UNIT-1

Environment: *Definition, Types of Environment, Components of environment, Segments of environment, Scope and importance, Need for Public Awareness.*
Ecosystem: *Definition, Types of ecosystem, Structure of ecosystem, Food Chain, Food Web, Ecological pyramid. Balance Ecosystem. Effects of Human Activities such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environment Impact Assessment, Sustainable Development*

INTRODUCTION:

Everything that surrounds or affects an organism during its life time is collectively known as its environment or simply put everything surrounding a living organism like people; place and things constitute its environment which can be either natural or man-made. The word environment has been derived from a French word 'environner' meaning to encircle or to surround. In the beginning, environment of early man consisted of only physical aspects of the planet earth such as land (lithosphere), air (atmosphere) and water (hydrosphere) along with biotic communities but, with the passage of time and advancement of society man extended his environment to include his social, economic and political functions too. At the organismic level it is essentially physiological interaction which tries to understand that how different organisms are adapted to their environment in terms of not only survival but also reproduction and propagation of their population.

Definition of Environment: -

'The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature behaviour and the growth, development and maturity of living organisms' (**Douglas and Holland).**

'Environment refers to the sum total of all conditions which surround man at a given point in space and time' (**C.C.Park)**

The entire range of external influence acting on an organism, both the physical and biological, and other organisms, i.e. forces of nature surrounding an individual.

(**Encyclopedia Britannica)**

Total environmental system including not only the biosphere, but also his interactions with his natural and man-made surroundings **(US Council on Environmental quality**).

Components or Segments of Environment

Environment is divided in following Components

1. Lithosphere

2. Hydrosphere

3. Atmosphere

4. Biosphere

(1) **Lithosphere:**

The lithosphere consists of upper mantle and the crust. The crust is the earth's outer skin that is accessible to human. The crust consists of rocks and soil of which the latter is the important part of lithosphere.

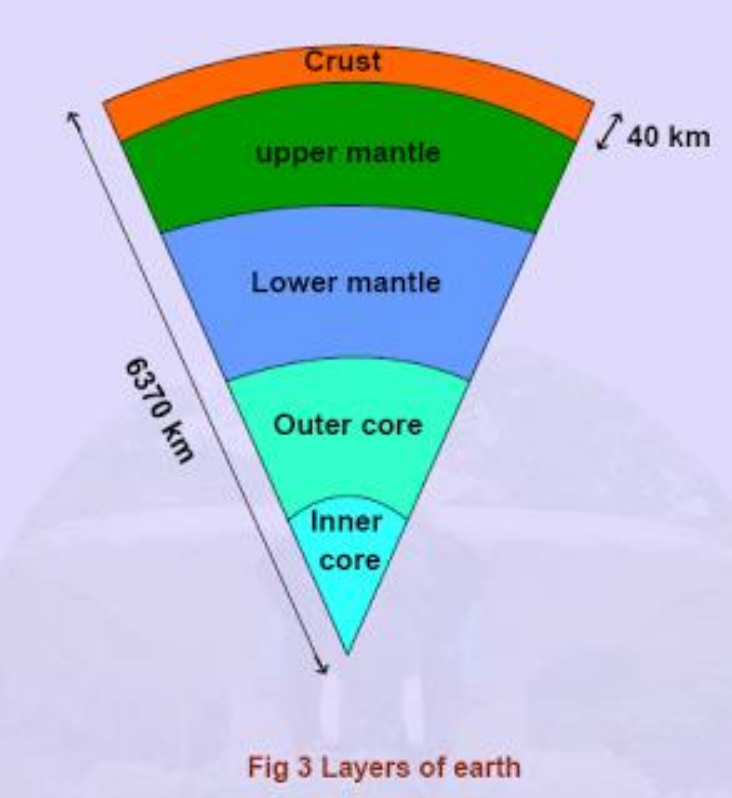


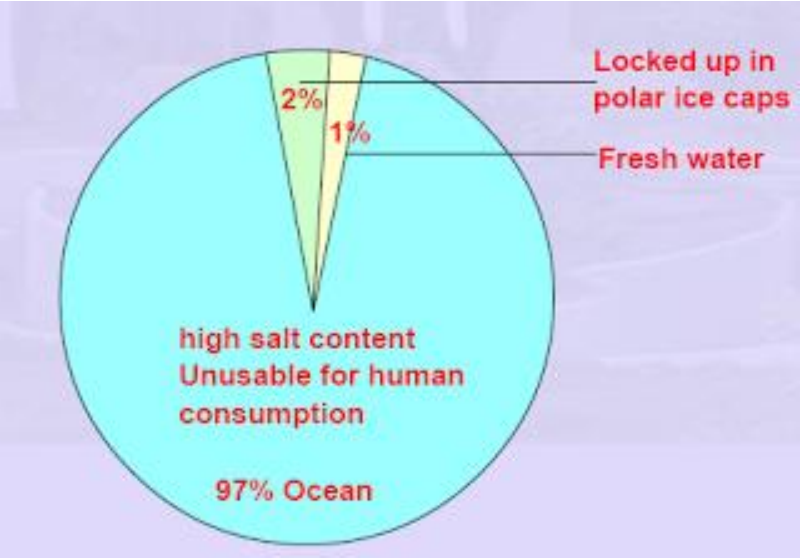
Fig 3 Layers of earth

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. Soil is usually defined as "any part of earth's crust in which plants root."

