

(b) What is sustainable development ? Write the aspects and measures for sustainable development ?

Ans. Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs.

aspects and measures for sustainable development

(i) Technology : Using appropriate technology is one which is locally adaptable, eco-friendly, resource efficient and culturally suitable. It mostly involves local resources and local labour. Indigenous technologies are more useful, cost-effective and sustainable. Nature is often taken as a model, using the natural conditions of that region as its components. This concept is known as “design with nature”. The technology should use less of resources and should produce minimum waste.

(ii) Reduce, Reuse, and Recycle Approach : The 3-R approach advocating minimization of resource

use, using them again and again instead of passing it on to the waste stream and recycling the materials goes a long way in achieving the goals of sustainability. It reduces pressure on our resources as well as reduces waste generation and pollution.

(iii) Promoting Environmental Education and Awareness : Making environmental education the centre of all learning process will greatly help in changing the thinking pattern and attitude of people towards our earth and the environment. Introducing subject right from the school stage will inculcate a feeling of belongingness to earth in small children. 'Earth thinking' will gradually get incorporated in our thinking and action which will greatly help in transforming our lifestyles to sustainable ones.

(iv) Resource Utilization as Per Carrying Capacity : Any system can sustain a limited number of organisms on a long-term basis which is known as its carrying capacity. In case of human beings, the carrying capacity concept becomes all the more complex. It is because unlike other animals, human beings, not only need food to live, but need so many other things to maintain the quality of life. Sustainability of a system depends largely upon the carrying capacity of the system. If the carrying capacity of a system is crossed (say, by over exploitation of a resource), environmental degradation starts and continues till it reaches a point of no return.

(v) Improving Quality of Life Including Social, Cultural and Economic Dimensions : Development should not focus just on one-section of already affluent people. Rather it should include sharing of benefits between the rich and the poor. The tribal, ethnic people and their cultural heritage should also be conserved. Strong community participation should be there in policy and practice. Population growth should be stabilized

(c) What are the impacts of industrialisation on human environment ?

Ans.

i. Pollution : Industrialization normally adds to pollution in air, water, soil, due to the waste products it produces.

- ii. **Extraction** : Industrialization makes use of resources - raw materials from the land, water, perhaps wood and plants, fossil fuels, etc. This has an effect on the environment, since demand for all these goes up, and more quantities are extracted from the land.
- iii. **Urbanization** : Industrialization needs people to work in factories. So, people move from rural/ agricultural areas, that are spread out, to industrialized cities, that are concentrated. A higher population puts added pressure on the local environment.
- iv. **Waste material** : Industrialization produces a greater amount of waste, both directly as a result of production of goods, as well as the disposal of those goods once their purpose has been served. For example, if a factory makes plastic furniture, it produces waste plastic ... and once the plastic furniture is worn, it is added to the rubbish pile too.
- v. Finally, there is a possible long term beneficial impact. Industrialization adds to the wealth of society, and makes a greater quantity of goods available at lower cost, thus uplifting the lives of many. If managed properly, with ill effects kept limited, this will allow humanity to have the resources to better manage the environment while having a high standard of living.

Conservation of water:

- . Use minimum water for all domestic purposes.
 - . check the water leaks in pipes and repair them properly.
 - . Reuse the soapy water, after washing clothes for washing courtyard, carpets etc.
 - . Use drip irrigation.
 - . Rain water harvesting system should be installed in all the houses.
 - . Sewage treatment plant may be installed in all industries and institution.
 - . Continuous running of water taps should be avoided.
8. Watering of plants should be done in the evening.

Conservation of soil:

- . Grow different type plants i.e trees, herbs and shrubs.
- . In the irrigation process, using strong flow of water should be avoided.
- . Soil erosion can be prevented by sprinkling irrigation.

5.(a) What is value education ?

Ans. It is an activity that can take place in any organization during which people are assisted by others, who may be older, in a position of authority or are more experienced, to make explicit those values underlying their own behavior, to assess the effectiveness of these values and associated behavior for their own and others' long term well-being and to reflect on and acquire other values and behavior which they recognize as being more effective for long term well-being of self and others.

(b) What are the hindrances in the development of nuclear power ?

Ans. By regulation, the design of the nuclear reactor must include provisions for human (operator) error and equipment failure. Nuclear Plants in the western world use a "Defense in Depth" concept which is a system with multiple safety components, each with back-up and design to accommodate human error. The components include:

1. Control of Radioactivity

This requires being able to control the neutron flux. Recall that in a nuclear reactor when a neutron is captured by a fuel nucleus (generally uranium) the nucleus splits releasing radioactive particles (or undergoes fission). Hence if we decrease the neutron flux we decrease the radioactivity. The most common way to reduce the neutron flux is include neutron-absorbing control rods. These control rods can be partially inserted into the reactor core to reduce the reactions. The control rods are very important because the reaction could run out of control if fission events are extremely frequent. In modern nuclear power plants, the insertion of all the

control rods into the reactor core occurs in a few seconds, thus halting the nuclear reaction as rapidly as possible. In addition, most reactors are designed so that beyond optimal level, as the temperature increases the efficiency of reactions decreases, hence fewer neutrons are able to cause fission and the reactor slows down automatically.

2. Maintenance of Core Cooling

In any nuclear reactor some sort of cooling is necessary. Generally nuclear reactors use water as a coolant. However some reactors which cannot use water use sodium or sodium salts.

3. Maintenance of barriers that prevent the release of radiation

There is a series of physical barriers between the radioactive core and the environment. For instance at the Darling Nuclear Generation Station in Canada the reactors are enclosed in heavily reinforced concrete which is 1.8m thick. Workers are shielded from radiation via interior concrete walls. A vacuum building is connected to the reactor buildings by a pressure relief duct. The vacuum building is a 71m high concrete structure and is kept at negative atmospheric pressure. This means that if any radiation were to leak from the reactor it would be sucked into the vacuum building and therefore prevented from being released into the environment.

The design of the reactor also includes multiple back-up components, independent systems (two or more systems performing the same function in parallel), monitoring of instrumentation and the prevention of a failure of one type of equipment affecting any other.

Further, regulation requires that a core-meltdown incident must be confined only to the plant itself without the need to evacuate nearby residence.

Safety is also important for the workers of nuclear power plants. Radiation doses are controlled via the following procedures,

- The handling of equipment via remote in the core of the reactor
- Physical shielding
- Limit on the time a worker spends in areas with significant radiation levels
- Monitoring of individual doses and of the work environment.

(c) **Discuss the Environmental Protection Act, 1986.**

Ans. Environmental Protection Act, 1986 :

The Act comes into force on Nov. 19, 1986, the birth anniversary of our late Prime Minister Mrs. Indira Gandhi, who was a pioneer of environmental protection issues in our country.

An Act to provide for the protection and improvement of environment and for matters connected there with :

WHEREAS the decisions were taken at the United Nations Conference on the Human Environment held at Stockholm in June, 1972, in which India participated, to take appropriate steps for the protection and improvement of human environment.

AND WHEREAS it is considered necessary further to implement the decisions aforesaid in so far as they relate to the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property.

It extends to the whole of India. It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint and different dates may be appointed for different provisions of this Act and for different areas. This Act gives the definitions of :

- (i) "environment" includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property;
- (ii) "environmental pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment;
- (iii) "environmental pollution" means the presence in the environment of any environmental pollutant;
- (iv) "hazardous substance" means any substance or

preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creatures, plant, micro-organism, property or the environment.

This Act consists of 4 chapters containing 26 Sections.

Chapter I contains 2 Sections.

Section 1 : Contains short title, extent and commencement.

Section 2 : Defines terminologies related to environment.

Chapter II contains 4 Sections.

Section 3 : Empowers Central Government to take measures to protect and improve environment.

Section 4 : Empowers Central Government for appointments of officers with their powers and functions for successful implementation of the Act.

Section 5 : Empowers Central Government to give directions.

Section 6 : Empowers Central Government to formulate rules or regulate environmental pollution.

Chapter III contains 11 Sections.

Section 7 : States that the industries carrying industrial operations are not allowed to emit or discharge environmental pollutants more than the established standards.

Section 8 : States that person handling hazardous substances need to comply with procedural safeguards.

Section 9 : Decides furnishing information to authorities and agencies in certain cases.

Section 10 : Has provisions of entry and inspections.

Section 11 : Has provisions to collect samples and their analysis.

Section 12 : Has provisions to set up environmental laboratories for testing and analysing air, water, soil, and other samples.

Section 13 : Has provisions for appointing government analyst for the purpose of analysis of samples of air, water, soil, or other substances sent to any established or approved environmental laboratory.

Section 14 : Refers to the reports of government analysis as devidence of facts.

