UG Programme

(Three Year Programme)

Curriculum, Programme Structure and Course Contents

(Prepared in conformity with LOCF) (2023-2024 onwards)

DEPARTMENT OF COMMERCE
Directorate of Distance and Continuing Education
Manonmaniam Sundaranar University
Tirunelveli - 627012

Course Objectives

1. **CO1:** To provide students with basic knowledge about the **multidisciplinary nature of environmental studies** and its significance.
2. **CO2:** To help students understand the **structure and functions of ecosystems** and ecological relationships.
3. **CO3:** To create awareness about **biodiversity, its importance, and conservation methods**.
4. **CO4:** To educate students about **various types of environmental pollution and their control measures**.
5. **CO5:** To make students aware of **social issues related to environment and sustainable development**.

Course Outcomes

At the end of the course, the students will be able to:

Course Outcome	Description	Bloom's Level
CO1	Explain the concept and importance of environmental studies and its multidisciplinary nature.	K2
CO2	Describe ecosystem structure, functions, and ecological balance.	K2
CO3	Identify biodiversity components and analyze conservation methods.	K3
CO4	Examine different types of environmental pollution and their preventive measures.	K4
CO5	Evaluate environmental issues and suggest sustainable solutions for environmental protection.	K5

CONTENTS

TEXT BOOKS

1. **Erach Bharucha**, *Environmental Studies*, Universities Press, Hyderabad.
2. **Anubha Kaushik & C.P. Kaushik**, *Environmental Studies*, New Age International Publishers, New Delhi.
3. **S.C. Santra**, *Environmental Science*, New Central Book Agency, Kolkata.
4. **R. Rajagopalan**, *Environmental Studies: From Crisis to Cure*, Oxford University Press, New Delhi.
5. **Benny Joseph**, *Environmental Studies*, Tata McGraw Hill Education, New Delhi.

REFERENCE BOOKS

1. **Miller, G.T. & Spoolman, S.**, *Living in the Environment*, Cengage Learning.
2. **Odum, E.P.**, *Fundamentals of Ecology*, W.B. Saunders Company.
3. **Cunningham, W.P. & Cunningham, M.A.**, *Principles of Environmental Science*, McGraw Hill.
4. **K.V.S.G. Murali Krishna**, *Environmental Studies*, Pearson Education.
5. **P.D. Sharma**, *Ecology and Environment*, Rastogi Publications.

OTHER SOURCES

1. **United Nations Environment Programme (UNEP)** – https://www.unep.org
2. **Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India** – https://moef.gov.in
3. **World Wildlife Fund (WWF)** – https://www.worldwildlife.org
4. **Environmental Protection Agency (EPA)** – https://www.epa.gov
5. **National Geographic Environment Resources** – https://www.nationalgeographic.com/environment

PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	2	3	2	2
CO2	3	2	3	2	3	2	3	2	3	2	2
CO3	3	2	3	2	3	2	3	2	3	2	2
CO4	3	2	3	2	2	2	3	2	3	2	2
CO5	3	2	3	2	2	2	3	2	3	2	2

TOTAL	15	10	15	10	12	10	15	10	15	10	10

UNIT 1

THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

CONTENTS

1.0 AIMS AND OBJECTIVES

After studying this unit, you should be able to:

- Define and explain the importance of environmental studies.
- Explain the various natural resources and the associated problems.

1.1 DEFINITION, SCOPE AND IMPORTANCE

Environment literally means surrounding in which we are living. Environment is the physical and biotic habitat that surrounds us.

Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non living component like soil, air and water.

Environmental studies is a multidisciplinary subject where different aspects are dealt with in a holistic approach. The science of environment studies comprises various branches of studies like chemistry, physics, life science, medical science, agriculture, public health, sanitary engineering, geography, geology, atmospheric science, etc. It is the science of physical phenomena in the environment. It studies the sources, reactions, transport, effect and fate of a biological species in the air, water and soil and the effect of and from human activity upon these.

1.2 NATURAL RESOURCES AND ASSOCIATED PROBLEMS

The natural resources include, air, water, soil, minerals, along with the climate and solar energy, which form the non-living or _abiotic' part of nature. The _biotic' or living part of nature consists of plants and animals, including microbes. Plants and animals can only survive as communities of different organisms. Thus, forests, grasslands, deserts, mountains, rivers, lakes and the marine environment all form habitats for specialised communities of plants and animals to live in. Interactions between the abiotic aspects of nature and specific living organisms together form ecosystems of various types.

1.3 FOREST RESOURCES

1.3.1 Use and overexploitation:

People who live in or near forests know the value of forest resources first hand because their lives and livelihoods depend directly on these resources. However, the rest of us also derive great benefits from the forests which we are rarely aware of. The water we use depends on the

existence of forests on the watersheds around river valleys. Our homes, furniture and paper are made from wood from the forest. We use many medicines that are based on forest produce. And we depend on the oxygen that plants give out and the removal of carbon dioxide we breathe out from the air.

1.3.2 Deforestation:

One of India's serious environmental problems is forest degradation due to timber extraction and our dependence on fuel wood. A large number of poor rural people are still highly dependent on wood to cook their meals and heat their homes. Deforestation is the cutting down of many trees and not replacing them. We must think about our future before cutting down acres of forests, without making plans to replace them.

1.3.3 Timber extraction:

Timber extraction, mining and dams are invariably parts of the needs of a developing country. If timber is overharvested the ecological functions of the forest are lost. Unfortunately forests are located in areas where there are rich mineral resources. Forests also cover the steep embankments of river valleys, which are ideally suited to develop hydro and irrigation projects. Thus there is a constant conflict of interests between the conservation interests of environmental scientists and the mining and irrigation Departments. What needs to be understood is that long- term ecological gains cannot be sacrificed for short-term economic gains that unfortunately lead to deforestation. These forests where development projects are planned, can displace thousands of tribal people who lose their homes when these plans are executed. This leads to high levels of suffering for which there is rarely a satisfactory answer.

1.3.4 Dams and their Effects on Forests and Tribal People:

Dams constitute a major direct and indirect cause of forest loss and most of them have resulted in widespread human rights abuses.

This lack of awareness can be explained by the fact that for many years large hydroelectric dams have been portrayed as synonymous with development. Another reason can be that most users of hydro-electricity live far away from the impacted areas and that the sites selected for dam building have been often those inhabited by indigenous people, tribal people, ethnic minorities and poor communities having little capacity of being heard by the wider national community.

The fact is that more than 40,000 large dams — those that measure more than 15 metres in height — are currently obstructing the world's rivers, whose reservoirs cover more than 400,000 square kilometers of land. These reservoirs have inundated millions of hectares of forests —

particularly in the tropics — many of which were not even logged and trees were left to slowly rot.

They have also resulted in deforestation elsewhere, as farmers displaced by the dams have had to clear forests in other areas in order to grow their crops and build their homes. Additionally, dams imply road building, thus allowing access to previously remote areas by loggers and ―developers‖, resulting in further deforestation processes.

However, the dam effects have included much more than forest loss and the major environmental changes have impacted on local people, at both the dam site and in the entire river basin. Not only are the best agricultural soils flooded by the reservoir, but major changes occur in the environment, where the river's flora and fauna begins to disappear, with strong impacts on people dependent on those resources.

At the same time, dams imply a number of health hazards, starting with diseases introduced by the thousands of workers that are brought in to build the dam (including AIDS, syphilis, tuberculosis, measles and others) and ending with diseases related to the reservoir itself (malaria, schistosomiasis, river blindness, etc.).

In far too many cases, dam-building has resulted in widespread human rights violations. As most of us would, local peoples have persistently resisted the destruction of their homelands and their forced ―resettlement.‖ As a result, they have had to face different types of repression, ranging from physical and legal threats to mass murders.

But resistance, consciousness and solidarity have grown. Local people have increasingly been able to organize themselves and to establish local, national and international alliances with other concerned organizations.

Major examples are the Narmada BachaoAndolan movement in India, the Bio Action Group in Chile, the Coalition of Concerned NGOs on Bakun in Malaysia, the People Affected by Dams movement in Brazil among many others. It has now become possible to stop large hydro dams. They are definitely not a symbol of development but one of economic and political power resulting in social and environmental degradation.

1.4 WATER RESOURCES

1.4.1 Use and over-utilization of surface and ground water:

The growth of human population and industries causes an increasing need for larger amount of water. Over utilization of fresh water leads to scarcity of water during summer months. Most people use water more than they need. Many farmers use water in surplus to grow crops

Surface water is found on the earth's surface in streams, rivers, lakes, ponds and reservoirs. The over utilization of surface water for agriculture, industries, domestic purposes etc., causes depletion of water level during summer.

Earth contains underground spaces that collect and store water in the underground. This water comes as rain that percolates into the soil and reaches down through cracks and spaces of sand. This can be used in drought periods. If water from the underground stores is used abundantly, the water table drops.

1.4.2 Floods:

Floods have been a serious environmental hazard. Deforestation is the main cause of floods. It damages crops, destroys homes and erodes the soil or land in the areas affected by flood. As the forests are destroyed, rain water no longer percolates into the sub soil. Hence, enormous quantities of rain water bearing large amount of top soil flow down very fast from the mountain side to plains. Thus river swell, burst their bank and cause flood which brings damage to agricultural farms, roads and homes.

1.4.3 Drought:

Drought is an unpredictable climatic condition and occurs due to the failure of monsoon rains. It varies in frequency in different parts of country. Several measures can be taken to minimize the serious impact of a drought. Good environmental management can reduce its serious consequences. Deforestation should be prevented in order to conserve rain water. Forests cover underground stores of water in natural aquifers during good monsoon. This can be used in drought periods. If water from the underground stores is used abundantly, the water table drops and vegetation suffers. Thus, the long term measures like soil, water management and afforestation can reduce the impact of drought.

1.4.4 Dams - Benefits and Problems:

Dams are constructed for storing huge quantities of water. These are used for irrigation, domestic and industrial purposes during the non monsoon seasons. Dams are also helpful to control floods.

Benefits of dams:

a) It provides adequate amount of water for agriculture.

b) It prevents river floods during monsoon seasons.

c) Dams are also useful for culture of fresh water fishes.

d) Dams supply water for hydro electricity generation.

Problems of dams:

a) The construction of large clams causes serious impact on the lives and cultures of tribal people. Tribal people are displaced during the construction of dams.

b) The streams of the forest carry large quantities of silt contents which are deposited in the dams. This leads to reduction in water holding capacity of dams.

c) The natural calamities like earthquake and heavy floods may cause breaches in the dams.

d) Construction of dams in the forest areas causes deforestation and depletion of natural resources like flora and fauna.

e) The heavy flow of water from dams causes fragmentation and physical transformation of rivers.

f) The emission of green house gases is released from dams due to rotting vegetation.

1.4.5 Water conservation:

Water is an important resource. Water is used for irrigation, industrial and domestic consumption. During dry months there is water scarcity in urban areas and even in places receiving heavy rainfall. Hence conservation of water is essential to tackle water problems.

Water conservation is needed to protect the agricultural crops during non monsoon period, to maintain regular supply of water to industries, rural and urban centres throughout the year.

Water conservation method:

Water conservation practices include the minimization of loss of water through evaporation, prevention of seepage of water and preservation of water in tanks, ponds, lakes, dams etc., to avoid scarcity of water during summer season. Check dams are constructed across small streams having gentle slopes. The site selected for check dams should have sufficient area to store water within a short time. Check dam is suitable for conservation of water in hilly and forest areas having small streams.

Small ponds and tanks are used as micro reservoirs for conserving the excess run off water during intense rainfall. They are subjected to seepage and evaporation losses. The seepage of water can be prevented by spreading thin layer of polythene sheets at the bottom layer of the ponds or lakes. Besides these, establishment of cement concrete linings in the bottom layer, the side walls of the ponds also minimize the seepage loss of water. Evaporation losses of water can be prevented by planting trees, herbs and shrubs in and around the ponds or lakes.

Rain water harvesting is another method of conservation of water. It is the process of collecting and storing rainfall in the dams, ponds and lakes for its effective utilization and conservation. It is a primary source of water. Rivers, lakes, ponds and ground water are secondary sources of

water. It is evident that, rain water is the primary source that feeds the secondary sources of water. Thus rainwater harvesting is an effective tool to utilize a large quantity of high quality water which otherwise goes as waste.

1.4.6 Watershed management:

The watershed is a drainage basin or catchment area in which water is drained by a stream or system of connecting streams. In this process water is stored (drained) in the water sheds and whenever water is required, it is discharged to the river or stream through a single outlet. A watershed may be spherical or rectangular or triangular in shape. The size of the watershed may be a few acres as in the case of small ponds or hundreds of square kilometers as in the case of the rivers or thousands of hectares as in the case of dams.

The task of watershed management includes the prevention of land erosion, periodical removal of excess silt content and weeds, conservation of natural resources etc., in the land covering the water sheds. Watersheds are helpful to store large quantity of quality water. Water discharged from the watershed can be used to irrigate the agricultural land during the non-monsoon seasons. Watersheds like rivers or lakes or dams can supply water for domestic consumption.

1.5 MINERAL RESOURCES

A mineral is a naturally occurring substance of definite chemical composition and physical properties. An ore is a combination of minerals from which metal can be extracted. This is used to manufacture various useful products.

1.5.1 Uses and exploitation of minerals:

Important metals like iron, aluminium, zinc, copper and manganese are used as raw materials in industries. Non-metal resources like coal, clay, cement, salt and silica are used to produce various products.

