SECTION – II

ENVIRONMENT

Our mother earth is the most precious gift of the universe .It is the sustenance of "nature" that is a key to the development of the future of mankind .It is the duty and responsibility of each one of us to protect nature. It is here that the understanding of the "Environment" comes into the picture. The degradation of our environment is linked with the development process and the ignorance of people about retaining the ecological balance. Indeed , no citizen of the earth can afford to remain aloof from the issues related to the environment . It is , therefore , essential that the study of the environment becomes an integral part of the education process.

UNIT VII

ENVIRONMENT

MAIN OBJECTIVE

To help students to develop in-depth understanding of various environmental issues and concerns of national and global importance.

LEARNING OUTCOME

- To understand and develop a balanced view of the relationship between environment and development.
- To understand basic concepts related to sustainable development vis-à-vis improvement of quality of life.
- To understand variety in living organism and recognize India as mega diversity nation.
- To understand the role of individual community, nation and international agencies in resolving environment problems.

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1. Concept of an Ecosystem
2. Non-living Resources
3. Biodiversity
4. Environmental Resources
5. Environmental Problem
6. Global Climatic Change

CONCEPT OF AN ECOSYSTEM

An ecosystem is a region with a specific and recognizable landscape form , such as a forest , grassland , desert wetland or coastal area. The nature of the ecosystem is based on its Geographical features like hills, mountains, plains, rivers ,lakes coastal areas or islands it is also controlled by climatic conditions- the amount of sunlight , the temperature and the rainfall in the region . The geographical , climatic and soil characteristics form its non – living or abiotic component . These features create conditions that support a community of plants and animals that evolution has produced to live in these specific conditions. The living part of the ecosystem is referred to as its biotic component.

Ecosystems are divided into terrestrial or land based ecosystems and aquatic ecosystems in water.

These form the two major habitat conditions for the Earth's living organisms.

All the living organisms in an area live in communities of plants and animals. They interact with their abiotic environment and with each other at different points in time for a large number of reasons. life can exist only in a small portion of the Earth's land , water and its atmosphere. At a global level, the thin skin of the earth on the land , the sea and the air , forms the biosphere.

At a sub global level , this is divided into biogeographical realms. For example , Eurasia is called the palearctic realm ; South and south – east Asia (of which india forms a major part) is the Oriental realm; North America is the Nearctic realm ; South America forms the Neotropical realm; Africa the Ethiopian realm; and Australia the Australian realm.

At a national or state level , this forms biogeographic regions . There are several distinctive geographical regions in india – the Himalayas , the Gangetic Plains , the highlands of central India the Western and Eastern Ghats , the semi – arid desert in the West , the Deccan Plateau , the Coastal Belts , and the Andaman and Nicobar Islands . These geographically distinctive areas have plants and animals that have been adapted to live in each of these regions.

At an even more local level , each area has several structurally and functionally identifiable ecosystems , such as different types of forests , grasslands , river catchments , mangrove swamps in deltas seashores , islands etc., to give just a few examples . Here too, each of these forms a habitat for specific plants and animals.

Definition : The living community of plants and animals in any area together with the non – living components of the environment – such as soil , air and water – constitute the ecosystem.

Some ecosystems are fairly robust and are less affected by a certain level of human disturbance .Others are very fragile and are quickly destroyed by human activities. Mountain ecosystems are extremely fragile , as the degradation of forest cover leads to severe soil erosion and changes in river courses. Island ecosystems , again are easily affected by any form of human activity , which can lead to the rapid extinction of several of their unique species of plants and animals . Evergreen forests and coral reefs are also examples of species –rich fragile ecosystems , which must be protected against a variety of human activities that may lead to their degradation. River and wetland ecosystems can be seriously affected by pollution and changes in surrounding land use.

UNDERSTANDING ECOSYSTEMS

Natural ecosystems include the forests , grasslands , deserts , and aquatic ecosystems like ponds , rivers , lakes , and the sea . Man – modified ecosystems include agricultural land and urban or industrial landuse patterns. Each ecosystems has a set of common features that can bo observed in the field :

1. 'What does the ecosystem look like?'

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

2. What is its structure?

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

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

3. what is the composition of its plant and animal species?

List the well known plants and animals you can see. Then, document their abundance and numbers in nature: very common, common, uncommon , rare. For example , wild mammals will not be seen in large numbers, cattle would be common. Some birds are

common; find out which are the most common species? Insect species are very common and most abundant. In fact , there are so many that they cannot be easily counted.

