Unit 16

Man and His Environment

Long Answer Questions

Q.1 Define environment and ecology.

Ans: Environment

An environment is the sum of physical (abiotic) and biological (biotic) components which influence that organism.

Ecology

The study of the interrelationship between living organisms and their environment is called ecology. **Or** The study of the interaction of organisms with their environment.

Q. 2 Explain Levels of Ecological Organization.

Ans: In ecosystem, the levels of organization range from organism to biosphere. The followings are the levels of ecological organization:-

1. Species

A species is a group of organisms which can interbreed freely in nature to produce fertile offspring.

Examples

Human, Cat, Dog etc.

2. Population

A group of organisms of the same species inhabiting a specific geographical area at a particular time is called population.

Example:- Number of rats in a field.

3) Community

All the populations that live in a habitat and interact in various ways with one another are collectively called a community.

Example

Forest is an example of community.

4) Ecosystem

Living organisms cannot live isolated from the nonliving part of their environment. The biotic (living organisms) and abiotic components (air, water, light, soil etc.) of environment interact with each other to form a stable system. The self-sufficient unit of an environment that is formed as a result of interactions between its biotic community and the abiotic components is called ecosystem.

Examples

i. A pond, a lake and a forest are examples of natural ecosystems.

ii. An aquarium is an example of artificial ecosystem.

5) Biosphere

Definition

All ecosystems of the world together form the biosphere. It includes all the ecosystems of the planet Earth. In other words, the biosphere consists of all organisms present on the earth and all regions of the Earth where they live.

Range

Biosphere ranges from the floor of oceans to the tops of the highest mountains.

Thickness

It is about 20 km thick. The biosphere makes a thin layer surrounding the planet Earth. If you consider the Earth as of the size of an apple, then the biosphere will be as thick as the apple's skin.

Q. 3 Explain Components of Ecosystem.

Ans. An ecosystem is comprised of two basic parts:-

1) Biotic Components **(Board 2014)**

Definition

The living parts (organisms) of the ecosystem is called biotic components.

Examples

- Producers (Plants, Algae and Cyanobacteria)
- Consumers (Animals, Protozoa)
- Decomposers (Bacteria and Fungi)

2) Abiotic Components

The non-living factors present in ecosystem are called abiotic components.

Examples:

i) Air **ii)** Water **iii)** Soil **iv)** Light **v)** Temperature

Biotic Components **(Board 2013)**

1) Producers

Definition

These are the autotrophs in an ecosystem. These organisms are able to synthesize complex organic compounds (food) from inorganic raw materials. Producers form the basis of any ecosystem.

Examples

(i) In terrestrial ecosystems, plants are the main producers.

(ii) In aquatic ecosystems, the main producers are the algae (phytoplankton) and Shallow water rooted plants.

2) Consumers

Definition

These are the heterotrophs in an ecosystem. These organisms are unable to synthesize their food and so depend upon producers for food. The animals are the major consumers of all the ecosystems.

Examples

Animals, Fungi, Protozoans and many of the Bacteria.

Types of Consumers

i. Herbivores

These animals feed directly on plants or products of plants. They are also called primary consumers.

Examples

Cattle, deer, rabbit, grasshopper etc.

ii. Carnivores

Those animals that feed upon other animals are called carnivores. The carnivores are of following types:

Types of carnivores

a) Primary carnivores

Those carnivores that feed upon herbivores are called primary carnivores. They are secondary consumers.

Examples

Fox, frog, predatory birds, many fishes and snakes.

b) Secondary carnivores

Those carnivores that feed upon primary carnivores are called secondary carnivores. They are tertiary consumers.

Examples

Wolf and owl etc.

c) Tertiary carnivores

Those carnivores that feed upon secondary carnivores are called tertiary carnivores. They are not eaten by any other animals. So they are also called top carnivores.

Examples

Lion, Tiger etc.

Omnivores

Those consumers that eat animal flesh as well as plants and plant products are called omnivores.

Examples

Human and Crow etc.

3) Decomposers or Reducers

Those organisms that break down the complex organic compounds of dead matter (of plants and animals) into simple compounds. They secrete digestive enzymes into dead and decaying organic matter to digest the organic material. Products of digestion are absorbed for their own use and remaining substances are added to the environment for reuse. The minerals, which are released by decomposers, are used as nutrients by the producers.

Examples

Bacteria and fungi.

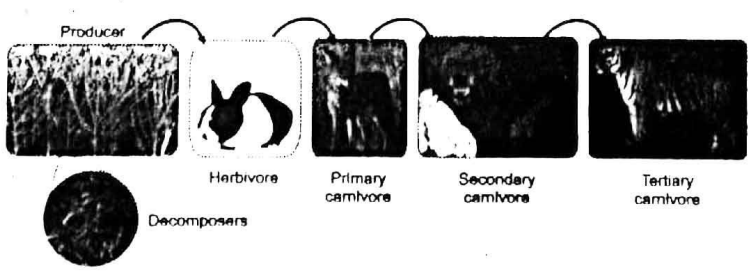


Figure 16.1: Producers, Consumers and Decomposers

Q4 Explain Flow of Energy in an Ecosystem.

Ans. In an ecosystem, energy as well as materials travels from one trophic level to the next.

Trophic Level

Trophic level is the level at which an organism feeds in food chain. The first trophic level is made of producers; the second of primary consumers and so on.

Flow of Energy

The flow of energy in different trophic levels of ecosystem is unidirectional. The following is an overview of the flow of energy in an ecosystem.

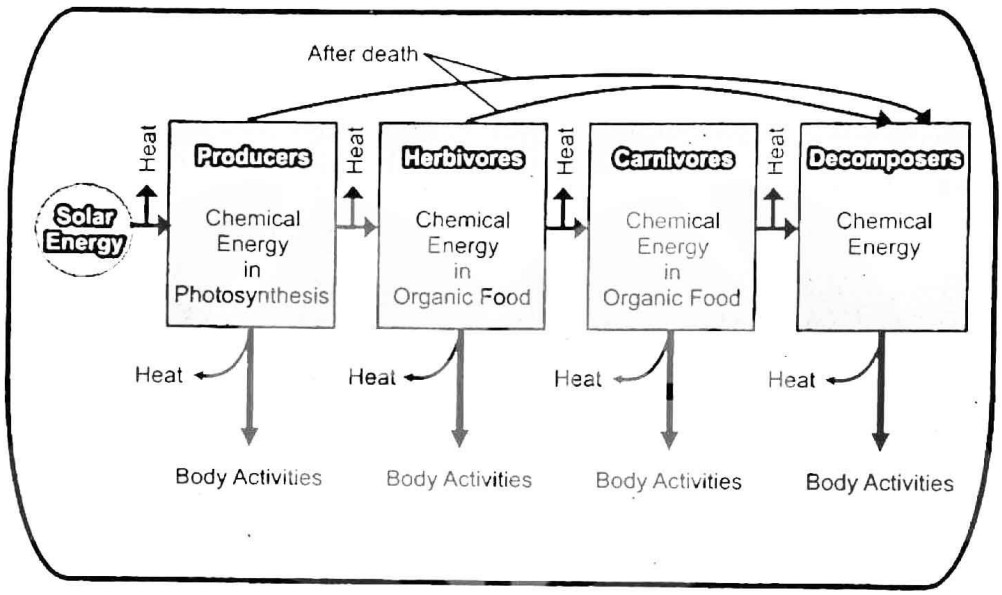


Figure 16.2: Energy flow in an ecosystem

Source of Energy in an Ecosystem

The Sun is the primary source of energy for all ecosystems. Producers get solar energy and transform it into chemical energy by the process of photosynthesis. They store this energy in their tissues and also transform it into mechanical and heat energy during their metabolic activities.

Movement of Energy

The energy in producers' tissues flows to herbivores when producers are eaten. Herbivores transform it into mechanical and heat energy during their metabolic activities and store the rest in their tissues. Carnivores eat herbivores and get energy. They also use it for their body activities and store the rest in their tissues. After the death of producers and consumers, the energy stored in their tissues is used by the decomposers.

Storage and Expenditure of Energy.