Minerals with special properties that humans used as ornaments are gold, silver, platinum, diamonds, emerald, rubies etc. Minerals in the form of oil, gas and coal were formed when ancient plants and animals were decomposed into underground fossil fuels.

Minerals and their ores are taken from the earth's interior surface. This process is known as mining. Mining operations are generally done through four stages.

The method of mining depends upon the presence of ore or mineral deposit nearer the surface or deep within the earth. Therefore mines are classified into surface mines and deep mines. The

metals and non-metals are mined differently as per the location of mineral deposits in the earth's interior surface.

1.5.2 Environmental effects:

Mining operations are considered as one of the main sources of environmental degradation. The extraction of minerals from the earth has a variety of environmental side effects. They are depletion of available land due to mining, pollution of land, water, air etc., which brings many damages to the environment.

Mining is a hazardous occupation. The dust produced during mining operations is injurious to health and causes lung diseases. Fumes generated by incomplete dynamite explosions are extremely poisonous to the miners and also it pollutes the environment. Methane gas produced from coal mines are hazardous to earth when it is released into the air.

1.6 FOOD RESOURCES

Food is a mixture of nutritive and non-nutritive substances. The main components of food are carbohydrates, fats, proteins, minerals, vitamins and water. These are supplied through cereals, pulses, oils, eggs, sweets, milk, meat, cheese and fruits. Our food comes from agriculture, fishing and animal husbandry.

1.6.1 World food problems:

Food is needed for healthy and productive lives. Most of the people live in rural areas of the poorest developing countries are considered as food deficient countries which cannot produce enough food or import enough food to feed the entire population. The two regions of the world with greatest food shortage are South Asia and Africa.

The average adult man requires 3000 kilocalories of food per day, whereas the average woman requires 2200 kilocalories of food per day. People who receive fewer calories than needed are undernourished. People should take enough calories of food with essential nutrients. Food with no essential nutrients in the diet will lead to malnutrition. Adults suffering from malnutrition are more susceptible to diseases. Children who suffer from malnutrition do not grow normally.

Producing enough food to feed the people is the greatest challenge in agriculture today because of population explosion.

Crop failures caused by drought and flood may result in severe food shortage (famine). Throughout human history, famine has struck one or more regions of the world every few years.

Food production is closely linked with population control and availability of water for farming.

1.6.2 Changes in agriculture:

Agriculture practices have transformed the landscape which has resulted in considerable environmental problems like soil erosion, depletion of soil nutrients etc. The use of chemical fertilizers and pesticides in the field also degrade the land and causes environmental pollution in air, water and soil. The intensive agricultural practices also cause the destruction of natural habitats like forest, wetlands etc.

Changing cultivation practices in agriculture causes environmental problems.

i) Shifting cultivation

This type of cultivation is generally practiced in the forest area where the rainfall is heavy. At first, the trees of the forest are cleared. Then, the land is used for cultivation of crops like cloves, cardamom etc. In this case, the natural ecosystem of the forest is disturbed which leads to environmental problems like soil erosion, floods etc.

ii) Sedentary cultivation

In this system, the natural ecosystem is permanently changed. The existing plants of the area are removed. Then this area is utilized for cultivation of food plants like maize, wheat, rice etc. This leads to depletion of nutrients and minerals in the soil.

iii) Crop rotation

This involves cultivation of different crops in the same field in a regular sequence for number of years. Nutrient consuming crops like cotton and maize are alternated with leguminous crops. This will enrich the nutrient depleted soil. In the following year, some other nutrient consuming crops like wheat, barley etc., can grow in the same field.

iv) Mono culture

This is the type of cultivation in which the same crop is cultivated year after year in the same field. The crop constantly depletes the same type of nutrients and minerals in the soil. This leads to complete exhaust of minerals in the soil. Hence, the soil becomes unfertile which is replenished by adding fertilizers in the soil.

v) Poly culture

This is the type of cultivation in which several crops are cultivated year after year in the same field. The crops constantly deplete several types of nutrients and minerals in the soil. If the soil is not supplied with adequate fertilizers, that soil become unfertile and the crop yields rapidly decline.

1.6.3 Effects of modern agriculture:

In recent years there has been a marked increase in agricultural productivity. Several high yielding varieties of crops have been produced. The higher yield of crop is achieved by the following factor

a) Use of high yielding better seeds

b) Cropping system

c) Timely irrigation input of adequate nutrients in the form of fertilizers (nitrogen, phosphate, potash etc.)

d) Proper plant protection measures like pest and disease control

Green revolution in our country leads to production of new high yielding varieties like wheat, rice, maize, sugarcane etc. Most of the new varieties are not season bound and can grow in any time of the year. They can be cultivated in rotation with other crops.

Crop rotation involves cultivation of different crops in the same field for a number of years. Nutrient consuming crops are alternated with leguminous crops which enrich the depleted soil with nutrients. Aeration, texture and fertility of the soil can be improved by ploughing the fields. Regular cultivation of crops in the fields is helpful to check the soil erosion in the field.

In mountain ranges, a large sloping drainage area is divided into a number of small flat fields called terraces which slow down the speed of runoff water and hold the water longer in the land. This results in higher crop yields.

Excessive use of chemical fertilizers in agricultural fields leads to alteration of soil composition. The soil becomes acidic and not utilized for further cultivation of crops.

1.6.4 Fertilizer-pesticide problems:

The excessive use of nitrogenous fertilizers in lands causes accumulation of nitrate in the soil which are transferred to man through food chain. In human body nitrates are converted into nitrosoamines which causes diseases like diarrhoea and blue jaundice in children and stomach cancer in man. The excessive use of potassium fertilizers in the soil depletes the ascorbic acid (vitamin C) and carotenes. This leads to the production of large sized vegetables and fruits which are more prone to diseases and pest attack. It is evident that there is 20% to 30% decline in protein content when crops like wheat, maize, corn etc., are grown on soils with NPK fertilizers (Nitrogen, Phosphate and Potash).

Although pesticides have their benefits, they are accompanied by several problems. Many pest species evolve resistance to pesticides after repeated exposure to them. Pesticides also attack beneficial insects in addition to the target pests which generate imbalances in the ecosystem. The

survey conducted by Indian Council of Medical Research reveals that the excessive residues of DDT, Benzene hexachloride are detected in cow milk, fruits, vegetables, rice, wheat, maize etc. This leads to contamination of food and causes major health hazards to human beings and domestic animals.

1.7 ENERGY RESOURCES

Energy is defined as the capacity to do work. Energy is found on earth in a variety of forms, some of which are immediately useful to do work, while others require transformation. The sun is the primary source of energy (solar energy). Plants depend on sunlight for their growth. Energy from the sun evaporates water from lakes, ponds, rivers, oceans to form clouds that turn into rain. Chemical energy is obtained by breaking chemical compounds in the presence of oxygen. Electrical energy is produced with the help of coal, nucleus of an atom, solar rays, water etc.

1.7.1 Growing energy needs:

Energy has always been closely related to the economic growth and development. The excessive energy utilisation leads to long term ill effects on society. Electricity is at present used by the large number of people worldwide and hence demand for electricity has tremendously increased.

1.7.2 Renewable energy sources:

The sources of energy which are being continuously produced in nature are known as renewable sources of energy.

Example: wind energy, solar energy, tidal energy, bio gas, hydro electric power geothermal energy, bio mass energy etc.

i) Solar energy

Sun gives us energy in the form of solar radiations. These radiations can be converted into other forms of energy such as heat or electricity which can be utilised by men. Solar energy is collected by several methods for heating water, generating electricity, cooking food etc.

a) Solar water heating: Most solar water heating unit comprises of the solar energy collector and storage tank. The solar energy collector is in the form of black flat plate or rectangular box with a transparent glass cover that face the sun. Small metal tubes run through the box, which carry the water to be heated. The metal tubes of the collector are connected by a pipe to an insulated storage tank. The solar energy collector absorbs solar radiation and transfers the heat into the water circulating in the tubes. Thus, the water found in the circulating tube is heated up.

b) Solar cookers: The heat produced by the sun can be directly used for cooking using solar cookers. A solar cooker is a metal box which is black inside to absorb and retain heat. The lid has a reflective surface to collect the heat from the sun into the box. The box contains black vessels in which the food to be cooked is placed.

ii) Wind energy

Wind energy conversion devices like wind turbines are used for converting wind energy into mechanical energy. Wind turbines consist of a few blades rotating from central axis. When wind blows against the blades, they rotate about the axis. By connecting the wind turbine to an electric generator, wind energy can be converted into electric energy.

iii) Biogas

Biogas is produced from plant material, animal waste, garbage waste etc. It is a mixture of gases which includes methane, carbon dioxide, hydrogen sulphide and water vapour. In this mixture, methane burns easily. The biogas plants use cow dung, which is converted into gas. It is used as a fuel for cooking purposes.

1.7.3 Non renewable energy sources:

The energy sources which cannot be reused are called non renewable energy. It consists of the mineral based hydrocarbon fuels like coal, oil and natural gases. Non renewable sources of energy like oils and minerals will be exhausted if we continue to extract these without a concern for subsequent generations.

1.7.4 Alternate energy sources:

The energy sources that are other than those derived from fossil fuels are called alternate energy sources. They are typically used interchangeably for renewable energy sources. Example: Wind energy, solar energy, biomass energy, tidal energy, wave energy, geothermal energy etc.

1.8 LAND RESOURCES

Land is a major constituent of the earth. Landforms such as hills, valleys, plains, river basins and wetlands include different resource generating areas. The people and other animals depend on these resources for their living. The roots of trees and grasses bind the soil. If the forests are depleted or the grasslands overgrazed, the land become unproductive and wasteland is produced. Intensive irrigation leads to water logging and salination, on which crops cannot grow. Land is also transformed into non renewable resource when highly toxic industrial wastes are dumped on it.

Man needs land for building houses, cultivating food, maintaining pastures for domestic animals. Adequate area of land is also required for developing industries, creating towns and cities. Man needs to protect the natural areas of the land such as forests, grasslands, wetlands, mountains, coasts etc., to protect our valuable biodiversity.

1.8.1 Land degradation:

The intense utilisation of farmlands causes degradation of farmlands. When soil is used more intensively by farming, it is eroded more rapidly by wind and rain. Over irrigation of farmland leads to salinisation and the subsequent evaporation of water brings the salts to the surface of the soil. This retards the growth of crops and crop roots are severely affected. The use of more and more chemical fertilizers pollutes the soil. Hence, the land becomes unsuitable for agriculture. The conversion of agriculture land and forest land for human settlements also leads to shrinkage of valuable land resources. This is a serious loss and has long term ill effects on the environment.

1.8.2 Man induced landslides:

The term landslide means the downward movement of several kinds of rocks, soil, debris and other materials from the slopes of a fragile mountain. Landslide may occur due to some natural reasons as well as manmade activities. Unaltered hilly terrain is essential for maintaining the rock soil integrity in the mountain. Construction of roads and dams on the hills alter the rock-soil integrity. Blasting carried out during these operations form cracks in rocks. This gives way for landslides. Terrace cultivation carried out by removing top soil and vegetation layer of the mountain slopes loosens the rocks and boulders from their stable state. As a result, after a heavy rain or slight earthquake, the durability of slopes totally breaks down and results into dangerous landslide.

The running rain water during rainy season in the hills is obstructed from its normal downward flow due to the indiscriminate house building in the foot hills. This causes stagnation of rainwater. In due course, this stagnant water looses the gravels and soil supporting large rocks causing landslide.

1.8.3 Soil erosion:

Loss or removal of the top layer of the soil by the action of water, wind or by the activities of men is termed as soil erosion. The factors which influence the soil erosion in the land are due to the heavy rainfall, the slope of the ground, the nature of the soil and the vegetation cover.

a) The soil is unable to absorb the heavy rainfall. This leads to heavy flow of water which removes the superficial layer of soil and results in soil erosion.

b) If the land has steep slopes, the infiltration of rainwater decreases. This causes rain water to flow much faster and results in soil erosion.

c) Rain falling on the bare land where there is no vegetation causes severe soil erosion because the top soil is loose and it is easily carried away by rain water.

1.8.4 Desertification:

Increasing human population has put a great pressure on the land. Vast areas of land have been cleared for cultivation of agricultural crops. The destruction of nature vegetation results in accelerated soil erosion. This leads to removal of the top fertile soil which results in the loss of soil productivity and the formation of deserts. Wind causes the shifting of sand dunes from one place to another. This also leads to conversion of the fertile land into deserts. Excessive grazing by livestock is another factor resulting in desertification.

Check your progress

1. The physical and biotic habitat that surrounds us is----------.
2. Naturally occurring substance of definite chemical composition is known as ----------.
3. Cultivation of different crops in the same field in a regular sequence for number of years is
4----------is the primary source of energy.
5. Removal of the top layer of the soil by the action of water, wind etc., is termed as ----------

LET US SUM UP

Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component or non living component. The natural resources on which we are dependent include air, water, soil, minerals, along with the climate and solar energy, which form the non-living or _abiotic' part of nature. The _biotic' or living part of nature consists of plants and animals, including microbes.

Over utilisation of any of these resources causes environmental degradation. The awareness must be created to minimize the risk.

KEY WORDS

Environmental studies: It is a multidisciplinary subject which comprises various branches of studies like chemistry, physics, life science, medical science, agriculture, public health, sanitary engineering, geography, geology, atmospheric science etc.

Natural resources: Air, water, soil, minerals, along with the climate and solar energy are the non-living part of nature. The living part of nature consists of plants and animals, including microbes.