4. How does the ecosystem work?

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

ECOSYSTEM DEGRADATION

Ecosystem are the basis of life itself! The natural ecosystems in the wilderness provide a variety of products and are regions in which a number of vital ecological process are present; without these processes, human civilization would not be able to exist.

However ecosystems are frequently disrupted by human actions, leading to the extinction of species of plants and animals that can live only in the different natural ecosystems. Some species, if eliminated, seriously affect the ecosystem. These are called 'keystone' species. Extinction occurs due to changes in land use. Forests are deforested for timber, wetlands are drained to create more agricultural land, and semi-arid grasslands that are used as pastures are converted to irrigated fields. The pollution from industries and the waste from urban settings can also lead to the poisoning and extinction of several species.

The reason for the depletion of natural resources is two-fold--- our rapidly exploding population that needs increasing resources to sustain itself, and the growth of affluent societies that consume and waste a very large portion of resources and energy. The increasing extraction of resources is at the cost of our natural ecosystems. leading to a derailing of their important functions. We all use a variety of resources in our daily lives. If traced back to their source, we find that the resources were originally obtained from nature and natural ecosystems. Our insensitivity to using resources carefully has produced societies that nature can no longer sustain. If we think before wasting resources such as water, reusing and recycling paper, using less plastic that are non-degradable, all this ca cumulatively conserve our natural resources.

RESOURCE UTILIZATION

Most of the traditional societies used their environment fairly sustainably. Though inequality in resource utilization has existed in every society, the number of individuals that used a large proportion of resources was extremely limited. In recent times, the proportion of 'rich' people in affluent societies, have grown rapidly. Inequality has thus become a serious problem. Whereas in the past many resources such as timber and fuel wood from the forest extracted sustainably, this pattern has drastically changed during the last century. The economically-powerful sections began to use greater amounts of forests products, while those people who lived in the forest became increasingly poor. Similarly, the building of large irrigation projects has led to wealth in those areas that had canals, while those who remained dependent on a constant supply of water from the river itself, have found it difficult to survive.

The key to this issue is the need for an 'equitable' distribution of all types of natural resources. A more even sharing of resources within the community can reduce these pressures on the natural ecosystems.

STRUCTURE AND FUNCTIONS OF AN ECOSYSTEM

Since each ecosystem has a non-living and a living part that are linked to each other, one needs to look around us and observe this closely.

The non-living components of an ecosystem are the amount of water, inorganic substances and organic compounds, and climate conditions, which depend on geographical conditions and location.

The living organisms in an ecosystem are inseparable from their habitat.

The living component of plant life ranges from extremely small bacteria, which live in the air, water and soil, algae which live in fresh and saltwater, to the terrestrial plants which range from grasses and herbs that grow after the monsoon every year, to the giant long- lived trees of the forest. The plants convert energy from sunlight into organic matter for their growth, thus functioning as producers in the ecosystem. The living component of the animal world ranges from microscopic animals, to small insects and the larger animals such as fish, amphibians, reptiles, birds and mammals. Man is just one of the 1.8 million species of plants and animals that inhabit the earth.

STRUCTURAL ASPECTS

The components that make up the structural aspects of an ecosystem include:

1) Inorganic compounds—C, N, CO2, H2O
2) Organic Compounds— protein, carbohydrates, lipids, which link the abiotic to biotic aspects
3) Climate regimes— Temperature, moisture, light and topography
4) Producers—plants
5) Macro-consumers---phagotrophs, i.e., large mammals
6) Micro-consumers—saprotrophs, i.e., absorbers like fungi.

Functional aspects

1) Energy cycles
2) Food chains
3) Diversity—interlinks between organisms
4) Nutrient cycles—biogeochemical cycles
5) Evolution.

Producers, consumers and decomposers

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

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

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

At a higher tropic level, there are carnivores animals, or 'secondary consumers', which live on the herbivores. In our forests, the carnivorous animals are tigers, leopards, jackals, foxes, and small wild cats.

In the sea, carnivorous fish live on other fish and marine animals. The animals that live in the sea range in size from microscopic forms to giant mammals such as the whale.

Decomposers or detrivores are a group of organisms consisting of small animals like worms, insects, bacteria and fungi, which break down dead organic material into smaller particles and finally into simpler substances that are used by plants as nutrition. Thus, decomposition is a vital function in nature, as without this, all the nutrients would be tied up in dead matter and no new life would be produce.