Muddy bottoms of ponds, ravines or glacial deposits, porous rock surface, bottoms of lakes peat etc., all are thus soil. A typical productive soil contains approximately 95 per cent inorganic matter and 5 per cent organic matter. Organic matter in the soil provides food for microorganism. This matter includes amino sugars, organic sulphur, organic phosphate, and polysaccharides.

Soil contains silicate minerals, which includes nearly 74 per cent Silicon and Oxygen, common elements in the soil are 46.4 per cent Oxygen, Silicon 27.7 per cent, Aluminium 8.1 per cent, Iron 5.6 per cent, Calcium 3.6 per cent, Sodium 2.8 per cent, Potassium 2.6 per cent, Magnesium 2.1 per cent. In some soils, manganese oxide and titanium oxide are also available.

(2) Hydrosphere: This includes all the surface and ground water resources such as oceans, seas, rivers, streams, lakes, reservoirs, glaciers, polar ice caps, ground water and water locked in rock and crevices and minerals laying deep below the earth's crust.



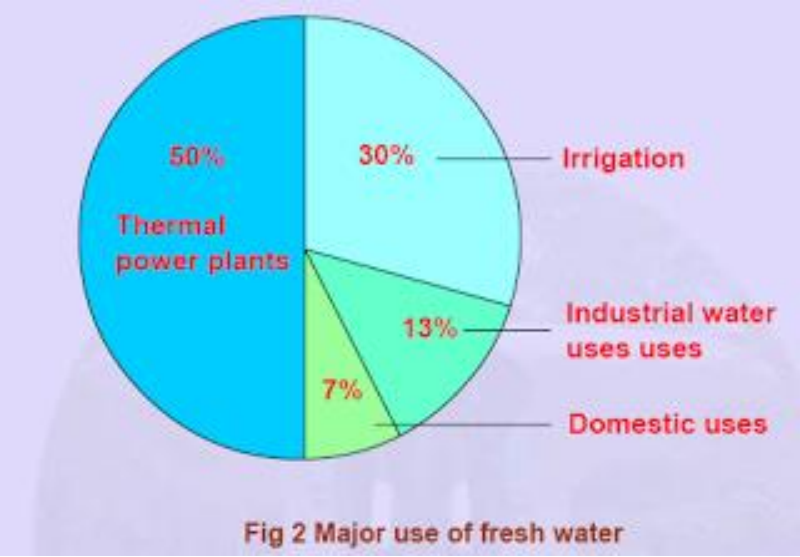


Fig 2 Major use of fresh water

1. Earth is called blue planet because 80 per cent of its surface is covered by water (97 per cent of the earth's water resources is locked up in the oceans and seas, 2.4 per cent is trapped is giant glaciers and polar ice caps.) Only 1% of the total water supply is available as fresh water in the form of rivers, lakes, streams and ground water for human consumption and other uses.

2. Water is universal solvent.

3. Water is also the main medium by which chemical constituents are transported from one part of an ecosystem to others.

4. Water has high specific heat, latent heat and relatively high freezing point.

5. Surface water contains a lot of organic matter and mineral nutrients, which feed large bacteria population and algae.

(3) Atmosphere: The gaseous envelope surrounding the earth is composed of an entire mass of air containing N2, 02, H20, C02 and inert gases is known as atmosphere.

1. Soil contains silicate minerals, which includes nearly 74 per cent Silicon.

2. The atmosphere is a reservoir of several elements essential to life and serves many purposes and functions.

3. The atmosphere is mobile, elastic, compressible and expansible.

4. Atmosphere serves many purposes and functions.

5. It absorbs most of the harmful radiations.

6. It maintains the heat balance of the earth.

7. 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 been an organism and its environment.

8. Atmosphere can be divided into several layers on the basic of temperature variations. They are troposphere, stratosphere, mesosphere and thermosphere.

The following points highlight the vital role played by atmosphere in the survival of life in this planet.

• The atmosphere is the protective blanket of gases which is surrounding the earth. It protects the earth from the hostile environment of outer space.

• It absorbs IR radiations emitted by the sun and reemitted from the earth and thus controls the temperature of the earth.

• It allows transmission of significant amounts of radiation only in the regions of 300 – 2500 nm (near UV, Visible, and near IR) and 0.01 – 40 meters (radio waves). i.e it filters tissue

damaging UV radiation below 300 nm.

• It acts as a source for CO2 for plant photosynthesis and O2 for respiration

• It acts as a source for nitrogen for nitrogen fixing bacteria and ammonia producing plants.

• The atmosphere transports water from ocean to land.

- 50% of the atmosphere by mass is below an altitude of 5.6 km (18,000 ft).
- 90% of the atmosphere by mass is below an altitude of 16 km (52,000 ft). The common altitude of commercial airliners is about 10 km (33,000 ft) and Mt. Everest's summit is 8,848 m (29,029 ft) above sea level.

