UNIT II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

2.1 Ecosystems

2.1.1 Concept of Ecosystem

Q1. Explain the concept of an Ecosystem. **(Imp.)**

Ans :

Meaning

- An 'ecosystem' is a region with a specific and recognizable landscape form, such as a forest, grassland, desert, wetland or coastal area. The nature of the ecosystem depends on its geographical features such as hills, mountains, plains, rivers, lakes, coastal areas or islands and is also controlled by climatic conditions the amount of sunlight, temperature and rainfall in the region.
- The geographical, climatic and soil characteristics form its non-living or abiotic components. These features create conditions that support a community of plants and animals that evolution has produced to live in these specific conditions. The living part of the ecosystem is referred to as the biotic component.
- Ecosystems are divided into terrestrial or land-based ecosystems and aquatic or water-based ecosystems. These form the two main habitat conditions for the earth's living organisms.
- All the living organisms in an area live in communities of plants and animals. They interact with the abiotic environment and with each other at different points in time for a large number of reasons. Life can exist only in a small portion of the earth's land, water and atmosphere. At a global level, the thin skin of the earth on the land, sea and air forms the biosphere.
- At a sub-global level, this is divided into biogeographical realms. For example, Eurasia is called the Palearctic realm; South and Southeast Asia (of which India forms a major part) is the Oriental realm; North America is the Nearctic realm; South America forms the Neotropical realm; Africa the Ethiopian realm; and Australia the Australian realm.
- At a national or state level are biogeographic regions. India has several distinctive geographical regions the Himalayas, the Gangetic plains, the highlands of Central India, the Western and Eastern ghats, the semi-arid desert in the West, the Deccan plateau, the coastal belts and the Andaman and Nicobar Islands. These geographically distinctive areas contain plants and animals that have adapted themselves to live in each of these regions. At an even more local level, each area has several structurally and functionally identifiable ecosystems, such as different types of forests, grasslands, river catchments, mangrove swamps in deltas, seashores or islands to give just a few examples. Here, too, each of these forms a habitat for specific plants and animals.

Definition

The living community of plants and animals in any area together with the non-living components of the environment soil, air and water constitute the ecosystem.

Understanding Ecosystems

Natural ecosystems include forests, grasslands, deserts and aquatic ecosystems such as ponds, rive lakes and the sea. Human-modified ecosystems include agricultural land and urban or industrial land u patterns.

Each ecosystem has a set of common features that can be observed in the field:

- **What does the ecosystem look like?**

  One should be able to describe specific features of the different ecosystems in one's own surroundings Field observations must be made in both urban and natural surroundings.

- **What is its structure?**

  Is it a forest, a grassland, a water body, an agricultural area, a grazing area, an urban area or an industrial area?

  What you should look for are its different characteristics. A forest has various layers from the ground to the canopy. A pond has different types of vegetation from the periphery to its centre. The vegetation on a mountain changes from its base to its summit.

- **What is the composition of its plant and animal species?**

  List the well-known plants and animals you can see. Then, document their abundance and numbers in nature very common, common, uncommon, rare. For example, wild mammals will not be seen in large numbers, cattle would be common. Some birds are common; find out which are the most common species. Insect species are very common and most abundant. In fact, there are so many that they cannot be easily counted.

- **How does the ecosystem work?**

  The ecosystem functions through several biogeochemical cycles and energy-transfer mechanisms. Observe and document the components of the ecosystem, which consist of its non-living or abiotic features such as air, water, climate and soil and its biotic components, the various plants and animals. Both these aspects of the ecosystem interact with each other through several functional aspects to form nature's ecosystems. Plants, herbivores and carnivores can be seen to form food chains. All these chains are joined together to form a 'web of life' on which man depends. Each of these food chains uses energy that comes from the sun and powers the ecosystem.

2.1.2 Structure of an Ecosystem

Q2. Explain the Structure of an Ecosystem.

Ans :

(Imp.)

Ecosystem or ecological system refers to an area of nature-having living organisms interacting with non-living components of the environment by interacting and exchanging material between them. In other words, ecosystem is the entire complex of a community of organisms and the physical environment with which they interact. The term ecosystem was coined by A.G. Tansley in 1935. The various synonyms used by ecologists for ecosystem are biocoenosis, microcosm, holocoen, biosystem, geobiocoenosis, bioenert body and ecocosm.

The ecosystem is broadly classified into,

1. Natural ecosystem
2. Artificial ecosystem (man-made ecosystem).

However, the various ecosystems in the biosphere are categorized as follows:

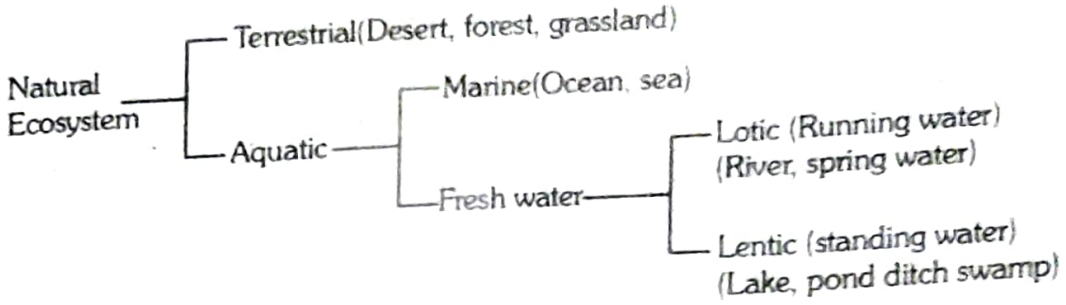


Fig.: Components of Ecosystem

Components of Ecosystem

The various components of the ecosystem are the non-living or abiotic components and the living or biotic components.

1. Non-living (or) Abiotic Components

The non-living or abiotic components of the ecosystem may be broadly categorized into,

(i) The physical condition of the region like air, water availability, light (intensity and duration), pH, geographic terrain, etc.

(ii) Climatic Factors: It includes the physical and climatic conditions of the region like atmospheric temperature, relative humidity, wind, etc.

(iii) Edaphic Factors: It includes the structure and composition of soil, soil types, soil profile, minerals, organic matter, water, etc.

(iv) Materials: Materials may be further categorized into inorganic materials and organic materials. The inorganic materials include water, carbon, oxygen, nitrogen, calcium, sulphur and phosphorus, all of which are involved in continuous circulation in the ecosystem (i.e., biogeochemical cycles). The organic materials include proteins, lipids, carbohydrates, etc.

2. Living (or) Biotic Components

The living or biotic components of the ecosystem are further categorized as follows,

(a) Autotrophic (Producers) Component: This component of the ecosystem includes the organisms which are able to prepare their own food using atmospheric carbondioxide as a source of carbon and ammonia or nitrates as a source of nitrogen, using solar energy to convert into potential chemical energy. These organisms are called as autotrophic organisms or autotrophs (Greek, autos = self and trophe = nutrition). The term autotroph means "self-feeders". An autotroph is a producer (or maker) in the food chain, example plants. They are called as producers, converters or transducers. Autotrophs are generally photosynthetic plants that synthesize high energy, complex organic compounds from inorganic raw materials with the help of sunlight by the process of photosynthesis. The food synthesized by the plants in the form of organic compounds are consumed by man and animals, hence termed as consumers (or eaters).

Types

The autotrophic component of the ecosystem may be grouped into,

(i) Phototrophs/Photosynthetic Autotrophs/Photoautotrophs (Auto = self, Troph = food, Photo = light)

They contain the green pigment chlorophyll, used in the synthesis of carbohydrates.

The producers in the ecosystem are the plants. They manufacture food using the radiant energy the sun and use it to convert carbondioxide into glucose (or other sugars). The other producers a the algae and cyanobacteria. They take energy from chemicals coming from the earth's interior an use it to make glucose or other sugars.

Example, algae, grasses, trees, photo-synthetic bacteria and cyanobacteria.

(ii) Chemoautotrophs/Chemosynthetic Autotrophs or Chemotrophs

These include some bacterias like nitrifying bacteria, non-pigmented sulphur bacteria that use inorgani compounds as hydrogen sulfide and ferrous iron.

The decomposers secrete enzymes that breakdown dead plants and animals into chemical nutrient like carbon and nitrogen which are released to the soil, air and water. The different types of decomposer in the environment are,

1. Bacteria

They are the most numerous microscopic organisms in the environment. They are ubiquitous in occurrence in the cold Antarctic region, in steamy geyser and in our stomach as well.

2. Fungi

This type of decomposers organisms includes molds and yeast. Fungi breakdown the cellulose in leaves and wood while molds are responsible for rotting of wood.

3. Actinomycetes

These are fungi like bacteria that decompose tough plant tissues like bark, paper and stems containing cellulose, chitin and lignin.