Section 15 : Has provisions of penalty for the contravention of the provision of the Act and the rules, orders, and directions.

Section 16 : Describes offences by companies.

Section 17 : Describes offences by government departments.

Chapter IV contains 9 Sections.

Section 18 : Provides protection of action taken in good faith.

Section 19 : Has provision of cognizance of offences.

Section 20 : Empowers Central Government regarding information, reports, or returns.

Section 21 : Declares members, officers, and employees of the authority constituted under Section 4 to be public servants.

Section 22 : Enforces bar of jurisdiction of civil court.

Section 23 : Describes powers to delegate.

Section 24 : Describes effects of other laws.

Section 25 : Provides power to make rules.

Section 26 : States that the rules made under this Act to be laid before Parliament.

Silent Features of EPA, 1986

1. Subject to the provisions of this Act, the Central Government shall have the power to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing controlling and abating environmental pollution. Central government have the power for such measures may include measures with respect to all or any of the following matters, namely :
 - (a) planning and execution of a nation-wide programme in its various aspects;
 - (b) laying down standards for the quality of environment in its various aspects;
 - (c) laying down standards for emission or discharge of environmental pollutants from various source whatsoever; provided that different standards for emission or discharge may laid down under this clause from different sources having regard to the quality or composition of the emission or discharge of environmental pollutants from such sources;
 - (d) restriction of areas in which any industries, operations or processes or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards;

- (e) laying down procedures and safeguards for the prevention of accidents which may cause environmental pollution and remedial measures for such accidents;
- (f) laying down procedures and safeguards for the handling of hazardous substances; examination of such manufacturing processes, materials and substances as are likely to cause environmental pollution ;
- (g) carrying out and sponsoring investigations and research relating to problems of environmental pollution;
- (h) inspection of any premises, plant, equipment, machinery, manufacturing or other processes, materials or substances and giving, by order, of such directions to such authorities, officers or persons as it may consider necessary to take steps for the prevention, control and abatement of environmental pollution;
- (i) establishment or recognition of environmental laboratories and institutes to carry out the functions entrusted to such environmental laboratories and institutes under this Act;
- (j) collection and dissemination of information in respect of matters relating to environmental pollution;
- (k) preparation of manuals, codes or guides relating to the prevention, control and abatement of environmental pollution;
- (l) such another matters as the Central Government deems necessary or expedient for the purpose of securing the effective implementation of the provisions of this Act.
- (a) What

hemically.

- (b) Give a comparison between in-situ and ex-situ conservation of biodiversity.

Ans. Ex-situ Conservation of Bio-diversity :

- (i) The Ex-situ Conservation is achieved by preserving wild life (plants as well as animals) through their preservation outside their natural habitats in zoos and botanical gardens and through preserving their genes in gene banks.

Exa : Nandankanan Zoo.

- (ii) Ex-situ Conservation of wild life is preferred for those species which are critically endangered and close to extinction.
- (iii) These are artificially developed habitats known as botanical gardens for plants and zoological parks or zoos for animals.

In-situ Conservation of Biodiversity :

- (i) The in-situ conservation is achieved by preserving the biological life within their natural habitats i.e., ecosystem by protecting those habitats.

Exa : Sunderbans (West Bengal), Similipal (Odisha), Niligiri (Tamil Nadu, Kerala and Karnataka) are some example of In-situ Conservation of biodiversity.

- (ii) In-situ Conservation of wild life is not preferred for extinct, endangered, vulnerable or rare species.
- (iii) These are the natural habitats for wild life.

(c) **Discuss about rain water harvesting. Write its advantages.**

Ans. Rain water harvesting (RWH) is a technique of collection and storage of rainwater into natural reservoirs of tanks, or the infiltration of surface water into sub-surface aquifers before it is lost as surface runoff. One method of rainwater harvesting is rooftop harvesting.

Rainwater harvesting is one of the simplest and oldest methods of self-supply of water for households.

Advantages :

- (i) **Reduces Flooding and Erosion :** Harvesting rainwater can help the environment in a number of ways. For starters, it can reduce erosion around downspouts and in gardens. It can also control storm water run-off. Rainwater doesn't produce scale and corrosion as hard water does. The collection of rainwater may reduce flooding in certain areas as well.
- (ii) **Reduces Water Bills :** Rainwater harvesting will not only help individual save on their water bills but can cut costs for entire community. The cost of supply mains and overall water services can be substantially reduced when many people in one community use rainwater. Having a source of water can also reduce dependence on municipal sources in case the water becomes contaminated. Rainwater can be used as the primary source of water or as a backup source when needed.
- (iii) **Reduces Demand on Ground Water :** Sources of ground water are increasingly being strained in many areas throughout the world. Digging deeper wells is not only expensive but can cause environmental damage such as collapsing the soil where the water used to be. It only makes sense to use source of rainwater whenever possible. Harvested rainwater can be stored and then used during times of drought and when the ground water supplies have been depleted.
- (iv) **Can be used for Non-drinking Purposes :** The majority of the water we need is used for non-drinking. Everything from washing clothes and dishes to bathing and flushing toilets require large amounts of water. Rainwater can be used for all of these things. Rainwater is soft and can lessen the need for detergents when washing clothes and

dishes. Rainwater can also be used for washing vehicles, bathing pets, and nearly all cleaning that uses water.

(v) Can Improve Plant Growth : Rainwater harvesting can also be used to improve plants and gardens. Using harvested water can flush the salt buildup from plants and soil. Harvested rainwater is generally free from several types of pollutants and man-made contaminants. Rain is also free from chlorination. Using water is this clean and healthy for plants and trees can save money on overall property maintenance and landscaping needs.

While regular maintenance is required, simple collection systems can be constructed that most people can easily build and maintain. Rainwater harvesting and storage can be incorporated in both rural and urban areas and provides many benefits to individuals, communities, and the environment.

(c) What are the various causes and issues related to the threats of biodiversity ?

Ans. Bio-diversity is the congregation of populations of plants, animals and micro-organisms in an ecosystem and also known as biological community. There are a number of issues threatening our planet's biodiversity, the major threat to the biodiversity is human intervention in the natural ecosystems. Several factors in multiple cause and effect model affect the biodiversity. Few of them are discussed below.

- (i) **Climate change** : Change in climate throughout our planet's history have, of course, altered life on earth in the long -run - ecosystems have come and gone and species routinely go extinct. For example, rising ocean temperatures and diminishing Artic sea ice affects marine biodiversity and can shift vegetation zones, having global implications.
- (ii) **Habitat Destruction (Deforestation) and Fragmentation** : These are considered as prime reasons to the biodiversity loss. An estimated 18 million acres of forest are lost each year, due to drainage, or filling of wet lands, overgrazing, expanding agriculture, urban development, construction of highway, building of dam, mining, forest fire, flood, land slides etc.
- (iii) **Over exploitation** : Overhauling, overfishing and over-harvesting contribute greatly to the loss of biodiversity, killing off numerous species over the past several hundred years. Poaching and other forms of hunting for profit, sports, illegal trades of fur, tusks, meat etc. increase the risk of extinction of many animals and birds like jaguar, cheetah, lion, elephants etc.
- (iv) **Invasive species** : The introduction of non-native species into an ecosystem can threaten endemic wildlife affect human health and upset economies.
- (v) **Pollution** : Burning of fossil fuels, use of plastics etc. cause air, water and soil pollution, leading to cause various disruptions in Earth's ecosystem due to ozone layer depletion, global warming, acid rain etc. These affecting negatively some species by changing breeding and feeding habits which affecting potentially their extinction.

(vi) **Man-Wildlife Conflict** : Human being is continuously interacting with many ecosystems, for his day to day affairs through several activities like hunting, food and fuel, recreation, urban development, waste disposal etc. Each activity is responsible directly or indirectly to create sufficient disturbance to many wild life species. The craze for personal and societal developments lead to extinction and resource depletion.

Other factors responsible for loss of biodiversity are -

- (a) Natural calamities such as floods, cyclones, earthquake, volcanism etc.
- (b) Over use of natural resources.
- (c) Global warming.
- (d) Use of high yielding varieties of plant and animal species etc.

(b) Write short note on watershed management.

Ans. Watershed Management : A watershed, also called a drainage basin or catchment area, is defined as an area in which all water flowing into it goes to a common outlet. People and livestock are the integral part of watershed and their activities affect the productive status of watersheds and vice versa. From the hydrological

point of view, the different phases of hydrological cycle in a watershed are dependent on the various natural features and human activities. Watershed is not simply the hydrological unit but also socio-political-ecological entity which plays crucial role in determining food, social, and economical security and provides life support services to rural people. Water is essential for our future. A healthy watershed provides the triple benefits of human, ecological and economic health. The goal of watershed management is to properly balance and manage this resource.