(4) Biosphere:

The biosphere refers to the realm of living organisms and their interactions with the environment (VIZ: atmosphere, hydrosphere and lithosphere)

- The biosphere is very large and complex and is divided into smaller units called ecosystems.
- Plants, animals and microorganisms which live in a definite zone along with physical factors such as soil, water and air constitute an ecosystem.
- Within each ecosystems there are dynamic inter relationships between living forms and their physical environment

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 penetrates into and is dependent on the atmosphere, hydrosphere and lithosphere. This denotes

the relating of living organism and their interactions with the environment. The biosphere is a relatively thin and incomplete envelope covering most of the world.

Since the environment includes both physical and biological concept, it embraces both the abiotic (non-living) and biotic (living) components of planet earth. Thus, on account of basic structure the components of environment may be classified into two basic types:

ABIOTIC COMPONENTS (NON-LIVING): - these are the most important determining factor of where and how well an organism exists in the environment. Although these factors interact with each other, one single factor can limit the range of an organism thus acting as the limiting factor. These factors can be categorised into following groups:

PHYSICAL FACTORS: - the major components are temperature, Water (Rainfall), Light (Energy), Soil, Atmosphere.

BIOTIC COMPONENTS (LIVING): - It consists of the living parts of the environment, including the association of a lot of interrelated populations that belong to different species inhabiting a common environment. The populations are those of the animal community, the plant community and the microbial community.

The biotic community is divided into:

a. Autotrophs,

b. Saprotrophs, and

c. Heterotrophs

AUTOTROPHS (derive from Greek word: auto - self, trophos - feeder) are called producers, transducers or convertors, as well. Those are photosynthetic plants, normally chlorophyll bearing, which synthesize a high-energy complex organic compound (food) from the inorganic raw materials utilizing the aid of the sun, and this process is called photosynthesis. Autotrophs form the core of all biotic systems.

HETEROTROPHS (from Greek: heteros - other; trophs - feeder) are the consumers, normally animals that feed on the other organisms.

SAPROTROPHS (from Greek again: sapros - rotten; trophos - feeder) are called the reducers or decomposers or osmotrophs. They break the complex organic compounds in dead matter down (dead plants and animals).

Types of Environment

The environment is divided into two parts which are as follows;

1. Geographical Environment
2. Man-Made Environment

Geographical Environment

Geographical environment refers to the terrestrial environment, which is made up of a variety of natural and environmental factors. It is the complement of direct interaction involving nature and human society, even though it developed independently of people. The geographical environment involves geology, the sciences of climatology, and biogeography. They are outward representations of human society's perceptions of the earth's landscape.

Because it interacts with nature, a geographical environment is often considered a natural environment. The natural environment includes the earth's surface, mountains, rivers, oceans, deserts, land, water, volcanoes, and so on.

Man-Made Environment

Because man is unable to live in his natural habitat, he creates some environmental circumstances to compensate. A man-made or human-made environment was created by humans. A social environment is considered a man-made environment.

There are two types of man-made environments which is as given below;

1. Inner Environment
2. Outer Environment

Inner Environment

The inner environment is a social environment that endures for as long as a civilization does. It has to do with rules, traditions, organisations, and institutions. It includes customs and folkways that can be found in any human community. Non-material culture, social heritage, and other terms are used to describe it. This legacy is necessary for human social life to thrive, and it is recognised to have an impact on an individual's life. The artificial environment, which is a modified form of the economic and physical environment, is considered two distinct components of the man-made environment.

Outer Environment

Humans have tried to alter the parameters of their physical environment through advancements in science and technology. This outer environment is the result of these changes, which include modern infrastructure in cities, our homes and associated amenities, our modes of communication and transportation, our resorts to conveniences and luxury, various types of electrical appliances, industry manufacturing luxurious commodities, and so on, all of which ultimately aim at civilization and urbanisation.

The inner and outer environments are inextricably linked and so inseparable.

Scope, IMPORTANCE and Need of Public Awareness

The environment studies make us aware about the importance of protection and conservation of our mother earth and about the destruction due to the release of pollution into the environment. The increase in human and animal population, industries and other issues make the survival cumbersome. A great number of environment issues have grown in size and make the system more complex day by day, threatening the survival of mankind on earth. Environment studies have become significant for the following reasons:

1. Environment Issues are being of Global:

It has been well recognised that environment issues like global warming and ozone depletion, acid rain, marine pollution and biodiversity are not merely national issues but are global issues and hence require international efforts and cooperation to solve them.

2. Development and Environment:

Development leads to Urbanization, Industrial Growth, Telecommunication and Transportation Systems, Hi-tech Agriculture and Housing etc. However, it has become phased out in the developed world. The North intentionally moves their dirty factories to South to cleanse their own environment. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Development of the rich countries of the world has undesirable effects on the environment of the entire world.

3. Explosive Increase in Pollution

World census reflects that one in every seven persons in this planet lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soil health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

4. Need for an Alternative Solution

It is essential, specially for developing countries to find alternative paths to an alternative goal. We need a goal as under:

A true goal of development with an environmentally sound and sustainable development.A goal common to all citizens of our planet earth. A goal distant from the developing world in the manner it is from the over-consuming wasteful societies of the “developed” world.It is utmost important for us to save the humanity from extinction because of our activities constricting the environment and depleting the biosphere, in the name of development.

5. Need for Wise Planning of Development

Our survival and sustenance depend on resources availability. Hence Resources withdraw, processing and use of the products have all to be synchronised with the ecological cycle. In any plan of development our actions should be planned ecologically for the sustenance of the environment and development.