The storage and expenditure of energy in an ecosystem is in accordance with the basic law of thermodynamics i.e. "energy can neither be created nor destroyed but can be transformed from one form into another". In an ecosystem there is,

- Constant flow of energy from the Sun through producers to consumers and decomposers.
- A significant decrease in useful energy during transfer of energy at each trophic level.

Q. 5 Explain Flow of Materials in an Ecosystem.

Ans: Introduction

The materials flow from one trophic level to the next by means of food chains and food webs.

Food Chain

A food chain is a series of organisms within an ecosystem, in which each organism feeds on the one before it and is fed by one after it.

Example

Grass ---------- Grasshopper ---------- Sparrow ---------- Hawk

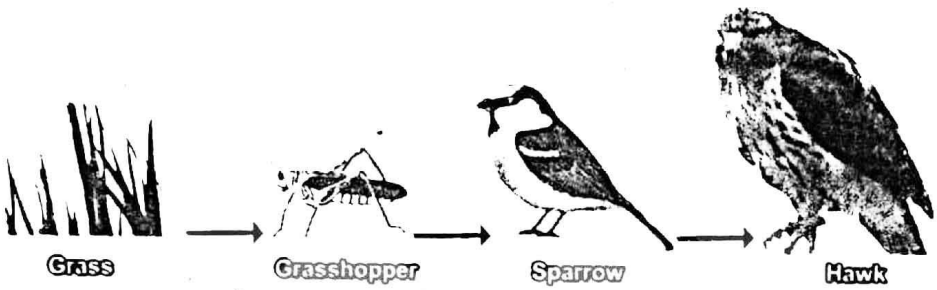


Figure 16.3: A Simple Food Chain

The base of food chain is always formed by a producer. It is eaten by a primary consumer, which is preyed upon by secondary consumer. The secondary consumer may be eaten by a tertiary consumer. A food chain, can therefore, be represented as,

Producer---------- Primary Consumer---------- Secondary Consumer---------- Tertiary Consumer

A food chain involves a nutritive interaction among the biotic components of an ecosystem. Usually there are 4 or 5 trophic levels. Shorter food chains provide greater available energy and vice - versa.

Food Web

In nature, food chains are very complex, as one organism may be the food source of many other organisms. So there is a web like structure formed by these interlinked food chains. Such interconnected food chains collectively make food web. OR

It may also be defined as, "a network of food chains which are interconnected at various trophic levels".

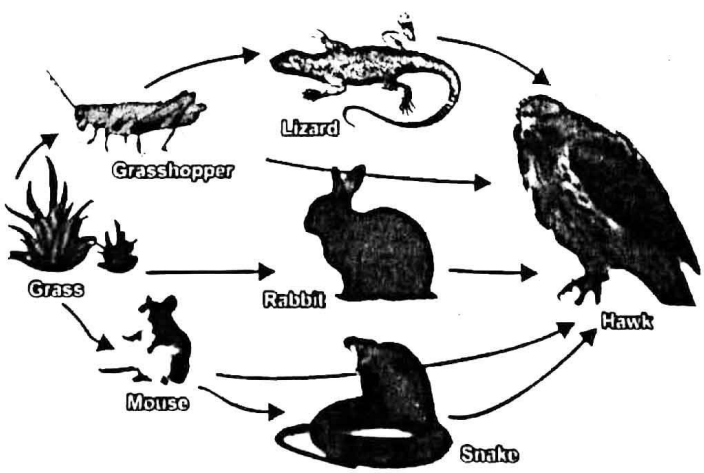


Figure 16.4: A Food Web in Grassland Ecosystem

Q.6 Describe types of Ecological Pyramids. **(Board 2014)**

Ans: Definition

Ecological pyramid can be defined as, "A representation of the number of individuals or amount of biomass or energy present in various trophic levels of a food chain".

Explanation

In 1927, Charles Elton (an English ecologist) developed the concept of ecological pyramids. He noted that the animals present at the beginning of food chain are abundant in number while the animals present at the end of food chain are fewer in number.

Types of Pyramids

Ecological pyramids are of three types:

1) Pyramid of Numbers

It is the graphic representation of the number of individuals per unit area at various trophic levels of a food chain.

Example

Usually, producers are present in large number, primary consumers are in lesser number, and secondary consumers are fewer. So, the producers are of smallest size but maximum in number, while the tertiary consumers are larger in size but lesser in number.

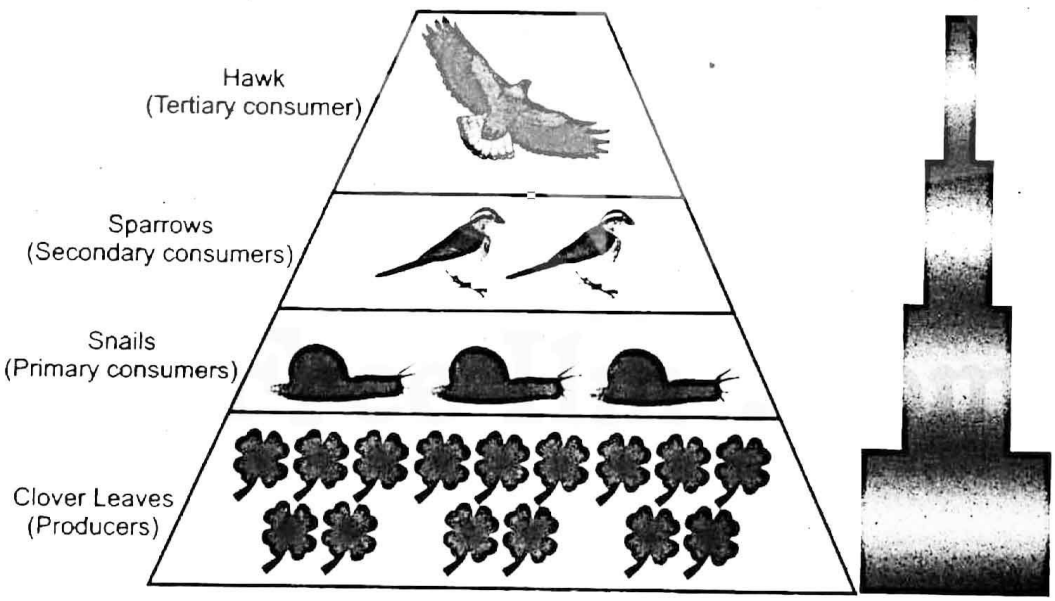


Figure 16.5: Pyramid of Numbers in an Ecosystem

2) Pyramid of Biomass

It is the graphic representation of biomass present per unit area at various trophic levels of a food chain.

Example

In a terrestrial ecosystem, the maximum biomass is of producers and there is progressive decrease in biomass from lower to higher trophic levels.

Biomass

The total amount of living or organic matter in an ecosystem at any time is called "biomass".

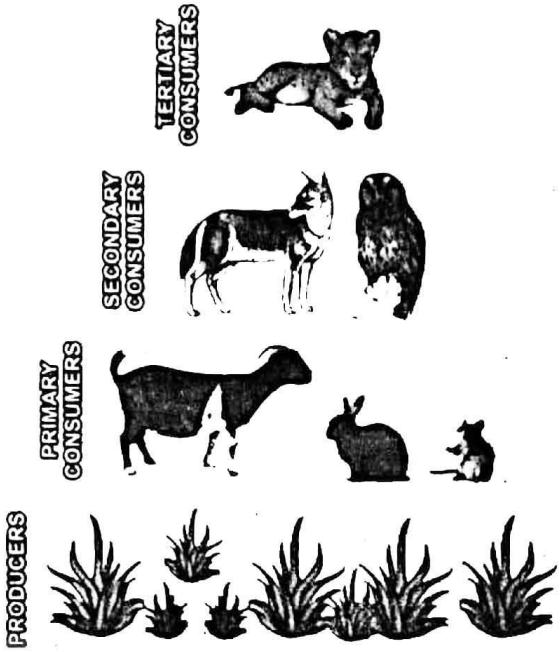


Figure 16.6: Pyramid of Biomass in an Ecosystem

3) Pyramid of Energy

It is a graphic representation of energy present in a biomass of living organisms at various trophic levels of a food chain.

Example

The amount of energy is decreased from producers to decomposers as some amount of energy is used by the organisms to perform work while some of it is lost.

