

Major Concept



7.1 INTRODUCTION

No living organism exists in isolation. Each and every living organism is surrounded by material and energy, which constitute its environment and from where it must derive its needs. Thus for its survival plants, animals and microbes etc. require from its environment a supply of energy, supply of materials and removal of waste products. For these basic requirements each living organism has to depend open and also interact with different nonliving (abiotic) and living (biotic) component of the environment. The abiotic components include inorganic elements such as water, carbon dioxide, oxygen, nitrates, carbonates etc. Organic compounds like carbohydrates, proteins, lipids etc. and physical features such as solar energy, wind, temperature, rainfall, soil etc. The biotic component consists of bacteria, fungi, plants, animals etc. The Scientific study of environment, ecology, evolution and global change with in a combined form called **environmental biology**. It examine the ways where organism, species and communities influence and impacted by natural and human altered ecosystem.

7.2 LEVELS OF ECOLOGICAL ORGANIZATION

Life is supported on earth within a thin envelop of air, water and soil. No life exists beyond the earth's atmosphere or deep beneath its upper crust. Thus life sustaining envelope of earth is called **biosphere**.

In ecology, the level of organization ranged from organism to biosphere. The area where an organism lives is called its habitat. It may be on land, in water or in the air.

For example

Habitat of frog is a pond. The group of organism belong to the same species lives in a particular area is called **population**. The group

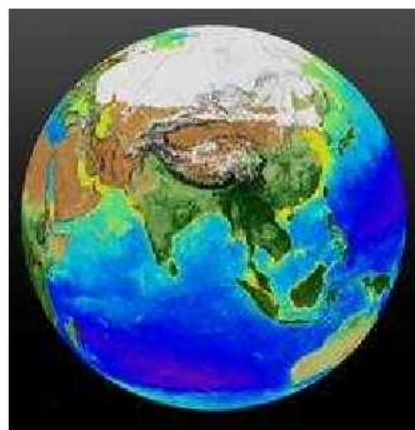


Fig.7.1 Biosphere



of populations that lives in a particular area or habitat and interact with each other is called **community**.



Fig. 7.2
Population of Deer Family



Fig. 7.3 Showing Some Members
of a Community

For example-A fresh water pond includes a population of *Hydrilla*, a population of frogs, insects, worms, rohu and many other kinds of animals. Members of community interact with each other as well as with their nonliving environment. During this interaction energy is also transferred from one to another level. So the area where these all interactions occur called **Ecosystem**.

The term 'ecosystem' was first proposed by Tansley in 1935, where 'Eco' means the environment (house) and 'System' implies an interacting area. An ecosystem is composed of organism interacting each other and with the abiotic environment, as well as flow of energy occurs in a given area. Thus an ecosystem may be as small as a dead trunk tree, a puddle or as large as an ocean or forest. The largest possible major community comprised of all living organisms on the earth is called **Biosphere**. All ecosystems on earth combine and constitute the giant ecosystem, the biosphere. The biosphere may be divided into sub-levels, biomes. Any bio-geographical region recognized by specific vegetation or climate called **Biome**.

7.2.1 Components of ecosystem

We have already studied in lower classes that ecosystem is comprised of two main components.

1. Abiotic Components
2. Biotic Components

1. Abiotic component

Abiotic components of an ecosystem are the physical aspects of its surrounding which influence upon the biotic components. They may control their distribution, reproduction, feeding, growth and metabolism. Many abiotic components affect an ecosystem but most important are light, temperature, water, soil and air. All these work in interacting manner.

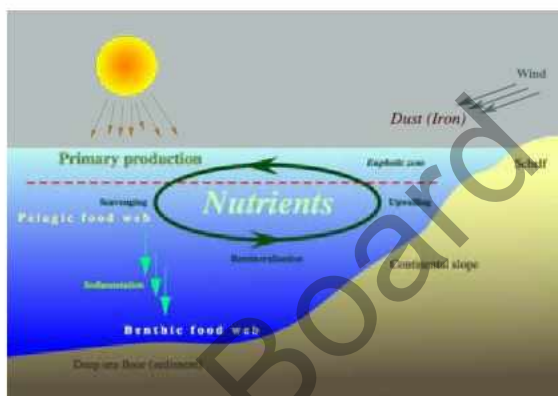


Fig. 7.4 Abiotic component

Light

It is the most vital factor, without it life cannot exist. It is a source of energy for every ecosystem. Plants convert this light energy into chemical energy by the process of photosynthesis. This chemical energy is stored in the form of food which is needed by every living thing. Distribution of plants and animals is affected by the type, intensity and exposure time of light. A small amount of this light is utilized in photosynthesis whereas the rest of it maintains the temperature of earth and atmosphere. Light is also necessary for vision and for the start of certain biological processes e.g. flowering of certain plant, making vitamin D in human beings and migration of many animals.

Temperature

Another important abiotic factor affecting an ecosystem is temperature. It is low at high altitudes and high latitudes, the flora and fauna changes accordingly. Temperature changes during day and night, also varies from season to season. Many birds and few mammals migrate or hibernate in winter. Enzyme activities of metabolic reactions are also altered with the changes in temperature. Most forms of life cannot survive this extreme temperature.



Water

All the living things need water. It is the major part of protoplasm. It acts as the solvent for most of the compounds, raw material of photosynthesis, inorganic substances enter in plants with water in dissolved form.

The amount of water on land is controlled by rainfall and snowfall. The vegetation on earth is depended on the rate of rainfall. It means it also controls the distribution of plants and animals on land. For example forest grows in the area which receives abundant rainfall whereas low rainfall in the area with extreme temperature develops desert conditions.

Soil

The upper layer of earth crust consists of particles of varying size and decomposed organic material by microorganism called **soil**. The decomposed dead animals and plants called humus. Humus enriches the soil and increases its water and air holding capacity. Plants are anchored in soil and depend on it for their growth by absorbing water and in organic substances. The type of soil and its fertility determines the flora hence fauna of an ecosystem.

Air

Air is the gaseous envelope which surrounds the earth. It plays an important role in smooth running of the ecosystem. Air is the mixture of N_2 , O_2 , CO_2 and H_2O vapours mainly. Nitrogen is an essential constituent of protein. Oxygen is vital for respiration of all living organisms whereas CO_2 is the main requirement of photosynthesis to produce primary product i.e. carbohydrates.

Humidity is the quantity of H_2O vapours in the air controls the rate of evaporation of H_2O and transpiration in plants. The composition of air and its velocity control other abiotic factors of environment which indirectly affect the plant and animal life as well as the ecosystem as whole.

2. Biotic components of an ecosystem

The living organisms which interact in an ecosystem are called biotic component. These living components include producers, consumers of all types and decomposers.

a. Producers

All living organisms which can trap and convert energy into food molecules called producers because they produce food for themselves and other organisms of ecosystem. They are primary source of energy for other organisms. Hence all members of community depend, directly or indirectly on the producers for their food and energy. These are photosynthetic bacteria, algae and plants.

b. Consumers

Animals and all other organisms which cannot make their own food are called consumers. They get energy and food from producers directly or indirectly.