Watershed management is an adaptive, comprehensive, integrates multi-resource management planning process that seeks to balance healthy ecological, economic, and cultural/ social conditions within a watershed. Watershed management serves to integrate planning for land and water ; it takes into account both ground and surface water flow, recognizing and planning for the interaction of water, plants, animals and human land use found within the physical boundaries of a watershed.

Watershed management provides a framework for integrated decision -making to help : assess the nature and status of the watershed ; indentify watershed issues ; define and re-evaluate short and long-term objectives, actions and goals ; assess benefits and costs ; and implement and evaluate actions.

The different objectives of watershed management programs are :

- To protect, conserve and improve the land of watershed for more efficient and sustained production.
- To protect and enhance the water resource originating in the watershed.
- To check soil erosion and to reduce the effect of sediment yield on the watershed.
- To rehabilitate the deteriorating lands.
- To moderate the floods peaks at down stream areas.
- To increase infiltration of rainwater.
- To improve and increase the production of timbers, fodder and wild life resource.
- To enhance the ground water recharge, wherever applicable.
- To reduce the occurrence of floods and the resultant damage by adopting strategies for flood management.

- To provide standard quality of water by encouraging vegetation and waste disposal facilities.

Watershed management practices in terms of purpose.

- To increase infiltration
- To increase water holding capacity
- To prevent soil erosion
- Influence of soil conservation measures and vegetation cover on erosion, Runoff and Nutrient loss.

In brief various control measures to enhance watershed management are :

- Vegetative measures (Agronomical measures)
- Strip cropping
- Pasture cropping
- Grass and farming
- Wood lands
- Engineering measures (Structrual practices)
- Contour bonding
- Contour trenching
- Terracing
- Construction of earthen embankment
- Construction of check dams
- Construction of farm ponds
- Construction of diversion
- Gully controlling structure
- Rock dam
- Establishment of permanent grass and vegetation
- Providing vegetative and stone barriers
- Construction of silt tanks dentension.

(b) Write the case study of Chernobyl nuclear hazard.

Ans. Chernobyl Nuclear Accident of April 26, 1986 in Soviet Union : The chernobyl disaster was a catastrophic nuclear accident that occurred on 26 April 1986 at the chernobyl nuclear power plant in Ukraine in which an explosion and fire released large quantities of radioactive particles and active material in the atmosphere spread around near the site and gaseous fission products as well as gases from the burning graphite were carried as a plume for many miles in the western USSR and Europe, as there was no control once the fire started. Four hundred times more radioactive material was released than had been by the atomic bombing of Hiroshima. The disaster released 1/100 to 1/1000 of the total amount of radioactivity released by nuclear weapons testing during the 1950s and 1960s. Approximately 100,000 km² of land was significantly contaminated with fallout, the worst hit regions being in Belarus, Ukraine and Russia.

Though, the immediate explosion killed only around 30 people, yet the large scale genetic effects of the resulting radioactivity shall continue for generations, and some estimates put the death toll of clean-up workers alone at 7,5000. In spite of several measures taken to avoid the long range genetic affects of radioactivity in the effected areas, and more than 50 lakh people being constantly subjected to regular medical check ups, several birth defects in farm animals and increased ill health among children and villagers, in a surey conducted in 1996, ten years after the accident. A spurt in genetic anomaties in newly borne children had also been found, as doctors observed clusters of children born with deformalities like monodactly (i.e., having only one finger or toe, or fingers fused together to form a paddle) and polydactyly (i.e., having many or several fingers or toes, especially more than the normal number, on hands and feet).

(c) What are the major points of Air Prevention and Control of Pollution Act., 1981 ?

Ans. Air Prevention and Control of Pollution Act., 1981 : The Air (Prevention and Control of Pollution) Act was established in the year 1981 with the following objectives :

- (i) Prevention, control and abatement of air pollution.
- (ii) Maintaining the quality of air, and
- (iii) Establishment of boards for the prevention and control of air-pollution.

Following are Powers and Functions of Boards :

- (a) Constitution and functions of central boards,
- (b) Powers of the board -
 - (i) power to declare air pollution control areas,
 - (ii) power to established standards for emission of air pollutants from automobiles,
 - (iii) power to restrict use of certain industrial plants.
 - (iv) power of entry and inspection, and
 - (v) power to take samples.
- (c) Penalties for violations of the provisions of the Act.

To have an integrated approach for tackling the problems related to pollution, this act provides that the boards for the prevention and control of water pollution constituted under section 3 and 4 of the water (prevention and control of pollution) Act 1974, shall also act as Air (prevention and control of pollution) Act as :

- (i) The central Board for the prevention and control of Air-pollution under section -3, and
- (ii) The state Board for the prevention and control of Air-pollution under section-4.

But in those states in which State Boards for Water-pollution are not established, separate State Boards for Air-pollution control will be established under section-5 of this Act.

Some of the Drawbacks of the present Act are :

- (i) Allotment of 60 days notice to the offender before taking him to the court as by the time the case is filled in court, the offender may destroy the evidence, in which case it becomes difficult to prove the offence.
- (ii) No permission is required to be taken from the Board for establishing an industry outside the Air-pollution control area, even though its emission may be reaching the Air-pollution control area also, and
- (iii) Discharge of any Air-pollutant into the atmosphere by a ship or air-craft is excluded from the prevention of the Act.

(c) Explain the different components of an Ecosystem.

Ans. Ecosystem is defined as any unit that includes all of the organisms in a given area interacting with the physical environment, so that a flow of energy leads to clearly defined trophic structures, biotic diversity and material cycles within the environment.

Components of Ecosystem :

Ecosystem is a complex interaction and interdependence of living and non-living factors. It is a dynamic system where in the living and non-living components influence each other, and both are indispensable for the maintenance of life in the world. The living factors in the environment is called biotic component and includes the complex of plant (flora) animal (fauna) and micro-organism communities. The non-living factor is called abiotic component. These two components are said to exhibit considerable dynamism, both individually and in their interactions.

The components of the ecosystem are presented in figure below.

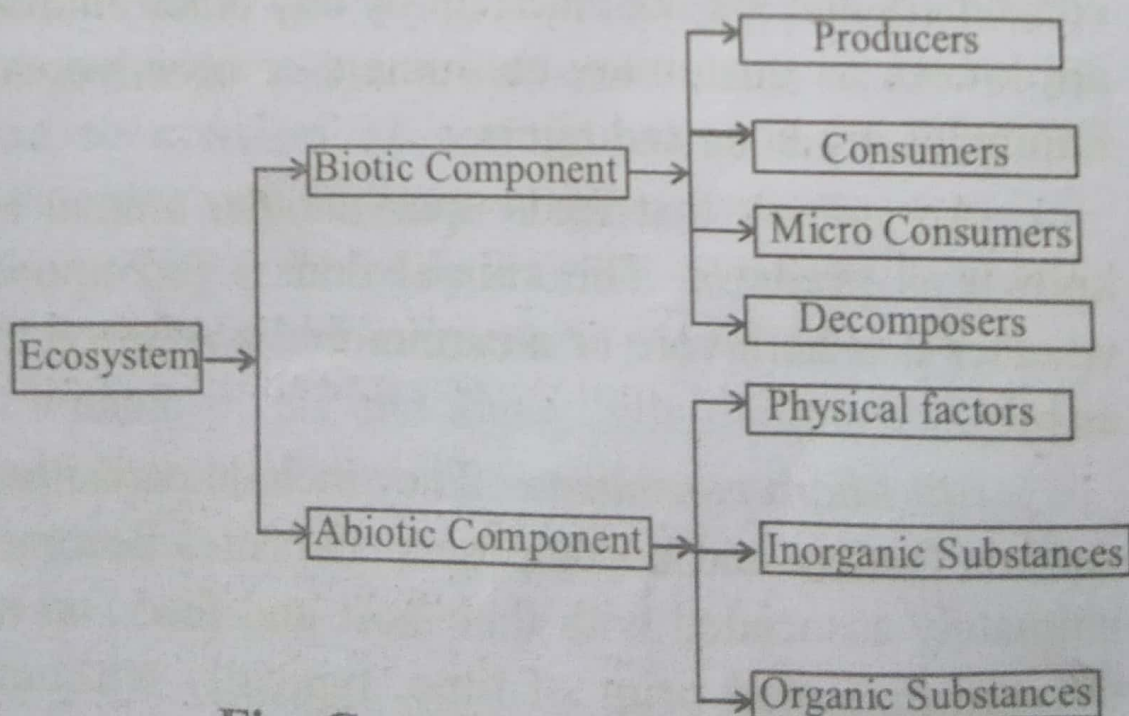


Fig: Components of Ecosystem

(a) Biotic Components : The living organisms including plants, animals and micro-organisms (Bacteria and Fungi) that are present in an ecosystem form the biotic components. From the tropic standpoint, they may be divided into four main groups :

(i) *Producers or Autotrophs* : They are self-nourishing green plants and certain photo-synthetic or chemosynthetic bacteria, which can convert the light energy into chemical energy in the form of organic compounds needed by the plants for their own growth and development. They are known as Autotrophs (i.e., auto = self, trophos = feeder). Oxygen is produced as a by-product that is needed by all living organisms for respiration. They are also known as converters or transducers, as they change radiant energy into chemical form. About 99% of living organisms are producers.