QUESTIONS FOR DISCUSSION

1. Explain deforestation and timber extraction.
2. What are the benefits and problems of dams?
3. Discuss the **e**ffects of modern agriculture.
4. What arerenewable energy sources? Explain.
5. Give a brief account of land degradation and soil erosion.

Check your progress:

Answer

1. Environment
2. Mineral
3. Crop rotation
4. Sun
5. Soil erosion

SUGGESTED READINGS

1. Text book of Environmental Chemistry, BalramPani, I. K. International Publishing House Pvt. Ltd.
2. Fundamental Concepts of Environmental Chemistry, G. S. Sodhi. Third Edition. Narosa Publishing House.
3. Environmental Chemistry.A. K. De. Seventh Edition. New age international Pvt. Ltd .
4. Environmental Studies, Dr. R. J. Ranjit Daniels, Dr. JagadishKrishnaswamy. Wiley India Pvt. Ltd.
5. A Text book of Environmental Chemistry and Pollution Control, Dr. S. S. Dara, Dr. D. D. Mishra. S. Chand & Company Ltd.

UNIT I – The Multidisciplinary Nature of

Environmental Studies

S.No	Question	Marks	Bloom's Level
1	Define Environmental Studies.	5	K1
2	State the importance of Environmental Studies.	5	K2
3	What is meant by natural resources?	5	K1
4	Explain the scope of Environmental Studies.	5	K2
5	List the components of the environment.	5	K1
6	Explain the multidisciplinary nature of Environmental Studies.	8	K2
7	Discuss the importance of environmental awareness in modern society.	8	K3
8	Explain the classification of natural resources with examples.	8	K3
9	Analyze the role of environmental education in sustainable development.	8	K4
10	Evaluate the importance of environmental protection in present times.	8	K5

UNIT

2

ECOSYSTEMS

CONTENTS

2.0 AIMS AND OBJECTIVES

After studying this unit, you should be able to:

- Explain the various ecosystems.
- Describe the energy flow in the ecosystem.
- Explain food chain, food web and ecological pyramids.

An ecosystem is all the living and non-living things in a particular area.

2.1 FOREST ECOSYSTEM

Forest is a natural ecosystem consisting of dense growth of trees and wild animals. About 40% of our land is occupied by forests. Wherever moisture is sufficient and temperature is not too low, that area is occupied by forests. The forests in India occupy an area little more than 1/10 of the total land. Depending upon temperature, available water and soil conditions, forests are broadly divided into five types

a. Tropical forests
b. Subtropical forests
c. Temperate forests
d. Alpine forests
e. Scrub jungle

Abiotic components:

In forest ecosystem organic and inorganic substances, light, temperature, soil, rainfall etc. form the abiotic components for their growth.

Producers:

Forest trees, shrubs and herbaceous plants are producers. They synthesize their own food by photosynthesis.

Consumers:

Ants, flies, elephant, beetles, deer etc., eat plant products. So they are primary consumers. Snakes, birds, lizards, fox etc., consume on herbivores. So they are called secondary consumers. The tertiary consumers include lion, tiger, leopard etc.

Decomposers:

Microbes such as fungi, bacteria and actinomycetes form decomposers. During decomposition of organic materials, they are transformed into inorganic minerals, which are further utilized by the producers for their growth. The types of producers and consumers living in forests differ depending on nature and types of forests.

2.2 GRASSLAND ECOSYSTEM

The plain lands occupied by grasses characterize the grasslands. Grasses form the climax community in this ecosystem.

Producers:

Trees are generally absent, if present, they grow along stream banks. Tall, medium and short grasses are abundant. These are producers, which capture the solar energy and produce food for the other animals of the ecosystem.

Consumers:

As grass forms the major habitat, grazing animals are abundant. The soil is rich in humus. Bison, wild horses, ass, zebra, ground squirrel are the herbivores. Prairie dogs, snake, buffalo etc., are the carnivores.

Decomposers:

The microbes such as fungi, bacteria and actinomycetes in the soil play an important role in decomposing the dead plants and animals and thus circulating the nutrients back into the ecosystem. It is evident that the type of producer and consumer differs depending on the type of grassland.

2.3 DESERT ECOSYSTEM

The desert ecosystem is a large wasteland where the availability of water is very low.

Abiotic components:

The abiotic factors influencing the desert ecosystem are water, air, light, temperature, humidity etc. Generally the desert ecosystem is always dry due to very low availability of water.

Producers:

Plants, which can adapt to the climatic conditions of the desert, can only live in the desert. Hence xerophytic plants form climax community in this ecosystem. Cacti are abundant. These succulent plants adapt themselves to the ecosystem and prepare food for the rest of the trophic levels of the ecosystem.

Characteristics of vegetation in desert ecosystem;

a. Trees and bushes are scarcely distributed.
b. Trees grow upto 30 m height.
c. The plants are spinous in nature.
d. The plants spread their root system near the top soil.
e. The stem and leaves are succulent.
f. The vegetation is of open canopy type.

Consumers:

Herbivores such as camel, sambar deer, kangaroo, rats, etc., are common in the deserts. The carnivores, which are predominant in this ecosystem, are red jungle cats, oryx, wolf, bats, ant eater etc.

Decomposers:

Microbes, which are tolerant to high temperatures, survive in this ecosystem. They decompose the organic wastes into inorganic nutrients. Sahara, Gobi, Kalahari, Thar etc., are the major desert ecosystems.

2.4 AQUATIC ECOSYSTEM

2.4.1 Pond ecosystem

A pond is a good example for fresh water ecosystem.

Characteristic features of pond ecosystem

i) Ponds are smaller in size with shallow and standing water with low salinity.

ii) As the pond is shallow, light penetrates up to bottom. Hence, plants can grow on the bottom.

iii) Hydrogen ion concentration (pH) varies from 6 to 9.The dissolved oxygen is less.

Structure of pond ecosystem

Abiotic components: The abiotic components are water, temperature, light, pH, pressure, inorganic compounds, organic compounds, oxygen, carbon dioxide etc.

Biotic components: The biotic component of pond ecosystem are producers, consumers and decomposers.

a) Producers: The major producers in pond ecosystem are phytoplanktons and other aquatic plants. The aquatic plants are either floating or submerged or rooted at the bottom (Azolla, Hydrilla, Pistia, Lemna, Eichhornia etc. The green plants convert the sunlight into chemical energy through photosynthesis and store in the form of food. It is utilised by the primary consumers. During photosynthesis, oxygen is evolved. This oxygen is used by all living organisms of pond ecosystem.

b) Consumers: These are all heterotrophic organisms.

They are as follows

i) Primary consumers: The animals which feed on green plants (producers) are called primary consumers. They are also known as herbivores. Example: Tad pole(larvae of frogs), zooplanktons such as Brachionus, Cyclops, Daphnia etc.

ii) Secondary consumers:These are carnivores which feed on the herbivorous animals. Example: Small fishes, water beetles feed on zooplanktons, frogs etc.

iii) Tertiary consumers: They are the top camivores which feed on the secondary consumers. Example: Large fishes, water birds, crocodiles,snakes etc.

c) Decomposers: A large number of bacteria and fungi decompose the dead bodies of aquatic plants and animals. Theyconvert the complex organic substances into simpler inorganic compounds and micro elements.

Example: Fungi such as Aspergillus, Pythium, Rhizopus, Penicillium, Fusarium etc.

2.4.2 River ecosystem

River is included under running water systems.

Characteristic features of river ecosystem

i) River is characterised by the movement of water.

ii) The velocity of water now varies greatly in different parts of the same river or stream.

iii) The oxygen content is higher.

iv) The animals in river ecosystem have streamlined body and swim against thewater current. Many animals have sticky under surfaces by which they adhere to the surface (snails and flatworms).

Structure of river ecosystem

Abiotic components: The abiotic components are light, temperature, dissolved oxygen, pH, organic and inorganic compounds, pressure etc.

Biotic components:

a) Producers: The producers of river or stream ecosystem are phytoplanktons like filamentous algae, green algae and a few rooted hydrophytes.

b) Consumers: They are heterotrophic organisms.

i) Primary Consumers: The organisms which feed on producers are called primary consumers (Herbivores).

Example: Zooplanktons like Brachionus, Cyclops and Daphnia, aquatic insects like Nepa and Ranatra

ii) Secondary consumers: They are carnivorous animals which kill and eat the primary consumers. Example: Hydra, Sponges, Snails, Frogs, Small fishes etc.

iii) Tertiary consumers: These are top camivores which feed on the secondary consumers. Example: large fishes, snakes etc.

c) Decomposers: Some bacteria and fungi decompose the dead plants and animals, they convert the complex organic substances into simpler inorganic compound. They are utilised by the producers.

2.4.3 Marine(Ocean) ecosystem

Approximately 70 percent of earth's surface is covered by oceans. Major oceans of the world are Indian ocean, Pacific ocean, Atlantic ocean, Arctic ocean etc.

Characteristic features of ocean ecosystem

i) The ocean is the largest ecosystem in the earth. It is covering about 70 percent of the earth's surface.

ii) The ocean is deep and continuous. All oceans are connected.

iii) Salinity of the ocean is very high. The average salinity is about 35 parts of salt per 1000 parts of water. The chief salts are chlorides, sulphates, carbonates, bicarbonates of sodium, magnesium, calcium, potassium etc.

iv) Waves are the more important physical features of the ocean. The water from one part of ocean moves to other part of the ocean. This movement of water is called ocean current.

vi) Tides are caused by the gravitational pull of sun and the moon. This leads to rise and fall in the level of ocean.

Structure of ocean ecosystem

Abiotic components: The abiotic components of ocean ecosystern are light, temperature, minerals, salinity, pH, pressure etc.

Biotic components:

i) Producers: The main producers in ocean ecosystem are phytoplanktons such as diatoms, dinoflagellates and algae. They are found floating on the surface of the ocean. They entirely depend on the abiotic substances for the preparation of food.

ii) Consumers: They depend on producers for their food.

a) Primary consumers:They are herbivorous animalsthat feed directly on producers.

Example: Crustaceans, Molluscs and small fishes.

b) Secondary consumers: They are carnivorous fishes which feed on the herbivorous animals.

Example: Squids, Sepia etc.

c) Tertiary consumers: These are also called as top carnivores. They prey upon the secondary consumers.

Example:Shark, Whale etc.

iii) Decomposers: The microbes such as bacteria and some fungi are active in the decay of dead plants and animals.

2.4.4 Estuarine Ecosystem

An estuary is a meeting point of river and sea. In the estuaries the river water mixes with the sea water. Hence the salinity is intermediate between river water and sea water. Thus, estuaries are considered as the transitional zones between river and sea.

Characteristic features of an estuary

i) Estuary is the meeting place of river water and sea water. River water carries more nutrients and sediments. Hence, the estuary is enriched by various kinds of nutrients.

ii) In estuaries salinity variations occur during tides and seasons. Fresh water flow into the estuary is less during summer. Hence salinity is higher during summer. During monsoon seasons more fresh water enters in to the estuary. Hence the salinity is less in the estuary. Moreover, at the time of high tide more sea water flows towards estuary and the salinity is higher. During low tide salinity is low because less sea water flows into the estuary. The salt water concentration (salinity) is less in the surface and gradually increased towards the bottom.

iii) Temperature fluctuates daily and seasonally in the estuarine ecosystem. The surface layer of water is warm and the bottom layer is cold

iv) The occurrence of waves in the sea carries nutrients from sea to the estuary. Thus the estuary is enriched with various nutrients.

v) Estuarine water is always turbid. This is due to the high silt content. It prevents the penetration of light and affects the growth of phytoplankton in the deep waters.

Structure of an estuarine ecosystem

Abiotic components: The chief substances are light, temperature, pH of water, organic and inorganic compounds, minerals etc.

Biotic components:

i) Producers: These are green plants and some photosynthetic bacteria. The producers fix solar energy with the help of chlorophyll.

ii) Consumers:

a) ***Primary consumers:*** These are herbivores feeding directly on living plants. Example: Zooplanktons, Molluscs, small fishes etc.

b) Secondary consumers: These are carnivores feeding on the herbivorous animals. Example: large fishes.

c) Tertiary consumers: These are top carnivorous animals feeding on secondary consumers.

Example: Crocodiles, snake etc.

iii) Decomposers: They are microbes such as bacteria and some fungi which decompose dead plants and animals.

2.5 ENERGY FLOW IN THE ECOSYSTEM

Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. Organisms get energy in different ways. Some organisms get energy directly from the sun, while others must eat plants or animals.

At the first trophic level, primary producers (plants, algae, and some bacteria) use solar energy to produce organic plant material through photosynthesis. Herbivores—animals that feed solely on plants—make up the second trophic level. Predators that eat herbivores comprise the third trophic level. If larger predators are present, they represent still higher trophic levels. Organisms that feed at several trophic levels (for example, grizzly bears that eat berries and salmon) are classified at the highest of the trophic levels at which they feed. Decomposers, which include bacteria, fungi, molds, worms and insects, break down wastes and dead organisms and return nutrients to the soil. On average about 10 percent of net energy production at one trophic level is passed on to the next level. Processes that reduce the energy transferred between trophic levels include respiration, growth and reproduction, defecation, and non predatory death (organisms that die but are not eaten by consumers).

2.6 ECOLOGICAL SUCCESSION

Communities in any area are not stable. They change from time to time and from one form to another form of community. Thus in a particular area one community may be replaced by another community or by a series of communities. A pond community may gradually change into a grassland community or even forest community. The orderly and progressive replacement of one community by another till the development of stable community in that area is termed as ecological succession.