Ecosystems:

The term Ecology was coined by Earnst Haeckel in 1869. It is derived from the Greek words Oikos- home + logos- study. So, ecology deals with the study of organisms in their natural home interacting with their surroundings. The surroundings or environment consists of other living organisms (biotic) and physical (abiotic) components. Modern ecologists believe that an adequate definition of ecology must specify some unit of study and one such basic unit described by Tansley (1935) was ecosystem. "An ecosystem is a group of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter". Now ecology is often defined as "the study of ecosystems".

An ecosystem is an integrated unit consisting of interacting plants, animals and microorganisms whose survival depends upon the maintenance and regulation of their biotic and abiotic structures and functions.

The ecosystem is thus, a unit or a system which is composed of a number of subunits, that are all directly or indirectly linked with each other. They may be freely exchanging energy and matter from outside—an open ecosystem or may be isolated from outside—a closed ecosystem

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…

Ecosystems show large variations in their size, structure, composition etc. However, all the ecosystems are characterized by certain basic **structural** and **functional** features which are common.

STRUCTURAL FEATURES

Composition and organization of biological communities and abiotic components constitute the structure of an ecosystem.

I.Biotic Structure

The plants, animals and microorganisms present in an ecosystem form the biotic component.

(a) Producers: They are mainly the green plants, which can synthesize their food themselves by making use of carbon di oxide present in the air and water in the presence of sunlight by involving chlorophyll, the green pigment present in the leaves, through the process of photosynthesis. They are also known as *photo autotrophs* (auto=self; troph=food, photo=light).

There are some microorganisms also which can produce organic matter to some extent through oxidation of certain chemicals in the absence of sunlight. They are known as chemosynthetic organisms or chemo-autotrophs. For instance, in the ocean depths, where there is no sunlight, chemoautotrophic sulphur bacteria make use of the heat generated by the decay of radioactive elements present in the earth's core and released in ocean's depths. They use this heat to convert dissolved hydrogen sulphide (H_2S) and carbon dioxide (CO_2) into organic compounds.

(b) Consumers: All organisms which get their organic food by feeding upon other organisms

are called consumers, which are of the following types:

(i) Herbivores (plant eaters): They feed directly on producers and hence also known as primary consumers. e.g. rabbit, insect, man.

(ii) Carnivores (meat eaters): They feed on other consumers. If they feed on herbivores they are called secondary consumers (e.g. frog) and if they feed on other carnivores (snake, big fish etc.) they are known as tertiary carnivores/consumers.

(iii) Omnivores: They feed on both plants and animals. e.g. humans, rat, fox, many birds.

(iv) Detritivores (Detritus feeders or Saprotrophs): They feed on the parts of dead organisms, wastes of living organisms, their cast-offs and partially decomposed matter e.g. beetles, termites, ants, crabs, earthworms etc.

(c) Decomposers: They derive their nutrition by breaking down the complex organic molecules to simpler organic compounds and ultimately into inorganic nutrients. Various bacteria and fungi are decomposers.

In all the ecosystems, this biotic structure prevails. However, in some, it is the primary producers which predominate (e.g. in forests, agroecosystems) while in others the decomposers predominate (e.g. deep ocean).

II. Abiotic Structure

The physical and chemical components of an ecosystem constitute its abiotic structure. It includes climatic factors, edaphic (soil) factors, geographical factors, energy, nutrients and toxic substances.

(a) Physical factors: The sunlight and shade, intensity of solar flux, duration of sun hours, average temperature, maximum-minimum temperature, annual rainfall, wind, latitude and altitude, soil type, water availability, water currents etc. are some of the important physical features which have a strong influence on the ecosystem.

We can clearly see the striking differences in solar flux, temperature and precipitation (rainfall, snow etc.) pattern in a desert ecosystem, in a tropical rainforest and in tundra ecosystem.

(b) Chemical factors: Availability of major essential nutrients like carbon, nitrogen, phosphorus, potassium, hydrogen, oxygen and sulphur, level of toxic substances, salts causing salinity and various organic substances present in the soil or water largely influence

the functioning of the ecosystem.

FUNCTIONAL FEATURES

Every ecosystem performs under natural conditions in a systematic way. It receives energy from the sun and passes it on through various biotic components and in fact, all life depends upon this flow of energy.

The major functional attributes of an ecosystems are as follows:

(i) Food chain, food webs and trophic structure.

(ii) Energy flow.

(iii) Cycling of nutrients (Biogeochemical cycles).

(iv) Primary and Secondary production.

(v) Ecosystem development and regulation.

Tropic structure: The structure and functions of the ecosystem are interrelated and influence each other. The flow of energy is mediated through a series of feeding relation ships in a definite sequence or pattern which is known as Food chain. Nutrients too move along the food chain. The producers and consumers are arranged in an ecosystem in a definite manner and their interaction along with the population size is expressed together as Trophic structure. Each food level is known as Trophic level and the amount of living matter at each Trophic level at a given time is known as **standing crop or standing biomass.**

(i) FOOD CHAINS

• **The sequence of eating and being eaten in an ecosystem** is known as food chain.

• All organisms, living or dead, are potential food for some other organism and thus, there is essentially no waste in the functioning of a natural ecosystem.