(ii) *Consumers or Heterotrophs* : The animals lack chlorophyll and are unable to synthesise their own food. Therefore, they depend on the producers for their food. They are known as heterotrophs (i.e., heteros = other, trophos = feeder).

An organism that feeds upon the producers is called a primary consumer or herbivores.

Example are rabbit, deer, goat etc.

An organism that feeds upon primary consumer is called a secondary consumer or carnivores.

Examples are cats, snakes etc.

The herbivores and carnivores together are known as tertiary consumers, macro-consumers, phototrophs or biophores.

Examples are wolves.

Animals that feed upon macro or tertiary consumers and are not eaten up by any other animal are known as quaternary consumers or omnivores. Examples are lions and tigers.

An animals that feeds upon another animal is known as predator. The animal that is fed upon, whether it is herbivore or a carnivore, is referred to as prey.

(iii) *Micro consumers* : They include parasites, detritus feeders and decomposers. Parasites become intimately associated with their host and feed on it over an extended period of time, typically without killing it but usually causing harm to it. Some parasites, such as tape worms live inside their host

and are called endoparasites. Other parasites, such as lice, attach themselves to the outside of their host and are called ectoparasites.

The dead plant material, dead animal bodies and faecal wastes, all comprise a mass of dead organic material called detritus. Organisms that feed upon detritus are often considered as detritus feeders.

(iv) *Decomposers or Reducers* : Much of the detritus, particularly dead leaves and wood is apparently not eaten by detritus but rots, decays and decomposes. Actually, this rotting or decomposition is caused by the feeding activity of certain organisms called decomposers. They are fungi and bacteria. The decomposers are also known as saprotrophs (i.e., sapos = rotten, trophos = feeder).

(b) Abiotic Components : The non-living factors or the physical environment prevailing in an ecosystem from the abiotic components. They have strong influence on the structure distribution and inter-relationship of organisms.

Structurally, abiotic components include :

(i) *Physical factors* : Physical factors such as light, temperature, precipitation, humidity, wind, soil, topography etc.

(ii) *Inorganic substances* : Inorganic substances include water, minerals and gases. The inorganic substances required for the synthesis of organic substances are biogenetic substances. The minerals and atmospheric gases keep on cycling. They enter into biotic systems and after the death and decay of organisms, return to the soil and atmosphere. This is known as biogeochemical cycle. This circulation of materials involve trapping of solar energy by green plants, which is ultimately lost by the organisms in several ways.

(iii) *Organic substances* : Organic substances include carbohydrates, proteins, lipids and humus. There are innumerable interactions among these abiotic factors. Despite their complexity, consideration of these factors is very important, because they determine the type or structure of the ecosystem. However, the overall structure of the ecosystem may be determined by a single abiotic factor known as limiting factor. For most of the land areas, the amount of rain fall in the limiting factor, which is responsible for the categorisation of the ecosystem into forests, grasslands or deserts.

(b) Explain the different components of water pollution.

Ans. Different Components of Water Pollution:

Water pollution is defined as the alterations in the physical, chemical or biological characteristics of water due to the presence of solid, liquid or gaseous substances in as much quantity as to make it harmful to public health or to the health of other biotic life, including animals, plants or aquatic organisms. Such a polluted or contaminated water becomes unsuitable for domestic, commercial, industrial, agricultural or other legitimate uses.

A water may become polluted due to various types of pollutants.

(i) Pathogens or Pathogenic Bacteria :

Bacteria are the minute single cell organisms, possessing no defined nucleus and having no green material (chlorophyll) to help them manufacture their own food. They are reproduced by binary fission and may be of various shapes.

Most bacteria present in water are harmless, and under certain conditions beneficial to human beings, animals and crops. Such bacteria or micro-organisms are called non-pathogenic bacteria or non-pathogens. However, certain other bacteria are the deadly foes of humans as well as animals and may enter their tissues, causing serious water borne diseases, such as cholera, typhoid, infectious hepatitis, etc., such harmful bacteria or organisms are known as the pathogenic bacteria or pathogens.

(ii) Biodegradable Oxygen Depleting Organic Matter :

The biodegradable organic matter in a water body is that larger fraction of the total organic matter, which is decomposed by bacteria under biological action within the water body. Since this oxidation of organic matter is caused by the bacteria, which consume the dissolved oxygen from water, this type of pollutants reduces the dissolved oxygen (DO) available in the given water.

The excessive disposal of organic matter in the given water body may, thus, quickly consume the D.O., killing all biological life, and turning the water body into a stinking dirty mass. To avoid excessive discharge of organic matter and large scale D.O. depletion in a water body, it becomes necessary to pre-treat the sewage and industrial effluents before they are discharged into the water body.

(iii) Non-Biodegradable Organic Substances and Chemicals :

The biodegradable organic chemicals represent another class of pollutants present in polluted waters. These substances may include organic substances like oils, gasoline, plastics, pesticides, cleaning solvents, detergents and many other chemicals. These are extremely harmful to aquatic life and human health. Moreover, pollutants like pesticides cannot be easily removed from the polluted waters by ordinary methods of treatment of raw waters.

(iv) Suspended Sediments of Inorganic Solids :

This class of pollutants represents the insoluble particles of soil and other inorganic solids that remain suspended in a moving water body like a river, but tend to settle down as and when the velocity of the moving water reduces. These sediments are produced due to erosion of soil from the land. Higher concentrations of these suspended settleable solids in a moving water body interferes with the penetration of sun-light, which reduces the photosynthetic activity of aquatic plants and algae, living within the water body, thereby disturbing the ecological balance of its aquatic life.

(v) Inorganic Nutrients :

Compounds containing inorganic plant nutrients like phosphorus, nitrogen etc. if present in excessive quantities in a given water body, may pollute

the water of that water body, since it leads to the excessive growth of plants and algae, which on decay and death, consume a lot of dissolved oxygen from the water, causing shortage of DO, leading to "fish kills" and ultimate development of anaerobic conditions and foul smelling putrefaction.

(vi) Water Soluble Inorganic Toxic Chemical Compounds of Heavy Metals :

This is another class of water pollutants, consisting of acids, salts and compounds of toxic heavy metals, such as arsenic, mercury, lead, cadmium, etc. The presence of higher concentrations of these metallic chemicals in water may cause several diseases, to make it unfit to drink to harm fish and other aquatic life, to reduce crop yields, and to accelerate the corrosion of equipment coming in contact with such polluted waters.

(vii) Water Soluble Radioactive Isotopes :

Water soluble radioactive isotopes may also pollute the surface waters, as they may get concentrated in various tissues and organs by passing through the food chain, as in the case of toxic heavy metals and pesticides. The ionizing radiations emitted by such isotopes may cause birth defects and genetic changes.

(viii) Hot Water Releases Causing Thermal Pollution :

The hot waters released by power plants and industries, using large volume of water for cooling processes, may result in a sharp and sudden rise in the temperature of the local water bodies, causing what is known as the thermal pollution.

Although small amounts of heat released into a water body may not have any serious repercussions, yet large quantities may certainly kill heat-in tolerant plants and water animals. Elimination of heat intolerant species would lead to flourishing of heat tolerant species, which are usually less desirable species.

(ix) Volatile Synthetic Organic Chemicals :

Volatile synthetic organic chemicals are usually not found in surface waters due to their tendency to evaporate. They may, however, be found in ground waters, due to leakages from the under ground storage tanks, or from the waste waters containing such chemicals - seeping to the underground reservoir, or

due to infiltration of rain water bringing such chemicals from the air atmosphere. These synthetic volatile organic chemicals (VOC_s) are produced and used in various industries and are extremely harmful to human health as they are highly carcinogenic and mutagenic.

(c) Describe the various methods of controlling Air-pollution from the Industry.

Ans. Various Methods of Controlling Air-pollution from the Industry : Industry is the single largest source of pollution in all over the world. The public can take individual and collective action to reduce industrial pollution. Following are some methods being adopted to control air-pollution from the industries.

(i) *Dilution method for controlling air-pollution from stationary sources or factories :* These can be done by spreading the emitted smokes from thermal power plant, diesel generator sets etc. Over a larger area through the use of high rise chimneys, thereby transporting the pollutants over larger distances, and, thus, reducing the pollution near the emission source.