Ecological succession may be primary or secondary. If community development starts on a sterile area, which has not been occupied by any community previously the succession is called primary succession. For example, the colonization of a newly discovered island. When

succession starts on sites previously occupied by well developed communities, the succession is called secondary succession. e.g. development of community in deforested areas.

If succession starts from water bodies, it is called hydrarch succession, but if it starts from bare rocky areas it is termed Xerarch succession.

When plant succession starts on a wet area, it is called hydrosere succession. When plant succession starts on a dry area it is called xerosere succession.

2.7 FOOD CHAINS

The biotic factors of the ecosystem are linked together by food. For instance the herbivores eat the plants, the herbivores form the food for carnivores. Thus the sequence of the eater being eaten is called food chain.

Producers → Herbivores → Carnivores

The various levels in a food chain are called trophic levels. Due to repeated eating and being eaten, the energy is transferred from one trophic level to another.

Example: Food chain in a pond.

Algae + Phytoplankton → Zooplankton → Fish → Snakes.

2.8 FOOD WEBS

In an ecosystem the various food chains are inter connected with each other to form a network called food web. Many food chains interlock to form food web. This is because each organism obtains food from one or more trophic levels. In other words, one organism form food for more than one organism of the higher trophic level.

2.9 ECOLOGICAL PYRAMIDS

The number, biomass and energy of organisms gradually decrease from the producer level to the consumer level. This can be diagrammatically represented in the form of a pyramid called ecological pyramid. The use of ecological pyramid was first described by Charles Elton in 1927. Ecological pyramid is the graphic representation of the number, biomass and energy of the successive trophic levels in an ecosystem. There are three types of ecological pyramids.

a) **Pyramid of number:** The number individuals at the trophic levels decrease from the producer level to the consumer level. In an ecosystem, the number of producers is far

high. The number of herbivores is lesser than the producers. Similarly the number of carnivores is lesser than the herbivores.

b) **Pyramid of biomass:** Biomass refers to the total weight of living matter per unit area. In an ecosystem, the biomass decreases from the producer level to the consumer level.

c) **Pyramid of energy:** The energy flows in an ecosystem from the producers to consumers. At each level 80-90% of energy is lost. Hence the amount of energy decreased from the producers level to the consumers level.

Check your progress

1. The plain lands occupied by grasses characterize the---------- --.
2. Xerophytic plants form climax community in ---------- ecosystem
3. Primary producers use ---------- energy to produce organic plant material through photosynthesis.
4. If succession starts from water bodies, it is called ---------- succession.
5. The number of carnivores is lesser than the number of ---------- --.

LET US SUM UP

An ecosystem is all the living and non-living things in a particular area**.** Forest, grassland, desert and aquatic ecosystem are present in our environment. Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. The orderly and progressive replacement of one community by another till the development of stable community in that area is termed as ecological succession.

The biotic factors of the ecosystem are linked together by food. The sequence of the eater being eaten is called food chain.

KEY WORDS

Ecosystem: An ecosystem is all the living and non-living things in a particular area.

Energy flow in the ecosystem: Energy from the sun enters the living animals through photosynthetic plants. This energy passes from one animal to another in the form of food.

Ecological pyramid: The number, biomass and energy of organisms gradually decrease from the producer level to the consumer level. This can be diagrammatically represented in the form of a pyramid called ecological pyramid

QUESTIONS FOR DISCUSSION

1. Explain forest ecosystem.
2. Discuss the various biotic and abiotic components of pond ecosystem.
3. Explain the ecological succession.
4. Discuss the desert ecosystem.
5. Give a brief account of food chain and food web.

Check your progress:

Answer

1. Grasslands
2. Desert
3. Solar
4. Hydrarch
5. Herbivores

SUGGESTED READINGS

1. Environmental Studies, Dr. R. J. Ranjit Daniels, Dr. JagadishKrishnaswamy. Wiley India Pvt Ltd
2. A Text book of Environmental Chemistry and Pollution Control, .Dr. S. S. Dara, Dr. D. D. Mishra. S. Chand & Company Ltd.
3. Environmental Studies, Rev. Fr. Ignacimuthu, MJP Publishers.

UNIT II – Ecosystems

S.No	Question	Marks	Bloom's Level
1	Define ecosystem.	5	K1
2	What are the components of an ecosystem?	5	K1
3	Write a short note on food chain.	5	K2
4	What is ecological pyramid?	5	K1
5	Explain the concept of food web.	5	K2
6	Explain the structure and functions of an ecosystem.	8	K2
7	Discuss the different types of ecosystems.	8	K3
8	Explain energy flow in an ecosystem.	8	K3
9	Analyze the role of producers, consumers, and decomposers.	8	K4

S.No	Question	Marks	Bloom's Level
10	Evaluate the importance of ecosystem balance.	8	K5

UNIT

3

BIODIVERSITY AND ITS CONSERVATION

CONTENTS

3.0 AIMS AND OBJECTIVES

After studying this unit, you should be able to:

- Define genetic, species and ecosystem diversity.
- Explain India as a mega-diversity nation.
- Describe the hot-spots and threats to biodiversity.
- Differentiate In-situ and Ex-situ conservation of biodiversity

3.1 INTRODUCTION

The great variety of life on earth has provided food and medicine for human need over thousands of years. This diversity of living creatures forms a support system in the earth. This has been used by each human generation for its growth and development. The people of ancient period had used this gift of nature carefully and sustainably survived. But the modern society has over

used or misused the biodiversity. This leads to disintegration of many useful animals, birds, plants etc., from the earth.

Definition:

The United Nations Convention on Biological Diversity states that biodiversity is the variety among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part includes diversity within species, between species and ecosystems. Biodiversity may also be defined as the sum total of species richness,that is the number of species of plants, animals and microorganisms occurring in a given region, country, continent or worldwide. There are three kinds of biodiversities namely genetic diversity, species diversity and ecosystem diversity.

i) Genetic diversity

The presence of variety of genes within species or within population which give every individual specific characteristics. This is known as genetic diversity. Each member of any plant or animal species differs widely from other individuals in its genetic make up. This leads to development of specific characteristics among every individual. For example, each human being is very different from all others. This genetic variability is essential for healthy breeding population of a species. If the number of breeding and individual is reduced, the dissimilarity of genetic makeup is reduced and inbreeding occurs. As a result, this can lead to extinction of species. The diversity in wild species forms the gene pool from which our crops and domestic animals have been developed over thousand of years. Today, modern biotechnology manipulates genes for developing better types of medicines and a variety of industrial products.

ii) Species diversity

The variety of species of plants and animals that are present within a region is referred as species diversity. This type of diversity is found in natural ecosystems and agricultural ecosystems. Some areas are richer in species than others. The natural undisturbed tropical forests have a much greater species richness than plantations. Modern agricultural ecosystems have a relatively lower diversity of crops than traditional farming system, where various types of crops were planted. The areas that are rich in species diversity are called hot spots of diversity.

iii) Ecosystem diversity

The presence of variety of animals and plant within and among ecosystems of the earth constitutes ecosystem biodiversity. There are a large variety of different ecosystems on earth. They have their own distinctive inter related species based on the differences in the habitat. The distinctive ecosystem of the earth includes forests, grasslands, deserts, lakes, ponds, ocean etc.

Each ecosystem is disturbed by human activities. They change natural ecosystem for the development of farmland and urban areas. If the natural ecosystems are not used in a proper manner, their productivity eventually decreases and they are then said to be degraded.

3.2 BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

India is having a geographical area of 32, 87, 591 square kilometer. The land frontier of the country is about 15, 200 kilometer long. Our country can be divided into ten major regions, based on the geography, climate and pattern of vegetation and the communities of amphibia, reptiles, birds, mammals and other invertebrates that live in them. Each of these regions contains a variety of ecosystems such as forests, grasslands, lakes, rivers, wetlands and hills. They are having specific plants and animals.

Biogeographical classification of India

i) The cold mountains snow covered trans Himalayan region of Ladakh

ii) The Himalayan ranges and valleys of Kashmir, Himachal Pradesh, Uttarakhand, Assam and north eastern states.

iii) The Terai, the low land where the Himalayan rivers flow into the plains.

iv)TheGangetic and Brahmaputra plains.

v) The Thar desert of Rajasthan.

vi)The semi grassland region of Deccan Plateau, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamilnadu.

vii) The northeastern states of India

viii) The Andaman and Nicobar islands.

ix) The Western Ghats in Maharashtra, Karnataka and Kerala.

x) The long eastern and western coastal regions with mangroves, forests and sandy beaches.

3.3 VALUES OF BIODIVERSITY

Biodiversity is essential for preserving ecological processes such as fixing and recycling of nutrients, soil formation, circulation and cleaning of air and water. Food, clothing, housing, energy, medicines etc., are important resources that are directly or indirectly linked to the biological variety present in the biosphere. Therefore, conservation of biological resources is essential for the well being and the long term survival of rnankind. The biodiversity provides valuable things and are very helpful to the mankind. They are as follows.

i) Consumptive value

The biodiversity of the ecosystem supplies variety of food and other essential materials to the living organism to maintain their life activities in the earth. The biodiversity of forest ecosystem provides food, firewood, fodder, medicines and variety of other products to human beings for their daily. The biodiversity of aquatic ecosystem (lake, pond, ocean etc.) gives variety of edible fishes, aquatic animals and plants for the survival of mankind.

ii) Productive values

The biodiversity provides various commercial products such as food grains, timber, fish, ivory, medicinal plants etc., to human beings. By selling these valuable products of the biodiversity in the market, people get constant income for their survival. The biotechnological research on genetic properties of plants and animals can be used to develop better varieties of crops and livestock. To pharmacist, biological diversity is the raw material from which new drugs can be synthesized from plant or animal products. To industrialist, biodiversity supplies rich source of raw material from which new products are developed.

iii) Social values

The traditional societies with small population required less resources. Hence they preserved their biodiversity as a life supporting resources. The modern man has depleted the resources of biodiversity. This is the main cause for the extinction of several species of plants and animals, which leads irrecoverable loss to mankind. The rich people of the society use more and more resources of the biodiversity than the poor. The traditional societies preserved the biodiversity to a great extent by knowing its value. They also understood that its depletion would be great loss to their society.

iv) Ethical values

Ethical values of biodiversity protection are based on the importance of protecting all forms of life. All plants and animals have an equal right to live and to exist on earth. Human beings are only a small part of the earth's big family of species. It is associated with the sanctity of all forms of life. Indian civilization has over several generations protected nature through local traditions. In India, a large number of sacred groves protected by tribal people are existing around the ancient sacred sites which are acting as gene banks of wild plants.

v) Aesthetic values

Biodiversity is a beautiful and wonderful aspect of nature. The beauty of nature encompasses every aspect of living and nonliving part of our earth. One can appreciate the magnificence of a mountain, the power of sea, the beauty of a forest and the vast expanse of desert. These natural

regions inhabited by several beautiful plants and animals which provide recreation. In addition, the psychological and physical health of the human also improved watching birds, animals and fishes.

3.4 BIODIVERSITY AT GLOBAL, NATIONAL AND LOCAL LEVELS

Millions of species are identified by scientists in the world. The majority of species are yet to be discovered. The developing nations such as India, Sri Lanka, Pakistan, Malaysia, Singapore, South Africa etc., possesses rich biodiversity than the developed nations like America, France, Italy, United Kingdom etc. Majority of the developed nations are exploiting valuable plants and animals from the biodiversity. These nations however have low levels of biodiversity. Thus the developed nation has come to support the concept that biodiversity must considered to be a global resource. Therefore, biodiversity at global level should form a common property resource to be shared by all nations.

Countries with biodiversities higher than India are located in Brazil, Indonesia and Malaysia. The species found in these countries are completely different from our own. Hence, it is essential to preserve our valuable biodiversity. Some of the mega diversity nations of the world have developed the technology to exploit their species for biotechnology and genetic engineering. These technologies are used to produce new variety of species, drugs and other useful products which are beneficial to mankind. India also developed various biotechnological research stations all over the country.

Everywhere in the world, the value of biodiversity rich natural areas is being recognized as unimaginable value. International convention of World Heritage makes effort to protect such areas. India has included several protected areas as World Heritage sites. These include Sunderbans in West Bengal, Nandadevi in the Himalayas, Manas on the border between Bhutan and India, Kaziranga in Assam and Bharatpur in Uttar Pradesh. India has also signed the convention in the trade of endangered species. This is intended to reduce the utilization of endangered plants and animals by controlling trade in their products.

3.5 INDIA AS A MEGA DIVERSITY NATION

India has been recognised as one of the world's top mega diversity nations. Our country has great variety of plants and animals, many of which are not found elsewhere. Among the known diversity of plant species, most are angiosperms, ferns and orchids. It is estimated that 18% of

Indian plant species are endemic to the country. These are not found elsewhere in the world. Among amphibians found in India, 62% are unique to this country. There are 153 species of lizards recorded in our country, of these 50% are endemic.

India also has a great diversity of cultivated crops and breeds of domestic livestock. The highest diversity of cultured crops is concentrated in the high rainfall areas of the Western Ghats, Eastern Ghats, northern Himalayas and the north eastern hills. In India, 34, 000 species of cereals and 22, 000 species of pulses are cultivated. India also has 27 indigenous breeds of cattle, 40 breeds of sheep, 22 breeds of goats and 8 breeds of buffaloes.