On the basis of feeding level (trophic) mainly consumers are of three types.

i. Primary consumers

The consumers which directly feed on producers i.e. get energy and food directly from producers called primary consumers e.g. a grasshopper or caterpillar feeding on leaves of plants are primary consumers. They are herbivores.

ii. Secondary consumers

The type of consumers which feed on primary consumers e.g. gets energy and food from primary consumers called secondary consumers. For example a bird is a secondary consumer gets its energy and food when it eats grasshopper or caterpillar. They are carnivores.

iii. Tertiary consumers

The organism which eats the secondary consumers to get energy and food called tertiary consumers and they are carnivores e.g. an eagle which eat the small bird, which has already eaten grasshopper.

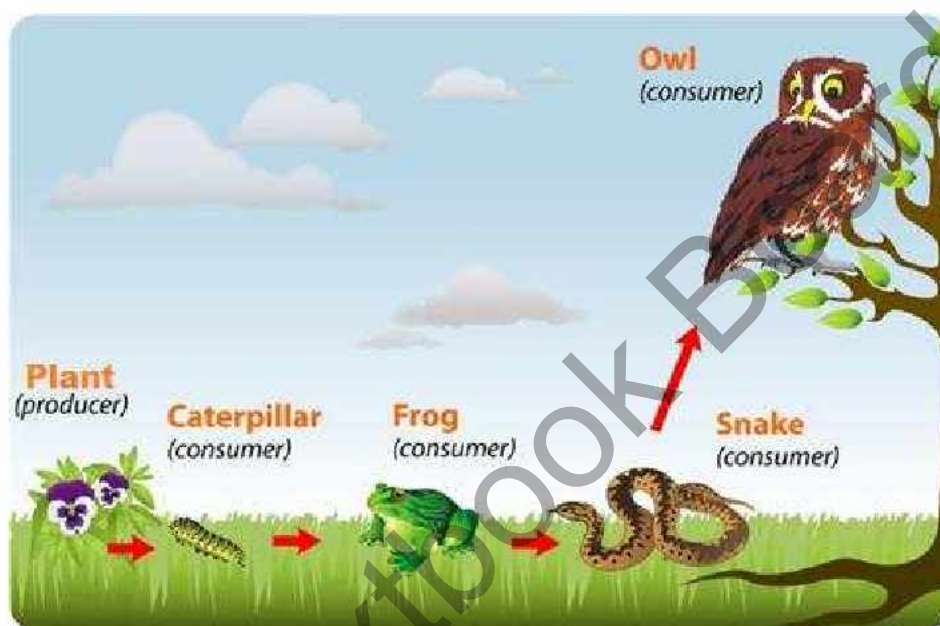
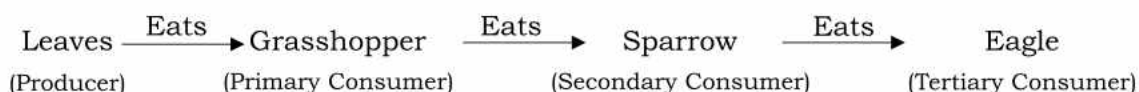


Fig. 7.5 Tertiary consumers

c. Decomposers

Microorganisms which break down complex food molecules of dead organisms called Decomposers. They are generally bacteria and fungi. They recycle the nutrients because they returned it by decomposing and converting complex organic molecules into simple inorganic molecules.

7.3 ENERGY FLOW IN AN ECOSYSTEM AS A NON-CYCLIC PROCESS

All the organisms in an ecosystem need energy to carry out their life activities to stay alive. Its primary source is solar energy coming through sun in the form of sunlight.

The energy of sun is trapped by producers (phototrophs) and converted into energy rich organic food molecules. Part of this energy is

transferred to primary consumers when they eat producers. Primary consumers when eaten up transfer this energy to secondary consumers which in turn form the meal of tertiary consumers. Hence the energy is transferred to next level, the tertiary consumers. These steps of transfer of energy rich food are called trophic levels, and this series of energy transfer from one trophic level to another by eating or being eaten up is called a food chain, represented by using arrows.

At each trophic level not all but a small amount of energy is transferred to the next level where it is stored as plant material or animal flesh. More than half of the energy is lost as heat. A significant quantity is consumed at each level by the organism itself in carrying out its own functions like movement, respiration, reproduction etc. It is therefore, all the energy at each level never reaches the next level, only 10% of energy at each level transferred to next level. This reduction in transfer of energy at various levels in an ecosystem is expressed in the form of a pyramid called pyramid of energy.

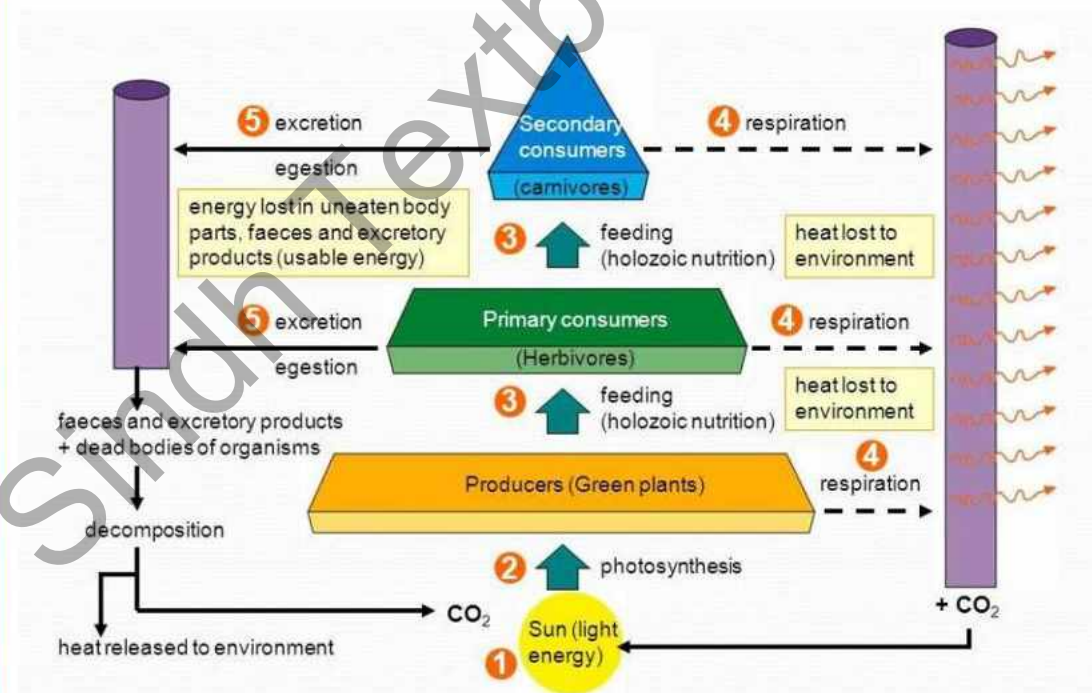


Fig. 7.6 Non- Cyclic energy flow in an eco system

7.4 FLOW OF MATERIAL IN ECOSYSTEM AS CYCLIC PROCESS

In an ecosystem organic and inorganic materials flow in two ways, which are cyclic and interlinked with each other in some manner. These are;

- i. Food chain and Food web
 - ii. Biogeochemical cycle
- i. **Food chain and food web**

In ecosystem, the flow of food material progresses through food chain in which one step follows another like in Grassland ecosystem. The grass is eaten by grasshopper, locust and rabbits etc. These in turn eaten by sparrows, lizards and jackals, respectively are secondary consumers. Sometimes these secondary consumers are eaten by hawks and tigers etc.