(ii) *Controlling air-pollution from stationary sources (factories) by installing engineering devices :* The important engineering devices, which are used to control emission of particulate matter, from the industrial activities are :

- Gravitational settling chambers.
- Centrifugal collectors including cyclone collectors and dynamic precipitators.
- Wet scrubbers (collectors) including spray towers, venturi-scrubbers and wet cyclone scrubbers.
- Electrostatic precipitators (ESP).
- Fabric filters.

The important engineering devices which are used to control emission of gaseous pollutants from the industrial activities are :

- Absorption units like spray towers and venturi scrubbers.
- Adsorption units like adsorption towers.
- Combustion or incineration devices, using direct flame combustion and catalytic combustion.
- Chemical alteration of the pollutant usually through combustion or catalytic treatment.

(iii) *Changing the raw materials* : If a particular raw material is responsible for causing air-pollution, use of a pure grade of raw is often beneficial and may reduce the formation of undesirable impurities and byproducts or may even eliminate the troublesome effluent. A typical example of this approach is the use of low-sulphur fuel in place of high sulphur ones. LPG (Liquid petroleum gas) and LNG (Liquified natural gas) may be used in place of coal, as they will produce much less pollutants in the emissions.

(iv) *Process changes* : Replacement of old obsolete processes in industries with the new efficient processes may also lead to reduced pollution emissions. For example, rotary kilns are a major source of dust generation in cement plants. Some degree of dust control may be achieved in the kiln operation by adjusting operating conditions. Reduction of feed gas velocities within the kiln, modification of the rate and location of feed introduction and employment of a dense curtain of light weight chain at the discharge end of the kiln can lead to dust control.

(v) *Equipment modification or replacement* : Air-pollutant emissions can be minimized by suitable modification or replacement of process equipment.

For example – Replacement of the open hearth furnace by oxygen furnace in steel industry and development of an alternative power source for automobiles in place of the I.C. engine are examples of equipment alternation.

(vi) *By complete combustion of fuels* : When a pollutant is to be destroyed, the combustion must be complete, otherwise intermediate products of combustion will form which may be more noxious than the original contaminant. For complete combustion, the oxygen must come into intimate contact with the combustible material through adequate turbulence at sufficiently high temperature and have a sufficiently long residence time. In fact time, temperature and turbulence have so predominant role in combustion reaction that they are often called the "three T's of combustion."

Other measures of prevention of industrial pollution are as follows :

- Properly centralize factories to reduce wastes emission from a single area.
- Consolidate legal systems for environmental protection, integrate legal approaches,

administrative methods, economic measures, technologic methods and thinking education.

- Establish evaluation sytem for environments of industrial production and construction and also include environmental protection into economic responsibility system of all levels.
- Afforestation : A heavily forested area is capable of reducing wind speed and drop down the large dust particle in the air, the rough surface of leaves is capable of absorbing and attaching plenty of floating dust.
- Support companies that promote green methods of production and products.

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7. (a) What is acid rain ?

✓ **Ans. Acid Rain :** In a broad sense, acid rain refers to several ways in which acids from the atmosphere are deposited on the earth. Acid deposition includes wet and dry deposition. Wet deposition refers to acidic water received through rain, fog and snow. Dry deposition relates to the wind blown acidic gases and particles in the atmosphere, which settle down on the ground. About 60% of the acidity is due to sulphur gases and about 40% is due to nitrogen gases.

Nitrogen oxides (NO_x), volcanic carbons (VOCs) and sulphur dioxide (SO_2) are produced during combustion of coal (in industry) and petroleum (in automobiles). Lightning in sky also produces NO_x naturally. These gases are highly reacting in air. They rapidly oxidise to acids (Sulphuric or nitric), which quickly dissolve in water and are washed out to the ground as "acid rain".

Normally rain water is slightly acidic ($\text{pH} = 4.0 - 4.5$) because water of CO_2 combines in air to form a weak acid. The pH of acid rain may be as low as 2.0.

(c) **How environmental education will help in nature of environment ?**

Ans. The important of environmental education cannot be over emphasized, because environmental is common heritage and its restoration either through preventive or curative stratege is an enoromous task. Each individual must develop a stake and becomes its protector. Environment is essentially partnership programme in which an individual plays a pivotal role. If individuals are environmentally educated, the society and government are automatically educated because the latter two are only an extension of an individual.

Environmental pollution is a social problem. The success of environmental protection and preservation depends upon the success of environmental education of the society. Awareness of the problem due to pollution and committment to their solution will definitely help to protect our environment.

The objective and during principle for developing environmental education in all these countries are as follows :

- 1. Awareness :** To help social groups and individual so as to get an awareness of an sensitivity to the total environmental and its called problems.
- 2. Knowledge :** To help social groups and individuals so as to gain a veriety of experience in and get a basic understanding of the environment and its associated problems.
- 3. Attitude :** To help social groups and individuals achieve a set of values and filling of concern for the environment and the motivation for activity participating in environmental improvement and protection.
- 4. Skill :** To help social groups and individuals so as to acuire skills for identifying and solving environmental problems.
- 5. Evaluation ability :** The help individuals and social group so as to evaluate environmental measures and education programme in terms of ecological, economic social, aesthetic and educational factors.
- 6. Participation :** To give social groups and individuals an oppotunity so as to be actively involved at all levels in working towards the resolution of environmental problems.

Guiding Principles :

The guiding principles of environmental education are :

1. The environment has to be considered in its totality natural as well as built technological and social, economic, political, moral, cultural, historical and aesthetic aspects.
2. Environmental education should be an interdisciplinary in its approach. The specific contents of each discipline should play specific role in making possible a holistic and balanced perspective.
3. Environmental education should be an continuous life process which in beginning at the pre-school level and continuing through all formal and non-formal stages.
4. Environmental education should emphasize active participation in preventing and solving environmental problems.
5. Environmental education should examine major environmental issues from local, national, regional and international point of view so that learners get onights into environmental conditions in other geographical areas.
6. Environmental education should focus on current and potential environmental situations while taking into consideration the historical perspective.
7. Environmental education should explicitly regard environment aspects in plans for development and growth.
8. Environmental education should be able to promote the value and necessity of local, national and international co-operation in the prevention and solution of environmental problems.
9. Environmental education should exphasize the complexity of environmental problems and thereby the need to develop critical thinking and problem solving skills.
10. Environmental education should use diverse learning environment and a broad array of educational approaches with due stress on practical activities and first hand experience.
11. Environmental education should help learners to find out the symptoms and the real causes of environmental problems.
12. Environmental education should be able to relate environment sensitivity, knowledge, problem-solving and values classification at every grade

(c) What is air-pollution ? What are its effects ? Explain the control strategies.

Ans. Air-pollution : The contamination of environmental becomes pollution, on these elevated concentration begin to have an adverse effect called pollution. Pollution is an undesirable change in physical, chemical or biological characteristics of our air, land

and water caused by excessive accumulation of pollutants. By polluting the environment, man has wiped out many of wild life and has pushed several other species in the danger of extinction. Pollution adversely affects biological species including humans. It damages our industrial processes, living conditions and cultural aspects by deteriorating our raw material resources.

Air-pollution may occur due to the increase in concentration of CO_2 , SO_2 and NO_x and other green house gases and depletion of stratospheric ozone layer. Natural pollution results from volcanic eruption. UV radiation, soil erosion, dust storms, decomposition of organic matter etc.

Important Primary Air Pollutants :

(i) **Carbon monoxide (CO) :** It is highly poisonous to most of the animals. When inhaled CO reduces the oxygen carrying capacity of blood. It is a product of incomplete combustion of fossil fuels. Nearly 50% of all CO emission originated from automobiles.

(ii) **Hydrocarbons (HCs) :** These are generated during the burning of fossil fuel (coal and petroleum). HCs are produced naturally during decomposition of organic matter and by certain types of plants. Methane (CH_4), the most abundant hydrocarbon in the atmosphere.

(iii) **Nitrogen oxides (NO_x) :** NO_x are formed mainly from N_2 and O_2 during combustion of fossil fuels at high temperature in automobile engines. Nitrogen oxides cause reddish-brown haze (brown-air) in traffic congested city air, which contribute to heart and lung problems and may be carcinogenic.

Nitrogen oxides also contribute to "acid rain" because they combine with water droplets to produce nitric acid (HNO_3) and other acids.

Secondary Air Pollutants :

Secondary air-pollutants are formed during chemical reactions between air-pollutants and other atmospheric constituents e.g., water (H_2O) vapours.

1. **Photo-chemical smog :** It refers gray air. It is formed by addition of mainly of ozone (O_3) + Peroxyacetyl nitrate (PAN) + NO_x . It is generally called as brown air where solar radiation is intense. PAN affects leaf chloroplasts.