Some common examples of simple food chains are:

Grass → grasshopper → Frog → Snake → Hawk (Grassland ecosystem)

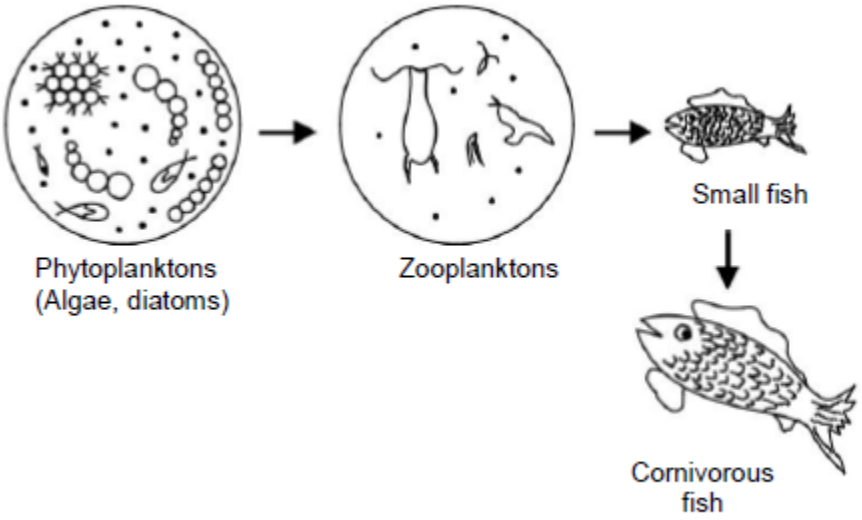
Phytoplankton's → water fleas → small fish → Tuna (Pond ecosystem)

Each organism in the ecosystem is assigned a feeding level or trophic level depending on its nutritional status. Thus, in the grassland food chain, grasshopper occupies the Ist trophic level, frog the IInd and snake and hawk occupy the IIIrd and the IVth trophic levels, respectively.

The decomposers consume the dead matter of all these trophic levels. In nature, we come across two major types of food chains.

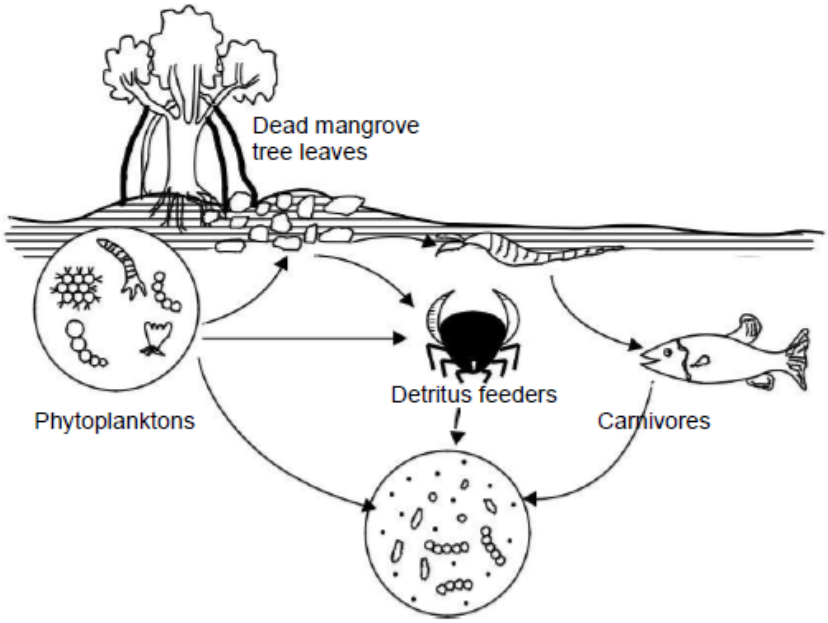
1. Grazing food chain: It **starts with green plants** (primary producers) and culminates in carnivores. All the examples cited above show this type of food chain. Another example could be

Grass → Rabbit → Fox



A grazing food chain in a pond ecosystem

2. Detritus food chain: It **starts with dead organic matter** which the detritivores and decomposers consume. Partially decomposed dead organic matter and even the decomposers are consumed by detritivores and their predators. An example of the detritus food chain is seen in a Mangrove (estuary)



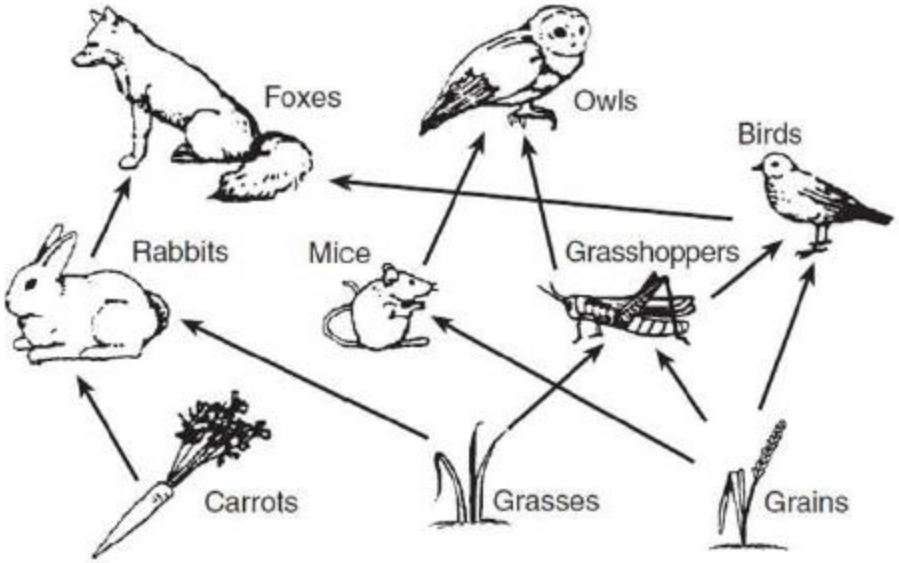
A detritus food chain in an estuary based on dead leaves of mangrove trees