3.6 HOT- SPOTS OF BIODIVERSITY

Hot-spots are specific ecological regions that harbour a great diversity of plant and animals species. The earth's biodiversity is distributed in specific ecological regions. There are more than 1000 major ecological regions in the world. of these, 200 ecological regions are said to be the richest, rarest and most distinctive natural areas. These natural areas of the earth are referred to as the global 200. It has been estimated that 20% global plant life (50, 000 endemic plant species) probably occur in 18 hot-spots of the world. Countries which have relatively large proportion of specific ecological regions (hot-spots) with diversity of endemic plants and animals are known as mega diversity nations. In India, globally accepted national hot-spots are in northern regions of Eastern Ghats and Western Ghats. These are included in the world's most biodiverstiy rich areas. The Andaman and Nicobar islands are extremely rich in species and many subspecies of different plants, animals and birds have evolved.

A major proportion of amphibian and reptile species are concentrated in the Western Ghats. Coral reefs in Indian sea waters surround the Andaman and Nicobar islands, Lakshadweep islands, the gulf areas of Gujarat and Tamilnadu. They are rich in species of coral reefs.

3.7 THREATS TO BIODIVERSITY

Man has begun to overuse most of natural ecosystems. It causes environmental degradation in all ecosystems. Forests and grasslands have been turned to deserts and wastelands. Mangroves have been cleared for fuel wood and prawn farming, which has led to a decrease in the habitat essential for breeding of marine fishes. Wetlands have been converted into agricultural land. These changes lead to grave threats to biodiversity. Due to rapid human population growth and

industrial development, there occurs the loss of wild habitats and hence the global biodiversity faces rapid destruction.

Habitat loss also results from man's introduction of species from one area into another, disturbing the balance of nature in existing communities. This process has led to the extinction of many local species. The destruction of natural ecosystems either for conversion to agriculture or industry leads to loss of species in the natural habitat. In addition, over extraction of natural resources by human and occurrence of pollution in air, water and soils also causes loss of species in the natural ecosystem.

Poaching of wild animals for food, fur, skin, musk, ivory, horn etc., have caused destruction of wildlife. Poaching endangers many larger animals such as tiger, cheetah and snow leopard, whose beautiful furs are quite valuable. Rhinoceroses are slaughtered for their horns, elephants are killed for ivory and musk deer are killed for musk. Bears are killed for their gall bladders, which are used in medicine to treat indigestion and heart diseases. Indian turtles are captured and exported illegally to Singapore, Malaysia, China etc., where they are killed for food. Crocodiles are killed for their skins, which are useful for making shoes and handbags.

3.8 ENDANGERED AND ENDEMIC SPECIES OF INDIA

The plant and animal species which are in danger of extinction are known as endangered species. A few plant and animal species originated from particular region of the country and not found in elsewhere in the world. These species are known as endemic species. In India, several plant and animal species are now found in one or a few protected areas. The important endangered species of animals are elephant, tiger, lion, rhinoceros etc. The well known major mammals restricted to a single area include the Indian wild ass, Kashmir stag, golden languor and pygmy hog. There are also endangered bird species such as the siberian crane, great Indian bustard, florican, vulture etc. Many species of coral reef are also endangered. Many plant species (trees, shrubs and climbers) are now increasingly endangered. There are thousands of small herbs which are greatly threatened by habitat loss. Several orchids, ferns and moss are yet another group of garden plants that are under threat. A variety of wild plants with real medicinal value are being over harvested.

3.9 CONSERVATION OF BIODIVERSITY

Recent times it is understood that the Conservation of biological diversity is an essential aspect for sustainable development for the future. Conservation of Biodiversity is fundamental to the success of the development process.

i) In-situ conservation

The conservation of ecosystems, natural habitats and the maintenance of viable species of plants and animals in their natural surroundings are known as in-situ conservation. The government of India made efforts to control the rapid decline of biodiversity by establishing several protected in-situ conservation areas in India. Biodiversity of plant and animal species are preserved in-situ by setting up of protected areas like National Parks and Wildlife Sanctuaries. They include a variety of ecosystems and habitats. Some have been created in order to protect highly endangered species of wild plants and animals found nowhere else in the world. As a result, the population of the great Indian bustard, tiger, lion, elephant, crocodile etc., has increased.

ii) ex-situ conservation

The conservation of plant and animal species outside their natural habitat is known as ex-situ conservation. The endangered species (wild plants or animals) which have reached a point of extinction in their natural habitat are transferred to other favourable habitat to ensure their survival. Therefore, ex-situ conservation, areas are established outside its natural habitat in a carefully controlled situation. This leads to the establishment of botanical garden for plants or a zoological park for animals. There are many experts in the zoological parks and botanical gardens to multiply the endangered species under artificially managed conditions.

There is also another form of preserving a plant by preserving its germ plasma in a gene bank so that it can be used if needed in future. However the most important step of a successful breeding program is the reintroduction of a species into its original wild habitat.

Check your progress

1. The presence of variety of genes within species or within population which give every individual specific characteristics is known as---------- diversity
2. The presence of variety of animals and plant within and among ecosystems constitutes ---------- biodiversity
3. Plant and animal species originated from particular region of the country and not found elsewhere in the world are known as ----------species.
4. Rhinoceroses are slaughtered for their ----------
5. The conservation of valuable species of plants and animals in their natural surroundings are known as---------- conservation

LET US SUM UP

Biodiversity is the variety among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part includes diversity within species, between species and ecosystems. Biodiversity is essential for preserving ecological processes such as fixing and recycling of nutrients, soil formation, circulation and cleaning of air and water. Our country has great variety of plants and animals, many of which are not found elsewhere. Conservation of biological diversity is an essential aspect for sustainable development for the future.

KEY WORDS

Biodiversity: It is the number of species of plants, animals and microorganisms occurring in a given region, country, continent or worldwide.

Hot-spots: They are specific ecological regions that harbour a great diversity of plant and animals species.

Endangered species: The plant and animal species which are in danger of extinction are known as endangered species

QUESTIONS FOR DISCUSSION

1. Discuss the various kinds of biodiversities.
2. What are the values of biodiversity?
3. Explainhot- spots of biodiversity.
4. What are **e**ndangered and endemic species?
5. Explain in detail the conservation of biodiversity.

Check your progress:

Answer

1. Genetic
2. Ecosystem
3. Endemic
4. Horns
5. In-situ

SUGGESTED READINGS

1. Environmental Studies, Dr. R. J. Ranjit Daniels, Dr. JagadishKrishnaswamy. Wiley India Pvt. Ltd.
2. Essentials of Environmental Studies, Kurian Joseph, R. Nagendran, Pearson Education Pvt. Ltd.

UNIT III – Biodiversity and Its Conservation

S.No	Question	Marks	Bloom's Level
1	Define biodiversity.	5	K1
2	List the types of biodiversity.	5	K1
3	What is conservation of biodiversity?	5	K2
4	Write a short note on endangered species.	5	K2
5	What is meant by hotspot of biodiversity?	5	K1
6	Explain the values of biodiversity.	8	K2
7	Discuss the threats to biodiversity.	8	K3
8	Explain in-situ and ex-situ conservation methods.	8	K3
9	Analyze the importance of biodiversity conservation.	8	K4
10	Evaluate the role of government and NGOs in biodiversity conservation.	8	K5

UNIT

4

ENVIRONMENTAL POLLUTION

CONTENTS

4.0 AIMS AND OBJECTIVES

After studying this unit, you should be able to:

- Explain the causes, effects and control measures of air, water, soil, marine, noise and thermal pollution.
- Describe the solid waste management.
- Explain the disaster management of floods, earthquake, cyclone and landslide.

4.1 AIR POLLUTION

Definition: The World Health Organization defines air pollution as ―the presence of materials in the air in such concentration which are harmful to man and his environment.‖

Causes of Air Pollution:

The various causes of air pollution are

(i) Combustion of natural gas, petroleum, coal and wood in industries, automobiles, aircrafts, railways, thermal plants, agricultural burning, kitchens, etc. (soot, fly ash, CO_2, CO, nitrogen oxides, sulphur oxides).

(ii) Metallurgical processing (mineral dust, fumes containing fluorides, sulphides and metallic pollutants like lead, chromium, nickel, beryllium, arsenic, vanadium, cadmium, zinc, mercury).

(iii) Chemical industries including pesticides, fertilizers, weedicides, fungicides, cosmetics, textiles, asbestos.

(iv) In agriculture during the application of pesticides, some amount of poisonous substances is carried away by wind to different places.

(v) Radioactive substances coming out from atomic power stations and nuclear explosions.

Effect of Air Pollutants:

Air pollutants are broadly classified into particulate and gaseous. The air pollutants have adverse effect on human beings, animals, vegetation and buildings. Air pollutants also change earth‘s climate.

(i) Dust and smoke particles cause irritation of the respiratory tract and produces bronchitis, asthma and lung diseases.

(ii) Smog is a dark or opaque fog which is formed by the dust and smoke particles. Smog harms plant life through glazing and necrosis besides reduced availability of light. In human beings and animals it produces respiratory troubles.

(iii) Particulate matter suspended in air, scatters and partly absorbs light. In industrial and urban areas, sunlight is reduced to 1/3 in summer and 2/3 in winter.

(iv) Excess of microbes in the atmosphere directly damage the vegetation, food articles and causes diseases in plants, animals and human beings. Excess of pollen causes allergic reactions in several human beings.

(v) Gaseous pollutants cause serious problems to plants, animals and human beings. Carbon monoxide formed by incomplete combustion of carbon fuels combines with haemoglobin of blood and impairs its oxygen carrying capacity. At higher concentration, carbon monoxide proves lethal. Sulphur dioxide produced during smelting of metallic ores and burning of

petroleum and coal in industries, thermal plants, home and motor vehicles cause acid rain. It causes chlorosis and necrosis of vegetation. Sulphur dioxide, above 1 ppm, affects human beings. It causes irritation to eyes and injury to respiratory tract. Due to excessive combustion activity, the $C0_2$ content steadily rises. This causes an increase in temperature referred to as the green house effect. Melting polar ice caps and glaciers could cause sea levels to rise, flooding most of the major population centres and fertile lands. Chlorofluorocarbons used in refrigeration react with ozone layers of stratosphere and hence deplete the same.

Control of Air Pollution:

1. Industrial estates should be established at a distance from residential areas.

2. Use of tall chimneys shall reduce the air pollution in the surroundings and compulsory use of filters and electrostatic precipitators in the chimneys.

3. Removal of poisonous gases by passing the fumes through water tower scrubber or spray collector.

6. Use of non-lead antiknock agents in gasoline.

7. Automobiles should be fitted with exhaust emission controls.

4.2 WATER POLLUTION

Definition:

Water pollution can be defined as the presence of impurities in such quantity so as to constitute a health hazard by lowering the water quality and making it unfit for use.

Causesof Water Pollution:

1. Domestic Wastes and Sewage

Raw sewage contaminates water with pathogens. Sewage produces foul-odour and makes the water brownish and oily. Modern day detergents degrade very slowly and render the water unfit for human and animal use. The phosphates present in detergents further stimulate algal growth.

2. Surface Run-Off

The pollutants present on the surface of land and fertilizers added to the soils are washed down into water reservoirs and water courses during rains. This flow of fertilizer rich water into streams and lakes gives rise to eutrophication.

3. Industrial Effluents

They are industrial wastes which are allowed to pass into water bodies. The important toxic chemicals presents in them are:

(i) Mercury - develop a crippling deformity called minamata disease

(ii) Lead - causes anaemia, headache and bluish lines round the gums.

(iii) Cadmium -It causes renal damage, emphysema, hypertension, testicular necrosis and damage to placenta.

(iv) Other metals

Copper, zinc, nickel, titanium etc., cause toxaemia and change in enzyme functioning.

(v) Liquid Effluents

Several types of liquid effluents containing toxic chemicals like acids and bases, added to the rivers and other water bodies kill fish and other aquatic life besides being toxic to human beings.

Effects of Water Pollution:

i) Sewage and agricultural wastes washed into the rivers or ponds may stimulate the growth of algae and aquatic weeds. This leads to depletion of dissolved oxygen in the water.

ii) Nitrates used in the fertilizers, enters the food chain of man. In the intestine of man nitrate is converted into nitrite. The nitrites combine with haemoglobin of the blood and reduces the oxygen carrying capacity of haemoglobin. It leads to suffocation and breathing troubles in man.

iii) Drinking contaminated water causes waterborne diseases like typhoid, dysentery and cholera.

iv) Drinking fluoride containing water cause fluorosis. This causes neuromuscular, respiratory, gastrointestinal and dental problems in human.

v) Radioactive pollutants enter humans through food and water and get accumulated in the blood, thyroid gland, liver, bones and muscles.

vi) Sediments in water bodies increase the turbidity in water reducing the amount of sunlight available for photosynthesis of the phytoplanktons and also cause breathing problem in fishes.

Control of Water Pollution:

The various methods for the control of water pollution are discussed below:

1. The sewage pollutants are subjected to chemical treatment to change them into non-toxic substances or make them less toxic.
2. Water pollution due to organic insecticides can be reduced by the use of very specific and less stable chemicals in the manufacture of insecticides.
3. Oxidation ponds can be useful in removing low level of radioactive wastes.
4. Thermal pollution can be reduced by employing techniques—through cooling, cooling ponds, evaporative or wet cooling towers and dry cooling towers.

5. Domestic and industrial wastes should be stored in large but shallow ponds for some days. Due to the sun-light and the organic nutrients present in the waste there will be mass scale growth of those bacteria which will digest the harmful waste matter.

6. Polluted water can be reclaimed by proper sewage treatment plants and the same water can be reused in factories and even irrigation. Such a treated water being rich in phosphorus, potassium and nitrogen can make good fertilizer.