Decomposers are important constituent of an ecosystem. These organisms release the atoms and molecules to the environment for reuse by other members of the ecosystem, the autotrophic organisms (such as plants), thus enabling recycling of matter. The nutrients are taken up by the plant and used to help the plants grow. Thus, decomposers keep matter moving between living and non-living parts of an ecosystem. Millipedes and woodlice are also called as decomposers as they consume dead organic matter and contribute to the process of decomposition.

From the above explanation, it may be observed that energy is utilized by plants for carrying out various metabolic activities like respiration, growth etc. A part of the energy remains unutilized and released as heat. The consumers that live on the producers are the herbivores. When the herbivores consume the plant material, the chemical energy present in the food is transferred to the animals. Part of this energy is utilized in their metabolic activities and growth and the remaining unused energy is dissipated as heat by these animals. This unused energy is lost to the environment. The carnivores live on the herbivores. The carnivores are the consumers of the second order. Some energy is again lost to the environment some part of it is utilized in metabolic activities. Thus, it is to be observed that the transfer of energy from one organism to the other is accompanied by a decrease due to waste.

The different types of consumers can be distinguished based on what they eat.

Consumer	Trophic Level	Food Source
Herbivores	Primary	Plants
Carnivores	Secondary	or higher Animals
Omnivores	All levels	Plants and animals
Detritivores	Detritus	

The primary consumers (herbivores) live on the producers. The secondary consumers (carnivores) live on herbivores. The decomposers comprise of the worms, insects, bacteria and fungi. All these organisms breakdown dead organic material into smaller particles to be used by plants as nutrition. Thus, it can be seen that there are various trophic levels in an ecosystem. Thus, there are four trophic levels (food levels) in an ecosystem. The food energy is transferred from one trophic level to the next alone the food chain.

2.1.3 Function of an Ecosystem

Q3. What are the Function of an Ecosystem?

Ans : **(Imp.)**

Each ecosystem comprises of habitats, which may vary in size and performs under natural conditions. Habitat refers to a place where a group of living organisms of the same kind i.e., population, live together.

The important functional aspects of ecosystems are:

1. **Regulation of Atmospheric Chemical Composition:** Ecosystems help to regulate essential ecological processes such as clean air, water and soil and maintain a balanced chemical composition in the atmosphere.

2. **Regulation of global temperature, precipitation and other climatic processes:** Meteorological phenomenon like global temperature, precipitation, greenhouse gas regulation, cloud formation are regulated by ecosystem by playing a role in the global carbon cycle. The greenhouse gases (example, carbondioxide) trap the solar radiation which results in warming up the earth's atmosphere. Since, the industrial revolution human activities have contributed to long term changes in the planet's climate. The forests serve as 'sinks' of carbon. The green cover absorbs carbondioxide during the process of photosynthesis. Thus, the green cover helps to prevent the build up of greenhouse gases.

3. **Storage, damping and other responses to environmental fluctuations:** Mitigation measures of storm, flood and drought are maintained by natural ecosystem.

4. **Regulation of Hydrological Flows:** The earth's land surface gets enough water as annual rainfall that can cover the land to a depth of one meter. The water is absorbed by the soil, taken up by plant roots into aquifers and surface streams.

5. **Storage and Retention of Water:** The vegetation on the land surface helps to prevent the impurities from entering water bodies and groundwater. The root system of plants and trees help to retain the soil porosity and allow water to filter through various soil layers before entering the water table. During this process, toxins, nutrients, sediments and other substances are filtered from water.

6. **Retention of Soil within an Ecosystem:** An import tint ecosystem service is to help keep soil intact and prevent it from eroding into water bodies. The root system holds the soil particles together, thus preventing soil erosion. The vegetation also helps to reduce the impact of heavy rainfall on the land surface, thus, reducing soil disturbance. The leaves and natural debris on the land surface slow the rate of water runoff and trap soil from being washed away.

7. **Soil Formation:** The loose superficial layer of the earth's crust is the soil formed by the disintegration or weathering of parent rocks by physical, chemical and/ or biological agents during the course of evolution.

8. **Nutrient Cycling:** Some elements like nitrogen, sulphur and phosphorus move in different forms in the food chain.

9. **Waste Treatment:** Tremendous amount of wastes generated from households, industries, agriculture etc., are detoxified and decomposed by organisms in natural ecosystems.

10. **Pollination(Fertilization of Flowers):** Natural pollination services are essential for reproduction of most flowering plants and their perpetuation. Free pollination services are provided by pollinators such as bats, bees, beetles, birds, butterflies and flies.

11. **Population Regulation:** Population regulation in natural ecosystem is brought about by weather and climate (drought, typhoon, hurricane, excessive rain, snow), geological disturbances like earthquake, tidal wave, volcanic eruption, increased rates of predation and parasitism, stress and behavioural problems due to overcrowding, available nesting habitat, water, oxygen etc.

2.1.4 Producers, Consumers and Decomposers, Energy Flow in Ecosystem

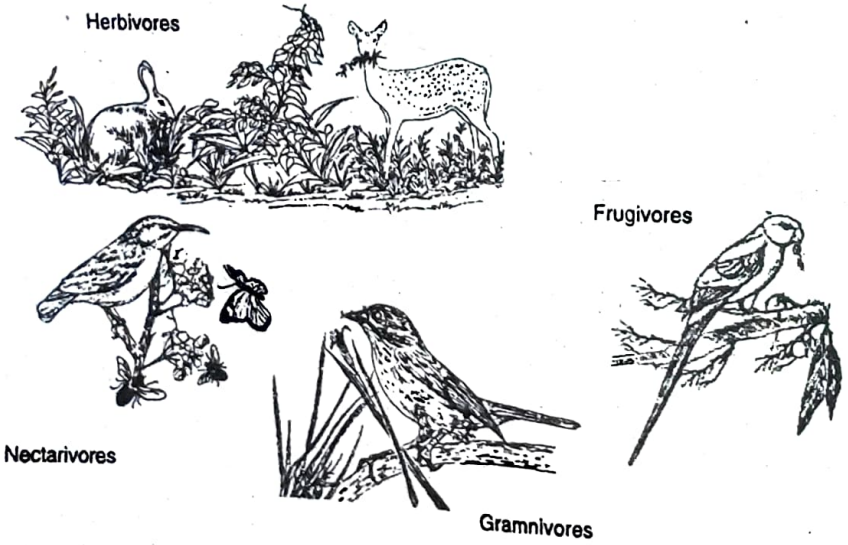
Q4. Explain the Producers, Consumers and Decomposers of an ecosystem.

Ans :

(i) Producers

Every living organism is in some way dependent on other organisms. Plants are food for herbivorous animals, which are in turn food for carnivorous animals. Thus, there are different tropic levels in the ecosystem. Some organisms such as fungi live only on dead material and inorganic matter.

Plants are the 'producers' in the ecosystem, as they manufacture their food by using energy from the Sun. In the forest, these form communities of plant life. In the sea, these include tiny algal forms to large seaweed.



(ii) Consumers

The herbivorous animals are 'primary consumers', as they live on the producers. In a forest, these are the insects, amphibians reptiles, birds and rnammals. The herbivorous animals include, for example, the hare, deer and elephants that live on plant life. They graze on grass or feed on the foliage from trees grasslands, there are herbivores such as the blackbuck that feed on grass. In the semi-arid areas, there are species such as the chinkara or Indian gazelle. In the sea, there are small fish that live on algae and other plants.

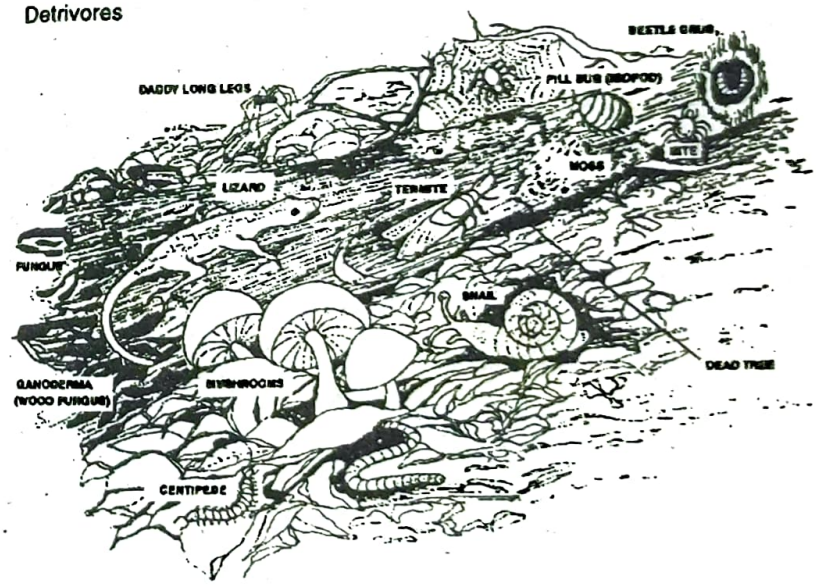
At a higher tropic level, there are carnivorous animals, or 'secondary consumers', which live on the herbivores. In our forests, the carnivores are tigers, leopards, jackals, foxes and small wild cats. In the sea, carnivorous fish live on other fish and marine animals. The animals that live in the sea range in size from microscopic forms to giant mammals such as the whale.