Oil Spills :

An accidental discharge of petroleum in ocean.

Green house gases :

CO_2 , CH_4 , N_2O , CFC-11 (Chlorofluorocarbons).
HFC-23 (Hydrofluorocarbons).

2. **Acid Rain** : In a broad sense, acid rain refers to several ways in which acids from the atmosphere are deposited on the earth. Acid deposition includes wet and dry deposition. Wet deposition refers to acidic water received through rain, fog and snow. Dry deposition relates to the wind blown acidic gases and particles in the atmosphere, which settle down on the ground. About 60% of the acidity is due to sulphur gases and about 40% is due to nitrogen gases.

Nitrogen oxides (NO_x), volcanic carbons (VOCs) and sulphur dioxide (SO_2) are produced during combustion of coal (in industry) and petroleum (in automobiles). Lightning in sky also produces NO_x naturally. These gases are highly reacting in air. They rapidly oxidise to acids (Sulphuric or nitric), which quickly dissolve in water and are washed out to the ground as "acid rain".

Normally rain water is slightly acidic (pH = 4.0 – 4.5) because water of CO_2 combines in air to form a weak acid. The pH of acid rain may be as low as 2.0.

Effects of Acid Rain :

- (i) Damage building material and furnishing fabrics, territorial and aquatic vegetation.
- (ii) Low pH condition of acid rain also damages soil microbial community.

According to the physical nature of pollutants, the other categories can be named as Gaseous pollution, Dust pollution, Thermal pollution, Noise pollution and Radioactive pollution etc.

From ecosystem point of view, pollutants can be categorized into three groups :

1. **Non-biodegradable pollutants** : For example, DDT, BHC, waste plastic bottles, polythene bags, used soft drinks cans, Non-biodegradable pollutants are difficult to manage.

2. **Biodegradable pollutants** : For example, market garbage, livestock wastes and municipal sewage. Biodegradable pollutants are easily manageable by natural process or in engineered systems like waste treatment plants.

3. **Aerosols** : Aerosols refer particulate matters *i.e.*, it comprises solid particles as liquid droplets, small enough to remain suspended in air *e.g.*, soot, smoke, dust, asbestos, fibres, pesticides, some metals including Hg, Pb, Cu and Fe and also biological agents like tiny mites and flower pollen.

(b) Explain Biotic and Abiotic Ecosystem.

Ans. Biotic Ecosystem : The biotic component of an ecosystem, called the biological environment consists of all the living organisms present in the particular ecosystem. All types of animals and plants do come in this category of living organisms. Some of the living animals and plant may be larger in size, while some may be tiny or even microscopic, which cannot be seen with a naked eye. Hence, bacteria, fungi, small algae, plants, shrubs, trees, insects, birds, fish, whales, elephants, lions and all types of animals do come within the biotic part. Man is also a part of this vast assemblage of organisms. He is the only organism, however, who can modify vast areas of his

environment (physical as well as biological) within a very short time, by using his muscle power and the tools and machines made by him.

The living organisms, forming the biotic component of an ecosystem can be divided into the following three types :

- (i) Producers
- (ii) Consumers and
- (iii) Decomposers

(i) Producers : The producers are plants and some bacteria, capable of producing their own food photosynthetically or by chemical synthesis. These organisms are, thus self-nourishing, as they can produce their own food by using the energy from the physical environment surrounding them. These are also known as autotrophic organisms.

All green plants are hence autotropic and since they use solar energy for producing their required food through photosynthesis, they are also called as photoautotrophs. Certain bacteria which can survive on the energy generated through chemical reactions alone are also include in this category of organisms and are called chemoautotrophs.

(ii) Consumers : The consumers are the animals that obtain their food directly by grazing on plants or by feeding on other animals or by both. Since these organisms consume food generated by producers, they are called the consumers.

Since these organisms depend on other organisms or on the food produced by other organisms for their nourishment (since they cannot make their own food from the energy of the physical environment alone), they are also called as heterotrophic organisms.

The consumers are sometimes grouped into the following classes :

- (a) Macro-consumers and
- (b) Micro-consumers.

The macro consumer class includes all types of animals, while the micro-consumer class includes microscopic sized bacteria and fungi that decomposes the organic matter produced by the living organisms as well as the remains of the dead organisms.

Depending upon as to whether the animals feed on plants or on flesh of other animals, the consumers are also divided into the following two categories :

(a) Herbivores and

(b) Carnivores

Plant eating animals including elephants are, thus, categorised as herbivores or herbivorous animals, while the animals who eat the flesh, like lions are categorised as carnivores or carnivorous animals. A third category of animals, is of omnivores and represent those animals who eat plant food along with eating meat (like cats, dogs, etc.).

(iii) Decomposers : The decomposers or recyclers or detritivores are the fungi and bacteria that decompose the dead organic matter of producers and consumers for their food, releasing simple inorganic and organic substances produced as by-products of their metabolisms. These simple substances are re-used by the producers, resulting in a cyclic exchange of materials between the biotic community and the abiotic environment of an ecosystem.

Abiotic Ecosystem : The abiotic component of an ecosystem is everything other than the living organisms. It includes the three basic elements of nature, i.e., (i) land (ii) water and (iii) air.

By including land, it includes all the organic and inorganic substances present in an ecosystem. By including water and air, it includes all the climatic factors that affect the functioning of the ecosystem. Like biotic component, each ecosystem is unique in possessing its own set of different abiotic factors.

Inorganic components like water, carbon dioxide, phosphates, carbonates, nitrates, etc. and chemical elements like carbon, nitrogen, sulphur, phosphorus etc. are found in the ecosystem. All simple and complex organic substances like amino acids, humic acid, acetates etc. are also included in the abiotic component.

These inorganic and organic substances may be present in the ecosystem in such a form that the living organisms can utilize them as food or for producing their food. Some substances, may however, be complex or bound with some other substance and thus may not become easily available to the living organisms. In any case, the life of all the living organisms depend upon the presence of these abiotic substances, since these substances are the building materials with which the living organisms construct their body structures.

As a matter of fact, the inorganic chemical elements are constantly circulating between the biotic and abiotic compartments of an ecosystem. For example, we exhale carbon dioxide and plants take it up to fix the carbon into a sugar molecule when the sugar molecule is oxidized, once again carbon dioxide gets produced.

Climatic factors also form a part of the abiotic component, because they control the entire functioning of an ecosystem.

(c) Write the function of food-chain and food webs in Ecosystem.

Ans. Function of Food-chain and Food Webs in Ecosystem : The animals of the biotic components of an ecosystem may feed on the plants, or may eat another animal and may, in turn, be eaten by yet another animal. The food energy may thus, get transferred from one living organisms to the other. This linkage between the living organisms (plants and animals) for the transfer of food energy is known as the food-chain.

The food-chain may be divided into the following two types :

- (i) the grazing food-chain and
- (ii) the detritus food-chain.

The grazing food-chain starts with a green plant, which will be eaten by a plant eating animal (herbivore). The herbivore will, in turn be eaten by a flesh eating animal (carnivore).

This food-chain can, thus be simply reflected as:

Plant → Herbivore → Carnivore
(Grass) (Insect) (Lizard/Frog/Bird)

An insect or a grass-hopper feeding on a particular plant, and a bird or a frog feeding on that insect or grass-hopper can be quoted as an example of such a simple grazing food-chain.

The detritus food-chain begins with the organic matter resulting from the wastes of animals and dead plants and animals, etc. This organic matter is degraded or decomposed by micro-organisms (called detritivores or decomposers). Thus, dead leaves, dead stems, dead plants, dead wood, etc. or dead animals or their organic wastes will be decomposed by decomposers. The decomposers like fungi will

generate their food by decomposing such organic wastes. Such decomposition of organic wastes may even release important inorganic nutrients, that can be once again used by other organisms. Thus, if there would have been no decomposers, a lot of energy would have remained locked up in the dead bodies of organisms. A simple illustration of grazing and detritus food-chains is reflected in figure with a insect like a grass-hopper feeding on a particular plant, and a frog eating that grass-hopper.

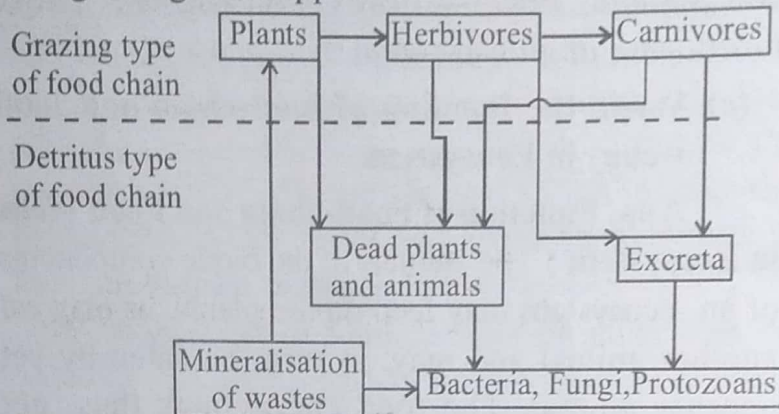


Fig. Simple grazing and detritus food-chains and their inter-relationship.