From above example, it is clear that the transfer of food material from producers through a series of organism i.e. producers to consumers, with repeated eating and being eaten is known as **food chain**.

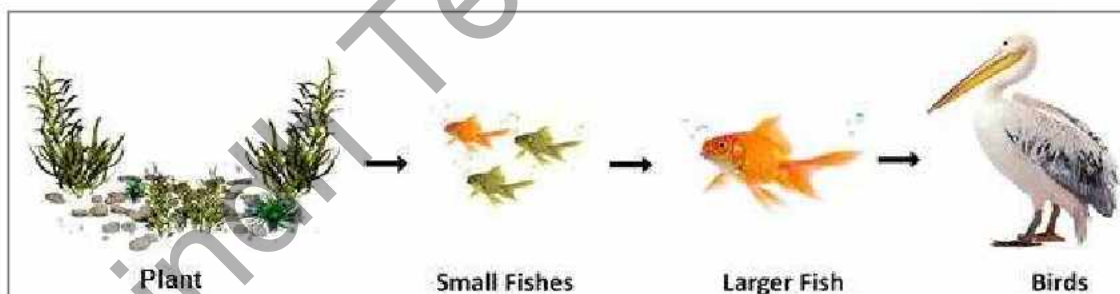


Fig.7.7 A Simple Food Chain

In nature simple food chain occurs rarely. An organism derives its food from more than one source. Even the same organism may be eaten by several organisms of high trophic levels or an organism may feed upon several different kinds of organism of a lower trophic level. Thus

in a given ecosystem various food chains are linked together and interact with each other to form a complete network called **food web**.

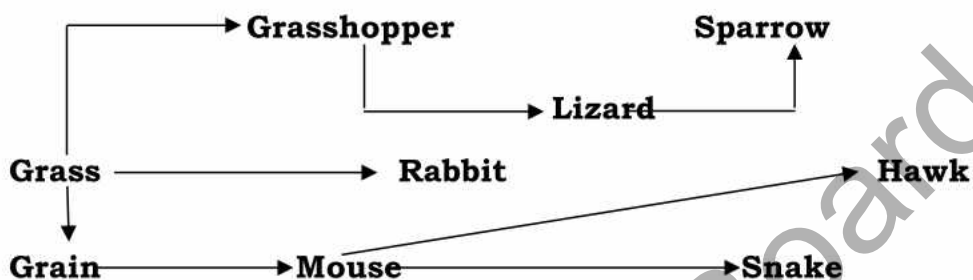


Fig. 7.8 A food web in grassland ecosystem

7.4.1 Ecological pyramids

An English ecologist Charles Elton develops the concept of ecological pyramids in 1927. It is a matter of common observation that the number of organisms in an ecosystem gradually decreases at each higher trophic level. He observed that the number of animals at low trophic level are abundant than the animals at high trophic level. Ecological Pyramid is defined as "Presentation of number of individuals or amount of biomass or energy in various trophic levels from lower to higher level". Two of them are given here.

i. Pyramid of number

Graphic presentation of members of population in an area at different trophic levels is called pyramid of number. When number of organisms is counted at each level, it is observed that previous one e.g. there are more mice than snakes which feed on mice, subsequently the number of eagles are much lesser than snakes. This relationship is also expressed in the form of pyramid known as pyramid of number.



Fig. 7.9

Pyramid of Numbers in an Ecosystem

Pyramid of biomass

Another type of pyramid, drawn on the same pattern, represents the total biomass (Total mass of dry organic matter per unit area) of organisms at each trophic level. Such a pyramid called the 'pyramid of biomass' shows that each higher feeding level contains less biomass than the previous trophic level. It results from energy loss in a food chain at each trophic level.

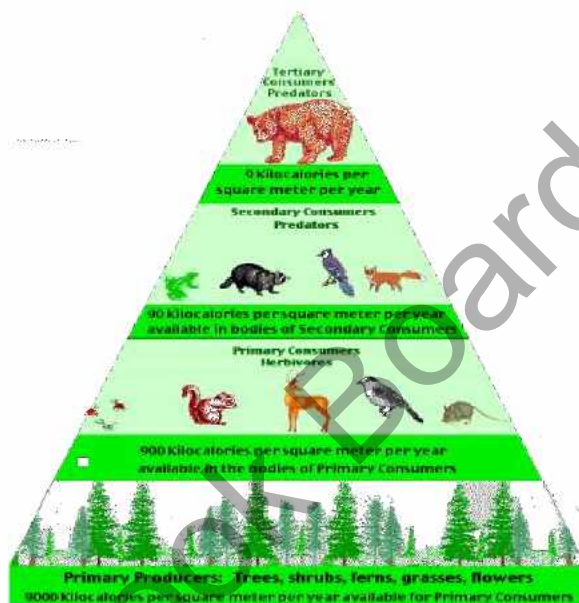


Fig. 7.10
Pyramid of Biomass in an Ecosystem

7.5 BIOGEOCHEMICAL CYCLES

The growth and life processes of living organisms require about 40 elements, among them six are needed in large quantities i.e. carbon, oxygen, hydrogen, nitrogen, phosphorous and sulphur. These elements are taken up from environment by producers, made a part of protoplasm and finally returned back to environment. So the elements cycle continuously through organism and environment. These cycles are called Biogeochemical Cycles.

A biogeochemical cycle has the following characteristics.

- Movement of the nutrient elements from environment to organism and back to environment.
- Involvement of biological processes.
- A geochemical reservoir.
- Chemical changes.

All biogeochemical cycles are closely interlinked with water cycle and energy flow in ecosystem. Following are some important biogeochemical cycle.

a. Carbon-oxygen cycle

All the life in the earth is based on carbon. It is needed for the formation of proteins, carbohydrates, fats and many other substances that make up living things. The carbon comes from carbon dioxide which is found in atmosphere. Plant takes this CO_2 from air and convert it into carbohydrates by photosynthesis. Carbon in this form passes into a food chain. Animals get carbon by eating plants and animals. The amount of CO_2 in the air stays the same because it is returned to the air as fast as plants take it in. All living organisms respire and thus exhale carbon dioxide whereas decomposers set the CO_2 free from bodies of dead organisms. It is also returned to air by combustion that is burning of wood and other organic fuel like coal, petrol and gas etc.