Leaf litter → algae → crabs → small carnivorous fish → large carnivorous fish (Mangrove ecosystem)

Dead organic matter → fungi → bacteria (Forest ecosystem)

FOOD WEB

Food chains in ecosystems are rarely found to operate as isolated linear sequences. Rather, they are found to be interconnected and usually form a complex network with several linkages and are known as food webs. Thus, "food web is **a network of food chains** where different types of organisms are connected at different trophic levels, so that there are a number of options of eating and being eaten at each trophic level."



Significance of food chains and food webs

Food chains and food webs play a very significant role in the ecosystem because the two most important functions of energy flow and nutrient cycling take place through them.

• The food chains also help in maintaining and regulating the population size of different animals and thus, help maintain the ecological balance.

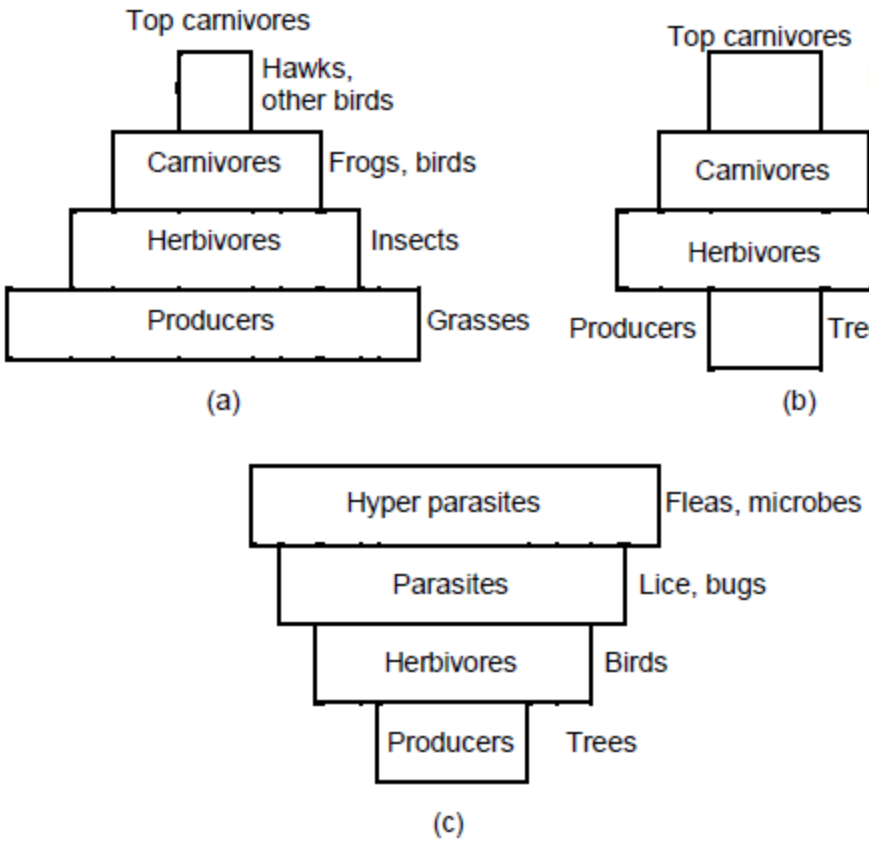
• Food chains show a unique property of biological magnification of some chemicals.

ECOLOGICAL PYRAMIDS

Graphic representation of tropic structure and function of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is knows as an ecological pyramid.

Ecological pyramids are of three types:

a) Pyramid of numbers: It represents the number of individual organisms at each trophic level. We may have upright or inverted pyramid of numbers, depending upon the type of ecosystem and f ood chain as shown in below Fig.



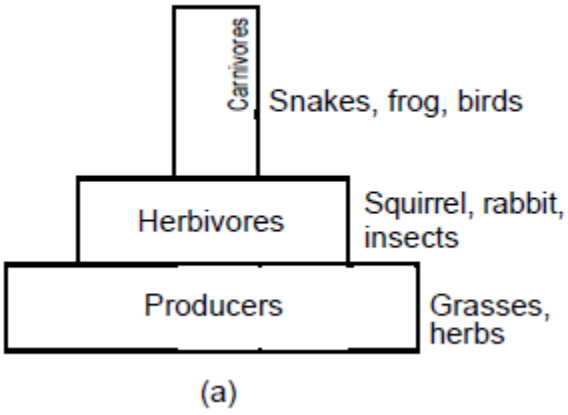
- A grassland ecosystem (Fig. a) and a pond ecosystem show an upright pyramid of numbers. The producers in the grasslands are grasses and that in a pond are phyto planktons (algae etc.), which are small in size and very large in number. So the producers form a broad base. The herbivores in a grassland are insects while tertiary carnivores are hawks or other birds which are gradually less and less in number and hence the pyramid apex becomes gradually narrower forming an upright pyramid.