However, in most of the ecosystems, the food-chains are not so simple and straight forward. An insect or a grass-hopper may feed on a dozen different plants instead of only on one single plant. Similarly, a frog may eat several other insects along with the grass-hopper. Thus, the food-chains do not remain simple isolated sequences. Actually, a lot of interlocking of food chains do take place. Such a food-chain is called food-web. This is because of the fact that a single animal, during its development and growth, may be a part of different food-chain, and hence a part of a food-web.

Although food-chains in an ecosystem, are generally complex and hence called food-webs, yet two food-webs involving the same number of steps, are said to be belonging to the same trophic level. For example-

- (i) Grass → Grass-hopper → Frog → Snake
- (ii) Tree → Beetle → Lizard → Bird

In both these food-webs, grass-hopper and beetle both occupy the same trophic level, and since both are directly using the plant as food, they are called as the primary consumers. The plants i.e., the grass and tree both are the producers. Likewise, the first animals eaters, i.e., frog and lizard occupy the same level, Both the frog and lizard will be the secondary consumers. Similarly, both the snake and bird are the tertiary consumers. The trophic levels can, thus be

states as :

Producer → Primary consumer → Secondary consumer

(Plants) (Hervibores) (Pre-dators)

Tertiary consumer (Large carnivores of upper level).

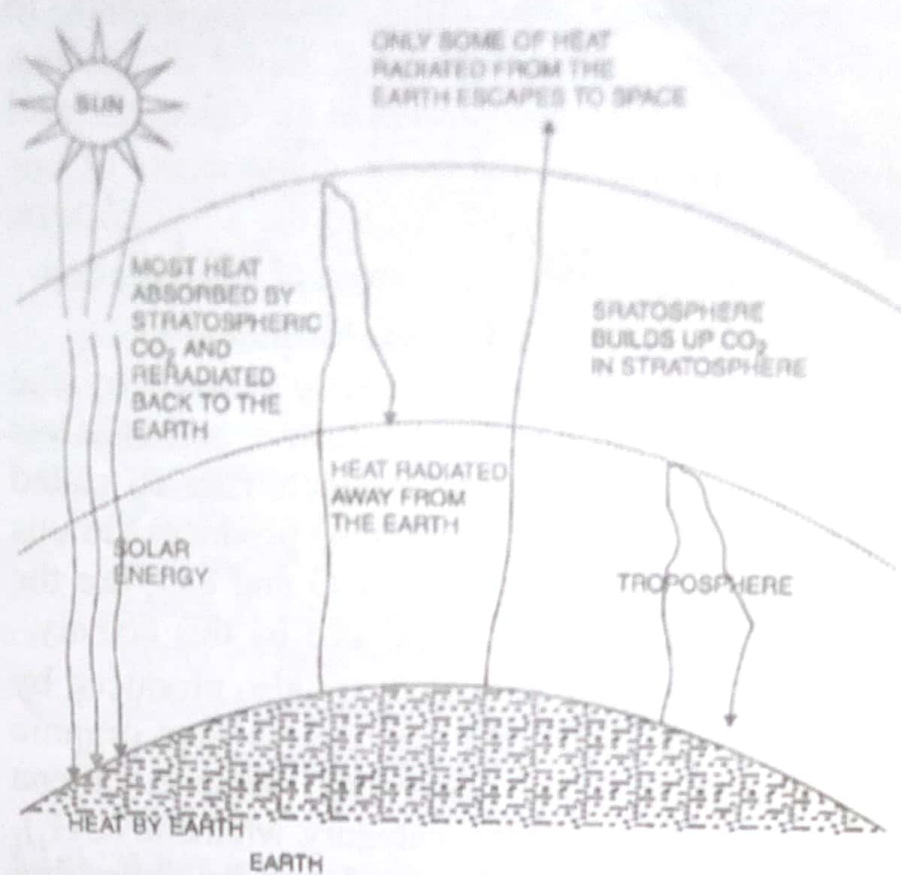
It is however, not necessary that one animal will always occupy only the trophic level, as it can occupy one or more than one trophic levels, depending upon the food-webs used by it.

(c) What is Green-house effect ? How does it cause global warming ?

Ans. Green-house Effect : When solar radiation arrives on earth atmosphere, about half of the visible light is reflected back into the space. Otherwise, the temperature of earth would be far too hot to support life. The remainder reaches earth surface and causes warming. The warm surface then reradiate this energy as heat energy which falls in the infrared portion of the electromagnetic spectrum. In infrared region, the water vapour, ozone, methane, carbondioxide present in the atmosphere readily absorb some of this heat and in turn warm the atmosphere creating green-house effect.

A botanical green-house operates on the same principle. The botanical green-house is made up of glass walls and roof which is of green colour and used for the study of germination of seeds. Glass transmits the visible light but blocks infrared radiation trying to escape. The effect is a warming of the air inside the green-house. In the warm weather, the windows of the green-house must be kept opened, otherwise the plants inside will over-heat and die.

All the green-house gases act as an absorbing blanket that prevents radiation losses and keeps earth atmospheric temperature comfortable in winter, however it is a problem in summer. Water vapours in atmosphere are subjected to such a vast cycles that manly activitie does not seem to alter it. Ozone is present in relatively low concentration and methane is produced naturally in vast quantities. So the attention should be focussed on carbondioxide the green house gas whose concentration in the atmosphere is closely related to human activity.



Stratospheric green-house gases act as irremovable permanent blanket for the earth for which global warming happens. The carbon dioxide is among the main green-house gases and its atmospheric concentration of carbon dioxide in 1900 was 296 PPM which became 318 ppm in 1970 and by 1993 it reached 360 ppm. The rate at which its concentration is increasing is quite alarming. Carbon dioxide is going to prove itself as a salient killer of the earth. The increasing concentration of carbon dioxide is attributed to deforestation, industrial emission, vehicular emission, wars, etc. Thermal power plants all over the world contributing a huge fraction of electricity about 80 percent of total power consumption, for the comfort of civilised life and these are the chief source for carbon dioxide emission into the atmosphere.

To control the global warming the only way available is to control human activity and minimise vehicular emission of carbon dioxide and deforestation. Forest is the only sink for carbon dioxide as trees translate carbon dioxide to usable form. Control in carbon dioxide emission world wide will undoubtedly be more difficult than to control CFCs or the acid rain as the source of its generation is unlimited. Global warming is a major potential problem and its effect appears to be measurable in the human time scale.

4 (c) What is it

(b) What is population explosion ?

Ans. Population Explosion : The population growth rate depend on the birth rate as well as death rate. The population explosion refers to the sudden and dramatic increase in the number of human beings which has ben observed in the recent years. The growth of population is as dangerous as explosion of bomb. Hence the word explosion is used with it. For most of the human history, the total human population remained small. It was less than 300 million before 2000 years, however by 1850 it reached 1 billion (1000 million) and since then it was grown very rapidly and exceeded 5000 million in 135 years. It is estimated that man in the stone age and an average life expectancy of only 17 years. However, the average life expectancy in many countries of the world today is more than 70 years. Many died due to disease, famine, war and large scale epidemics which swept across the continents from time to time. Wars are also responsible for killing large numbers of people including civilans. Wars cause famine and diseases. Despite of all the odds the growth of human population favoured. The population explosion is attributed to remarkable increase of life expectancy and sharp decline in the death rate and natural checks are successfully mitigated.

Whenever something increases in such a way that the increase in fixed proportion of its own size of any

time, the growth is said to be exponential. This exponential growth curve for population growth indicate the awaiting population explosion. Population growth curve vary from nation to nation. Nations having growth rate of 3 percent or more is high growth rate, some are not growing at all and few others have declining population. Human population can be maintained due to attainment of demographic transition. It is the point where birth and death rate are roughly equal.

(b) How social awareness can improve environmental management ?

Ans. There is a need to develop strategy for the management of environment. This should be expressed in a language which will appeal to the common man in a creative manner by establishing the relevance of environmental education to their day-to-day lives. Man's basic needs are food, shelter, clothing and recreation. The concern about the environmental education arising out of food production, enhanced ways of earning livelihood, effect of technology on day-to-day life and the impact of all these developments on health will be more relevant to a common man.