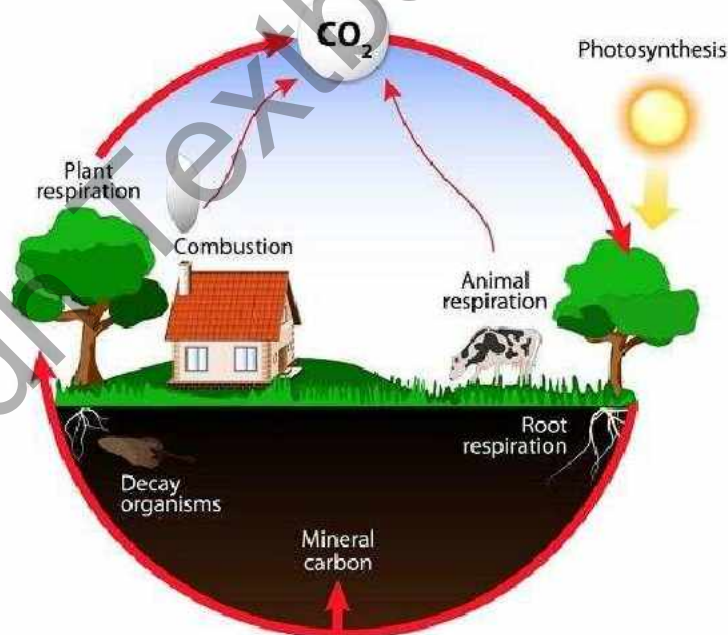


Fig. 7.11 Carbon-oxygen cycle

Two important life processes, the respiration and photosynthesis help a lot to run the carbon-oxygen cycle. Respiration consumes oxygen for the combustion of food for release of energy. During this process carbon dioxide is produced and released in the atmosphere. Photosynthesis on the other hand consumes CO_2 and release O_2 and thus the balance is maintained.

b. Nitrogen cycle

Nitrogen is one of the important constituent of protein and DNA. It is therefore, an essential element in the structures of all living things. Plants use atmospheric nitrogen in the form of nitrates.

This cycle consists of three steps.

- i. Nitrogen fixation
- ii. Nitrification
- iii. Denitrification

i. Nitrogen fixation

Conversion of atmospheric free nitrogen gas into nitrates called Nitrogen fixation. The atmospheric Nitrogen combines with oxygen during lightning to make certain compound which ultimately form nitrates and reach to soil by rain water. The atmospheric Nitrogen also fix by three types of bacteria. One group live in water which is photosynthetic called cyanobacteria, second group lives in the soil and third group of bacteria lives in the roots of certain leguminous plants. The bacteria perform this function of nitrogen called Nitrogen fixing bacteria.

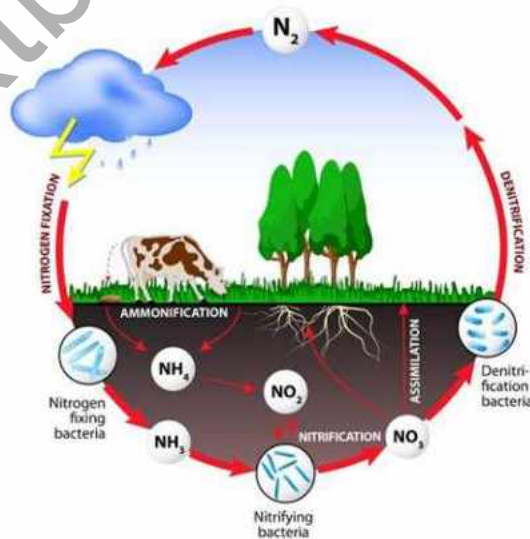


Fig. 7.12 Nitrogen cycle

ii. Nitrification

Process where nitrogenous compounds of living organism convert into nitrates called Nitrification. It is also performed by microorganisms live in soil. These nitrates are reabsorbed by plants and the Nitrogen cycle starts again. Protein of dead animals and plants, excretory waste like ammonia, urea, uric acid are all nitrogenous wastes.

If soil does not contain proper nitrogen containing compound then farmer use different type of fertilizers in fields to increase nitrates

iii. Denitrification

Process of converting nitrogenous compound into free nitrogen called denitrification. It takes place by special bacteria which lives in anaerobic condition of soil. These bacteria called denitrifying bacteria. These bacteria breaks ammonia or nitrates into free nitrogen, which is released in the air so as to complete the cycle and to keep the nitrogen balance in nature.

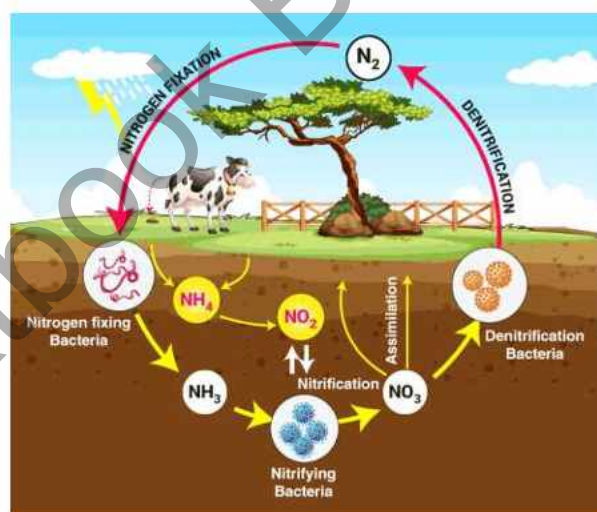


Fig. 7.13 Denitrification

7.6 INTERACTION IN THE ECOSYSTEM

It has been observed that in an ecosystem living organisms develop number of relationships according to their needs. The herbivores develop their relation with producers, in the same manner carnivores depend on herbivores for their food.

Some other interesting biotic relationships are also common in community. These association maintain balance in the growth population. Such interactions take place between the two organisms by permanent or temporary association. It may be beneficial only one or



both the associates or may be beneficial to one and harmful to the other. Some types of these relationships are competition, predation and symbiosis.

i. Competition

This type of a relationship is actually a cold war between the organisms of a community occupying the same habitat. This competition may be intraspecific i.e. between the members of same species or interspecific i.e. between the members of different species. Intraspecific competition is mainly for mate, better shelter, better and high amount of food, while the interspecific competition is for food. This competition becomes a limiting factor ends in the survival of the fittest, to keep the size of population and community in balance.

ii. Predation

A predator is an organism which captures and kill the alive animal for its food. The animal being killed is called prey. Predator in an ecosystem are either secondary or tertiary consumers usually. Some plants are also predators, these plants are called carnivore plants i.e. pitcher plant, venus fly trap etc. Predator relationship is an important factor in which one population continually determine the population of the other predator- prey relationship is an effective tool for biological control of the population of various organisms.



Fig. 7.14 Some Carnivores Animals



Fig. 7.15 Some Carnivores Plants

iii. Symbiosis

It is an association between the two organisms of different species which live together. In this association either one is benefited while the other is harmed or at least one is benefited while other is neither benefited nor harmed or both mutually benefited. So this symbiotic association is of three type the Parasitism, Commensalism and Mutualism respectively.

7.6.1 Parasitism

Most common association is the interaction of organism called parasite which lives in or on the body of other organism called **host**. The parasite gets food from host. Sometimes the parasite gets place to live also thus benefited whereas its host is harmed. Parasites cause diseases, these disease causing parasites are viruses, bacteria, fungi, protozoa, insects, worms etc. A successful parasite takes just enough food from the host to grow and reproduce. They have rapid rate of reproduction.