Carnivores

(iii) Decomposers

Decomposers or detrivores 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. Thus, decomposition is a vital function in nature, as without this, all the nutrients would be tied up in dead matter and no new life would be produced.

Detrivores



Most ecosystems are highly complex and consist of an extremely large number of individuals of a wide variety of species. In the species-rich tropical ecosystems (such as in our country), only a few species are very common, while most species have relatively few individuals. Some species of plants and animals are extremely rare and may occur only at a few locations. These are said to be 'endemic' to these areas.

When human activities alter the balance in these ecosystems, such perturbations often lead to the disappearance of some uncommon species. When this happens to an endemic species that is not widely distributed, it becomes extinct forever.

Q5. Explain the energy flow in the ecosystem.

Ans :

Every ecosystem has several interrelated mechanisms that affect human life. These are the water cycle, the carbon cycle, the oxygen cycle, the nitrogen cycle and the energy cycle. While every ecosystem is controlled by these cycles, each ecosystem's abiotic and biotic features are distinct from each other.

All the functions of the ecosystem are in some way related to the growth and regeneration of its plant and animal species. These interlinked processes can be depicted as the various cycles; all these processes depend on energy from sunlight. During photosynthesis, carbon dioxide is absorbed by plants and oxygen is released into the atmosphere. Animals depend on this oxygen for their respiration. The water cycle depends on the rainfall, which is necessary for plants and animals to live. The energy cycle recycles nutrients into the soil on which plant life grows. Our own lives are closely linked to the proper functioning of these cycles of life. If human activities go on altering them, humanity cannot survive on Earth.

2.1.5 Food Chains

Q6. Explain the concept of food chain.

Ans :

Food chain may be defined as a unidirectional process where one organism devours the other (producer → primary consumer → secondary consumer → decomposers.)

(or)

A sequential process of transfer of food from one trophic level to another.

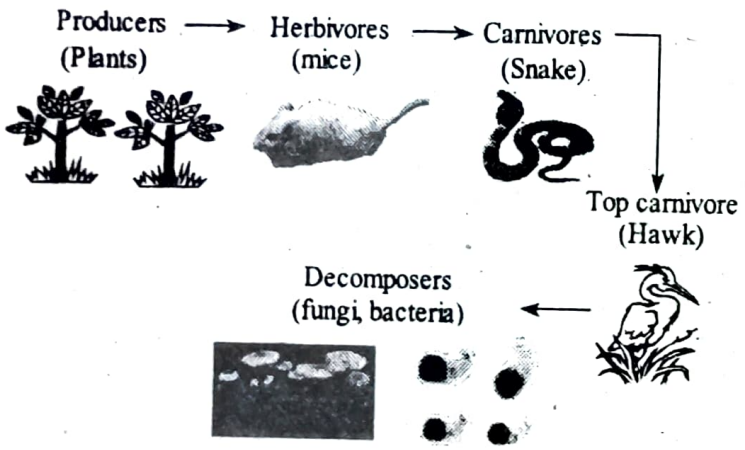


Fig.: Food Chain

- Plants signify the producer level as they require sunlight to prepare food. They form the first trophic level.
- Mice eat plants, hence are herbivorous in nature. They are known as the first order consumers and represent the second trophic level.
- Snakes consume the mice, hence they are carnivores or the second order consumers. They represent the third trophic level.
- Hawk consumes the snake and is the top carnivore, representing the fourth trophic level.
- When the hawk dies, its dead body gets decomposed by bacteria and fungi.

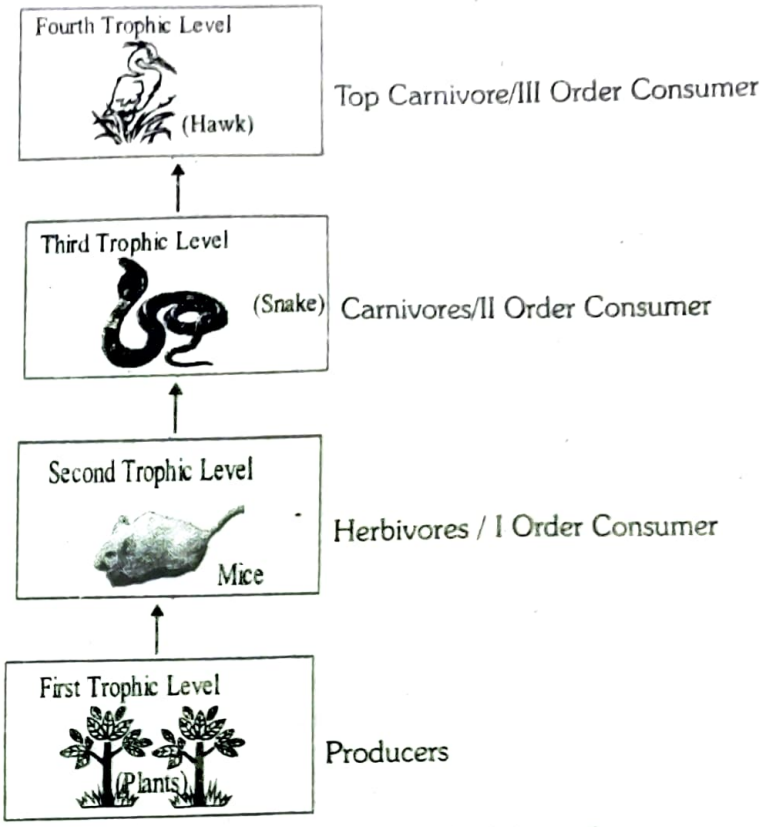


Fig.: Diagram of a Food Chain Depicting the Various Trophic Levels

Trophic level provides a uniform structure to the ecosystem, i.e., represents each step of the food chains. Thus, an ecosystem comprises of four trophic levels.

Functions

(a) Represent the biotic or life community of the biosphere.

(b) Helps in the transfer of energy from one trophic level to another.

(c) Also transfers material from one trophic level to another.

Types

1. Grazing Food Chain

The base of this type of food chain is formed by green plants/producers (as they trap sunlight in the presence of chlorophyll and produce food). The producers are consumed by herbivorous animals (eat plants) and they in turn are consumed by carnivorous animals (eat other animals). Hence, this food chain starts from green plants and ends with carnivores.

Example:

Plants ⟶ Goat ⟶ Tiger

(Producer) (Herbivore) (Carnivore)

Fig.: Grazing Food Chain

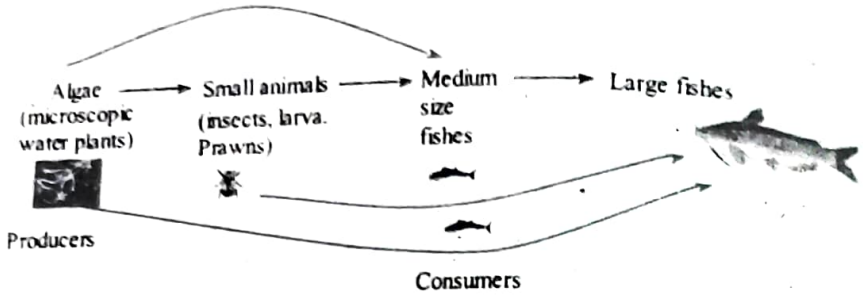


Fig.: Grazing Food Chain

Grazing food chain depends on the sunlight energy, as the green plants form the basis of this food chain. Divisions of Grazing Food Chain

(a) Predator Food Chain: In this type of grazing food chain, small animals (prey) are eaten by larger animals (predators).

Example:

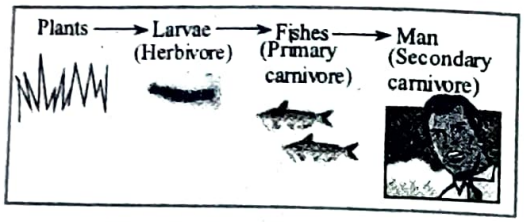


Fig.: Predator Food Chain

(b) Parasitic Food Chain: The parasites may infect the plants and animals of grazing food chain. Thus, parasites meet their requirements by consuming the plants and animals without killing them directly.

2. Detritus Food Chain

This type of food chain is initiated by microorganisms like bacteria and fungi (known as detrivores). They do not depend on sunlight for their energy, as this type of food chain is seen in decomposed waste.

Example:

In the forest, leaves fall from the trees which get decomposed by bacteria and fungi in the absence of sunlight. Small worms feed on the organic matter or microorganisms. These worms are in turn eaten by small birds, which in turn serve as the main food for hawks.