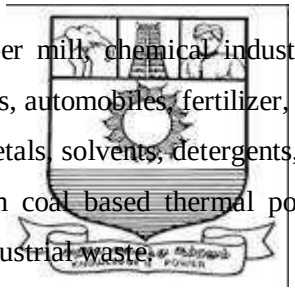
7. Suitable strict legislation should be enacted to make it obligatory for the industries to treat the waste water before being discharged into rivers or seas.

4.3 SOIL POLLUTION

Definition:

Soil pollution is the contamination of soil by soil pollutants. Soil pollutants have harmful effects on physical, chemical and biological properties of the soil and reduce its productivity.

Causes of soil pollution:



Industrial waste: Waste from paper mill, chemical industries, oil refineries, sugar factories, tanneries, textile, iron and steel, dues, automobiles, fertilizer, pesticide industries release a variety of pollutants such as toxic heavy metals, solvents, detergents, plastics suspended particulates and refractory chemicals. Fly ash from coal based thermal power plants, dumping of untreated, inadequately treated mining and industrial waste.

Urban waste: Garbage, plastics, glasses, fibres, paper, dried sludge of sewage etc.

Radioactive substances: Explosion of nuclear devices and radioactive waste products during nuclear testing.

Agricultural wastes: Chemical fertilizers, herbicide, weedicide, pesticides etc. Farm waste, manure slurry, debris etc.

Biological agents: Human, animal and bird excreta, faulty sanitation, municipal garbage and industrial parasites, viruses, earth worms

Effectsof soil pollution:

- Toxicants enter animal body through food chain – affect metabolic activities and cause diseases.
- Heavy metals fatal to living organisms.
- Destroy beneficial microorganisms in soil.
- Alter the physical texture of soil.

- Waste materials suppress function of essential nutrients in top soil and affect soil fertility.
- High acidity and alkalinity cause severe crop damage.
- Fly ash cause soil degradation.
- Pathogenic bacteria, parasitic worms produce disease.
- Arsenic pesticides make soil permanently infertile.

Control of soil pollution:

- Salinity checked by improving drainage.
- Soluble salts should not be allowed to mix with soil.
- Careful use of fertilizers and pesticides.
- Domestic and industrial wastes properly treated.
- Nuclear waste not mixed with soil.

4.4 MARINE POLLUTION

Definition:

Marine pollution is defined as the discharge of waste substances into the sea resulting in vigorous harm to living resources, hazards to human health, hindrance to fishery and impairment of quality of sea water. Marine pollution is resulted in changes of physical, chemical and biological conditions of the sea water. This water is also unfit for human consumption and industrial purposes because of high salt content.

Causes and effects of marine pollution:

i) Nuclear wastes: The most dangerous marine pollution is occurred due to dumping of nuclear wastes into the ocean by nuclear power plants.

ii) Pesticides: It is estimated that 25 percent of the pesticides will finally reach the ocean through the rivers. The pesticides such as DDT, BHC, aldrin, endrin etc., are more toxic arid dangerous to marine living organisms.

iii) Toxic metals: The industrial effluents discharged into the ocean increases heavy metal concentration. Heavy metals such as mercury, lead,nickel and cadmium are fatal to sea life.

iv) Sewages: Untreated domestic sewages discharged into the sea increases the growth of microscopic plant life and phytoplankton. This leads to formation of algal blooms in the surface of the sea. It prevents the sunlight penetration deep into the sea affectingphotosynthesis.Thedissolved oxygen content in sea water isalso reduced. Thus marine

plants die in large numbers and are decomposed by bacteria which further decrease oxygen content in sea water. As a result, marine animals start to die due to the scarcity of dissolved oxygen in sea water.

iv) Hot water:Industries and nuclear power plants use huge quantity of fresh water for cooling the machineries. After cooling, the warmwater is discharged into the sea.It raises the temperature of sea water which causes the depletion of dissolved oxygen content which affects the marine life.

v) Oil pollution in sea:Oil pollution in sea water is due to cargo tanker washing at sea, loading and unloading of oils in ships at harbours, maritime accidents due to collision, fire, explosion etc., and oil wastes from refineries discharged into the sea. Floating of oil in the surface of seawater prevent the diffusion of atmospheric oxygen and light penetration into the sea water.

Control of marine pollution:

a) The industrial effluents, domestic sewages should be discharged into the ocean after proper treatment

b) The floating oil can be absorbed by suitable absorbing material.

c) Physico-chemical changes in oil would sink the oilin sea water decreasing its toxicity.

d) Burning the oil on the open seas help to evaporate volatile substance more quickly.

4.5 NOISE POLLUTION

Definition:

Noise pollution is defined as the unwanted sound dumped into environment.

Causes of noise pollution:

1) Natural – thunder.

2) Industrial noise: Textile mill, printing press, metal works

3) Road noise: Road traffic, rail traffic, aircraft noise

4) Neighborhood noise: TV, grinder, mixer, AC, radio, washing machine

Effects of noise pollution:

- **Physical effect** –affect hearing ability, crack in building, break window door, glass.
- **Physiological effect**-increase heart beat rate, heart pain, narrow arteries, fluctuation of BP, head ache, affect brain, pregnant women, foetus.
- **Psychological effect**-depression, disturbed sleep, emotional disturbance.

Control of noise pollution:

- Industrial workers should use ear protection aids. Noisy machines must be replaced.
- Installing in sound proof chambers.
- Machines should be provided with vibration dampers and silencers.
- Increase distance between source and receiver.
- Planting trees around schools, hospitals and factories.
- Use of crackers should be limited.

4.6 THERMAL POLLUTION

Definition:

Thermal pollution is defined as the warming up of an aquatic ecosystem to the point where desirable organisms are adversely affected.

Causes of thermal pollution:

1) Nuclear power plants

2) Industrial effluents --industries use water for cooling

Effects of thermal pollution:

- Reduction in dissolved oxygen.
- Increase toxicity of poison in water.
- Interfere with reproduction of aquatics.
- Change metabolic rate.
- Pathogenic microorganisms accelerated.
- Excessive algal growth.

Controlof thermal pollution:

- Cooling towers.
- Cooling ponds.
- Artificial lakes.

4.7 SOLID WASTE MANAGEMENT

Solid waste management is defined as the generation, storage, collection, transport, separation, processing, recycling and disposal of solid waste.

Causes of solid waste:

- Over population
- Technology

Collection of solid waste:

- **Disposal**-manual usable component separation, compaction, incineration.
- **Land filling method**-spread in thin layer and covered by soil.
- Burning without oxygen (anaerobic)
- **Composting**-bacterial decomposition.

4.8 DISASTER MANAGEMENT

4.8.1 Flood:

India is one among the most flood prone countries in the world. Structural and non-structural measures are taken to control floods.

a) Structural measures: In structural measures we keep the water-away from the people. Some of the structural measures helped to control floods are given below.

i) Watershed management: Cleaning, deeping of natural water reservoirs drainage channels must be taken up once in a year. It will help to store flood water and prevent flood damage in rural and urban areas.

ii) Reservoirs: In every village, the village panchayats should dug up village ponds. The government officials should remove the encroachments on ponds and tanks beforethe onset of monsoons.

iii) Natural water retention basins: The natural water retention basins such as ponds, lakes and dams should be inspected by the government officials periodically. If necessary, the flood protection embankments, ring bunds andother bunds should be strengthened to prevent floods.

iv) Safe disposal of surplus water*:* Usually the water level is gradually increased in the ponds, lakes and dams during monsoon seasons. If the water level is full, the surplus water should be removed out by opening the shutters. This may help to prevent breaking up of water basins due to high pressure.

b) Non-structural measures: In non-structural measures, we keep the people away from the water. The aim of the non-structural measures is reducing flooddamage by involving people. Some of the non structural measures usedto control floods are given below.

i) Flood plain zoning*:* Flood plain is the land adjoining the river. The flood plain zone is occupied by water during high floods. Whenever flood occurs the people living at the flood plain zone should be evacuated.

ii) Flood forecasting and warning*:* The flood occurring areas are forecasted and warning should be issued through media.

iii) Flood proofing: Raising the level of' the building with the help of earth fill and the ring bunds may be constructed around village or group of properties.

Flood Management

a) Pre flood measures: The following pre-flood measures should be taken to prevent calamities to be occurred by floods.

i)Identification of low lying areas which are vulnerable toflooding either by river or rainfall. Availabilityof open spaces for setting up evacuation camps. It will provide shelter to people from submerged localities.

ii) Availability of safe drinking water and food reserves.

iii) The district headquarter relief committee should be headed by district collector assisted by various heads of departments and voluntary agencies. Their telephone number should be published.

b) During the flood

i) Rescue and evacuation operations should be done immediately in the flood affected area.

ii) The following personals should be used for rescuing the people from the floods affected area. (Home guards, police men, ex-servicemen, fire service, defencepersonnel, divers etc.)

iii) All deaths occurred due to floods must be promptly identified and handed over to the relatives.

iv) The people in the floods hit area and evacuation centre should be provided with food, safe drinking water, medicines etc.

v) A team of doctors and Paramedical staff ready at flood hit area.

c) Post flood measures

i) The medical team should make regular visits to all the flood affected areas ever after the flood water have subsided. This is essential to prevent spreading of epidemics among the people.

ii) A comprehensive survey should be made to assess the damage caused by floods. On the bases of information provided by survey teams, the government should give necessary compensation to the flood affected people.

iii) Repair of water supply system, roads, canals, railway lines, electrical lines should be started as soon as possible.

4.8.2 Cyclone:

India with its long coastal line is vulnerable to cyclones. It develops in the Bay of Bengal and Arabian sea. Cyclones are intense low pressure systems that develop in the oceanic area. These systems are classified on the basis of velocity of surface winds. They are given below.

There are two cyclone seasons in India. The first is the premonsoon season (April and May) and the second is postmonsoon season (October to December). The cyclones of the post-monsoon season are more severe than pre-monsoon season. The frequency of cyclone is more in east coast than the west coast.

Impact of cyclone

i) Uprooting of trees which disturb transportation and relief supply to the people of cyclone affected area.

ii) Sudden fall of electric poles, sign posts and transmission line towers.

iii) Damage to windows, roof projections and sunshades of the buildings.

iv) Fall of weakly built walls and light weight roof coverings.

Cyclone warning system in India

The Indian Meteorological Department is the nodal agency for observing, detecting and forecasting cyclones which develop in the Indian seas. The cyclones are monitored through synoptic charts and INSAT (Indian National Satellite). When the cyclones approach the coastal areas they are observed through cyclone detection radars. They are installed in coastal stations of east and west coasts.

Cyclone warning is provided in two stages. In the first Stage, a cyclone alert issued 48 hours before the commencement of the adverse weather along the coast. In the second stage, a cyclone warning issued 24 hours before the cyclones anticipated heavy rainfall. The cyclone warning messages are continuously broadcasted throughtelevision and radio till the cyclone crosses the coast.

Cyclone management

All the district of the maritime states is vulnerable to the cyclone impacts to a different degree. Therefore, the concerned district Collectors should be familiar and get prepared with the measures to be taken in the event of cyclone disaster.

a) Pre cyclone measures

i) Prior to the cyclone season (April and May, October to December) pre-cyclone measures should be carried out in the cyclone vulnerable areas. The measures taken before the cyclone are such as the strengthening of communication facilities, checking and repair of cyclone shelters,

repair of roads, make arrangements for the storage of food, first aids kits, availability of safe drinking water etc.

ii) After receiving first warning from the concerned cyclone warning centre, the district administration should have constant touch with the concerned cyclone warning centre.

iii) Publicity of cyclone warnings which increases the alertness of the public, particularly the fishermen community.

iv) Keep adequate number of vehicles ready at the nearest point. It helps to evacuate the people from low lying areas in a shorter time as and when required.

v) The materials such as hooks for cleaning debris, rubber tyres and tubes for using as floats in water tents , kerosene lanterns, large cooking vessels, ropes, wires, torches, polythene bags etc., should be in adequate quantities.

b) Post cyclone measures

i) After the cyclone, rescue the people who are affected.

ii) As early as possible, restore the supply of power, remove the fallen trees on the roads.

iii) Food and water should be supplied to the affected people

iv) Appropriate vaccination must be undertaken to prevent any outbreak of epidemics among the cyclone affected peoples.

v) Essential commodities such as rice, wheat, pulses, salt, match box, kerosene, diesel etc., should be supplied to cyclone, affected areas at concessional rates or free of cost.

vii) Land survey of the affected area should be undertaken to assess the damage caused.

ix) Loan should be sanctioned on the basis of survey to repair the damaged houses.

c) Suggestions for the future

i) The roads adjoining to the coastal areas should be improved. This is to facilitate quick evacuation of people and supply relief to the affected.

ii) Construct a high level coastal road with its top about one metre above the sea level. It should have adequate drainage openings.

iii) The government officials working in the cyclone prone areas should be provided adequate training related to the cyclone preparedness and relief work.

iv) The fishermen may be advised to avoid fishing during cyclone.

4.8.3 Earthquake:

Earthquakes are unpredictable and strike suddenly without warning. The magnitude of earthquake is measured in Richter scale. Earthquakes of magnitude 8. 0 and above are considered as very destructive.