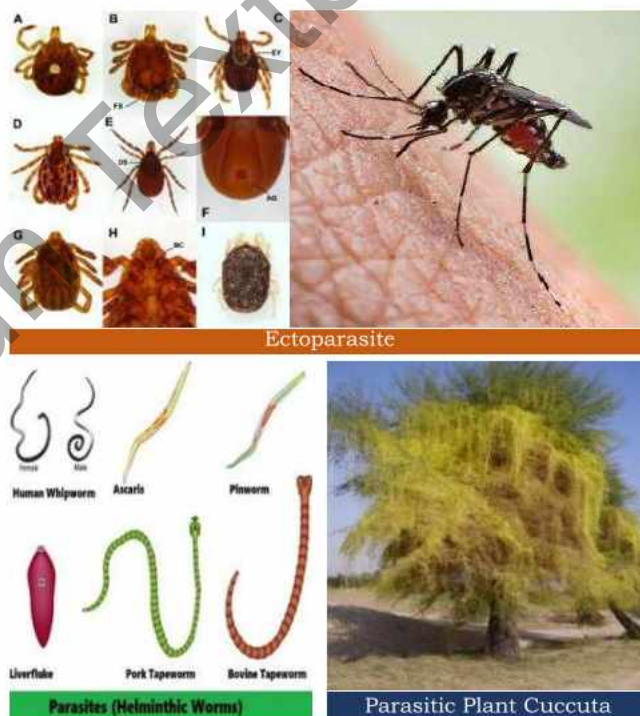


Fig. 7.16 Some parasitism

7.6.2 Commensalism

It is a type of symbiotic relationship in which one of the organism **commensal**, gets the benefit whereas the other is neither benefited nor harmed. A good example is spirochaetae, a kind of spiral shaped bacteria, living between our teeth to obtain food but causes no harm to us.



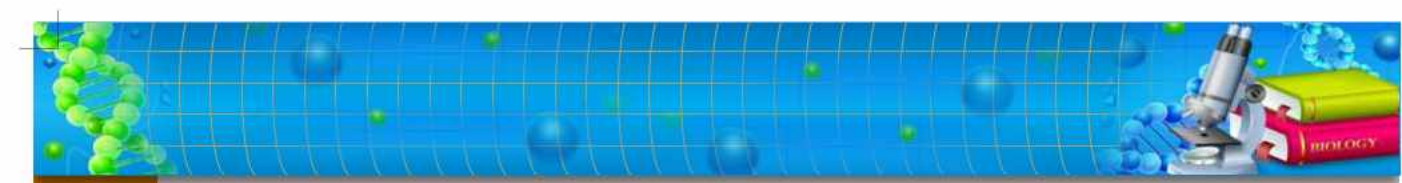
Fig. 7.17 Sucker fish and shark and Epiphyte Plant Growing on Tree Trunk

7.6.3 Mutualism

In mutualism two different kind of organisms get benefit from living together. Usually they cannot live without each other. Example is the nitrogen fixing bacteria, *Rhizobium*, live in the root of leguminous plants. The bacteria get food from these plants while in return they fix gaseous nitrogen into nitrates for plant which is required for their growth.



(A) (B) (C)
Fig. 7.18 Mutualistic Association between (A) Bacteria and Nodulated Roots, (B) Hermit Crab and Sea Anemone & (C) Human Gut and *E.coli*



7.7 ECOSYSTEM BALANCE AND HUMAN IMPACT

In an ecosystem living organisms interact with other living organisms as well as with their abiotic factors. This interaction takes place by food chain, food web, energy cycle and biogeochemical cycle. These all interactions are important and help to keep the ecosystem balanced. This is called Ecological balance. Ecological balance is a term describing how ecosystem is organized in a state of stability where species exist with other species and environment. Let's take an example of demonstrating the importance of ecological balance. A great example of ecological balance is the predator. If prey population increases the number of predators will increase. When more predation will take place the prey population will be reduced. When prey population decreases the predator will come under stress ultimately their population will be reduced also. This predator-prey cycle therefore helps in maintaining the ecological balance.

Sometimes this ecological balance is disturbed by either natural disasters or by human activity e.g. the population of rabbits when first introduced in Australia, rapidly grew so large that it created a menace. Since no predators were present in that ecosystem and hence there was no check on their population growth. Then predators were introduced to counter the situation.

The human environment is the earth we live on. It includes all the physical parts of earth such as air, soil, water minerals and all its biological inhabitants such as animals, plants, bacteria, fungi etc.

The modern man, with all his technical know how, is exploiting natural resources at an alarming rate, in the way he is adversely damaging environment. His scientific inventions provided him many comforts of life. These comforts have been achieved at the expense of his healthy environment. Thus due to his numerous ecological disturbances, short sightedness and greedy exploitation of natural resources, he is confronted today with a number of serious environmental problems. These include desertification of land due to erosion and deforestation, flooding, accumulation of waste and toxic



substances in his surrounding, pesticide contamination, radio-isotopes accumulation, depletion of natural resources, spread of infection disease etc. All these upset delicate balance in ecosystems and environment as well. Some of them are population growth, urbanization, global warming, deforestation and acid rain.

7.8 POPULATION GROWTH

There is a popular saying that our all miseries lie in three 'Ps' i.e. population, pollution and poverty. The last two are directly related to the first one. It is said that human population is growing exponentially. Dr. Paul Ehrlich of Stanford University regards this 'population explosion' as a 'population bomb' which is more dangerous and catastrophic than atom bomb.

The birth rate at present is 55 Million per year about 100 babies are born per minute. The rate of growth in Pakistan during 1960 to 2000 were approximately 3.0% which is now declined to 2.0% which is still highest in the world. This increase in population will create the problem of shortage of food, health facilities, starvation, epidemics etc.

Year	Population in Millions	In Each 5 Year	Growth Rate
1960	44.9		
1965	50.92	1960-1965	1.20
1970	58.14	1965-1970	1.44
1975	66.82	1970-1975	1.74
1980	78.05	1975-1980	2.25
1985	92.2	1980-1985	2.83
1990	107.65	1985-1990	3.09
1995	123.78	1990-1995	3.23
2000	142.34	1995-2000	3.71
2005	160.31	2000-2005	3.59
2010	179.42	2005-2010	3.82
2015	199.42	2010-2015	4.00
2020	220	2015-2020	4.12

Growth Rate of Population in Pakistan After Each FIVE Years

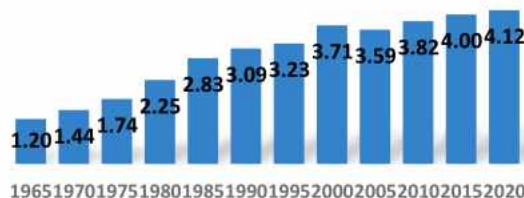


Fig. 7.19

Population of Pakistan from 1960 to 2020 Source "The World Bank"

7.8.1 Urbanization

The rapid increase in the population has generated another serious problem i.e. urbanization. The people from rural areas migrate continuously to urban areas for better jobs, education and better standard of living. In 1947 urban population was 18%. Today it is more than 40%. The katchi abadi increases in urban area. It causes pollution of air, water and soil. Beside these social evils also increase. These include drug abuse, looting, arson, kidnapping, dacoities, religious conflicts, ethnic clashes, linguistic riots. If we will not control birth rate and rapid growth of urban areas, history indicates that nature forcefully perform natural population controls by disease, famine and war.



