UNIT I – INTRODUCTION TO ENVIRONMENTAL SCIENCE

MODULE NO 1- ENVIRONMENTAL STUDIES (DEFINITION, SCOPE, IMPORTANCE AND NEED FOR PUBLIC AWARENESS)

Definition of Environment: Environment means all the conditions that surround the living organisms and contribute towards their existence, expansion and development. Man is the important component of all living beings. In other words Environment may be defined as follows:

Environment: "All the factors that contribute to the existence, sustenance, comfort and development of man and his surroundings is defined as Environment.

The above definition includes the earth we live on, the air we breathe, the living organisms that surround us and the water we drink. The surroundings are technically named as

1. Lithosphere (soil) 2. Atmosphere (air) 3. Biosphere (living organisms) and 4.Hydrosphere (water)

Definition of Environmental science: Environmental science may be defined as the branch of science that deals with the conditions that are responsible for the existence, sustenance and development of all living beings. It also deals with the influence of the surroundings on man and the influence of man on nature.

Importance of Environmental science: "Science is a branch of philosophy that deals with a analytical power to understand nature, In this process he conveniently classified his surroundings into several branches of science such as Botany, Zoology, Geology etc. To prove certain observations, man started doing experiments. During the course of his experiments man has accidentally run into certain difficulties which proved to be costly and started polluting his environment. To stop this damage caused by his experiments to the nature, man felt the necessity to understand the environment. The start of his study culminated in the origin of a new branch of science namely 'Environmental Science'.

To know the scope of the Environmental Science one has to understand several branches of science.

Relation between environmental science and other branches of science:

The earth we live on, forms the primary part of our environment. The branch of science which deals with the 'soil' is **Geology.** The plants and trees come next to soil, the study of 'plants' is **Botany.** We live along with many other beings on this earth. The animals and all living beings are studied under **Zoology.**

Necessity:

1. It helps the society to acquire basic understanding of environment identifying and solving associated problems.
2. It helps us for self development which helps in maintenance of life and health.
3. It helps us for understanding the environment and hazards leading to pollution of air, water and soil.

Multidisciplinary nature of environment:

The environmental science is a complex interdisciplinary subject to understand the substances of environment and has to study all branches of science.

1) **Botany:** The most important components of environment are plants and trees. To know about plants and trees one has to study "Botany".
2) **Zoology:** We know that all living beings belongs to Biosphere. The study of Zoology explains the Biosphere.

   In recent years man has realized that not only certain branches of science but also certain Social Sciences, Physics, Chemistry, Engineering, Agriculture Technology etc., are related to environmental science. A few are explained below
3) **Hydrology:** To understand the importance of water to all living beings one has to study the formation of water and its utility.
4) **Geology:** The earth we live on is an essential part of our environment. The "soil formation" can be understood by study of Geology.
5) **Meteorology:** The study of climatic conditions of the environment is known as "Meteorology".
6) **Petrology:** The concept of rocks and rock formation can be understood by the study of "Petrology".
7) **Agriculture:** The various kinds of crops we grow are explained by the branch of "Agriculture".
8) **Bio-Technology:** Bio-Technology deals with the biological research with its application in agriculture, forestry, industry etc.
9) **Science and Technology:** In our first birth we are not different from animals in our behavioral patterns and life styles. The advantages bestow by science and technology enabled us to assert our self in this environment with increasing power.

   Even though we study these branches of science differently they are inter-related and interdependent. Therefore we conclude that environmental science is multidisciplinary.

Important components of the Environment: The environment is composed of four important components namely: 1) Lithosphere 2) Atmosphere 3) Biosphere 4) Hydrosphere

1. **Lithosphere:** The earth we live on forms the Lithosphere. More precisely the solid outer layer of the earth is called Lithosphere. It is somewhat loose in texture and acts as the main source of nutrients for plants that grow on it.

   The composition of the top soil is as follows. Inorganic salts and oxysalts such as sulphates, silicates, carbonates etc-60%, organic matter in the form of putrefied plants, animal products-30%, water-5%, air-5%. The structure of the earth appears as follows.

   The top soil alone is suitable for the growth of plants and for agriculture. The diameter of the earth we live on is 12,756 K.M.

The centre of the earth called the core is still a boiling cauldron with the oxides and pure metals such as Nickel and Iron in liquid state at about 3000°C. These metals in large quantities at the centre of the earth are responsible for the gravitational attraction of the earth.