Earthquake management

The following measures are taken for earthquake management

a) Pre-earthquake activities

i) Severe earthquake results in the falling of objects and debris from buildings. Hence, the shelves (wooden) should be fixed to the walls. The heavy objects from shelves above head level should be removed.

ii) Bed should be placed away from windows and heavy object. Donot hang mirrors or picture frames over beds.

iii) Appliances used in houses and industries should be tightened.

iv) Keep adequate safe drinking water, food, first aid kit, medicine, tools, torch with batteries, blankets etc., in a secure place at your residence.

b) During the earthquake

i) Do not afraid, stay calm and wait for information from official sources.

ii) Most injuries occur while people enter or leave buildings. So do not move when the tremors occur.

iii) If you are inside the buildings, stay under unbreakable table or desk. Stay away from glass windows and outside doors. If unable to move, cover your head and body with pillows, blankets etc., to protect yourself from falling objects.

iv) Donot use elevators as power may have failed. Do not run in the staircases.

v) If an earthquake occurs when you are outside, get away from buildings, walls, trees and utility wires. Stay in an open area until tremors stop.

vi) If you are driving, stop and stay inside. Do not remain next to large buildings. Do not remain on bridges and flyovers.

vii) Check for injuries, apply first aid. Inform police.

viii) Evacuate the building if a gas leak is suspected. Donot light matches.

c) Post-earthquake activities

i) Temporary shelters should be provided to earthquake affected people.

ii) Arrangements have to be made for the medical care for the injured.

iii) Restoration of transport and communications in the earthquake affected area.

iv) Temporary support to the cracked buildings with the help of iron bars.

v) Distribution of relief supplies such as blankets, medicines etc., to the earthquake affected people.

vi) Search and rescue operations should be made in the earthquake affected area.

vii) Quick assessment of damage caused by earthquake and provide compensation to the affected people.

4.8.4 Land slide:

A falling of a rock or soil from steep slope is cal1d landslide. It is a serious geological hazard common in hilly regions of India. Landslides cause extensive damage to roads, bridges, agricultural lands, forests, orchards etc, resulting in the loss of property as well as life. Economical degradation of hill areas has been increased due to landslides.

Landslide preventive measures

i) Construction of check dams in the landslide vulnerable areas. It may prevent the fast flowing of rainwater and land erosion.

ii) Road side drains are formed to facilitate surf ace drainage of water. It helps to prevent road erosion. iii) Sub surface trench drains are constructed to facilitate sub surface drainage of water.

iv) Concrete retaining walls are constructed in the landslide prone areas to prevent land erosion.

v) Display boards are installed for the public in the landslide prone areas to avoid accidents.

vi) Plant suitable trees in barren-lands and sloppy areas.

Risks due to landslide incidence

i) Landslides lead to spread and deposition of debris which blocks the flow of water in streams.

ii) Breaches occur in the buildings, roads and bridges.

iii) Communication lines and supply lines are disturbed.

iv) Landslides bring huge quantities of soil which blocks the roads and prevent the supply of essential commodities through vehicle.

v) The consequences of landslides include loss of homes, loss of agricultural land, loss of employment, loss of revenues, increased medical needs etc.

Check your progress

1. Dust and smoke particles cause---------- diseases
2. Stimulated algal growth due to the flow of fertilizer rich water into streams is known as -------
3. Collection, recycling and disposal of solid waste is ----------
4. Warming up of an aquatic ecosystem is---------- pollution.
5. Earthquake is measured in----------scale.

LET US SUM UP

Any change in the physical, chemical and biological characteristic of environment which causes undesirable and harmful effects is called pollution. Air, water, soil, marine, noise and thermal pollution are the various types. Natural disasters such as earthquake, cyclone, flood etc., can be checked by taking timely action.

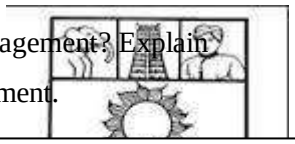
KEY WORDS

Pollution: Any change in the physical, chemical and biological characteristic of environment which causes undesirable and harmful effects is called pollution.

Disaster management: Earthquake, cyclone, flood etc are natural disasters. The measures to be taken to control and to manage these are known as disaster management.

QUESTIONS FOR DISCUSSION

1. What are the causes of air pollution?
2. Discuss the effects of water pollution.
3. How to control soil pollution?
4. What is meant bysolid waste management? Explain
5. Explain in detail cyclone management.



Check your progress:

Answer

1. Lung
2. Eutrophication
3. Solid waste management
4. Thermal
5. Richter

UNIT IV – Environmental Pollution

S.No	Question	Marks	Bloom's Level
1	Define environmental pollution.	5	K1
2	What are the types of pollution?	5	K1
3	Write a short note on air pollution.	5	K2
4	What is water pollution?	5	K1
5	State the causes of soil pollution.	5	K2
6	Explain the causes and effects of air pollution.	8	K3
7	Discuss the causes and control of water pollution.	8	K3
8	Explain the impact of noise pollution on human health.	8	K4
9	Analyze the environmental effects of industrial pollution.	8	K4
10	Evaluate the measures to control environmental pollution.	8	K5

SUGGESTED READINGS

1. Environmental Pollution Control Engineering, C. S. Rao, New age international Pvt. Ltd. Publishers.
2. Fundamental Concepts of Environmental Chemistry, G. S. Sodhi, Third Edition,Narosa Publishing House.
3. Environmental Chemistry, A. K. De, Seventh Edition. New age international Pvt. Ltd.
4. Text book of Environmental Chemistry, BalramPani. I. K. International Publishing House Pvt. Ltd.

UNIT

5

SOCIAL ISSUES AND THE ENVIRONMENT

CONTENTS

5.0 AIMS AND OBJECTIVES

After studying this unit, you should be able to:

- Explain global warming, acid rain and ozone depletion.
- Describe the various Environment Protection Acts.
- Explain the six broad categories of fundamental rights.

5.1 CLIMATIC CHANGE

The average temperature in many regions has been increasing in recent years. In some regions of Asia and Africa severe droughts have been observed in recent decades. The great warm storms have been more frequent, persistent and intense in some parts of Asia and Africa. As these are signs that the earth is sick, climate is changing and making it more difficult for survival of mankind. The earth is losing its ability to balance itself due to the imbalances created by human activities in the environment. Human societies will be seriously affected by extremes of climate such as floods and droughts. This is a major concern for human health. Hygienic health of people depends on safe drinking water, sufficient food, secure shelter and good social conditions. All these factors are affected by climate change. Fresh water supplies may be seriously affected, reducing the availability of clean water for drinking and washing, during drought as well as floods. The risk of the spread of infectious diseases to human will increase. The climate change also leads to spreading of diseases such as malaria and filariasis in new areas. Food production will be seriously reduced due to climate change. The local reduction in food production would lead to starvation and malnutrition with long term. The recent studies have shown that in the near future, the global mean surface temperature will rise by 1.4 to 5.8°

C. Temperature will be greatest in the land surface areas. The frequency of weather extremes is likely to increase leading to floods or drought. There will be less cold season and more summer with heat waves. Global mean sea level is projected to rise. Due to global rise of sea level, the human habitats adjacent to the coastal regions and the islands will be submerged under the sea in the near future.

5.1.1 Global warming

The energy of the sun is emitted as heat radiations. About 75 percent of solar energy reaching the earth is absorbed and retained by the earth's surface. The rest of the heat radiates back to the atmosphere. The temperature of the earth's surface is determined by the energy balance between the heat energy reaching the earth's surface and the heat energy that is radiated back into space. Fossil fuel based industrialisation and over exploitation of resources like coal, oil and gases by the people have raised the concentration of green house gases like carbon dioxide, methane, chlorofluoro carbons and water vapour. These green house gases in the lower levels of atmosphere trap the solar radiation and not allow the solar rays to escape into outer space. Thus, the green house gases add heat on the earth's surface. This results an increase in temperature on the earth's surface and is commonly known as global warming.

Rise in the global temperatures will result in melting of the ice masses in the Arctic and Antarctica regions, resulting in rising of sea level and low lying coastal areas will be submerged. The summers will be longer and hotter whereas the winters will be shorter and warmer. Due to increased concentration of carbon dioxide the growth and yield of plants will increase resulting in rapid depletion of nutrients from the soil.

5.1.2 Acid rain

Combustion of fossil fuels like coal, oil, natural gas etc., produces chemicals such as sulphur dioxide and nitrogen oxides. In the atmosphere these chemicals react with sunlight and water present in the air to produce sulphuric acid and nitric acid. These chemicals are carried by air currents and move upwards into the atmosphere. During rainfall these chemicals finally return to the earth's surface in the form of acid rain.

Acid rain dissolves and washes away nutrients in the soil. Actually nutrients like calcium, potassium, iron and magnesium have been leached away from the soil by acids. These nutrients are essential for the plant growth. Acid rain causes reduced rate of photosynthesis and growth. The activity of symbiotic nitrogen fixing bacteria present in the root nodules of leguminous plant is inhibited by acid rain. This also destroys the fertility of the soil.

Acid rain that falls on the surface of the earth reaches rivers, lakes, ponds etc., and causes water in them to become acidic. This affects plants and animal life in aquatic habitat. Acid rain corrodes buildings, monuments, statues, bridges etc. Acid rain is known to be corrosive to basic materials such as lime stone and marble. The fish caught in acid waters may be harmful to human consumption. Acid rain and dry acid deposition in the air causes respiratory problems in human.

Control of acid rain:

The best way to stop the formation of acid rain is to reduce the emission of sulphur dioxide and nitrogen oxides into the atmosphere. This can be achieved by using less quantity of fossil fuels in power plants, vehicles and industry.

5.1.3 Ozone layer depletion

A layer of ozone is present in the upper atmosphere, mainly in the stratosphere at a height of 16 kilometre to 40 kilometre above the earth. Ozone is formed by the reaction of ultraviolet rays on oxygen in the atmosphere. It filters out the harmful ultraviolet radiations and prevents them from reaching the surface of the earth. Thus, this ozone layer serves as a protective umbrella or shield which protects the life on earth from the harmful effects of the ultraviolet radiations. In the

stratosphere, ozone (0_3) reacts with chlorine, water vapour and nitrogen oxides which convert ozone into oxygen molecules. This leads to depletion of ozone layer in the stratosphere.

The pollutants which cause ozone layer depletion are released by high altitude air-crafts. Chloro F1uoro Carbons (CFC) is released into the atmosphere from the appliances like refrigerators, air conditioners, fire extinguishers etc. Nitrogen oxide produced by the action of bacteria in soil is released into the atmosphere. Huge quantities of gases and chemicals are emitted into the atmosphere by industries and automobiles.

Effects of ozone layer depletion

Depletion of ozone layer would result in an increase in the ultraviolet radiations reaching the earth's surface. This leads to many harmful effects such as

i) Damage to immune system and reduce the resistance to diseases in human.

ii) Eye diseases such as cataract occur in human beings.

iii) Marked rise in skin melanoma (skin cancer)

iv) Reduce the chlorophyll content in the plants and increase the harmful mutations. This restrict the growth of plants and crop yield significantly.

5.2 WASTELAND RECLAMATION

Loss of vegetation cover on the surface of the lands leads to loss of soil through erosion. This ultimately creates waste lands. If it remains unchecked, it will affect the production of food grains, vegetables, fruit, fodder and fuel wood. Hence, conservation of soil and reclaiming the waste lands are important tasks of planning for the future.

Wastelands can be classified into easily reclaimable, reclaimable with some difficulty and reclaimable with extreme difficulty. Easily reclaimable wastelands can be utilized for agricultural purposes. Those which can be reclaimed with some difficulty can be used for agro forestry. Wastelands that are reclaimed with extreme difficulty can be utilized for forestry.

Process of wasteland development

For agriculture purpose, the wasteland can be reclaimed by reducing salt content in the existing land. This process can be done by leaching and flushing the soil with adequate amount of fresh water. Then, gypsum, urea, potash and compost are added before planting crops in such lands.

The agro forestry system of cultivation helped wastelands for various purposes. The wastelands are reclaimed by cultivation of trees and agricultural crops alternatively in certain area. In addition, live stocks (sheep, broilers etc) are also developed simultaneously. The waste excreted

by the live stocks and dry leaves fallen on the surface of wasteland add manure in the land and soil becomes fertile.

Saline and alkaline soils are unfit for cultivation of plants and agricultural crops. Alkaline soils contain high amounts of carbonates and bicarbonates of sodium. Saline soils contain chlorides and sulphates of sodium, calcium and magnesium. Field experiments have shown that, it is possible to reclaim the alkaline soils with the cultivation of fodder grasses and tree species. If tree seedlings or grasses are planted in alkaline soils with mixture of original soil, gypsum and manure, better growth can be achieved.

Advantages of wasteland reclamation

Wasteland reclamation provides a source of income for the rural poor. It makes the soil fertile by preventing soil erosion and conserving moisture. It also helps to maintain an ecological balance in the area. The increasing vegetation cover helps in maintaining local climatic conditions. The trees help in holding soil moisture and reduce soil erosion.

5.3 CONSUMERISM AND WASTE PRODUCTS

Modern societies are based on using large amounts of use and throw goods. This causes the production of extremely large quantities of waste products. Over utilisation of consumer products by each family of the city leads to more production of wastes. For instance, two hundred million cans, bottles, plastic containers, paper plates and paper cups are thrown away each year in the developed countries. Disposable items greatly increase the waste materials in the land. The increasing demands of consumption of goods in urban centers cause enormous amounts of waste production. Hence, the useful materials from the wastes are recovered before they are disposed into environment. Therefore, reuse of goods and waste utilization should become a part of the production-consumption cycle. The industrial sector disposes large quantities of solid wastes. Burning or dumping wastes into streams or oceans or lands damages the environment. It is estimated that the per capita production of domestic waste is many times higher in a developed country than developing country. Large quantities of solid, liquid and gaseous waste is produced by urban people in the form of plastic, paper, tin cans, bottles, leather, mineral refuse and pathological waste from hospitals. These wastes are considered to have great economic value which enhances pollution in the environment. Dead animals, agricultural wastes, fertilizer, pesticide, animal excreta etc., are some of the waste products produced by rural people.