Fig. 7.20 Urbanization

Year	Urban Population in %	Urban Population
1955	19.70%	7,968,418
1960	22.10%	9,926,658
1965	23.50%	11,954,323
1970	24.80%	14,416,426
1975	26.30%	17,592,808
1980	28.10%	21,910,455
1985	29.40%	27,060,895
1990	30.60%	32,923,693
1995	31.60%	39,104,110
2000	32.10%	45,687,389
2005	32.60%	52,301,807
2010	33.30%	59,691,513
2015	34.20%	68,226,783
2016	34.40%	70,005,271
2017	34.50%	71,795,700
2018	34.70%	73,630,430
2019	34.90%	75,510,639
2020	35.10%	77,437,729

Urban Population % of Pakistan



Fig 7.21

Urban Population of Pakistan from 1955 to 2020 Source "The World Bank"

7.8.2 Green house effect (global warming)

In urban areas during burning of fossil fuels, CO₂ and methane produces which are generally called **greenhouse gases**. These gases if produced in high quantity in atmosphere will accumulate below the ozone layer, which do not allow heat energy of sun to reflect back in space. As a result, heat remains with in the earth's atmosphere and increases the temperature. This is called **global warming** or **greenhouse effect**.



Fig 7.22

Effect on global warming on galceirs

This is called **global warming** or

greenhouse effect.

Due to global warming more evaporation of H_2O which ultimately reach to high rainfall, melting of polar ice and glaciers at high rate, rise of sea levels and ultimately reach to flood.

7.8.3 Acid rain

Due to urbanization and industrialization more fuel burn, more acids are used in industries, as a result of these consumptions more CO_2 , SO_2 , NO_2 are liberated in air from their chimnies. When rain falls through these polluted air H_2O react with these gases in air and produce carbonic acid, sulphuric acid and nitric acid, respectively. These acids remain as vapours and condense into liquid when temperature falls. The acid destroy soil, micro-organisms of soil, skin of animals, building material.

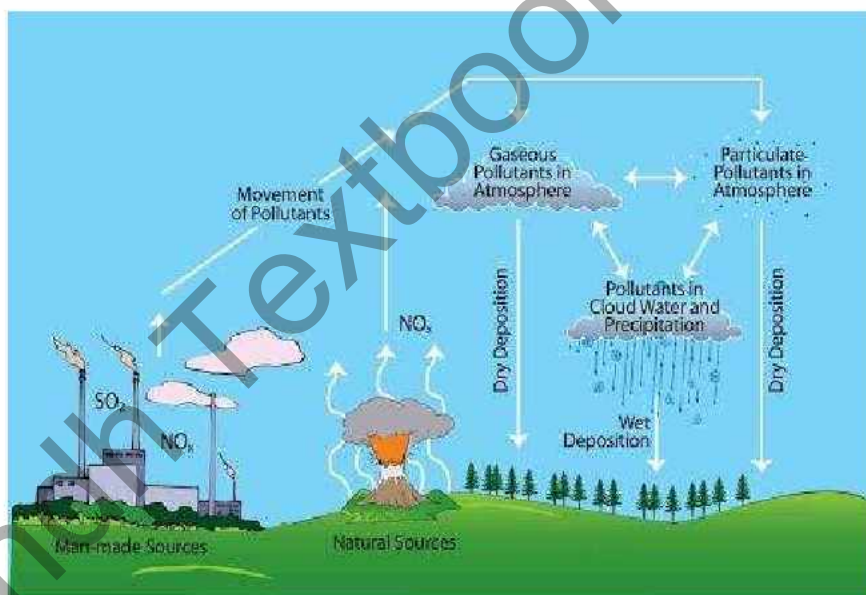


Fig. 7.23 Acid rain and its impact on Ecosystem

7.8.4 Deforestation

Forests are now being cut rapidly all over the world for fuel, fodder, timber, agricultural needs, river valley projects, industrial purposes, for construction of dams, roads, building etc. It has been estimated that every year 40 million acres of forests are cutting or destroying, this process is called **deforestation**.

Deforestation result in recurrent floods, soil erosion, lowering of ground level, declination of annual rain fall, loss of fertility of the soil, reduction in wild life and greater incidence of diseases because of loss of organism which helped in controlling the vectors.



Fig. 7.24 Forest are the Lungs of Earth, Destroying Day By Day

7.9 POLLUTION

What is pollution? Literally it means destruction of purity: Scientifically 'Pollution' may be defined as any undesirable change in the physical, chemical or biological characteristics of air, land, water and soil which may or will harmfully affect human life, plants, animals, our industrial processes, living conditions and cultural assets.



Fig. 7.25 Pollution

What are pollutants? All those substances that cause pollution called pollutants.

Common pollutants are:

1. Deposited matter such as soot, smoke, tar, dust and grit.
2. Gases like SO_2 , CO , CO_2 , NO_2 , Cl_2 , O_3 etc.
3. Chemical compounds like aldehyde, arsines, hydrogen flouride, chloro flouro methane, phosgene, detergents etc.
4. Heavy metals like lead, mercury, iron, zinc etc.
5. Economic poison like herbicide, fungicide, insecticide etc.
6. Fertilizers.
7. Sewages.
8. Radioactive substances.
9. Noise and heat.



Generally pollution is classified as:

- i. **MATERIAL POLLUTION:** where some material or substance become excessive in environment; like air, water or soil pollution.
- ii. **NON-MATERIAL POLLUTION:** where material does not increase but environment disturb or become unbearable to live, i.e. noise, heat or radiation pollution.

7.9.1 Air pollution

When amount of solid waste or concentration of gases other than oxygen increases in atmosphere called air or atmospheric pollution.

Main causes:

Automobile, electrical power plant use coal, gas, diesel or petrol, industrial processes, heating and cooking plants, transport industry etc. These machines produce smoke, carbon mono-oxide (CO), carbon dioxide (CO₂), sulphur oxide (SO₂), nitrogen oxide (NO₂), chloro fluoro carbon (CFC) etc., due to which photochemical haze produces, acid rain occurs, greenhouse effect take place as well as ozone depletion occurs. We have already discussed acid rain and greenhouse effect. Let us now see what is meant by depletion of ozone.

Depletion of ozone

In upper atmosphere a protective layer of ozone (O₃) is present which is very important for us because it checks the ultraviolet radiations from sun which are lethal for living organisms. Scientists have found this protective layer is gradually depleting (getting thin) due to chloro fluoro carbon, as they react with ozone and convert it into O₂. The CFC used as propellant in pressurized aerosol, foaming agent, refrigerators etc. Each one atom of chlorine converts more than 100000 molecules of ozone.