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

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

ENERGY FLOW IN THE ECOSYSTEM

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

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

Ecology is important for the survival of all living beings, forests, grassland, desert, water bodies are the different ecosystem which helps the human beings. Interaction which is existed between biotic mean living organisms and abiotic mean non-living components in an ecosystem.

Anything acquired by us for living are resources. Resources are non-living, bio-resources and environmental resources. All these resources are important but as they are exploited on a large scale, resources are depleting at an alarming rate. Non-living resources include air, water, soil and minerals.

Ecology term is derived from two Greek words, oikos mean house and logos mean study. It was coined by a German biologist Earnist Haeckel in 1869.

We are surrounded by mixture of different gases like nitrogen, oxygen, carbon dioxide and others. We breathe oxygen. Air traps the sun's heat and keeps the earth warm. In air, dust, water vapours, pollen, seeds, etc. are present water is a renewable resource and is vital to life for all physiological activities of plants and animals. Water covers about three quarters of earth surface and constitutes 60-70% of total body weight of living organisms.

Top layer of earth is called soil which supports all living beings on land. Interaction between weathering of rocks, rain, wind, temperature, with plants, animals and microbes is responsible for soil.

Minerals are naturally occurring, inorganic, crystalline solids with definite chemical composition and particular physical properties. Gold, silver, iron, mica are different minerals and metals. They are non-renewable resources. Minerals are important for the development of the mankind.

•Natural Cycles:

There are four types of cycles exist in the nature. They are 1) Carbon cycle, 2) Nitrogen cycle 3) Water cycle and 4) Phosphorus cycle.

Carbon Cycle: Carbon is the important component of all the organic compounds like carbohydrates, proteins, lipids, enzymes and nucleic acids of the protoplasm. In atmosphere, it is present as carbon dioxide. Carbon dioxide is released during respiration of both producers and consumers. During decomposition of organic compounds of dead bodies, during burning of fossil fuels like wood, coal, petroleum, etc. Through volcanic eruption and hot springs and during weathering of rocks by acids produced by micro-organisms and roots of higher plants.

Nitrogen Cycle: Nitrogen is the basic component of amino acids, proteins, enzymes and nucleic acids of the protoplasm. Our atmosphere contains 78.62% of nitrogen in gaseous state. Nitrogen fixation, ammenification, nitrification and denitrification are the four steps involved in nitrogen cycle.

Water Cycle: Water that acts as a habitat for hydrophytes and many aquatic animals is the most abundant component of protoplasm. It is good ionizer, good solvent, temperature buffer and transporting of minerals. It too helps in digestion of organic compounds and in photosynthesis of plants. There are global water cycle and biological water cycle.

Phosphorus Cycle: Phosphorus is present in the phosphate rocks which contain phosphate in combination with calcium and iron. The chemical weathering and erosion of phosphate rocks add the phosphate compounds into the soil.

Resources are sources of supply or support generally hold in reserve. We have bio-resources. Bio-resources include micro-organisms, plants and animals. Nature is responsible for blessing bio-resources. All green plants like plants, algae, grass, trees make food for themselves and for others. There are innumerable micro-organisms which are helping us in many ways. There are herbivores, carnivores and omnivores animals. Herbivores feed mainly on plants where as carnivores like lion, tiger feed on herbivores. Omnivores are those who consume both plants and animals.

Biodiversity refers to different types of plants and animals existing on the earth. Biodiversity has great significance to mankind. It provides ecosystem services. It has scientific importance. It provides drugs and medicine. Biodiversity has a lot of commercial significance and also has aesthetic as well as ethical values.

Genetic diversity, species diversity and eco diversity are three types of biodiversity. Genetic diversity takes place due to variations of genes within species. The genetic diversity is expressed in the forms of breeds, races, varieties and forms. Species diversity represents a variety of species in a region. Eco diversity of ecological complexity showing variations in food webs, nutrient cycling.

Ecosystem is an integrated system resulting from interaction of living and non-living factors of the environment.

Ecosystems exist in aquatic form as fresh water and marine. Also as terrestrial, wetland and artificial. Forests, grassland and desert are terrestrial ecosystems. Fresh water and marine ecosystems represent aquatic where as mangroves and estuaries are wetland ecosystems. Besides these, they are artificially created lakes, ponds, parks, gardens are there which constitute artificial ecosystems.