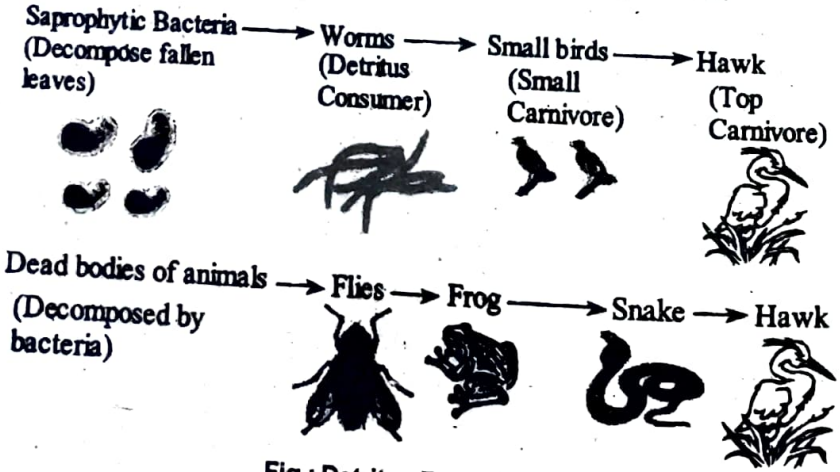


Fig.: Detritus Food Chain

antages

More calories can be obtained by consuming the producers of the food chain.

Cropland ecosystems can be improvised by solar energy.

dvantages

The more the steps (i.e., away from the producer level), the lesser energy man gets due to wastage of energy from one trophic level to other.

Pesticides enter the human body through the food chain.

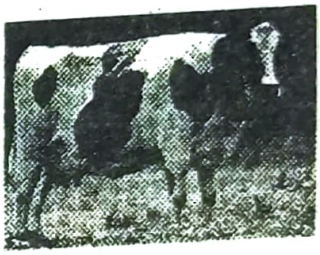
Example:

Plants ⟶ Cow ⟶ Man

(Absorb pesticcides from the soil when sprayed)

(Receives pesticides when it consemes the plants)

(Pesticcides enter the human body through milk and meat)



Shortening the food chains alters the ecosystem.

Example:

In a forest if the population of lions decrease, then the deers (herbivores) may consume all the producers, thereby eliminating them.

6 Ecological Pyramids

What is Ecological pyramids? Explain different types of ecological pyramids.

(Imp.)

ning

Ecological pyramids are defined as the graphical representation of food chain levels (i.e., trophic s) in the form of pyramids. The base of the pyramid comprises the producers (green plants). It is essively followed by primary consumers (herbivores), secondary consumers (carnivores) and tertiary umers (top carnivore).

es

Pyramid of Numbers

It is constructed based on the number or abundance of organisms at each trophic level. This type of ecological pyramid is in upright position (exception, the pyramid of numbers in the tree ecosystem is inverted).

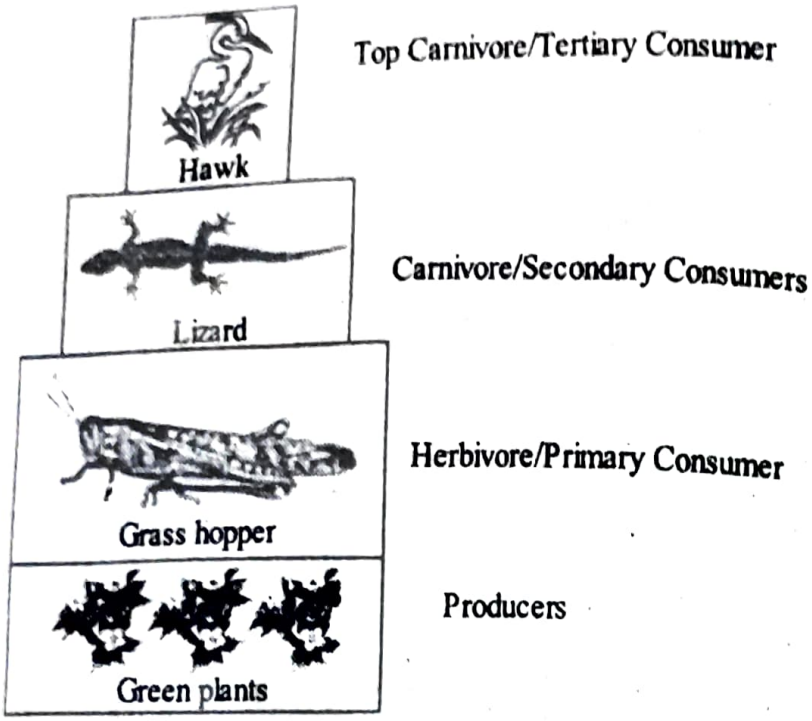


Fig.: Terrestrial Ecosystem

In a terrestrial ecosystem, the green plants (producers) are maximum in number. They are consum by herbivores, which are less in number when compared to producers hence the pyramid size the II trophic level decreases. Herbivores are consumed by carnivores which are less in numb Finally, they are consumed by top carnivores which are least in number. Hence, the pyramid numbers is upright.

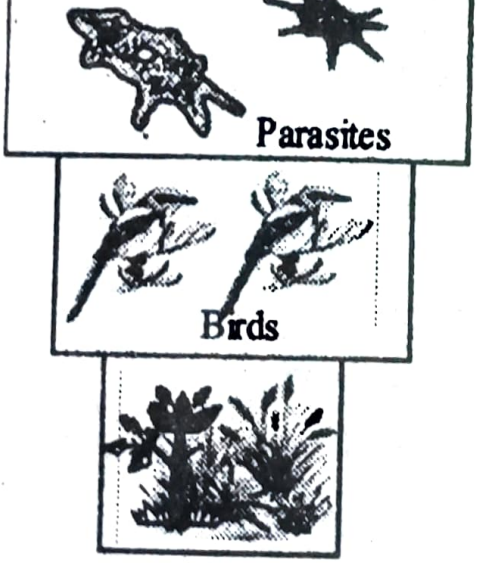


Fig.: Tree Ecosystem

In the tree ecosystem, one tree consists of many birds which feed on the fruits and seeds of th trees. These birds consist of many parasites, which are more in number than them. Hence, the tr ecosystem in pyramid of numbers is inverted (exceptional case).

2. Pyramid of Biomass

A pyramid of biomass is constructed based on the mass or weight of the organisms per unit area at each trophic level. This type of ecological pyramid is in upright position (exception - the pyramid of biomass in pond ecosystem is inverted as the weight of organisms increases from producers to carnivores).

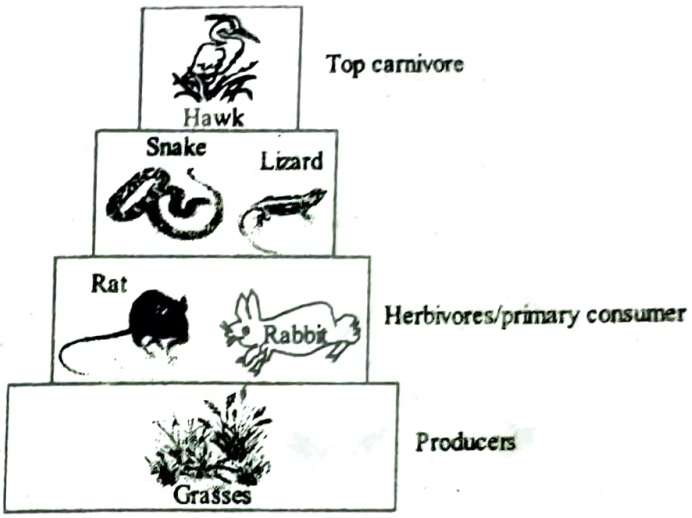


Fig.: Terrestrial Biomass Pyramid

The weight of grasses is more and the biomass of the top organism is less. As the apex is decreasing from producer to top carnivore, hence the pyramid of biomass is upright.

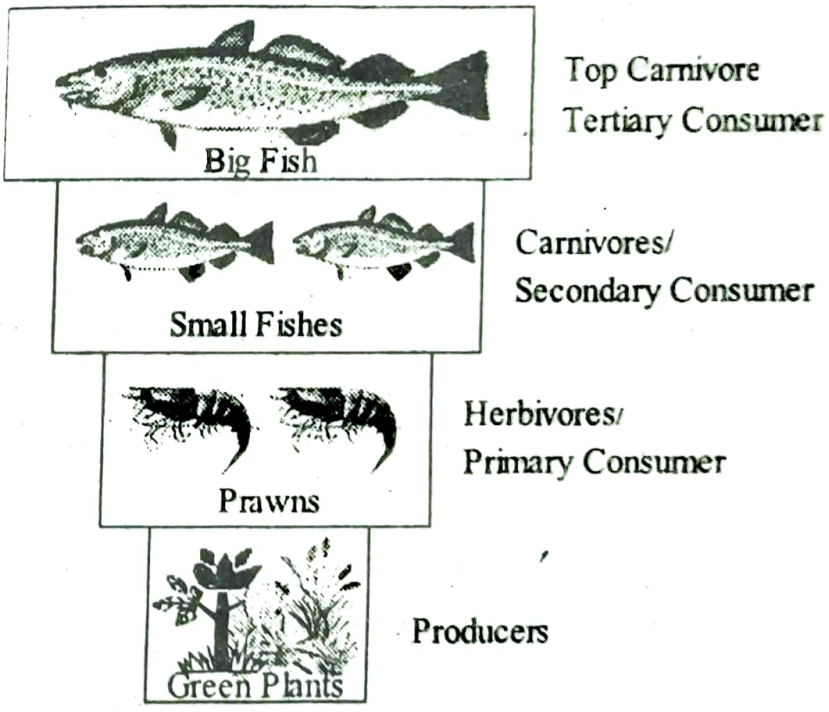


Fig.: Biomass Pyramid Depicting Pond Ecosystem

The green plants have negligible biomass when compared to prawns. The prawns biomass is less when compared to secondary consumers (small fish). The tertiary consumer (big fish) has the maximum biomass, hence the pond ecosystem is inverted in biomass pyramid (exceptional easel.

