energy available on earth is utilized by plants. So only 10 J (1% of 1000 J) is trapped by plants and the rest 990 J of energy is lost to the environment. So, plants utilizes only 10 J of energy. Next, only 10% of the 10 J energy of plant, that is, 1 J, is available to the herbivore animal while 9 J is lost to the environment. Again, just 10% of the 1 J of energy of herbivore animals is utilized by carnivore animals. Thus, carnivore animals have only 0.1 J of energy while 0.9 J is lost to the environment.

Trophic Levels: The various steps in the food chain at which the transfer of food (or energy) takes place is called trophic levels.
There is a gradual decrease in the amount of energy transfer from one trophic level to the next trophic level in a food chain.
So only 10% of energy is transferred to next trophic level while 90% of energy is used by present trophic level in its life processes.
The various trophic levels are given below:

- The plant or the producers constitute the first trophic level.
- The herbivores or primary consumers form the second trophic level.
- Carnivores or secondary consumers make up the third trophic level.
- Large carnivores or the tertiary consumers which feed upon the small carnivores constitute the fourth trophic level.

Flow Open Energy
Energy is used and conveyed from one trophic level to another in a food chain. This is called flow of energy. Green plants capture about 1% of the solar energy incident on the Earth through the biochemical process of photosynthesis. A part of this trapped energy is used by plants in performing their metabolic activities and some energy is released as heat into the atmosphere. The remaining energy is chemical energy stored in the plants as 'carbohydrates'. When plants are eaten up by herbivores, the chemical energy stored in the plants is transferred to these animals. These animals (herbivores) utilize some of this energy for metabolic activities, some energy is "released as heat and the remaining energy is stored. The process of energy transferred is similarly repeated with carnivores and so on.