Fossil fuels and non-fossil resources constitute environmental resources. Fossil fuels are non-renewable sources of energy. Among the non-renewable sources of energy coal, petroleum and its products and natural gas are exhaustible and cannot be replaced, once they are used.

Renewable energy sources are in exhaustible and continues in supply. The sun is the source of the solar energy. A wind mill uses kinetic energy generated by movement of large masses of air. Hydro power plant harness power from speedily housing water. In ocean thermal energy, difference of temperature between warm and cold water is harnessed. Tidal power is harnessed from the kinetic energy of tides, biomass mean living matter or its residues. Biomass is used to produce biogas. Use of biodiesel is gaining importance and plants like Jathropa are used for extracting biodiesel.

Resources Conservation:

There is urgent need of conservation of natural resources by protection and preservation of critical habitats of wildlife through legislations, regulating trade, public education and awareness. We have to follow 3 R approach (Reduce, Reuse and Recycle) towards natural resources. Judicious utilization of natural resources is required to avoid their over exploitation.

Sustainable development is that process of development which meets the needs of present generation without compromising the ability of the future generations to fulfil their own needs. By reducing use of fossil fuels, improving the quality of materials and reducing transportation it is possible to achieve sustainable development.

ENVIRONMENTAL PROBLEMS

The unfavourable changes in the physical, chemical or biological characteristics of air, water, soil and living organisms, may be called as environmental pollution. Today, increasing pollution has been a serious concern as it's adversely causes bad effects on the health of human beings, plants and other animals.

Domestic and industrial wastes account for the soil pollution. Sewage and other waste, industrial effluents, agricultural wastes and chemicals are responsible for causing water pollution. The presence of pollutants causes atmospheric pollution. Besides, natural sources like volcanic, dust-storm, cosmic, marine, and biological or forest fire, the anthropogenic or manmade activities are responsible for the atmospheric pollution. Carbon dioxide, Hydro carbons, heat, nitrogen oxide, ozone are some of the anthropogenic pollutants threatening the lives of innumerable living organisms.

Petroleum refineries, cement factories, chemical factories emit SO2, NO2 and other hazardous chemicals and gases that are threat to living as well non-living things. Agricultural activities in which pesticides, insecticides and other chemicals are used causes air pollution. Transportation vehicles exhaust toxic smoke and lead. Thermal power and nuclear plants are also a major source of atmospheric pollution.

The atmospheric pollution causes eye and lung irritation. Inhalation of it in large quantity may give rise to gum inflammation, pneumonia, cancer. High concentration of carbon monoxide slow down mental and physical growth and cause heart and brain damage measures to control atmospheric pollution:

Not burning leaves, paper, and rags.
Preventing use of fireworks.
Using clean fuel like CNG for vehicles.
Tree plantation.
Recycling and reusing products.

Implementing air (Prevention and control of pollution) Act, 1974 and the motor vehicle Act 1988.

Global Climatic Change:

Rapid rate of industrialization, urbanization, agricultural development, depletion of earth's natural resources, an alarming rate of population growth have resulted in threatening our earth. There are changes taking place in the physical and environmental factors all over the globe over long period of time collectively is known as global climatic change.

Anthropogenic activities of mankind are responsible mainly for the climate change. Population explosion, rapid industrialization, urbanization, injudicious use of fossil fuels, greenhouse gases like CO2, methane, N2O and Chlorofluoro carbons (CFC's) in the atmosphere and cause increase in the average global temperature.

Global warming will account for rise in sea level which inundates low lying coastal areas. It will also increase in global temperature. It will result in ecological disturbances chances of hurricanes, cyclones and floods will be more which will damage the lagoons, estuaries and coral reefs. Increase in carbon dioxide concentration will adversely affect the agricultural production and chances of spreading malaria, filariasis and other diseases are more.

OZONE DEPLETION

Ozone depletion is a phenomena observed since the late 1970s where in there is a steady decline of about 4% per decade in the total volume of ozone in Earth's stratosphere (the ozone layer), and a much larger springtime decrease in stratospheric ozone over Earth's polar regions. The latter phenomenon is referred to as the ozone hole. In addition to these well-known stratospheric phenomena, there are also springtime polartropospheric ozone depletion events.