3. Pyramid of Energy

Pyramid of energy is constructed based on the unidirectional energy flow rate at each trophic le
This type of ecological pyramid is always upright due to gradual decrease in the energy from produ
to consumers (i.e., follows 10% law in the transfer of energy from one trophic level to anothe
The producers have the maximum energy as they prepare their own food. As the food consumpti
from herbivore reaches to carnivore, energy decreases. Thus, the carnivores get the least ener
whereas herbivores get the maximum energy as they directly consume the producers.

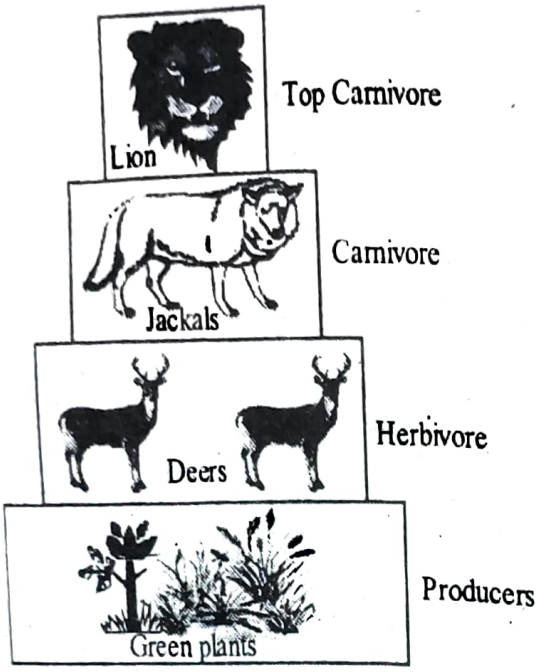


Fig.: Pyramid of Energy

2.2 Aquatic Ecosystem (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)

Q8. What is an Aquatic Ecosystems?

Ans :

Meaning

In aquatic ecosystems, plants and animals live in water. These species are adapted to live in differe types of aquatic habitats. The special abiotic features are its physical aspects such as the quality of t water, which includes its clarity, salinity, oxygen content and rate of flow. Aquatic ecosystems may b classified as being stagnant ecosystems, or running water ecosystems. The mud gravel or rocks that for the bed of the aquatic ecosystem alter its characteristics and influence its plant and animal specie composition. The aquatic ecosystems are also classified into freshwater, brackish andmarine ecosystem which are based on the salinity levels.

The freshwater ecosystems that have running water are streams and rivers. Ponds, tanks and lak are ecosystems where water does not flow. Wetlands are special ecosystems in which the water lev fluctures dramatically in different seasons. They have expanses of shallow water with aquatic vegetation which forms an ideal habitat for fish, crustaceans and water birds.

Marine ecosystems are highly saline, while brackish areas have less saline water such as in riv deltas. Coral reefs are very rich in species and are found in only a few shallow tropical seas. The riches coral reefs in India are around the Andaman and Nicobar Islands and in the Gulf of Kutch.

Brackish water ecosystems in river deltas are covered by mangrove forests and are among the world's most productive ecosystems in terms of biomass production. The largest mangrove swamps are in the Sunderbans in the delta of the Ganges River.

Q9. Explain briefly about pond ecosystem.

Ans :

The pond is the simplest aquatic ecosystem to observe.

There are differences between a temporary pond that has water only in the monsoon season and a larger tank or lake that is an aquatic ecosystem throughout the year. Most ponds become dry after the rains are over and are covered by terrestrial plants for the rest of the year.

When a pond begins to fill during the rains, its life-forms - such as the algae and microscopic animals, aquatic insects, snails, and worms - come out of the floor of the pond where they have remained dormant during the dry phase. Gradually, the more complex animals such as crabs, frogs and fish return to the pond. The vegetation in the water consists of floating weeds and rooted vegetation on the periphery, whose roots are in the muddy floor under the water and whose foliage emerges out of the surface of the water.

Fig.: Pond Ecosystem

As the pond fills in the monsoon season, a large number of food chains are formed. The algae are eaten by microscopic animals, which are in turn eaten by small fish, on which the larger carnivorous fish depend. These are in turn eaten by birds such as kingfishers, herons and birds of prey. Aquatic insects, worms and snails feed on the waste material excreted by animals and the dead or decaying plant and animal matter. They act on the detritus, which is broken down into nutrients which aquatic plants can absorb, thus completing the nutrient cycle in the pond. The temporary ponds begin to dry up after the rains and the surrounding grasses and terrestrial plants spread into the moist mud that is exposed. Animals like frogs, snails and worms remain dormant in the mud, awaiting the next monsoon.

Q10. Explain the structure of pond ecosystem.

Ans :

The structure of the pond ecosystem has two major components,

1. The Non-living (Abiotic) Components

The abiotic components include sunlight, temperature, water, amount of inorganic substances (such as C, H, O, N P, Ca, S, etc.,) the amount of organic substances (eg., carbohydrates, proteins, lipids etc).

2. The Living (Biotic) Components

The biotic components of pond ecosystem include the producers/autotrophs which include phytoplanktons and macrophytes. The other biotic components are heterotrophs which includes primary consumers (or herbivores), secondary consumers (or carnivores), tertiary consumers (or top carnivores) and decomposers (or microconsumers).

The flora of the Lotus pond include the following,

Agave angustifolia, Baringtonia aclutang, cockspur coral tree, Nelumbo nucifera, Wedelia trilobata (creeping daisy), Atrophaneura hector, Diospyros Chloroxylon, Filicium decipiens (fern), Ficus benjamina (weeping fig), Galphimia gracilis (golden Thyrallis), Allamanda cathartica (golden trumpet), Hydrilla verticillata and Jatropha podagrica (Buddha belly plant).

The fauna of the Lotus pond include the following, Fulica atra (common coat), Catopsilia pomona, Alcedo at this (common kingfisher), Gallinula chloropus (common moorhen), Pochliopta aristolochiae, Mesophoyx intermedia (intermediate egret), Phalacocrorax Dendrocygna javanica (lesser whistling duck), Phalacocrorax niger

ttle cormorant), Egretta garzetta (little egret), achybaptus ruficollis (little grebe), Psammophilus lorsalis (peninsular rock agama), Hydrophasianus chirurgus (pheasant tailed jacana).

Q11. Write the functions of pond ecosystem.

Ans :

A large number of interlinking of various food chains through different types of organisms at different trophic levels. The energy from the sun is used by green algae attached onto a substrate to prepare food and thus thrive. The microscopic animals feed on these algae, which are in turn, eaten by small fish. The large fish depend on small fish for food. The fishes are eaten by birds (eg., Kingfisher). The other aquatic animals such as worms, snails and insects feed on the excreta of animals and the dead or decaying plant and animal matter. The nutrients are used up by the aquatic plants. Such interlinking of food chains provide stability to the ecosystem.

Infact, the lotus pond is definitely worth visiting to gain awareness of what life is like in and around a pond, to identify and describe key physical characteristics, flora and fauna at the pond. The lush greenery and beautiful landscape of the lotus pond is definitely an unforgettable and enriching experience.

Q12. Discuss about :

(a) Lake ecosystem

(b) Stream and river ecosystem

(c) Marine ecosystem

(d) Seashore ecosystem

Ans :

(a) Lake Ecosystems

A lake ecosystem functions like a giant permanent pond. A large amount of its plant material is the algae, which derives energy from the Sun. This is transferred to the microscopic animals, which feed on the algae. There are fish that are herbivorous and are dependent on algae and aquatic weeds. The small animals such as snails are eaten by small carnivorous fish, which in turn are preyed upon by roger carnivorous fish. Some specialized fish, such as catfish, feed on the detritus on the muddy bed of the take; they are called 'bottom feeders'.