Q. 7 Define biogeochemical cycles. Also explain different cycles in ecosystem.

Ans. Source of bioelements

Environment provides bioelements which are used by organisms for their bodies and metabolism. The materials are continuously recycled between organisms and environment. They are also called nutrient cycles.

Biogeochemical cycles

Biogeochemical cycles are the cyclic pathways through which materials move from environment to organisms and back to the environment.

1. Carbon Cycle

Introduction

Carbon atom is the principal building block of many kinds of biomolecules.

Occurrence of Carbon

Carbon is found as graphite and diamond in nature. It also occurs as carbon dioxide in atmosphere.

Sources of Carbon

Major sources of carbon for the living world are:

- Carbon dioxide present in atmosphere and water.
- Fossil fuels like peat, coal, natural gas and petroleum also contain carbon.
- Carbonates of Earth's crust also give rise to carbon dioxide.

Effects of upsetting of carbon cycle

The balance of carbon cycle has been upset by human activities such as deforestation and excessive burning of fossil fuels. As a result, the amount of carbon dioxide in atmosphere is increasing, causing the green house effect and global warming.

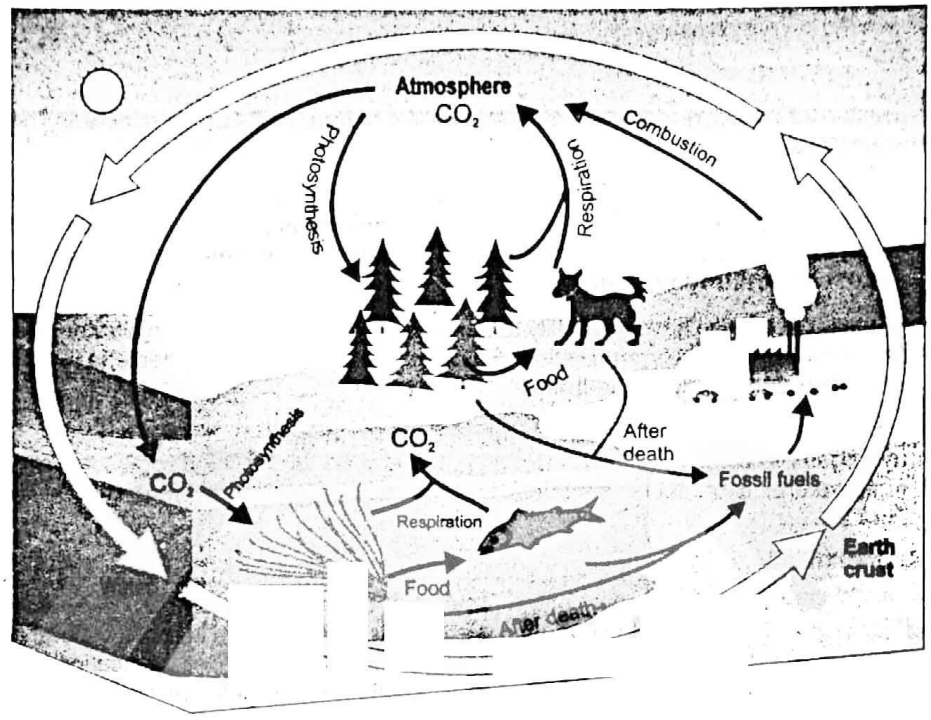


Figure 16.7: Carbon Cycle

Steps of Carbon Cycle

(a) Entry of Carbon into Living Organisms

The major process that brings carbon from the atmosphere or water into living world is photosynthesis.

(b) Transfer of Carbon

Producers take in carbon dioxide from atmosphere and convert it into organic compounds and becomes a part of the body of producers. This carbon enters in food chains and is passed to herbivores, carnivores and decomposers.

(c) Release of Carbon

- Carbon dioxide is released back to environment by respiration of producers and consumers.
- It is also released by the decomposition of organic wastes and dead bodies by decomposers.
- Burning of wood and fossil fuels also add large amount of carbon dioxide into atmosphere.

2) Nitrogen Cycle

Importance of Nitrogen

Nitrogen is an important component of all biomolecules like proteins and nucleic acids (DNA and RNA). These are the most abundant biomolecules in the body of all living organisms.

Unavailability of molecular Nitrogen

Atmosphere is the reservoir of free gaseous nitrogen. Living organisms are unable to use this gaseous nitrogen directly from atmosphere (except for nitrogen fixing bacteria). It has to be converted into nitrates to be utilized by plants.

Steps of Nitrogen Cycle

Nitrogen cycle consists of following steps:

a) **Formation of Nitrates**

b) **Assimilation**

c) **Denitrification**

a) **Formation of Nitrates**

It is done by following ways:

i) **Nitrogen fixation**

Conversion of nitrogen gas into nitrates is called nitrogen fixation. It occurs in the following ways:

- **Atmospheric nitrogen fixation**

Thunderstorms and lightning convert atmospheric gaseous nitrogen into nitrous acid and nitric acid. The acids in turn combine with other salts to produce 'nitrates' this is called atmospheric nitrogen fixation.

- **Biological nitrogen fixation**

Some bacteria also have the ability to transform gaseous nitrogen into nitrates. It is called biological nitrogen fixation. Some of these nitrogen fixing bacteria live as symbionts and many are free living.

- **Industrial nitrogen fixation**

Nitrogen fixation is also done in industries. In industrial nitrogen fixation, hydrogen is combined with atmospheric nitrogen under high pressure and temperature. It produces ammonia which is further converted into ammonium nitrate.

ii) **Ammonification**

Ammonification is the breakdown of proteins of dead organisms and nitrogenous wastes (urea, uric acid etc.) to ammonia. It is done by ammonifying bacteria.

iii) **Nitrification**

After the formation of ammonia, it is converted into nitrites and nitrates. This is called nitrification and is done by nitrifying bacteria. Firstly ammonia is converted into nitrites by bacteria called *Nitrosomonas*. The nitrites are then converted into nitrates by other bacteria called *Nitrobacter*.

b) Assimilation

The nitrates when absorbed by plants and utilized for making proteins, nucleic acids etc. Animals take nitrogenous compounds from plants. The utilization of nitrates by organisms is called assimilation.

c) Denitrification

It is a biological process in which nitrites and nitrates are reduced to gaseous nitrogen by denitrifying bacteria. In this way nitrogen is returned to the atmosphere.

Effect of excessive denitrification

Excessive denitrification reduces soil fertility and is stimulated by water logging, lack of aeration and accumulation of organic matter in the soil.