• In a forest ecosystem (Fig. b), big trees are the producers, which are less in number and hence form a narrow base. A larger number of herbivores including birds, insects and several species of animals feed upon the trees (on leaves, fruits, flowers, bark etc.) and form a much broader middle level. The secondary consumers like fox, snakes, lizards etc. are less in number than herbivores while top carnivores like lion, tiger etc. are still smaller in number. So the pyramid is narrow on both sides and broader in the middle.

• Parasitic food chain shows (Fig. c) an inverted pyramid of number. The producers

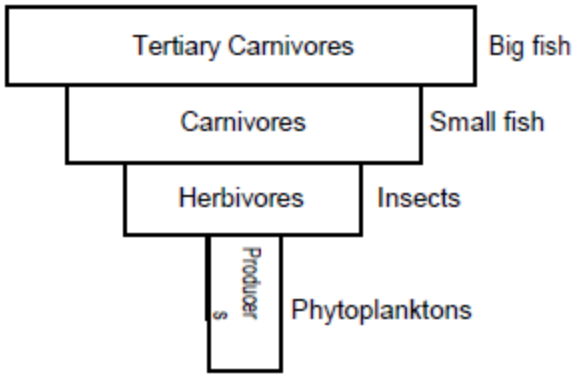
like a few big trees harbour fruit eating birds acting like herbivores which are larger in number. A much higher number of lice, bugs etc. grow as parasites on these birds while a still greater number of hyper parasites like bugs, fleas and microbes feed upon them, thus making an inverted pyramid.

b) Pyramid of biomass: It is based upon the total biomass (dry matter) at each trophic level in a food chain. The pyramid of biomass can also be upright or inverted.



(a)

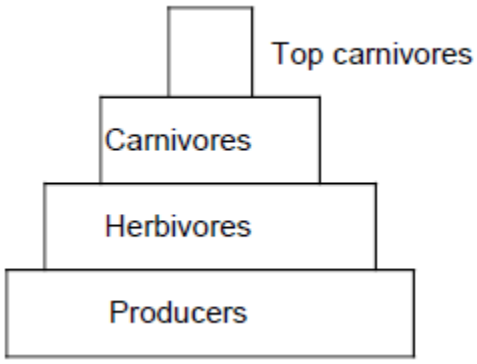
above Fig. (a, b) shows pyramids of biomass in a forest and an aquatic ecosystem. The pyramid of biomass in a forest is upright in contrast to its pyramid of numbers. This is because the producers (trees) accumulate a huge biomass while the consumers' total biomass feeding on them declines at higher trophic levels, resulting in broad base and narrowing top.



(b)

The pond ecosystem shows an inverted pyramid of biomass (Fig. b). The total biomass of producers (phytoplankton's) is much less as compared to herbivores (zooplanktons, insects), Carnivores (Small fish) and tertiary carnivores (big fish). Thus the pyramid takes an inverted shape with narrow base and broad apex

c) Pyramid of Energy: The amount of energy present at each trophic level is considered for this type of pyramid. Pyramid of energy gives the best representation of the trophic relationships and it is always upright.



At every successive trophic level, there is a huge loss of energy (about 90%) in the form of heat, respiration etc. Thus, at each next higher level only 10% of the energy passes on. Hence, there is a sharp decline in energy level of each successive trophic level as we move from producers to top carnivores. Therefore, the pyramid of energy is always upright as shown in Fig.

Effect of Human Activities on The Environment

Humans impact the environment in several ways. Common effects include decreased water quality, increased pollution and greenhouse gas emissions, depletion of natural resources and contribution to global climate change. Some of these are the direct result of human activities, whereas others are secondary effects that are part of a series of actions and reactions.

1. **Deforestation:**
2. **Water Pollution:**
3. **Air Pollution:**
4. **The exploitation of Marine Life:**
5. **Global Warming:**

6. **Habitat Loss:**

7. **Extinction:**

Human Activities are triggering extinction on an unprecedented and mass scale. The destruction of natural habitats, Environmental hazards, global warming, poaching, pollution, and deforestation are some of the leading causes of this tragedy.