Energy cycles through the lake ecosyst from the sunlight that penetrates the water surf to the plants. From the plants, the energy transferred to herbivorous animals and carnivor Animals excrete waste products, which settle on t bottom of the lake, and is broken down by sm animals that live in the mud in the lake bed. Th acts as the nutrient material that is used by aqua plants for their growth. During this process, plan use carbon from CO_2 for their growth and in th process release oxygen. This oxygen is then use by aquatic animals, which filter water through the respiratory system.

(b) Streams and Rivers Ecosystems

Streams and rivers are flowing wate ecosystems, in which all the living forms are speciall adapted to different rates of flow. Some plants an animals, such as snails and other burrowing animals can withstand the rapid flow of the hill-streams. Othe species of plants and animals, like water beetles an skaters, can live only in slower moving water. Some species of fish, like the Mahseer, go upstream from rivers to hill-streams for breeding. They need crystal-clear water to be able to breed.

As deforestation occurs in the hills, the water in the streams that once flowed throughout the year becomes seasonal. This leads to flash-floods in the rains and a shortage of water once the streams dry up after the monsoon.

The community of flora and fauna of streams and rivers depends on the clarity, flow and oxygen content, as well as the nature of their beds. The stream or river can have a sandy, rocky or muddy bed, each type having its own species of plants and animals.

Indian Ocean, the Arabian Sea and the Bay of Bengal constitute the marine ecosystems around peninsular India. In the coastal area, the sea is shallow while further away, it is deep. Both these are different ecosystems. The producers in this ecosystem vary from microscopic algae to large seaweeds. There are millions of zooplankton and a large variety of invertebrates which fish, turtles and marine mammals feed on.

The shallow areas near Kutch and around the Andaman and Nicobar Islands are some of the most

incredible coral reefs in the world. Coral reefs are only second to tropical evergreen forests in their richness of species. Fish, crustaceans, starfish, jelly fish and the polyps that deposit the coral are just few of the thousands of species that form this incredible world under the shallow seas.

The deforestation of the adjacent mangroves leads to silt being carried out to sea where it deposited on the coral, which gets bleached and then dies. There are many different types of coastal ecosystems, which are highly dependent on the tide.

(c) Marine ecosystem

The marine ecosystem is used by coastal fisherfolk for fishing, which is their livelihood. In the past, fishing was done at a sustainable level and the marine ecosystem continued to maintain its abundant supply of fish over many generations. Now, with the growth of intensive fishing by using gaint nets and mechanized boats, the fish catch in the Indian Ocean has dropped significantly.

(d) Sea shore ecosystem

Beaches can be sandy, rocky, shell-covered or muddy. On each of these different types, there are several specific species which have evolved to occupy a separate niche. There are different crustaceans, such as crabs, that make holes in the sand. Various shore birds feed on their prey by probing into the sand or mud on the seashore. Several different species of fish are caught by fishermen. In many areas the fish catch has decreased over the last two decades.

Q13. What are the threats to Aquatic Ecosystems?

Ans :

- Water pollution occurs from sewage and poorly-managed solid waste in urban areas when it enters the aquatic ecosystem of lakes and rivers. Sewage leads to a process called eutrophication, which destroys life in the water as the oxygen content is severely reduced. Fish and crustaceans cannot breathe and are killed; a foul odour is produced; gradually, the natural flora and fauna of the aquatic ecosystem are destroyed.
- In rural areas, the excessive use of fertilizers causes an increase in nutrients, which leads to eutrophication.
- Pesticides used in adjacent fields pollute the water and kill off its aquatic animals. Chemical pollution from industry kills a large number of life forms in adjacent aquatic ecosystems.
- Contamination by heavy metals and other toxic chemicals affects the health of people who live near these areas as they depend on this water.
- Other than water quality, the quantity of water in freshwater ecosystems also poses a significant threat.
- Dams built across rivers greatly alter the flow of natural river ecosystems, causing some rivers to slowly run dry as they no longer join a sea.
- Further, changing the nature of an aquatic ecosystem from a flowing water one to a static one destroys the natural biological diversity, causing habitat loss to the species that require running water.
- In some semiarid areas that are artificially irrigated, the high level of evaporation leads to severe salinization as salts are brought up into the surface layers of the soil. Land is therefore eventually rendered unproductive.
- The social implications of large dams cannot be undermined all over the world, thousands of people have been displaced and lost their livelihoods because of the construction of large dams.

Q14. How are acquatic ecosystem used?

Ans :

Man uses aquatic ecosystems for the clean freshwater on which his life is completely dependent. We need clean water to drink and for other domestic uses. Water is also essential for agriculture. Fisherfolk use the aquatic ecosystems to earn a livelihood. People catch fish and crabs; they also collect edible plants. These are used locally as food or for sale in the market. Over-fishing leads to a serious decline in the catch and a long-term loss of income for the fisherfolk.

Marshes and wetlands are of great economic importance for people who live on their fish, crustaceans, reeds, grasses and other produce.

Modern man impounds water in dams to be able to store it throughout the year. Agriculture and industry are highly dependent on large quantities of water. However this leads to problems for tribal people who have lived there before the dams were built as they are displaced for these dams.

Dams are built across rivers to generate electricity. A large proportion of this energy is used by urban people, by agriculturists in irrigated farmlands and in enormous quantities for industry. Large dams have serious ill-effects on the natural river ecosystems. While the water from dams used for irrigation has led to economic prosperity in some areas, in semi-arid areas that are artificially irrigated the high level of evaporation leads to severe salinization as salts are brought up into the surface layers of the soil. This makes such lands gradually more and more saline and unproductive.

Q15. How are acquatic ecosystems be conserved?

Ans :

For the sustainable use of an aquatic ecosystem, water pollution must be prevented. It does not make sense to allow water to be polluted and then try to clean it up.

Changing the nature of the aquatic ecosystem from a flowing water ecosystem to a static ecosystem restroys its natural biological diversity. Thus, dams built across rivers decrease the population of species that require running water, while favoring those that need standing water.

Aquatic ecosystems, especially wetlands, need protection by including them in sanctuaries or national parks in the same way in which we protect our natural forests. These sanctuaries in aquatic ecosystems protect a variety of forms of life as well as rare fish which are now highly endangered, such as the wanseer. Wetland sanctuaries and national parks are of the greatest importance, as they are among the most threatened of our ecosystems. As the proportion of the Earth's surface that is naturally covered by wetlands is very small compared to forests or grasslands, wetland ecosystems are very highly threatened.

2.3 Energy Resources

2.3.1 Growing Energy Needs

Q16. What are Energy Resources? Expla growing energy needs.

Ans :

Energy is defined by physicists as the capac to do work. Energy is found on our planet in variety of forms, some of which are immediat useful to do work, while others require a process transformation. The sun is the primary energy sou in our lives. Besides, water, fossil fuels such as co petroleum products, water, nuclear power pla are sources of energy.

Growing Energy Needs

Energy has always been closely linked man's economic growth and development. Prese strategies for development that have focused rapid economic growth have used energy utilizati as an index of economic development. This ind however, does not take into account the long-te ill effects on society of excessive energy utilizatio

For almost 200 years, coal was the prim energy source fueling the industrial revolution the 19th century. At the close of the 20th centu oil accounted for 39% of the world's commer energy consumption, followed by coal (24%) a natural gas (24%), while nuclear (7%) and hyd renewable (6%) accounted for the rest.

2.3.2 Renewable and Non-renewa Energy Sources

Q17. What are renewable and non-renewa energy sources?

Ans :

It refers to any material in the environm that can be used to generate energy for a us purpose. They are categorized as,

1. Renewable Energy Resources

Renewable energy systems use resources are constantly replaced and are usually polluting. Examples include hydropo solar, wind, and geothermal (energy from heat inside the earth). We also get renew

energy from burning trees and even garbage as fuel and processing other plants into bio-fuels.

- **Wind Energy:** The moving air or wind has huge amounts of kinetic energy, and it can be transferred into electrical energy using wind turbines. The wind moves the blades, which spins a shaft, which is further connected to a generator, which generates electricity. An average wind speed of 14 miles per hour is needed to convert wind energy into electricity. Wind generated electricity met nearly 4% of global electricity demand in 2015, with nearly 63 GW of new wind power capacity installed.

- **Solar Energy:** Solar energy is the light and heat procured from the sun. It is harnessed using an ever evolving technologies. In 2014, global solar generation was 186 terawatt-hours, slightly less than 1% of the world's total grid electricity. Italy has the largest proportion of solar electricity in the world. In the opinion of International Energy Agency, the development of affordable, inexhaustible, and clean solar energy technologies will have longer-term benefits.

- **Biomass Energy:** When a log is burned we are using biomass energy. As plants and trees depend on sunlight to grow, biomass energy is a form of stored solar energy. Although wood is the largest source of biomass energy, agricultural waste, sugarcane wastes, and other farm by products are also used to produce energy.

- **Hydropower:** Energy produced from water is called hydropower. Hydro-electric power stations both big and small are set up to produce electricity in many parts of the world. Hydropower is produced in 150 countries, with the Asia-Pacific region generating 32 percent of global hydropower in 2010. In 2015, hydropower generated 16.6% of the world's total electricity and 70% of all renewable electricity.