Control of air pollution

Air pollution can be controlled by following ways.

Use of proper filters: Industrial air pollutants should be passed through filters and other devices. So in this way particulates matter is removed before they release in air.

Use of solar cooker: Industry should use solar cooker or bio-gas producing units.

Environment friendly fuels: Use lead free fuels, Sulphur free fuels, use of CNG gases.

Afforestation: Development of new forest or plantation. Forest use excessive CO_2 , plants also absorb other air pollutants.

7.9.2 Water pollution:

The main cause of water pollution is human activity which pollutes streams, canals, lakes, rivers and sea. These pollutants affect the aquatic organism and quantity of water which directly or indirectly effect the life of human. Main source of water pollution are:

- i. **Organic Pollutants:** Domestic sewage, agriculture run off, organic waste from breweries, bacteria, milk dairies, sugar mills, hotels etc.
- ii. **Chemical Pollutants:** Pesticides, insecticides, fungicides, herbicides, detergents, heavy metals, acid, mine waste, oil and oil dispersants, radioactive material etc.
- iii. **Thermal Pollutants:** Effluents from electric power plants or nuclear reactor plants.
- iv. **Siltation:** Deposition of soil and sand in the bottom of water reservoirs which raise the water levels and decrease water holding capacity. At last this silting cause floods.

Eutrophication or algal bloom

Growth of algae with very high rate due to increase in phosphorous and nitrogen containing compounds called algal bloom or



eutrophication. Sewage water and agricultural field run off poses rich quantity of phosphorous and nitrogen containing compounds like are detergents. They accumulate in water reservoirs and promote algal growth up to dangerous level i.e. algal bloom. Algal bloom when floats on water surface spoil fishing, swimming and recreational qualities of water. These algal species when die not only add more organic matter to water but sometimes release toxins which have lethal effect to various organisms. The excessive growth of other decomposers also use the excessive oxygen present in water which leads to the death of other organisms. It also reduces the light reaching to lower layer in water.



Fig. 7.26 Growth of algae

Control of water pollution

- Public awareness at all levels is important. It should be through social media, political leaders, institution from pre-primary level.
- Strict legislation and implementation is required on sewage treatment and industrial recycling processes.
- No industrial and agricultural waste should be added to water bodies before complete treatment.



Fig. 7.27 Sewage Water

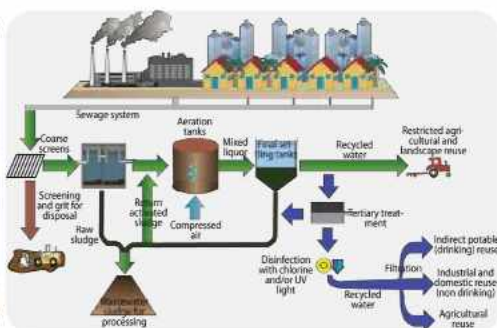


Fig. 7.28 Sewage Treatment

7.9.3 Soil pollution

The pollution of soil has resulted from a number of human activities related to utilization of land resources. Mining, excavation of soil for bricks, cement making and construction of roads, dams, building etc. Dumping of solid waste in open space have reduced soil resources.

Deforestation for building and industries, over grazing by cattle of domestic use have destroyed the properties of soil. Excessive use of fertilizers, pesticides and poor drainage system have resulted into problems. Pakistan is facing a massive problem of water logging and salinity due to improper canal system. Over grazing and deforestation leads to most serious problem of soil erosion by wind and water.

In agriculture country like Pakistan, land and water are the most valuable assets and we are steadily destroying our most valuable resources. According to a report published by National conservation secretariat Islamabad, from total irrigated land area of 66.1 million hectors in Pakistan, about 24 million hectors is exposed to severe environmental threats, suffering from various kind of degradation. Eroded soil ultimately get in water bodies and cause problem of siltation.

Control:

- Recycling of solid waste
- Proper dumping of solid waste
- Plantation, development of forest
- Development of pasture and meadows for grazing of animals.
- Proper irrigation system like drip system.

7.10 CONSERVATION OF NATURE

Our environment is the source of all type of essential resources which are required to maintain our life on earth. It is a direct or indirect source of food, shelter, clothing, fuel, paper, luxury, beauty and recreation as well as wealth.



These resources may be renewable or non-renewable. Air, water, food, land, forest, live-stock, wildlife, are renewable. These resources can use again and again if we use it wisely. Overuse of these resources affect natural recycling process. Therefore, these natural resources should be conserved by the process of conservation.

Conservation is a plan of avoiding the unnecessary use of natural materials or resources or a careful preservation and protection of natural resources by planned management to prevent exploitation of, destruction or negligence.

We can also conserve non-renewable resources but they can not replenished. To do so we have to find alternative ways to slow down the dependency at one resource, just like petrol for automobile or metals. For maintaining the quality of resources we have to adopt the old principle of Reduce, Reuse and Recycle. Reduce means found ways to reduce the wastage like water usage and power usage. Reuse means to develop methods to reuse the resources again and again. Whereas recycle means material like paper, glass, metal, plastic etc. can be recycled.



Fig. 7.29 Some endangered mammals of Pakistan



Fig. 7.30 Some endangered birds of Pakistan

Plans for Conservation of Nature in Pakistan:

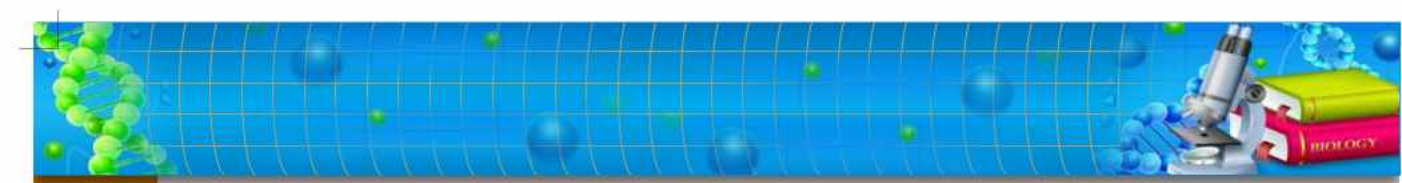
- Pakistan has diversified ecosystems therefore authorities developed different plans.
- National Parks 29
- Wild life Sanctuaries 69
- Game reserves 26
- Protected Wetlands 19
- Protected and reserved forest 07
- Marine protected areas
- Biosphere reserves (MAB) Lal suhanar Biosphere reserve Punjab, Ziarat Juniper forest, Pallas valley in Kohistan KPK.
- Pakistan National Biodiversity strategy and action plan 2015.
- Biodiversity Action plain by IUCN/ WWF/ World Bank, 1999.
- National Conservation Strategy plan, 1993.
- Wild life conservation project in Pakistan, 2007.
- Sustainable Forest Management UNDP in Pakistan. Project 2016-2020.
- Himalayan Jungle Project (HJP), 1991-1994.