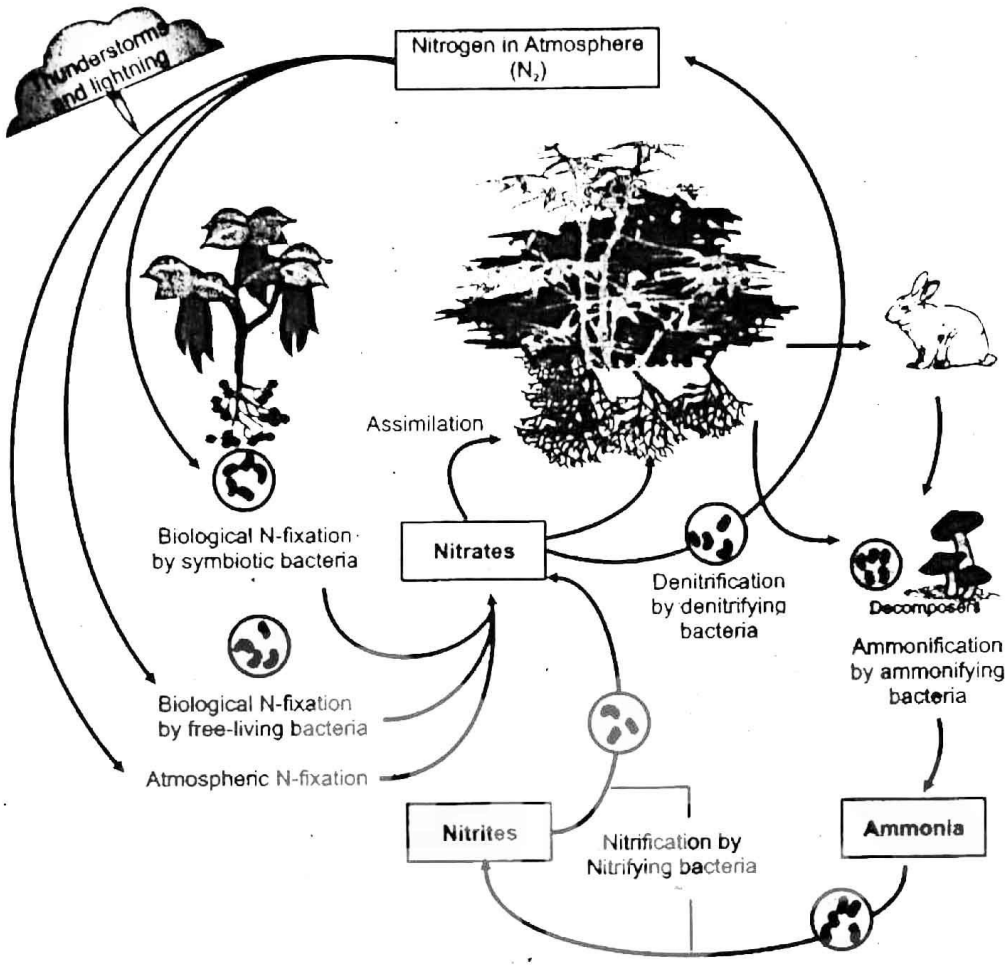


Figure 16.8: Nitrogen Cycle

Q 8 Explain various types of interactions in an ecosystem.

Ans: In all ecosystems, there are many kinds of interaction among living organisms.

(i) Intraspecific interactions

The interactions between the members of the same species are called intraspecific interactions

(ii) Interspecific interactions

The interactions between the members of different species are called interspecific interactions.

Some important interactions among living organisms in ecosystem are given below:

1. Competition **2.** Predation **3.** Symbiosis

1) Competition

In ecosystems, the natural resources e.g. nutrients, space etc. are usually in short supply. So, there is competition among the organisms of ecosystem for the utilization of resources. The competition may be intraspecific or interspecific.

Intraspecific competition is always stronger and more severe than the interspecific competition. Competition helps in maintaining a balance between the available resources and the number of individuals of a species.

2) Predation

Definition

It is an interaction between two animals of different species or between a plant and an animal. In predation, one organism (the predator) attacks, kills and feeds on other organism (the prey). All carnivore animals are predators. Some examples of predation are given below:-

Examples

1. Frog preys upon mosquito and fox preys upon rabbit. There are some examples where a predator is preyed upon by a second predator and then the second one is preyed upon by a third predator. For example, frog (predator 1) is preyed upon by a snake (predator 2) and the snake is preyed upon by an eagle (Predator 3).

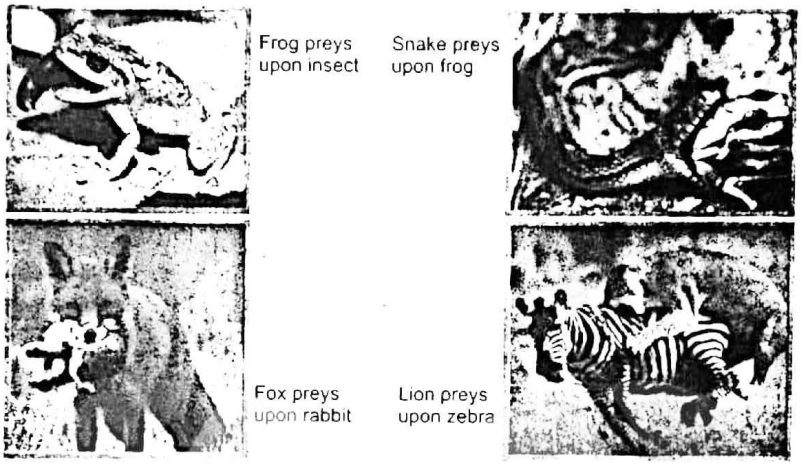


Figure 16.9: Examples of Predators and Their Preys

2. Certain plants (Pitcher plant, Sundew, Venus fly trap etc.) are carnivorous and live as predators. Such plants live in the areas where minerals and other nutrients are lacking. They feed on insects to fulfill their nitrogen requirements. These plants have mechanism to attract insects. For example, they secrete sweet nectar that attracts the insects searching for food. Their leaves are also modified to capture the prey.

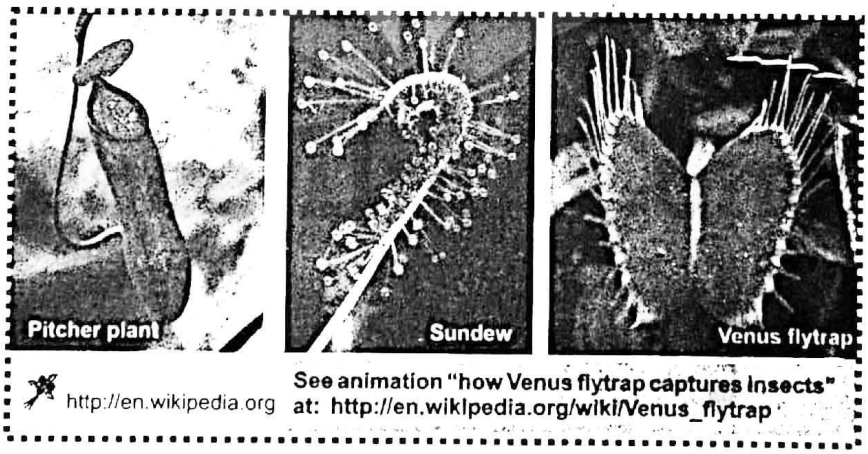


Figure 16.10: Predator Plants

Importance of predation

Predation keeps the prey population under check, so as to maintain an ecological balance. Humans benefit from this interaction in the biological control of weeds and pests. In order to control pests in an area, their predators are released there.

3) Symbiosis

Definition

It is a relationship between members of different species, in which they live together for longer or shorter periods of time.

Example

Lichens (Association between algae and fungi)

Types of symbiosis

A. Parasitism **(Board 2013)**

Definition

It is a type of symbiosis in which smaller partner (parasite) derives food and shelter from the body of larger partner (host) and, in turn, harms it.

Host

The organism on which a parasite feeds is called host.

Parasite

Parasite is an organism that gets shelter and food from its host and in return harms it. Host can survive without parasite, but parasite cannot survive without host.

Types of Parasites

a) Ectoparasites

Ectoparasites live outside i.e. on the surface of host's body and get food from there.

Examples

Mosquitoes, leeches, lice etc.

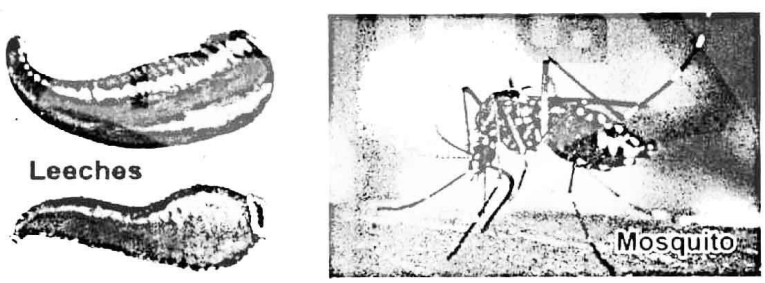


Figure 16.11: Ectoparasites

b) Endoparasites

Endoparasites live inside the body of host and get food and shelter from there.

Examples

Bacteria, viruses, tapeworm, Ascaris, Entamoeba, Plasmodium etc.