- **Tidal and Wave Power:** The earth's surface is 70% water. By warming the water, the sun creates ocean currents and the wind that produces waves. It is estimated that the solar energy absorbed by the tropical oceans in a week could equal the entire oil reserves of the world – 1 trillion barrels of oil.

- **Geothermal Energy:** It is the energy stored within the earth ("geo" for earth and "thermal" for heat). Geothermal energy starts with hot, molten rock (called magma) deep inside the earth which surfaces at some parts of the earth's crust. The heat rising from the magma warms the underground pools of water known as geothermal reservoirs. If there is an opening, hot underground water comes to the surface and forms hot springs, or it may boil to form geysers. With modern technology, wells are drilled deep down the surface of the earth to tap into geothermal reservoirs. This is called direct use of geothermal energy, and it provides a steady stream of hot water that is pumped to the earth's surface.

2. Non-renewable Energy Resources

These energy resources are exhaustible and include the fossil fuels like coal, oil, natural gas, etc. All these fossil fuels that pollute the environment are limited in nature.

- **Fossil Fuels:** They include coal, gas and oil as they are formed from the organic remains of prehistoric plants and animals. These fossil fuels provide about 66% of the world electrical power and 95% of the total energy demands all over the world. They are non-renewable energy resource, because once they are burnt, there isn't any more left.

- **Nuclear Power:** It contributes to 15% of the world's energy demands. The energy is generated from splitting uranium atoms.

- **Solar Power:** It is the energy obtained from the sun which is free, does not produce waste or contribute to pollution. Solar power is renewable.
- **Wind Power:** It is the energy obtained from the wind by setting up windmills in areas where the wind is strong and reliable like coastal areas, hill tops, open plains and gaps in mountains. The energy obtained from the wind is free, does not produce waste or greenhouse gases. This is one of the best methods to provide energy to remote areas.
- **Tidal Power:** It is the energy obtained from the seas, which is harnessed to generate electricity. The tidal energy is renewable as the tides continue to ebb and flow.
- **Hydroelectric Power:** It is the power generated from falling water.
- **Wave Power:** It is the energy obtained from the waves, which is used in the operation and maintenance of wave power stations.
- **Geothermal Energy:** It is the energy produced from the earth which is practised in around 20 countries all over the globe including America, Siberia and the Pacific Rein. The geothermal energy does not contribute to pollution and greenhouse effect and no fuel is required to generate electricity from geothermal sources.
- ***Biomass Energy:*** It is the energy derived from organic material like wood, animal, crops, etc.

2.3.3 Land as a Resources

Q18. Explain briefly about lands as a resources.

Ans : **(Imp.)**

It is estimated that in our country there has been a slight increase in the net sown area. About 23 million ha have been added over three decades. This is about 47.7% of total area. Another 1.3% of he land is under fruit trees. Nearly 5% of the land falls under fallow land. This land is cultivated onc in every 2-3 years. In this way on an average nearl 51% of the total area, is cultivated every year. Effort are made to restore the fertility of fallow land b use of fertilizer and new technology. In view of th rapidly increasing population pressure on land meagre pastureland is left. Generally for self contained economy and proper ecobalance at leas one-third of the total land area must be under fores and natural vegetation. But in our country it is as low as 19.3%. As shown by satellities only about 46 million ha is under real forest. As such it is essential for us to increase our area under forests.

Integrated Land Use Planning

Although land is an important component of the life support system in our country, it has been overused and even abused over the centuries. In 1972 Mrs. Indira Gandhi said, "We can no longer afford to neglect our most important natural resource. This is not simply an environmental problem but one which is basic to the future of our country." In a predominantly agricultural country like India land becomes more important. Due to exploding population, soil is being used increasingly. It poses a great threat to its productivity because careless use of soil leads to adverse results as under:

1. Damage to soil
2. Reduction in quality and quantity of woodland, grassland, cropland
3. Soil erosion
4. Degradation of watersheds and catchments
5. Deforestation and desertification

At present land is under stress due to sprawl in agriculture, industry and urbanization. India has one of the lowest men: land ratio-hardly 0.48ha/ per capita. It is essential to develop a strategy to cure past damage and to save the country from future damage to land.

This can be achieved by using following means:

1. Preparation of accurate land use data through remote sensing etc.
2. By a time bound nation-wide survey programme of micro-level land use planning

giving short and long-term scenatious.

3. Preparation of land use classes.

4. Review all existing legislations and updating them.

5. Preparation of management plans for land amelioration. It is incumbent upon as to adopt a dynamic land-use policy. Our Government is not unaware of this all. Headed by the Prime Minister, the Government has constituted an apex body called the National Land use and Wastelands Development Council (NLUWDC).

At the second level two boards were set up in 1985 as under:

1. First National land use and Conservation Board (NLICB) (Ministry of Agriculture);

2. Second National Wastelands Development Board (NWDB) (Ministry of Rural development).

Their working is as under:

(i) Wastelands Development

Wastelands are those pieces of land which for one reason or the other like the life sustaining potential. Besides earlier existing wastelands increasing misuse of land resources through shortsighted development policies have resulted into wastelands. Nearly half of the land area of the country is lying as wasteland. Degraded, mined and other wasteland should not be left as it is. Instead it should be reclaimed and put to some productive use.

(a) **Degraded Land:** In view of the incessantly increasing population in India more land is needed for agriculture and forestry. Good land is shrinking both in quantity and quality. The various reasons responsible are-unexpected demands besides soil erosion, desertification, waterlogging, salinity, alkali soil and toxic effects of agrochemicals and industrial effluents.

It is essential to reclaim and develop degraded land such as ravines, gulies waterlogged, alkaline, saline and riverine lands, lateritic soils, land infested with unwanted shrubs and bushes, stony and gravelly land etc.

(b) **Mined Areas:** It is opined that in our-country most mining work has been unscientific with no environmental protection. As a result, large tracts have lost productivity. Besides water and air pollution there is despoliation of land and deforestation. Mined areas should be reclaimed for agriculture, forestry, fisheries and recreation through standard methods of reclamation. A number of mining operations are going on affecting forest and cultivated land areas mainly in U.P. Bihar, M.P., Orissa and Andhra Pradesh. Urbanisation and allied processes like large-scale use of land for townships, communication, excavation and transport affected the socio-economy and ecology of these areas. Consequently, Ecological problems have developed in coal mine areas in Ranchi, Hazaribagh (Bihar), Bina Project (U.P.) and Singrauli complex at Gorbi (U.P.) and Jayanto (M.P.) Ranchi several hundred of sq. km. of land has become wasteland. In Singrauli complex forests and hillocks are damaged by the construction of high power transmission lines, Roads and rail tracks. Besides, establishment of cement factories, super thermal power stations around coalmines have resulted into environmental degradation to a great extent.

Successful results are at hand. At present two successful cases of reclamation of mined areas in India are as under:

1. Neyvely Lignite Corporation Ltd., in Tamil Nadu and

2. Stone Quarries of Sayaji Iron work in Gujarat.

It is essential to revise the Mines and Minerals (Regulations and development) Act, 1957 (MMRD Act) to bring in it the environmental concerns.

(ii) National Wastelands Development Board

The Board was founded in 1985 to formulate action plans to arrest land degradation and deforestation. The board is entrusted with the following function:

1. Regeneration of degraded forest areas and

2. Reclamation of ravines, user lands, arid tracts, mine spoils etc.

In the initial four years the Wastelands Development Programme laid emphasis on tree planting. In 1989-90 the programme was suitably restructured.

At present the Board is performing the following functions:

1. To check land degradation,
2. To bring wastelands into sustainable use,
3. To increase biomass availability,
4. To restore ecological balance.

The functioning of the Board during the last seven years has demonstrated that it is possible collectively to meet the challenge of regenerating India's wastelands.

The Ministry of Environment and Forests initially selected five districts in the country for going to the ground and drawing up action plans for reforestation and amendment of degraded land there.

Success is achieved in the preparation of maps on 146 districts in the country representing every state for identifying the wastelands and plantations. The five districts chosen were Almora (U.P.) Purulia (W. Bengal), Bellary (Karnatak), Durgapur (Rajasthan) and Sundargarh (Orissa).

In 1992 the NWDB was merged with the Ministry of Rural Development and a new

Department of Wasteland Development was established under a Minister of State.