The details of polar ozone hole formation differ from that of mid-latitude thinning, but the most important process in both is catalytic destruction of ozone by atomic halogens. The main source of these halogen atoms in the stratosphere is photodissociation of man-made halocarbon refrigerants (CFCs,freons, halons). These compounds are transported into the stratosphere after being emitted at the surface. Both types of ozone depletion were observed to increase as emissions of halo-carbons increased.

CFCs and other contributory substances are referred to as **ozone-depleting substances** (**ODS**). Since the ozone layer prevents most harmful UVB wavelengths (280–315 nm) of ultraviolet light (UV light) from passing through the Earth's atmosphere, observed and projected decreases in ozone have generated worldwide concern leading to adoption of the Montreal Protocol that bans the production of CFCs, halons, and other ozone-depleting chemicals such as carbon tetrachloride and trichloroethane. It is suspected that a variety of

biological consequences such as increases in skin cancer, cataracts, damage to plants, and reduction of plankton populations in the ocean's photic zone may result from the increased UV exposure due to ozone depletion.

RURAL DEVELOPMENT

Agriculture is the single most important source of livelihood for the majority of the rural population in India. Many activities that support agriculture and village life are also sources of livelihood for people in rural India. Once upon a time, a large number of artisans such as potters, carpenters, weavers, ironsmiths were supported by the agriculture. However, the green revolution that took place in 1960 and 1970 had initiated modernisation of agriculture. It was largely funded by international agencies that were based on providing high yielding variety (HYV) seeds along with pesticides, fertilizers and other inputs to farmers. Agricultural productivity increased sharply because of the new technology. India was able to become self-sufficient in food grains production for the first time in decades. However, there were certain negative serial and environmental effects were seen.

In most of the Green Revolution areas, it was primarily, the medium and large farmers who were able to benefit from the new technology. The introduction of machinery led to the displacement of the service caste groups who use to carry out agriculture related activities. In market oriented cultivation, especially where a single crop is grown, a fall in prices or a bad crop can spell financial ruin for farmers. It also contributed to decrease in species diversity in crops. Newly developed crops were not resistant to diseases and insects. Due to extension of irrigation and use of wide range of different techniques for water abstraction and application has increased the extent and degree of salinity. Salination retards plant growth and has serious implications on soil productivity. Water logging and salinization affect many thousands hectares of land countrywide.

The chemicals used for the agricultural production releases pollutants. They pollute the soil and other water resources. The continuous uses of chemical fertilizers change the soil chemistry by making it too alkaline or acidic. Use of chemicals has resulted in eutrophication wherein proliferation of algae due to high concentration of nitrates and phosphates in water and their decomposition of micro-organisms has depleted the oxygen content. Excessive growth of algae has caused death to aquatic plants and animals. For preservation and artificial ripening of the fruits, chemicals which are hazardous are used have accounted in creating numerous health related issues and has number of ill effects.

Today, there is urgent need to follow organic farming. By using manure and bio fertilizers, there is possibility of increasing not quantitative but qualitatively production of the food grains. Organic substances obtain from the decomposition of vegetables and animals

waste by the action of micro-organisms. Farmyard, compost and green manures are necessary for the organic farming. By using alternative biological control methods natural enemies of pests can be artificially introduced. These bio insecticides are non-persistent, non-toxic and biodegradable. Bio herbicide involves the biological control of weeds by some living organisms. Integrated pest management, bioremediation and pest resistant crops help to increase productivity through organic farming.

Multiple cropping is the process of growing two or more different crops together in the same field is known as mixed or multiple cropping. It helps in restoring soil fertility as the products and waste material from one crop, help for the growth of other crops. Cotton and groundnut, maize and udid and soya bean are generally grown together in multiple cropping.

Crop rotation is the process in which different types of crops are grown alternately in the same field. Crop rotation by growing alternate leguminous crops of pulses or groundnut helps in making soil rich in nitrogen.

Application of biotechnology in crop improvement has proved useful since it has improved nutritional quality, better nitrogen fixation and production of disease resistant plants. Tissue culture technique and cell fusion are being used by agricultural bio-technologists for introducing the better characters in plants. Plant tissue culture technique is used to select somaclones that are resistant to herbicides. In cell fusion, chromosomes of different species can be combined particularly in those species which are otherwise incompatible.

In integrated agriculture, animal husbandry, poultry and bio gas are the most essential activities. Dairy farming which involves domesticating animals that give milk for commercial purposes. By making use of cow dung's and using decomposing waste materials, generation of bio gas through the bio gas plant is possible.