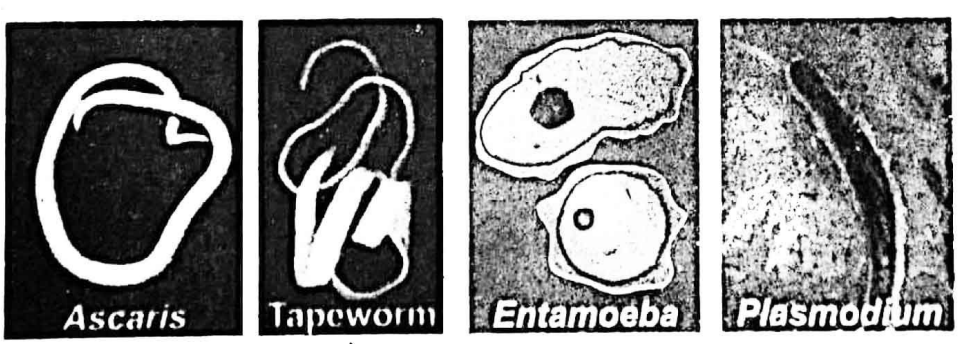


Figure 16.12: Some Endoparasites

Parasitic Plants

Some plants (e.g. Cuscuta, also called dodder) are parasites on other plants. Parasitic plants grow special types of roots (haustoria) into host body and suck the required nutrients from the vascular tissues of host.

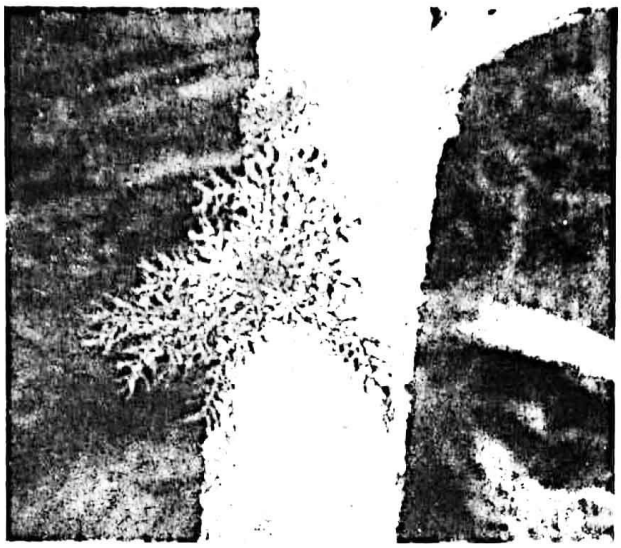


Figure 16.13: A parasitic plant and its host tree trunk

Types of Parasitism

a) Temporary Parasitism

In temporary parasitism, the parasite spends most of its life cycle as independent free- living organisms. Only a part of its life cycle is spent as a parasite. Leech, bed bug, mosquito are common temporary parasites of humans.

b) Permanent Parasitism

In permanent parasitism, the parasites spend their whole life cycles as parasites. Many disease causing bacteria and all viruses are permanent parasites.

B) Mutualism

The type of symbiosis in which both partner get benefit from each other and neither is harmed.

Examples

(i) Termites eat wood but are unable to digest it. A protozoan called zooflagellate lives in its intestine. It secretes 'cellulase' enzyme to digest the cellulose of wood. In turn, the termite provides food and shelter to the protozoan.

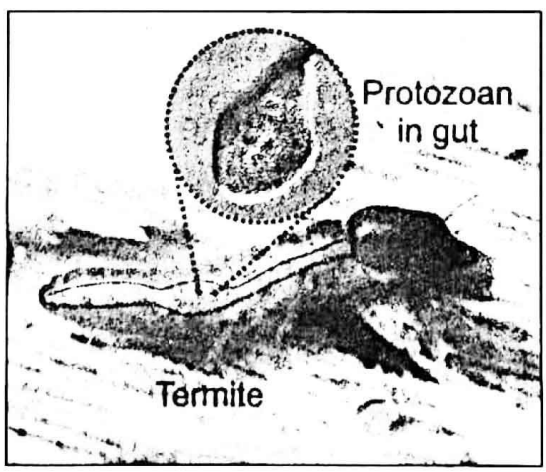


Figure 16.14: Termite, with a Protozoan in its gut

(ii) The nitrogen fixer bacteria *Rhizobium* live in the root nodules of leguminous plants like pea, gram etc. The bacteria obtain food and shelter from plants while in return they fix gaseous nitrogen into nitrates for the plant which is required for their growth.

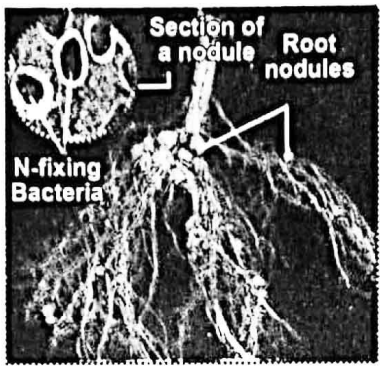


Figure 16.15: Bacteria in Root Nodules

C) Commensalism

It is a type of symbiosis in which one partner is benefited while the other is neither benefited nor harmed.

Examples

i. Epiphytes are small plants found growing on other larger plants for space only. They absorb water and minerals from the atmosphere and prepare their own food. The larger plants are neither benefited nor harmed in any way.

ii. Sucker fish attaches to the surface of sharks by its sucker. In this way, the shark provides easy transport to the sucker fish to new feeding grounds.

Figure 16.16 (a): An Epiphyte Orchid Plant Growing on a Tree Trunk.

Figure 16.16 (b): A Sucker Fish Attached with Shark

iii. An example of commensalism (Honey Guide bird and Badger)

The honey guide bird feeds on wax and the larvae present in honeycombs. It flies around looking for honeycombs, but it is not strong enough to open the comb. Badgers are large mammals that feed on honey. When a honey guide bird goes to find honeycombs, the badger follows it. When

the bird find a honeycomb, it calls the badger. Sometimes the bird has to stop and wait for the slow-moving badger. After reaching there, the badger open the honeycomb and both of them eat their foods together. Traditionally, humans have also used these birds to find honeybee colonies.

Q. 9 Explain Ecosystem Balance and Human Impact.

Ans: (a) Interaction among organisms

The interactions among organisms and between organisms and their abiotic components of their environment produce steady and balanced ecosystem.

(b) Biogeochemical cycles

Biogeochemical cycles also maintain the balance in ecosystems by recycling natural resources, so that they do not deplete.

(c) Disturbance of the balance in ecosystem

Humans try to modify environment (e.g. cutting of trees) to fulfill their needs. This has upset the delicate balance in ecosystems and nature as well. Some of the human impacts on the balance of ecosystems and nature are described as follows;

1. Global Warming

(a) Process of temperature increase

The addition of greenhouse gases (e.g. carbon dioxide, methane, ozone) in atmosphere increases the temperature of the earth. These gases in the lowest part of Earth's atmosphere do not allow solar radiations to reflect back into space. As a result, heat remains within the Earth's atmosphere and increases its temperature. This is called global warming.

(b) Effect of global warming

Due to global warming, polar ice-caps and glaciers are melting faster than the time taken for new ice layers to form. Sea water is also expanding causes sea level to rise. Due to melting glaciers, rivers overflow and cause floods.

(c) Threat to the Maldives' Survival

Scientists fear that the sea level is rising up to 0.9 cm a year. Rise in sea level has worst effects on coastal countries. Most of the islands of the Maldives are less than 1 metre above sea level. It is estimated that within 100 years, the Maldives might become uninhabitable and the citizens would be forced to evacuate.

(d) Green House Effect

It refers to the phenomenon in which certain gases (Carbon dioxide, methane, nitrous oxide) called greenhouse gases trap heat in the atmosphere. These gases act like the glass in a green house, which does not allow the inner heat to escape. When sunlight reaches the surface of the earth, much of its energy is transformed into heat energy. The earth surface reflects this heat energy towards space as infrared radiation. The greenhouse gases trap these and send it back to earth which increases temperature.

2. Acid rains

Certain chemicals such as oxides of sulphur and nitrogen when react with water vapours in the presence of sunlight to form sulphuric acid and nitric acid. These acids remain as vapours at high temperatures. As temperature falls, the acids begin to condense into liquid form and mix with rain or snow. On the way down to the earth, this makes rain acidic with pH range of 3-6.

Effects of acid rains

1) Lowering in pH

Acid rain destroys the necessary nutrients present in the water of rivers and lakes etc. It also lowers the pH of water. Most of the aquatic animals cannot survive at this pH.

2) Damages to Plants

Acid rain washes nutrients out of soil, damages the bark and leaves of trees and harms root hairs. Leaf pigments (chlorophyll) are also destroyed.

3) Corrosion on Metallic surfaces

Metallic surfaces exposed to acid rain are easily corroded. Fabrics, paper and leather products also lose their material strength.