8. **Overuse Of Harmful Pesticides And Fertilizers:**

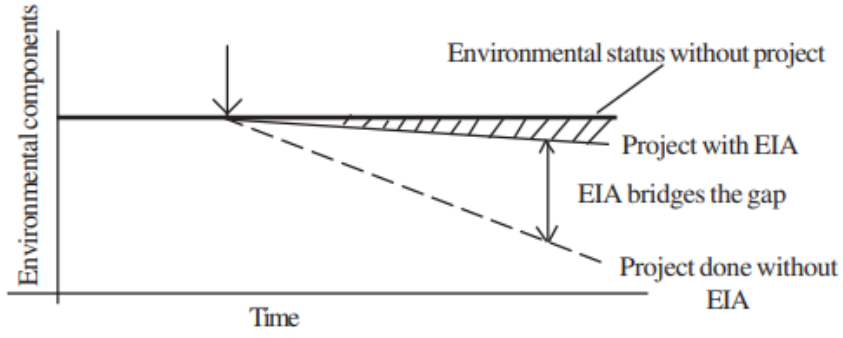
9. **Urbanization:**

10. **Ozone Layer Depletion:**

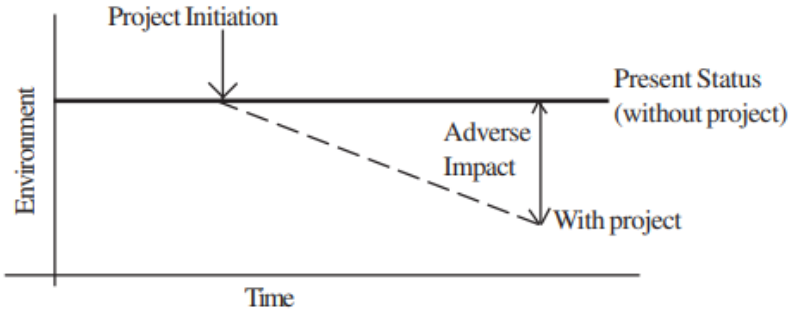
ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Every country strives to progress ahead one aspect of progress is economic development through manufacturing and trading. Every country builds industries which provide employment, serve the consumers needs and help to generate revenue.

In view of the colossal damage to environment by developmental activities people are now concerned about the environmental impact of developmental projects. EIA enables the decision makers to analyse the effect of developmental activities on the environment, if any well before the developmental project is implement.



Environmental impact rectification after EIA



Anticipated environmental impact of developmental project.

Environmental clearance or the 'go ahead' signal is granted by the Impact Assessment Agency in the Ministry of Environment and Forests, Government of India. All projects that require clearance from central government can be broadly categorized into the following:- (1) Industries (2) Mining (3) Thermal power plants (4) River valley projects (5) Infrastructure and CRZ (Coastal Regulation Zone) (6) Nuclear power projects

Environment Impact Assessment Notification of 2006 has decentralized the environmental clearance projects by categorizing the developmental projects in two categories, i.e., Category A (national level appraisal) and Category B (state level appraisal).

Environmental Impact Assessment (EIA) Process

The table below will mention the EIA Process in brief:

Process	Details in Brief
Screening	Which projects need a full or partial assessment study is decided in this stage
Scoping	• Which impacts are necessary to be assessed is decided in this stage. While doing so, legal requirements, international conventions, expert knowledge, and public engagement are also considered.

	• Alternative solutions that avoid or at least reduce the adverse impacts of the project are also studied in this stage • Investigation of alternate designs or sites that avoid or mitigate impact takes place
Assessment & Evaluation of Impacts and Development of Alternatives	Environmental impacts of the proposed project are analyzed and light is thrown upon the alternatives present to such projects
EIA Report also called Environmental Impact Statement (EIS)	An environmental management plan (EMP) and also a non-technical summary of the project's impact is prepared for the general public in this stage
Decision Making	The fate of the project is decided. Whether the project is to be given approval or not and if it is to be given, under what conditions
Monitoring, compliance, enforcement and environmental auditing	Monitoring whether the predicted impacts and the mitigation efforts happen as per the EMP
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Sustainable Development: Meaning and Features

The idea of environmental conservation gains real momentum if we are able to conserve resources and use them in a manner that they are sufficiently available for the coming generation as well. The **United Nations Conference on Environment and Development (UNCED)** defines this using the concept of **sustainable development**. It explains sustainable development as a process that provides for the present generation without compromising on the needs of the future generations.

Principles/Premises of Sustainable Development

The following principles/premises underlying the concept of sustainable development:

- Sustainable development is the alternative method for development, which by definition is eco-friendly and resource-efficient.
- There is a symbiotic relationship between consumer and producer's natural systems.
- The present generation should meet its needs without compromising the ability of future generations to meet their own needs i.e to ensure that productive assets available to future generations are not unfairly minimized.
- Those who enjoy the fruits of economic development must not make the resources of future generations worse by excessively degrading the Earth's exhaustible resources and polluting its ecology and environment. The development should not focus only on growth, insted it should aim for broader goals of social transformation. Internally and

externally sustainable development are two major aspects of sustainable development. With both, no real sustainable development would emerge.

- In the long term, sustainable development has to maintain relations with ecology, resources, and people along with their service agencies, institutions, and other aspects of their social organizations.
- The economic progress which destroys natural capital is not often successful.
- Sustainable development is largely responsible for the poor, and hence it should ensure that the poor have adequate access to sustainable and secure living.
- The past environmental mistakes should not be repeated as past patterns of environmental degradations are unavoidable.
- The environment and development are not mutually incompatible. Both a healthy environment and a healthy economy is essential for economic development.

Sustainable Development Examples

Listed below are some sustainable development examples, few of which do not just have minimal effect on the environment, but are also economical over an extended period of usage.

- Hydro energy as used in turbines.
- Wind energy is often employed in wind mills.
- Solar energy is finding wider implementation with innovations in solar cells and allied technologies.
- Efficient and recycled use of water.
- Green architecture and other sustainable constructions.
- Crop rotation and similar agricultural methods.
- Maintenance and growth of sustainable green spaces.