Agriculture : It was the activity in the evolutionary process of present civilisation. The concern about environment has come up because of the rapidly changing balance between the forested and cultivated land. When man took to agriculture there was very little fear of adverse effect on environment. The traditional agriculture has been based on renewable energy resources, solar energy, rainfall, animal residues, waste products and the microbial activity which decompose them. The concept of industrial inputs in agriculture like chemical ferertilisers, pesticides and farm machines evolved new problem for environment.

Land use Patterns : In India land use planning is guided by economics. Due to expanding population, soil is cultivated extensively which poses a threat to productivity. The problems has further aggravated due to soil erosion and deforestation. For various reasons the top soil is damaged year after year. So a well planned policy of land use is most inevitable.

Water Resources : Water is an integral input into agricultural productivity besides being a major life support system. Its misuse can cause degradation as well as erosion, affecting lives of people and crop yields. Most of the North Indian rivers are augmented by melting of snow but Southern rivers do not have this advantage. These are dependent on land surface management. Nearly 70% of the area in India is subjected to water stress i.e., water scarcity or flood.

This is furhter aggravated by -

- (i) ignorance about nation's water capacity the common man considers it to be abundant and unlimited.
- (ii) the concept of water conservation and management is still alien to the mass.

The chronic water shortage in Tamil Nadu in recent years is a warning signal for the years to come.

Irrigation : Irrigation schemes have been developed as an answer to unpredictable rain pattern in India. On the other hand, large areas, which have become submerged under reservoirs got water logged or were destroyed by the construction of roads and colonies. This has resulted in less cultivated area, displacement of local people and other problems related to forced migration.

The concern with increasing agricultural productivity is wide spread in terms of its implication as well as the categories of people involved. A farmer, the immediate persons to be affected are, as much involved in the precesses of destruction and

regeneration, as is the planner at the national level. Hence social awareness can help better management of the resource and environment. Maintaining the quality of life amidst population explosion, increased consumption and increased waste accumulation calls for disciplined human decision. The general public be made conscious of any unavoidable effects.

That may result from encroachments on environment and be helped to tackle them so that the adverse effects may be minimised. These safeguards are possible only if a multifaceted approach is taken and directed all strata of the society through a hierarchical national network.

✓ (c) Explain 'Global Warming'.

Ans. Global Warming : It has been observed and scientifically proven that the Earth is getting hotter and hotter, year after years. The average increase in its temperature in the post industrial era and during the last about 100 years has been estimated to be about 0.75°C with maximum contribution from the last three decades. This warming of the Earth is called Global Warming.

The primary reason for this warming of the globe is found to be increasing concentration of carbon dioxide (CO_2), carbon monoxide (CO) and other such gases, together called green house gases (GHGs) in the lower atmosphere of the Earth. These GHGs—primarily CO_2 , existing in the lower atmosphere of the Earth, in fact act like the glass of a green house, trapping some of the heat as it radiates back from the

Earth into the space. Such gases and their heating effects, have in fact, survived life on earth, as otherwise, temperature on earth could well have been below freezing, like that on Mars, where the temperature may be as low as -140°C . Excessive quantities of these gases, evidently, may cause excessive heat, again to make life impossible, like that on Venus, where CO_2 is found 60,000 times higher than that on Earth, giving it as high a temperature as 460°C .

Thus, the very existence of the right and the balanced amount of CO_2 in our atmosphere, that trapped the right amount of heat from escaping, has made our planet (Earth) liveable. However the large scale emission of CO_2 due to the continuous and excessive burning of fossil fuels, such as coal, oil, natural gases etc. to run our power plants, factories, automobiles, planes, cooling etc. in the industrialized world has been found to be disturbing this CO_2 balance in the Earth's atmosphere. Besides these mass scale urbanization, industrialization etc. due to population growth etc., causing to deforestation. As a result the natural carbon sinks i.e., forests are extinguishing at an alarming rate, which is also contributing to rise in CO_2 concentration in the atmosphere.

Effects of Global Warming :

- (i) Due to the rise in concentration of GHGs like CO_2 etc., the earth's temperature is now increasing, which is the main cause to melt the ice bergs in the poles. East Antarctica for example, has been losing at least 5 billion tonnes (Bts) of ice per year. All ice sheets of Arctic and glaciers are thus losing their ice, causing reduced capacity to reflect back sun light and thereby further contributing to the global warming.
- (ii) The global warming has also resulted in raising the water level of the oceans, partly due to the thermal expansion of water, volume contained in the world ocean, and partly due to the melting of glaciers and ice sheets. Due to rise in sea levels, more than half of the world's population, living within 60 km of the seas will be seriously affected by the submerged land and ingress of salt water.
- (iii) Human society is also likely to be seriously affected by the changing climate, which will

increase floods and droughts. The rainfall is likely to increase in higher altitude areas and decrease in lower levels. There will be increased frequency of droughts cross the world. The frequency and occurrence of tropical cyclones will increase. There will be more warm nights and fewer cold ones.

- (iv) Food production may be adversely affected in vulnerable regions directly and also indirectly through the increase in pests and plant or animal diseases.
- (v) Climate change related impacts on human health may lead to large scale migration and displacement of large number of people, creating environmental refuges.
- (vi) Changes in climate may also increase the spread of vector born species, such as mosquitoes, which in turn may increase the spread of diseases such as malaria, filariasis, dengue, yellow fever etc. All in all, severe climate changes may adversely affect human health quite severely, leading to large scale death and destruction.

(c) Define urbanisation. Describe the effect of urbanisation on the environment.

Ans. Urbanisation is the process by which large number of people become permanently concentrated in small areas forming cities. The definition of city and urban area changes from time to time and place to place, the UNO has recommended that member countries regard :

All places with more than 20,000 inhabitants living close together as urban.

The 1961 and 1971 census of India has defined urban areas to include :

- all such places which have minimum population of 5000.
- places where atleast 75% of the male working population are employed in occupations other than agriculture.
- all places which have a population density of more than 1000 persons per square km.
- all municipalities, corporations, cantonments and notified town areas.

Human settlements are growing tremendously throughout the world thwarting environmental degradation in a number of ways, such as :

- (i) Enchroachment of agricultural and fertile land for housing, industries, construction of roads and dams etc.
- (ii) Depletion of water resource due to increase in the water requirement.

(iii) Pollution from industrial and other human activity.

(iv) Emergence of slums which deteriorates the surrounding areas.

1. Change in land use : Town and cities grow with economic growth of human societies. These, therefore, emerge at locations where land provides a base for some viable economic activity both of agriculture and non-agricultural types. As towns grow they invade the productive crop lands and rich forests. Both intracity and regionally open lands are converted into built up areas. Thus, the land with all its biological resources is irreversibly lost.

2. Depletion of water resource : Water requirement of the urban population also increases many times and almost all of it has to be met through the water supply system. With rapidly increasing urban population and limited resources, it is becoming increasingly difficult to meet the requirements of the municipal water supply. As a result most of the cities have to draw water from outside. With further growth the demands increase and cities draw water from distant sources. Presently Delhi is drawing water from Ram Ganga 180 km. away. In each of the case, water from the cities has to be drawn at the cost of cultivation and rural demands, path followed also affects the ecosystem.

3. Building materials : Construction of houses and other structures need large quantities of building materials. Huge quantity of bricks took their shape from fertile land thus causing further damage to good agricultural land.

4. Industries : Industrial development goes almost hand in hand with urbanisation. Metropolitan towns like Kolkata, Mumbai and Chennai are alarming examples. Nearly 60% of industries in Maharashtra are located in Mumbai alone. Industries draw upon water resources heavily.

5. Slums : Slums represent one of the worst type of environmental degradation which have become concomitant to urbanisation and industrialisation. National Building Organisation reveal that in small and medium towns slum dwellers comprises about 10% while the figure is 20% for cities. Bihar has largest slum dwellers. The slum dwellers have an environment, with inadequate living space, water supply, sewerage facilities. This causes steady deterioration of surrounding regions as well as human health.

6. Water pollution : Pollution of fresh water

through urbanisation and industrialisation is colossal. About 90% of the drinking water in the country comes from rivers polluted by these human activities. In India, cities are either not fully seweraged or have very inadequate facilities. Thus sewage either seep into the soil and pollute ground water or it flows through streams and rivers.

7. Air pollution : Most of the air-pollution in urban locations results from the discharge of sulphur dioxide, oxides of nitrogen, hydrogen sulphide and suspended particles, such as fly ash etc. The ingredients which are causing air-pollution come from automobiles, industries, kitchens and cause considerable damage to plants, animals and to human health.

In addition to environmental degradation, urbanisation has affected the social organisation, family structure, culture and behaviour of the population living in the urban areas as well as those who are living outside the urban centres.