4) Weakening on Building Material

Building materials such as limestone, marble, dolomite, mortar and slate are weakened with acid rains because of formation of soluble compounds. The building of famous Taj Mahal has been corroded at many places, due to acid rains.

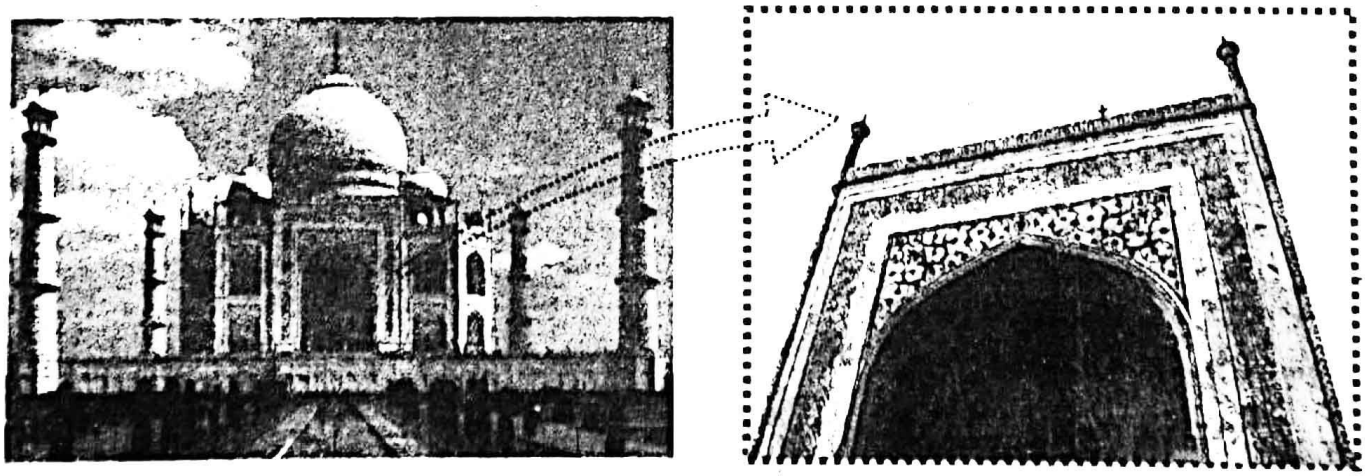


Figure 16.17: Taj Mahal and its Corroded Door

3. Deforestation:

Definition

Deforestation means clearing of forests by natural causes or humans.

Causes of deforestation

- Large areas of forests have been cleaned for agriculture, factories, roads, rail tracks and mining.
- Humans cut trees for getting wood (lumber), which is then used for making structures and for heat production.
- Human preys upon forest animals, which are the predators of many insect pests. In this way, insect pests destroy forests by eating the shoots and spreading diseases.

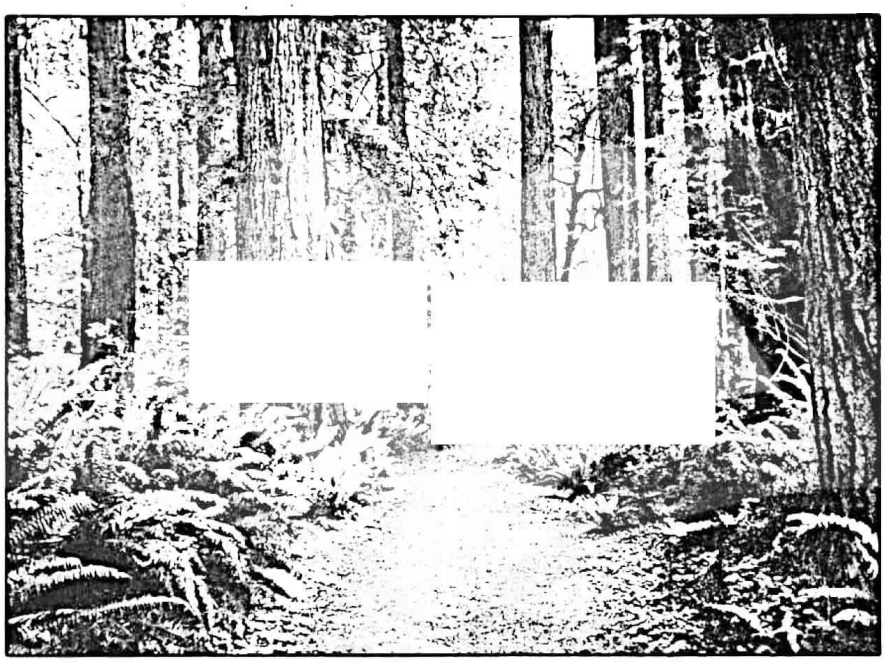


Figure 16.18: Forests are Cut for Making Roads

Effects of deforestation

- Floods
- Droughts
- Landslides
- Soil erosions
- Global warming
- Loss of habitat of many species

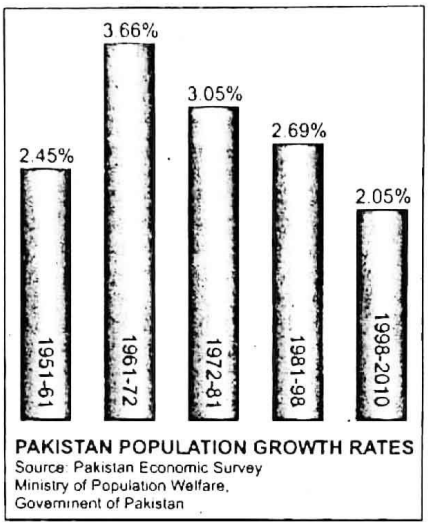
4. Overpopulation

Growth of population

When the industrial revolution started some 250 years ago, the world population was 600 million that time seems like a lot of people but now the world population is almost ten times at 6 billion and will grow to 8 billion by 2025.

Causes of Overpopulation

Better health facilities and lowered mortality rates have contributed in population growth.



PAKISTAN POPULATION GROWTH RATES
Source: Pakistan Economic Survey
Ministry of Population Welfare,
Government of Pakistan

Year	Population	Year	Population
1981	85,096,000	1999	132,790,000
1984	92,284,301	2002	144,902,409
1987	99,953,232	2005	155,772,000
1990	107,975,060	2008	166,111,487
1993	116,444,165	2009	169,708,303
1996	126,409,851	2010	173,510,000

The Population of Pakistan
Source: The World Bank

5. Urbanization:

Definition

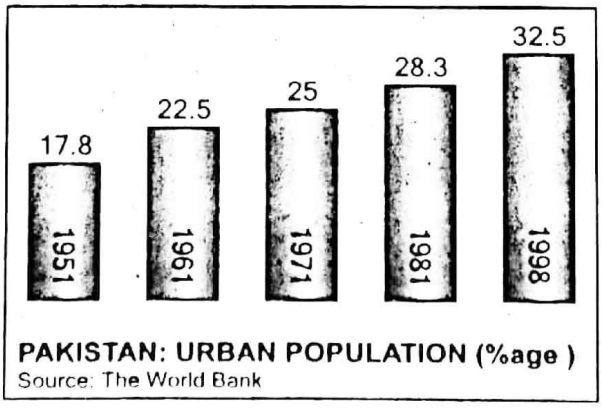
Urbanization means growing of cities.

Cause of urbanization

People move from rural areas to cities in search of better jobs, education opportunities and higher standards of living.

Effects of rapid urbanization

1. If there is rapid urban growth, the governments find it difficult to provide even the basic facilities like health, education, shelter, water, electricity etc.
2. Most of the migrants in cities do not find good jobs and become the part of urban poor.
3. There is overcrowding in schools, hospitals etc.
4. The slum areas increase in number and people living there are at greater risk of diseases.



PAKISTAN: URBAN POPULATION (%age)
Source: The World Bank

Methods to solve problems created by urbanization

Urbanization is a global problem and cannot be stopped but it can be managed. The current level of urbanization in Pakistan is about 32% which is not high by global standards. A planned urbanization can solve many problems.

1. The cities should have thick green belts in their surroundings to control pollution.
2. The open spaces in cities should be reserved through zoning and land plans.
3. The urban spread out should also be controlled.
4. Utilization of public transport instead of individual transports also proves effective way to manage urbanization.