- Palas Conservation and Development Project (PCDP) 1994
- Indus Dolphin Project (IDP), 1977
- Marine Turtle Conservation Project, 1980
- Kirthar National Park, Sindh
- Toghar Conservation Project (TCP), Balochistan, 1985
- Conservation of Chilghoza Forest and Associated Biodiversity of Suleiman Range, Balochistan, 1992
- Maintaining Biodiversity with Rural Community Development, 1999
- Mountain area Conservancy project (MACP), 1999
- Northern area Conservation Project (NACP), 2000
- Conservation of snow leopard in Northern Pakistan
- Conservation of Migratory birds in Chitral, NWFP (KPK), 1992
- Himalayan Wild life Project (HWP), 1993
- Conservation of Chiltan Markhor in Hazarganji Chiltan National Park, Quetta.
- Protected areas Management Project
- Bear Baiting in Pakistan

Institution in Pakistan Work for Conservation:

- Environment and Climate Change (UNDP) In Pakistan
- Society for Conservation and Protection of environment, SCOPE
- Environment and Natural Resource Management (National Rural Support program)
- Conservation in Pakistan
- National Energy Efficiency & Conservation Authority
- Environmental organization in Pakistan (Help save Pakistan's environment)
- Pakistan Environmental Protection and Resources Conservation Project.
- Pakistan Environmental protection Agency(PEPA)
- Himalayan Wild life Foundation (HWF)

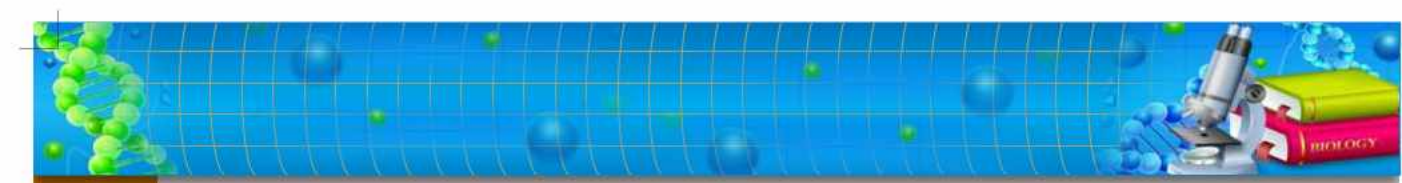


SUMMARY

- ◆ The Scientific study of environment, ecology, evolution and global change with in a combined form called is **environmental biology**.
- ◆ The scientific study of the various relationships exists between organism and their environment is called **Ecology**.
- ◆ An area where community interacts with non-living environment and flow of energy occur is called Ecosystem.
- ◆ Life sustaining envelope of earth is called **biosphere**.
- ◆ The group of organism belong to the same species live in a particular area is called **population**.
- ◆ The largest possible major community comprised of all living organisms on the earth is called **Biosphere**.
- ◆ Any bio-geographical region recognized by specific vegetation or climate is called **Biome**.
- ◆ Abiotic components of an ecosystem are light, temperature, water, soil and air.
- ◆ The living components include producers, consumers of all types and decomposers are called biotic component.
- ◆ All the organisms in an ecosystem need energy to carry out their life activities.
- ◆ In an ecosystem, organic and inorganic material flow in two ways, cyclic and interlinked with each other in some manner.
- ◆ In ecosystem, the flow of food material progresses through food chain
- ◆ The number of animals at low trophic level are abundant
- ◆ Graphic presentation of members of population in an area at different trophic levels is called pyramid of number.
- ◆ The pyramid of total biomass (Total mass of dry organic matter per unit area) of organisms at each trophic level.
- ◆ The elements cycle continuously through organism and environment are called Biogeochemical Cycles.



- ◆ In an ecosystem living organisms develop number of relationships according to their needs.
- ◆ Herbivores develop their relation with producers, in the same manner carnivores depends on herbivores for their food.
- ◆ Some type of these relationships are competition, predation and symbiosis.
- ◆ This competition may be intraspecific i.e. between the members of same species or interspecific i.e. between the members of different species.
- ◆ Parasitism associated between host and parasite.
- ◆ Commensalism is a type of symbiotic relationship in which one of the organism commensal, gets the benefit whereas the other is neither benefited nor harmed.
- ◆ In mutualism two different kinds of organisms get benefit from living together.
- ◆ The all interactions are important and help to keep the ecosystem balanced. This is called Ecological balance.
- ◆ The modern man, with all his technical know how, is exploiting natural resources at an alarming rate, in the way he is adversely damaging environment.
- ◆ Our all miseries lie in three 'Ps' i.e. population, pollution and poverty.
- ◆ Heat remains with in the earth's atmosphere and increases the temperature is called global warming or greenhouse effect.
- ◆ Forests are cutting or destroying, this process is called deforestation.
- ◆ Growth of algae with very high rate due to increase in phosphorous and nitrogen contain compounds called algal bloom or eutrophication.



EXERCISE

A. MULTIPLE CHOICE QUESTIONS

Choose the correct answer:

- i)** The life sustaining envelop of earth is
(a) Biomass (b) Biomes
(c) Biosphere (d) Atmosphere
- ii)** The group of organisms belong to the same species live in a particular area called
(a) Community (b) Species
(c) Genes (d) Population
- iii)** An area where community interacts with non-living environment is called
(a) Community (b) Ecology
(c) Ecosystem (d) Biome
- iv)** Any biological region recognized by its climate or vegetation is called
(a) Ecosystem (b) Biomes
(c) Biosphere (d) Biomass
- v)** The transfer of food material from producers through some organisms with repeated eating and being eaten is called
(a) Food pyramid (b) Food chain
(c) Food web (d) Ecological pyramid
- vi)** The elements in ecosystem recycle through organisms with environment is called
(a) Food chain (b) Food web
(c) Chemical cycle (d) Biogeochemical
- vii)** Process where nitrogenous compound of living organism convert into nitrates is called
(a) Ammonification (b) Nitrification
(c) Denitrification (d) Deamination



viii) The cold war between the organisms of a community occupying the same habitat is called

- (a) Predation
- (b) Competition
- (c) Mutualism
- (d) Commensalism

ix) The association between two different types of organism which get benefit to each other, cannot live without each other is called

- (a) Parasitism
- (b) Commensalism
- (c) Mutualism
- (d) Predation

x) The amount of solid waste or concentration of gases other than oxygen increase in atmosphere is called

- (a) Air pollution
- (b) Ozone depletion
- (c) Acid rain
- (d) Greenhouse effect

B. SHORT QUESTIONS:

i) What is the effect of light on ecosystem?

ii) Which one is the first trophic level of ecosystem and how?

iii) What do we mean by nitrogen fixation and how it occurs in an ecosystem?

iv) What is interaction?

v) What is pyramid of number?

vi) What is greenhouse effect?

vii) What is algal bloom and how it destroy the life of an aquatic ecosystem?

viii) What measure can be taken to control water pollution?

ix) Write down the name of some endangered mammals of Pakistan.

x) Draw the diagram of nitrogen cycle.

C. EXTENSIVE RESPONSE QUESTIONS:

i) Describe biotic factors of an ecosystem.

ii) Describe nitrogen cycle as biogeochemical cycle in detail.

iii) What is pollution? Describe different types of hazardous effects caused by air pollution.