The principles such as reduce, reuse and recycle should be employed. The consumers should use the products as much they required (water, food, paper etc.,). Donate old clothes to the poor people, instead of throwing away. Wet garbage includes kitchen wastes which can be used for composting. Avoid use of non-biodegradable materials such as styrofoam and certain types of plastics. Do not throw garbage in public places. Garbage can cause diseases and health problems.

Use and Throw plastics

There are biodegradable and nonbiodegradable types of plastics. The biodegradable type of plastics can be recycled and reused. But the nonbiodegradable type of plastics accumulates in the environment. The modern man uses plastic carrier bags, use and throw plastic cups, plates, mineral water bottles etc., in their routine life. After use they throw away these plastic materials into the land surface. Often, these plastic materials are consumed along with their foodstuff by domestic animals like sheep, cow, dog etc. As a result, the plastics cannot be digested and result into death of animals. In addition, the use and throw plastics when dumped in the surface of the land cannot allow percolation of water into soil. In due course, plants cannot get adequate amount of water and become dry. Moreover, underground water also decreases in the land.

5.4 ENVIRONMENT PROTECTION ACT, 1986

Objectives:

a) Protection and improvement of environment (air, water, land).
b) Prevention of hazards to all living creatures and property (humans, plants, animals).
c) Maintenance of harmonious relationship between human beings and their environment.
d) Planning and execution of nation wideprogramme to prevent, control and abate environmental pollution.
e) Laying down the standards for the emission or discharge of environmental pollutants from various sources.
f) Restricting areas in which industries, operations or processes shall not be carried out.
g) Carrying out investigations and research in environmental pollution problems.
h) Inspection of any premises, industries, manufacturing process, equipment or machinery and giving directions to prevent, control and abate environmental pollution.
i) Establishment of environmental laboratories and institutes.

j) The central government and its officers have the power to take samples of air, water, soil or substances from the factory or place, for analysis.

k) The central government has the power to appoint or recognise government analysts for the purpose of analysis of samples of air, water, soil or any other substance.

l) The report signed by a government analyst may be used as evidence of the facts stated therein in any proceeding under the legislation.

m) The central government has the power to close, prohibit or regulate any industry.

5.5 AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981

Objectives:

a) Prevention, control and abatement of air pollution.

b) Maintaining the quality of air.

c) Establishment of state or central pollution control boards for the prevention and control of air pollution.

Powers of the board:

a) Power to declare any areas or areas as air pollution control areas by notification in the official gazette.

b) Prohibit use of any fuel or appliance or burning of any material causing or likely to cause air pollution in an air pollution control area.

c) Power to establish standards for emission of air pollutants from automobiles laid down by the state board.

d) No person shall establish or operate any industrial plant in an air pollution control area, without the previous consent of the state board.

e) No person shall discharge any air pollutant in excess of standards laid down by the state board in an air pollution control area.

f) Any person empowered by a state board shall have right to enter any place or industry for examining and testing any control equipment, industrial plant, record, register, documents etc.

g) Any officer empowered by the state board has the power to take samples of air or emission from any chimney and send the same for analysis to the laboratory recognised by the state board.

Penalties for violations of the provision under the act:

Any person failing to comply with any of the provisions of the act shall be punishable with imprisonment for a term which may extend to three months or with fine which may extend to ten thousand rupees or both. In the case of continuing violation, an additional fine which may extend to five thousand rupees for every day.

5.6 WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974.

Objectives:

a) Prevention and control of water pollution

b) Maintaining or restoring healthy and hygienic water.

c) Establishment of Central board and State board for the prevention and control of water pollution.

Provisions of the act: (Central Water Pollution Control Board)

a) To lay down standards for streams and wells and to promote their cleanliness.

b) To advise and provide technical assistance to the central government on matters concerning the prevention and control of water pollution.

c) To prepare manuals or guides for treatment and disposal of sewage and industrial effluents and to establish or recognise laboratories for analysis of water samples.

Provisions of the act: (State Water Pollution Control Board)

a) Planning a comprehensive programme for prevention, control and abatement of pollution of streams and wells.

b) Advising the state government regarding water pollution control or location of industries.

c) Conducting and encouraging research relating to different aspects of water pollution.

d) To collaborate with the central water board for training personnel for handling water pollution programmes.

e) Inspecting industrial effluents and waste water treatment plants.

f) Evolving economical and reliable methods of disposal, treatment and reuse of waste water in agriculture.

g) Laying down the standards of treatment of sewage and industrial effluents to be discharged into any stream.

h) Establishing or recognising laboratories for analysis of water samples.

Powers of the board:

a) The water pollution control board officers have the power to take samples of water of any stream or well or effluents discharged from the industry for analysis.

b) Without the proper consent of the water pollution control board, no person shall establish any industry which is likely to discharge any sewage or effluents into stream or well or on land.

5.7 WILD LIFE PROTECTION ACT, 1972

Objectives:

a) To maintain essential ecological processes and life supporting systems.

b) To preserve the biodiversity

c) To ensure protection and conservation of wild life.

Provisions:

a) The central government may appoint a Director of wildlife preservation, Assistant Director of wildlife preservation and other required officers and employees.

b) The state government may appoint a Chief Wildlife warden, Wildlife wardens and other required officers and employees.

c) The state government or union territory may constitute a Wildlife Advisory Board. It advises the state government about selection of areas to be declared as sanctuaries and national parks formulation of the policy for protection and conservation of wildlife and specified plants.

d) Prohibition of Hunting endangered species of animals.

e) The Chief Wildlife Warden may grant permission to any person on payment of the prescribed fee, allowing him to hunt any wild animal for the purpose of education, scientific research, collection of specimens and collection of snake venom for the manufacture of life saving drugs.

f) Prohibiting picking and uprooting of specified plants.

g) The central government shall constitute a body to be known as Central Zoo Authority for taking care of the animals kept in a zoo, assessment of the functioning of the zoos and identification of endangered species of wild animals for the purpose of captive breeding.

Powers of Chief Wildlife Warden and authorised officers:

a) Power of cancellation of gun license of any person who has committed offence against this act.

b) The director or forest officer or any police officer not below the rank of a Sub Inspector has the power to stop any vehicle in order to conduct search.

c) If any person possess any captive animal, wild animal, animal article, meat etc., in his custody is considered as offence committed against this act. Arrest such a person with warrant and detain him.

Penalties for violation of the provisions:

a) A person violating any provision of this act shall be punished with imprisonment or a fine or both.

b) The license held by the offender shall be cancelled and he shall not be eligible for a license for a period of 5 years from the date of conviction.

5.8 FOREST CONSERVATION ACT, 1980

Objectives:

a) Protection and conservation of forests.

b) To ensure judicious use of forest products.

Provisions:

a) This act was enacted with a view to check indiscriminate diversion of forest land to non forest purposes.

b) Under this act prior approval of central government is required before any reserved forest is declared as dereserved or forest land is diverted to non forest purposes.

c) If diversion is permitted, compensatory afforestation is raised over equivalent area of non forest lands.

d) According to this act six regional offices have been set up for monitoring forest conservation matters by department of environment, forests and wildlife.

Powers of the central government:

a) The land that has been notified or registered and mentioned in government records as forest land, may not be used for non forest purpose. If the state government wants to convert the forest land into non forest purpose, it should get prior permission from the central government.

b) The state forest department should not have power to provide lease any forest land to any person or agency or organisation without prior approval of central government.

c) This act also prohibits the cutting of naturally grown trees in the forest land for the purpose of reforestation.

5.9 POPULATION EXPLOSION

India is the second largest populous country in the world. The population is increasing by about 17 million every year. The exploding human population leads to lack of resources it needs. It is evident that without controlling human members, the earth's resources will be rapidly exhausted. As population expands further, shortage of safe drinking water will become acute, soil will become unproductive, rivers, lakes, ponds and coastal waters will be polluted.

India's most populous regions are in coastal areas like Mumbai, Calcutta, Chennai etc. These coastal areas are rapidly destroyed due to population explosion. Environmental pollution in the coastal ecosystem changes the climate and affects the survival of high population. Human populations will expand from agricultural land into the adjacent forests. Many such encroachments cause forest loss. It has long term negative effects on water and air quality and the loss of biodiversity. These are the major deterrent to human well being. The growing populations require large amounts of energy for their production, packaging and transport of consumer goods. Our growing population also adds large quantity of liquid and solid wastes into the environment. Thus, it causes severe pollution in the environment and affects the survival of human.

Family welfare programme

In response to our tremendous population growth, the government of India launched the National Family Welfare Programme in 1951. The main objective of the programme is to reduce the birth rate and stabilise the population level.

Slogans such as "We two,We have two" indicated that each family should not have more than two children. In order to achieve the objectives of family welfare, following measures have been taken by the ministry of health and family welfare.

i) Contraceptive method: The success of family welfare programme depends upon the adoption of various family planning methods by every married people. Various contraceptive methods are available in India to control birth.

ii) Incentives and awards: Various state governments have introduced incentives in the form of compensation for the loss of wages due to sterilisation, lottery ticket schemes and issuing IndraVikhasPatra to the acceptors of the sterilization. Ministry of Health and Family Welfare, Government of India grants national awards to the best performing states.

iii) Mass education and media activities:

Mass education and media activities play an important role in educating the people about family welfare programmes. These are carried out by the respective states and union territories and the media units of the ministry of information and broadcasting. Multi-media campaigns are helpful to promote planned parenthood, delaying of marriage and the birth of first child, limiting the family for the progress and prosperity of the individual and fertility control for better quality of the life.

5.10 HUMAN RIGHTS

The constitution of India offers to all citizens individually and collectively some basic freedom. These are guaranteed in the constitution in the form of six broad categories of fundamental rights which are justiceable. Such rights are considered to be essential for the proper, moral and material upliftment of people. If any of these rights is violated the individual affected is entitled to move to the high court or Supreme court for the protection and enforcement of his rights.

These are explained below

i) Right to equality including equality before law prohibition of discrimination on grounds of religion, race, caste, sex or place of birth and equality of opportunity in matters of employment.

ii) Right to freedom of speech and expression, assembly, association or union, movement, residence and right to practice any profession or occupation.

iii) Right against exploitation, prohibiting all forms of forced labour, child labour and traffic in human beings.

iv) Right to freedom of conscience and free profession, practice and propagation of religion.

v) Right of any section of citizens to conserve their culture, language or script and right of minorities to establish and administer educational institutions of their choice.

vi) Right to constitutional remedies for enforcement of fundamental rights.

Check your progress

1 ----------layer serves as a protective umbrella or shield which protects the life on earth from ultraviolet radiations.

2. Carbon dioxide, methane, chlorofluoro carbons are known as ----------.

3.---------- act prohibits the cutting of naturally grown trees in the forest.

4.Environment protection act was formed in the year----------.

5. The main objective of the ---------- programme is to reduce the birth rate and stabilise the population level.

LET US SUM UP

Combustion of fossil fuels, industrialization, the exploding human population etc., causes global warming, acid rain and ozone depletion which are harmful to animals, plants, buildings, monuments, statues, bridges etc.

To protect the environment several acts are formed.

The constitution of India offers to all citizens individually and collectively some basic freedom known as fundamental rights which are justiceable. Such rights are considered to be essential for the proper, moral and material upliftment of people. If any of these rights is violated the individual affected is entitled to move to the high court or Supreme court for the protection and enforcement of his rights.

KEY WORDS

Climatic change: climate is changing and making it more difficult for survival of mankind. The earth is losing its ability to balance itself due to the imbalances created by human activities in the environment.

Human Rights: The constitution of India offers to all citizens individually and collectively some basic freedom. These are guaranteed in the constitution in the form of six broad categories of fundamental rights which are justiceable. Human societies will be seriously affected by extremes of climate such as floods and droughts.

QUESTIONS FOR DISCUSSION

1. What is global warming. Give its ill effects effects

2. Discuss the causes and effects of acid rain and ozone layer depletion

3. What is meant by wasteland reclamation? Explain.

4. What are the objectives and provisions of forest conservation act?

5. Give a brief account of human rights.

Check your progress:

Answer

1. Ozone
2. green house gases
3. Forest conservation act, 1980
4. 1986
5. Family Welfare

UNIT V – Social Issues and the Environment

S.No	Question	Marks	Bloom's Level
1	What is sustainable development?	5	K1
2	Define environmental ethics.	5	K1
3	What is climate change?	5	K2
4	Write a short note on environmental movements.	5	K2
5	What is environmental legislation?	5	K1
6	Explain the concept of sustainable development.	8	K2
7	Discuss the role of public awareness in environmental protection.	8	K3
8	Explain the impact of climate change on the environment.	8	K4
9	Analyze the role of environmental laws in India.	8	K4
10	Evaluate the importance of environmental management for future generations.	8	K5

SUGGESTED READINGS

1. Chemistry of the Environment, Ronald A. Bailey, Herbert M. Clark, James P. Ferris, Sonja Krause, Robert L. Strong. Second Edition. Academic Press. An imprint of Elsevier.
2. Text book of Environmental Chemistry, BalramPani. I. K. International Publishing House Pvt. Ltd.
3. A Text book of Environmental Chemistry and Pollution Control, Dr. S. S. Dara, Dr. D. D. Mishra. S. Chand & Company Ltd.