Q. 10 Define and explain different types of Pollution.

Ans. Definition

Pollution is defined as any undesirable change in the physical, chemical or biological characteristics of air, water and land that may harmful for humans, other living organisms and natural resources.

Pollutants

The agents which are responsible for pollution are called pollutants.

Types of Pollutants

Pollutants are of two types i.e. biodegradable and non-biodegradable.

Sources of pollutants

They may be the industrial effluents, domestic wastes, medical wastes.

Examples

CO_2, CO, SO_2, CFCs etc.

Types of Pollution

A) Air Pollution

Definition

It is defined as the change of composition in the air by the addition of harmful substances (e.g. industrial and automobile gases and particulate matter).

Sources of Air Pollution

All sources of air pollution are related to human activities. Burning of coal produces a lot of smoke and dust whereas burning of petroleum produces sulphur dioxide. In addition to these, air pollutants include the carbon monoxide, carbon dioxide, nitrogen oxides, hydrocarbons, particulate matter and traces of metals. Different industries produce air pollution in the following ways:-

- **Fertilizer Industries**

  Fertilizer industries release oxides of sulphur and nitrogen, hydrocarbons, particulate matter and fluorine.

- **Thermal Industries**

  Thermal industries are coal based and their pollutants are fly ash, soot and sulphur dioxide.

- **Textile Industries**

  Textile industries release cotton dust, nitrogen oxides, chlorine, smoke and sulphur dioxide.

- **Steel Industries**

  Steel industries release carbon monoxide, carbon dioxide, sulphur dioxide, phenol, fluorine, cyanide, particulate matter etc.

Effects of air Pollution (Board 2013)

1. Global Warming

It is known that global warming is one of the consequences of air pollution. According to estimates, at the current rate of increase, the average global temperature will go up by 3°C to 8°C in next 100 years. Other effects of air pollution are as follows;

2. Smog Formation

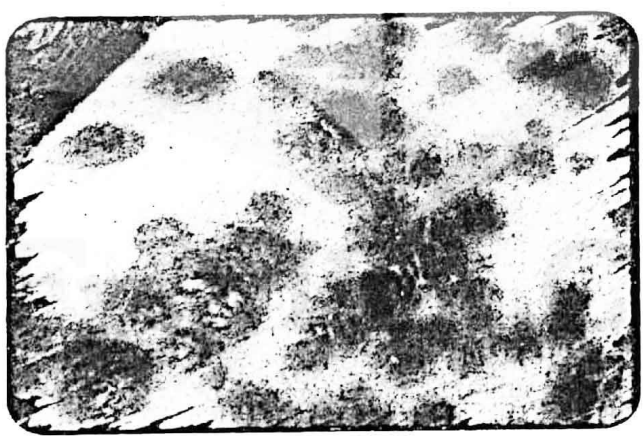
When pollutants like hydrocarbons and nitrogen oxides combine in the presence of sunlight, smog is formed. This is a mixture of gases. It forms a yellowish brown haze especially during winter and hampers visibility. It also causes many respiratory disorders and allergies as it contains polluting gases.

3. Acid Rains

The air pollutants like sulphur dioxide and nitrogen oxides react with water vapours in the atmosphere producing acid rains.

4. Ozone Depletion

Upper layer (stratosphere) of the atmosphere has ozone (O_3) which absorbs ultraviolet rays present in the sun's radiations. However the air pollutants like chlorofluorocarbons (CFCs) destroy the ozone molecules and so break the ozone layer. Ozone holes are created which permit UV rays to reach the Earth's surface. The UV rays increase the temperature and also cause skin cancers.



The harmful effects of the UV rays are visible in the countries such as Australia and New Zealand where the rate of skin cancer is higher than the other regions of the world.

Control of Air Pollution

For effective control of air pollution, it is important to create public awareness about the ill effects of air pollution. Air pollution can be controlled by following ways:

1) Afforestation

It means the establishment of new forests by planting on non-forest areas. Forests are effective means to control air pollution because plants can filter and absorb air pollutants.

2) Modification of industrial effluents

The air pollutants coming from industries should be passed through filters and other devices, so that the particulate matter is removed before the waste gases are released out. The smoke producing units should have long chimneys to take the polluting gases far above and then disperse over a larger area. Industries should also invest for solar cookers or for producing bio gas.

3) Environment friendly fuels

Lead-free fuels should be used in automobiles. Similarly sulphur-free fuel should be used in coal-based industry to reduce pollution by sulphur dioxide.

B) Water Pollution

Definition

It is the change in the composition of water by the addition of harmful substances. Water pollution severely affects the health of people.

Sources of Water Pollution

- **Sewage**

Sewage is one of the major pollutants of water. It contains organic matter and the excreta of humans and other animals. Organic matter encourages the growth of micro-organisms which spread diseases.

- **Industrial Wastes**

i. The wastes of industries (acids, alkalis, dyes and other chemicals) are disposed in nearby water bodies. These wastes change the pH of water and are harmful or even fatal to aquatic organisms.

ii. Certain industries release a lot of hot water from their cooling plants. It results in heating up of water bodies and kills aquatic life.

- **Fertilizers and Pesticides**

Fertilizers and pesticides enter into water bodies with the rain water flow and the ground water by seepage. These chemicals remain in water for a long time and can enter food chains. They cause a number of diseases in animals.

- **Petroleum Hydrocarbons**

Oil tankers and offshore petroleum refineries cause oil leakage into water. Oil floats on the water surface and prevents atmospheric oxygen from mixing in water. So, aquatic animals begin to die due to shortage of oxygen.

- **Heavy Metals**

Some heavy metals e.g. Lead, Mercury, Arsenic and Cadmium also make the water polluted. Such metals can be present in the water, released from industrial and urban areas. If water with such heavy metals is given to plants, the metals enter the vegetables that grow on these plants. Such contaminated vegetables are harmful for human health.

Diseases in humans

i. Heavy metals reduce growth and development, and cause cancer and nervous system damage.

ii. Mercury and Lead can cause joint diseases such as rheumatoid arthritis, diseases of Kidneys, circulatory system and nervous system.

Tanneries

There are more than 200 tanneries (industry where raw skin is treated to make leather) operating in Kasur city.

(a) Industrial Discharge

The industry discharges 9000 cubic meters of water daily into the nearby water bodies. This water contains heavy metals and becomes the part of the underground water.

(b) Effects

(i) In 2003, a survey showed that two-thirds of residents and 72% of tannery workers suffered cancer, infections of the Kidneys, or loss of eyesight.

(ii) Tests showed that the drinking water was contaminated with Lead, Mercury and Chromium.

(c) Kasur Tannery Pollution control project

Pakistan government and the United Nations development programme (UNDP) launched the Kasur tannery pollution control project. The project has established an effluent treatment plant, chromium plant and a solid waste disposal site.

Effects of water pollution

The followings are the major effects of water pollution.

I. Eutrophication

Enrichment of water with inorganic nutrients (nitrates and phosphates) is called eutrophication. The sewage and fertilizers contain large amount of inorganic materials. When sewage and fertilizers reach water bodies, the nutrients present in them promote algal blooms (excessive growth) there. Rich algal growth leads to increase in the number of decomposers.

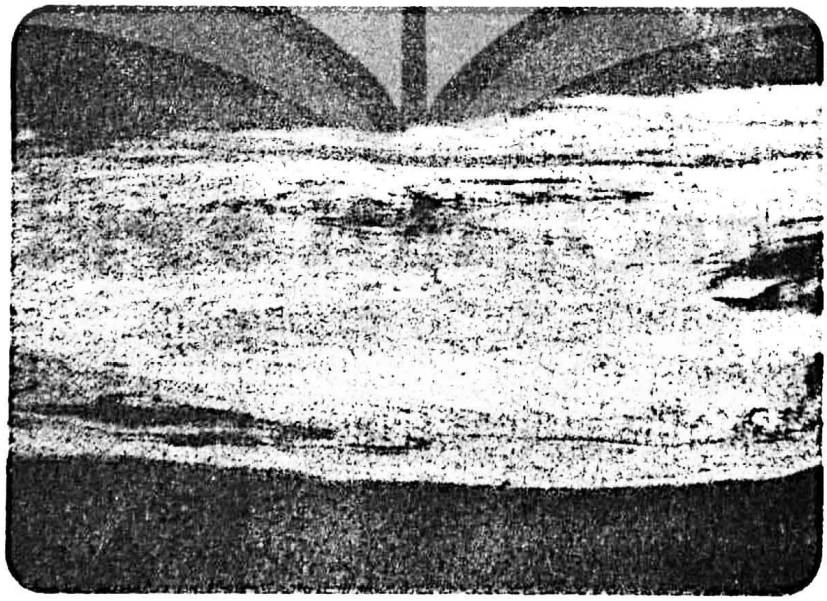


Figure 16.19: Eutrophication in a Lake

Harmful effects of eutrophication

1) Decomposers use the oxygen present in water and it results in the depletion of oxygen.