Non-government organization (NGOS):- Several NGOS have also been putting endeavours in the direction of wastelands management. Some are as under:

1. The Indian Farmers Fertilizer Cooperative Ltd. (IFFCI) is providing funds for schemes of wasteland development in Udaipur and other areas of Rajasthan. "IFFCO Farm Forestry Project" has been taken up by IFFCO in ten states to cover a total of 50,000 hectare of wasteland.
2. Ramakrishna Mission Ashram, Bihar, insisting upon afforestation in tribal areas.
3. Forestry project of Chandmura, W.Bengal, insisting upon regeneration of degraded land through social forestry as people's involvement.
4. Comprehensive Social Service Society, Andhra Pradesh insisting upon afforestation by women's involvement.
5. Brukhy 'O' Jeever Bandho Parishads, Orissa, insisting upon environmental conservation.
6. Magra Mewar Vikas Sanstha, Rajasthan, insisting upon ecological restoration.
7. Kerala Sastra Sahitya Parishad, Kerala, for mobilising people's power by rousing awakening in them.
8. People Nurseries Scheme and Tree Grower's Co-operative besides National Dairy Development Board are helping in wasteland management.
9. A great number of registered non-profit organizations, are registered with the societies Cooperatives, companies, trusts etc. and Recognised schools. Colleges and universities that are financially supported by Govt. of India. For the purpose have undertaken the wasteland management programmes.

Some programmes aiming wasteland management are as under:

1. Green Haryana Programme,
2. Green Delhi Campaign,
3. Green Rajasthan Programme,
4. Smriti Vans etc.
5. Eco-Task Forces in different states.
6. A national fund for afforestation and Wastelands Development is set up. Donations to this fund are eligible for 100% income tax exemption.

UNIT - II

2.3.4 Land Degradation

Q19. Explain briefly about Land Degradation. (Imp.)

Ans :

Soil is no less than our mother as it is indispensable for our survival. It is formed over long periods of time. But man is degrading it with his misdeeds. Many of our once-fertile soils have already been converted to agriculturally unfit alkaline or saline land or marshlands. It is estimated that there is more than 25 million hectares of such barren lands throughout the world.

Our soil constitutes a biogeochemical shell around land and shallow waters. It is a product of the interactions of living matter with rocks. It profoundly affects the growth of living organism (especially plants) however; in turn it is influenced by the activities of the latter.

2. Reasons

Various factors have led to Land Degradation. Some of them are as under:

i) Rapid increase in industrialization, urbanization and other activities or civilized man have exercised a tremendous impact on the soils and on other components of the biosphere.

ii) Unplanned destruction of forests and forest litter has brought about serious changes both in land and water.

iii) The washing off of fine soil particles from deforested areas has caused great soil erosion.

iv) Soil erosion has resulted in a great increase in run-off, pollution turbidity and mineralization in rivers and extensive silting in water reservoirs.

2.3.5 Soil Erosion and Desertification

Q20. What are the causes of Soil Erosion?

Ans :

Meaning

The loose superficial layer of the earth's crust is the soil. The various components of the soil are mineral matter, soil water, soil organic matter, soil organisms and soil air. Soil degradation refers to the undesirable depletion of the physical components of the soil, thereby rendering it unhealthy for cultivation. This may also be referred to as soil retrogression/regression. The degradation of the soils is caused by agriculture, deforestation, overgrazing, erosion by wind and water. Given below is the description of each cause.

Causes

1. Soil Erosion by Water

The flowing water and continuous rains erodes the soil from the surface of the earth by four ways. They are,

(a) **Sheet Erosion:** Heavy rains cause the removal of the upper layers of the soil. This is referred to as sheet erosion.

(b) **Rill Erosion:** Small stream like structures are formed with the flow of water resulting in loss of the productive part of the soil profile.

(c) **Gully Erosion:** The fast flowing water cause cuts in the soil to form narrow channels having steep and sharp sides with depth of about 0.5m.

(d) **Riparian Erosion:** The fast flowing rivers cut off the margins of the bank of rivers due to water currents, resulting in physical disruption of the soil.

Leaching of the soil is a common phenomenon due to the heavy rains wherein the minerals in the upper layers of the soil dissolve and penetrate (or seep) into the subsoil due to which the fertility of the soil is lost.

(e) **Rains:** During rainfall, the fine particles of the soil get detached from the ground and wash off with the runoff water. The clay portion of the soil rich in nutrients is also lost.

2. Soil Erosion by Wind

Severe wind erosion of soil takes place in areas of scanty vegetation like parts of Rajasthan, Kutch and Madhya Pradesh. Winds carry the fine soil particles and sand

from one place to another resulting in the formation of sand dunes. As a consequence of this, there is loss of nutrients from top soil, along with accumulation of dust and sand on roads, railway lines and water supply channels.

3. Deforestation

The organic content of the forest soil is high and when a forest is cleared, the trees are burnt thus leading to the loss of organic matter above and in the soil. The soil organisms are deprived of the carbon source leading to massive emissions of carbon dioxide and contributing to global warming. The various forms of deforestation are,

(a) Felling of trees for firewood and building material: Wood is the primary source of fuel in most of the developing countries. It is used to make thousands of consumer products like building material, furniture and paper.

(b) Conversion of forests to agricultural lands to meet the demands of the growing population.

(c) Cultivation of cash crops and development of cattle/sheep ranching form a good source of income to the Government.

(d) Commercial logging of teak, mahogany and ebony destroys the trees and clears up the forests for agriculture.

(e) Industrial and mining activities pollute the forest ecosystem.

4. Natural Factors

The natural factors that contribute to soil degradation are,

(a) Heavy Rainfall on Weak Soil: Raindrops cause detachment of fine soil particles which are transported along with runoff water.

(b) Droughts: When the water dries up, the soil particles loosen up which may be carried away by wind or rain.

(c) Steep Slopes: Water flows along soil particles along steep slopes du gravitational force.

(d) Severe storms: floods and torna have disastrous effects on the struc of the soil.

5. Human Induced Factors

These include,

(a) Intensive farming to increase agricultural products. The fertile soil g damaged by the excessive use fertilizers and irrigation methods.

(b) Development of Houses: Unmanag construction activity by construction houses leads to loosening of soil partic which can be easily carried away rainwater or wind.

(c) Construction of roads too contributes soil degradation. The loose soil alo roadsides can be easily carried away b rainwater or wind.

6. Gravity

Due to the gravitational force of the earth the land and water are pushed downhill. I fact, the steeper the slope, the more the so is pushed downhill and the faster the wate flows.

7. Compaction

Due to compaction of the soil by cattle, sheep or heavy machinery, the porosity of the soi is lost. Along with that, the soil is unable to absorb or drain water resulting in water logging.

8. Desertification

It is the degradation of soil structure in arid, semi-arid and dry sub-humid areas as a result of climatic variations and anthropogenic activities.

9. Salinization of Soils

The salts are built up in soils to such an extent that it may be toxic to the plants. This is referred to as salinization of soils. The

presence of salts in soil decreases the osmotic potential of the soil so that plants are unable to take up water from it. Soil salination leads to degradation of soils and vegetation. The ions responsible for salination are Na^+, K^+, Ca^{2+}, Mg^{2+} and $C1^-$.

Q21. Describe various measures to prevent Soil Erosion?

Ans :

The erosion of soil by various agents can be controlled by developing a strong vegetative cover to increase plant water use. It can be done in various ways.

1. Strip Cropping

This involves planting of crops in the form of strips. This method of checking soil erosion and wind erosion is done by four ways.

(a) **Contour Strip Cropping:** The crops are grown at right angles to the natural slope of the land.

(b) **Field Strip Cropping:** The crops are grown in strips of uniform width in a horizontal manner.

(c) **Wind Strip Cropping:** The crops are grown at right angles to the direction of the wind.

(d) **Buffer Strip Cropping:** Various types of plants and annual crops are grown in between the strips mentioned in field strip cropping and wind strip cropping.

2. Restoration of Fertility of Soil

A very common way of restoring soil fertility is by growing leguminous plants, thus aiding in fixing nitrogen to the soil. Adding of humus to the soil increases its porosity, water holding capacity and fertility of soil. Commercial fertilizers like ammonium phosphate, ammonium sulphate, potassium nitrate, rock phosphate (basic slag) too add to the fertility of the soil.

Q22. What is meant by Desertification?

Ans :

It is the process of formation of deserts (conversion of fertile lands to arid lands) due to climatic factors or due to human interference. Desertification is the degradation of soil structure in arid, semi-arid and dry sub-humid areas as a result of climatic variations and anthropogenic activities.

Example: The famous Sahara Desert is formed due to extensive overgrazing by herbivores. The predators (lions) were captured by Romans, hence the population of herbivores increased drastically.

The factors which contribute to desertification include,

1. Deforestation
2. Overgrazing of the lands by herbivorous animals
3. Increase of atmospheric dust particles
4. Climatic factors
5. Improper usage of land resources also leads to desertification.

Q23. State the causes of Desertification.

Ans :

Causes of Desertification

1. Man Made

Most of the vegetation in arid and semi-arid regions is threatened with man-made desertification, a result of excessive, indiscriminate, and archaic land-use practices.

2. Forest Grazing

Forest grazing is the most serious cause of desertification in arid and semi-arid areas.

3. Shifting cultivation

Shifting cultivation is likewise important in the humid tropics and N.E. Himalayas.

4. Increasing Population

Increasing population pressure has greatly accentuated the adverse impacts of the above causes.