2) Algal bloom also reduces the light reaching the lower layers of water.

II. Food chain Contamination

The non-biodegradable water pollutants may stay in water for long times. From water, they enter into small organisms, which are fed upon by fish. The fish in turn are fed upon by land animals including humans.

III. Epidemics

Organic pollutants in water facilitate the growth of germs. Such polluted water causes epidemics like cholera, gastroenteritis etc.

Control of Water Pollution

The following methods should be used to control water pollution:

1) Public should be made aware of the dangers of water pollution.
2) Before releasing the sewage into water bodies, it must be treated through sewage treatment techniques.
3) Industrial wastes should also be treated before they are released into water bodies.

C) Land Pollution

Definition

It is the change in the composition of land (soil) by the addition of harmful substances.

Land is an important resource as it is the basis for the growth of producers. In the recent times, soil has been subjected to the pollution.

Causes of Land Pollution

1) The pesticides used in agriculture have chemicals that stay in soil for long times.
2) The acid rains change the pH of soil making it unsuitable for cultivation.
3) The household and other city garbage lies scattered in soil in the absence of a proper disposal system.
4) Materials like polythene block the passage of water into soil and so decrease the water holding capacity of soil.

Figure 16.20 Can We Control Land Pollution?

5) Many industries produce harmful chemicals which are disposed off without being treated.
6) Improper disposal of nuclear wastes also causes radioactive substances to remain in soil for a long time.
7) Open latrines in villages and some part of the cities are also the source of land pollution.

Control of Land Pollution

- There should be suitable and safe disposal of wastes including nuclear wastes.
- Non- biodegradable materials like plastic, glass, metals etc. should be recovered and recycled.
- Inorganic pesticides should be replaced by organic pesticides.

D) Noise Pollution

Definition

Unwanted, unpleasant and annoying sounds are termed as noise. Noise is also considered as a form of pollution.

Effects

Annoyance and aggression, hearing loss, depression, hypertension etc.

Q.11. Explain Conservation of Nature.

Ans. Definition

Conservation of nature means the conservation of natural resources. Everything that we use or consume e.g. food, petrol etc. is obtained from natural resources.

Types of resources

a. Renewable natural resources

b. Non-renewable resources

a) Renewable natural resources

The renewable natural resources e.g. air is reproduced easily.

b) Non-renewable resources

The non-renewable resources (e.g. minerals and fossil fuels) are not replenished once they get depleted. We have to conserve the non-renewable resources because their reserves are limited and humans are heavily dependent on them for daily needs. The renewable resources too have to be judiciously used. To ensure sustainable use of resources in our environment, we should act upon the principle of 'The 3R' i.e. Reduce, Reuse and Recycle.

The R1: Reduce

We should use the natural resources less and should not waste them. We should use this principle at different places, in our daily lives. We should not waste water, electricity, fuel etc. We should turn off the tap when not in use. We should bath with a bucket instead of shower. The lights and fans should be off when we are not in room. We should take public transport or walk short distances instead of using motor fuel. We should not waste food and should give unused food to poor people.

The R2: Reuse

We should use things again and again. We should not throw away materials such as glass containers, plastic bags, paper, cloth etc. These should be reused at domestic levels rather than being thrown. It also reduces solid waste pollution.

A recycling of one tonne of paper can save 17 trees.

The R3: Recycle

Materials such as paper, plastic, glass etc. can be recycled. This decreases the volume of refuse and helps in conservation of natural resources.

The R4: Reforest

Trees should be planted. Trees make our environment more cool, shady and green.

Plans for the Conservation of Nature

The following are the projects and plans of our government for the conservation of other resources.

1- National Conservation Strategy

In 1992, Pakistan developed the National Conservation Strategy. The main objectives of this strategy are conservation of natural resources and improved efficiency in the use of resources. It also covers the policies for promoting efficiency and conservation of energy resources.

2- National Drinking Water and Sanitation Policy

The Federal Ministry of Environment has launched the national Drinking Water and Sanitation Policy. It focuses on the provision of clean drinking water to entire population and the conservation of the water resources. Water purification plants are being installed all over the country.

3- Mass awareness for water Conservation and Management

In 2006, the UNDP (UN Division for Sustainable Development) launched the project "Mass Awareness for Water Conservation and Management". The objective of the project was to launch a comprehensive awareness campaign for the conservation and management of water resources in Pakistan.

4- Society for conservation and protection of Environment

The organization SCOPE (Society for Conservation and Protection of Environment) works with the government for mass awareness and research of the conservation of natural resources in Pakistan.

Clean water, air, fuels, agricultural land and forests appeared to be plentiful earlier, but now these are becoming scarce. If we continue depleting them like this, we will be creating untold misery for ourselves and for our future generations.

Role of WWF

The WWF (old name is World Wildlife Fund but now it is called World Wide Fund for Nature) is working on many projects related to the conservation of nature. The following are some important programmes of WWF-Pakistan (in collaboration with the government of Pakistan).

1) Improving sub-watershed management and environmental awareness around Ayubia National Park.
2) Plantation of trees of Jatropha and Mangroves at District Thatta, Sindh.
3) District-wise forest covers assessment of Pakistan.
4) Saving Wetlands Sky High Programme (for the conservation and management of high altitude wetlands).
5) Indus Basin Water Security Project (to protect the water-flow needed for the maintenance of river ecosystem and for the benefit of nearby areas).
6) Regional Climate Risk Reduction in Himalayas.

Q.12 Write a note on Dengue Fever.

Ans: Introduction

It is a viral infection transmitted through a mosquito *Aedes aegypti.*

Occurrence

It has become a major health problem in tropical and sub-tropical countries, including Pakistan.

Types of Dengue Virus

There are four types of dengue viruses. Recovery from infection by one provides lifelong immunity against that virus but provides no protection against infection by the other three.

Dengue Infection per year

According to WHO, there are 50 million dengue infections worldwide every year. Now there are 2.5 billion people at risk from dengue.

Spreading

The female *Aedes* mosquito gets the virus when it bites an infected person. When an infected mosquito bites another person, viruses enter his/her blood and attack white blood cells. Inside WBCs, viruses reproduce and destroy them.

In severe cases, the virus affects liver and bone marrow. As a result there is a decrease in the production of blood platelets and patient suffers from bleeding.

Other symptoms

High fever, severe headache, pain behind eyes, muscle joint pains and rash

Adult → Eggs of Aedes → Larva of Aedes → Pupa of Aedes

DHF and DSS

Sometimes, dengue fever converts into dengue haemorrhagic fever (DHF) or into dengue shock syndrome (DSS). DHF results in bleeding, low levels of blood platelets and blood plasma leakage. In DSS, the blood pressure falls dangerously low.

Treatment

There is no vaccine or treatment for dengue fever.

Control

(a) Check the spreading of *Aedes*

At present, the only method of controlling dengue virus transmission is to check the spread of *Aedes* mosquitoes. *Aedes aegypti* breeds primarily in the containers used for water storage, discarded plastic containers, used automobile tyres and other items that collect rainwater.

(b) Proper solid waste disposal

The mosquitoes can be controlled through proper solid waste disposal and improved water storage practices.

(c) Killing the Larvae of the Mosquito

Small fish and crustaceans have also been used for killing the larvae of the mosquito. Insecticide sprays have not proved efficient in killing the mosquitoes because spray does not penetrate all habitats of adult mosquitoes.