The hot centre of the core of the earth thus accounts for the existence of volcanoes and hot water springs even at the coldest areas such as the foot of the Himalaya mountains. At first the top soil was a solid rock but gradually it crumbled into fine particles due to weathering process.

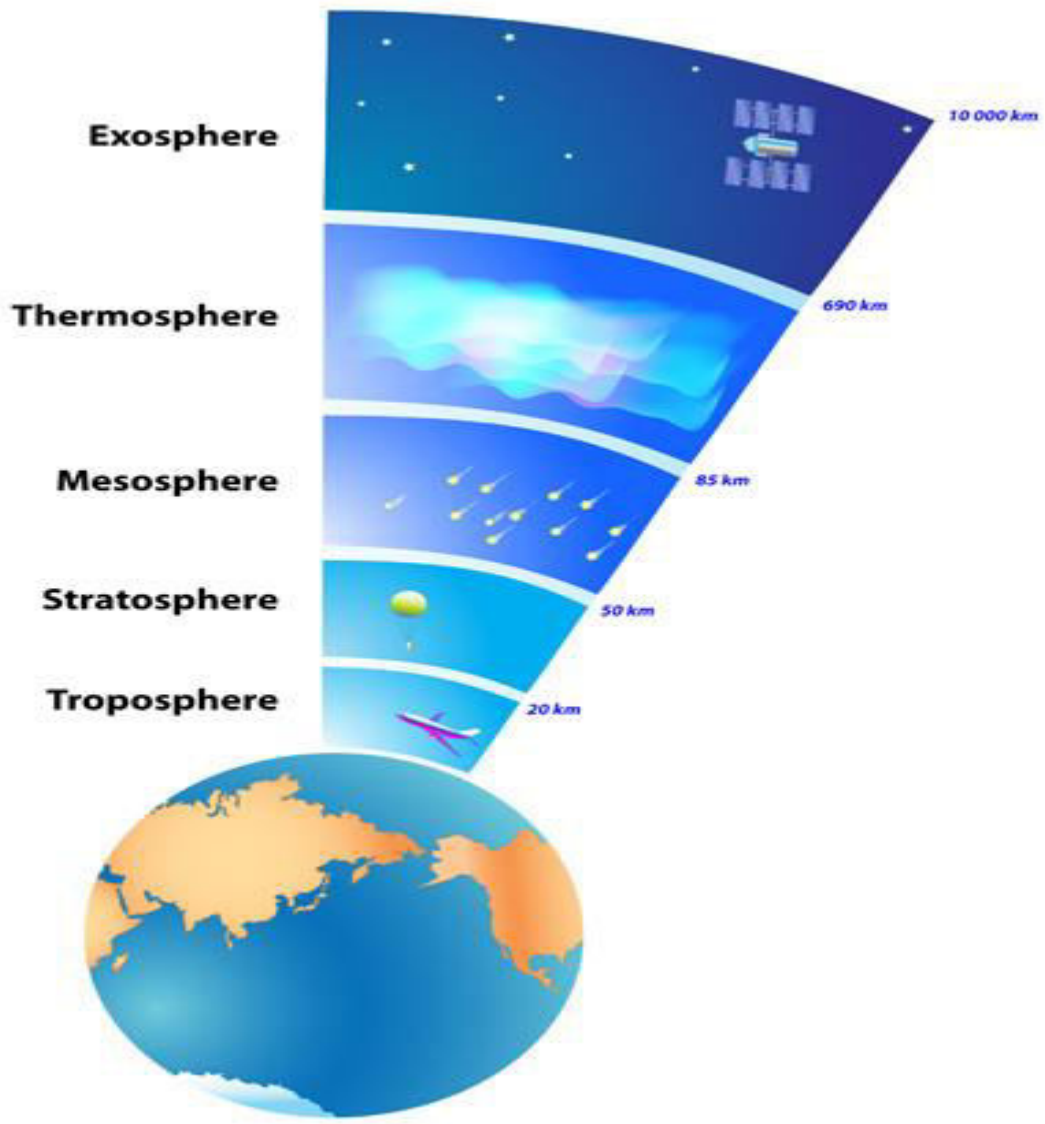
2. **Atmosphere:** The second important component of the environment is the atmosphere that surrounds us. The atmosphere may be divided into four regions namely:

A) **Troposphere:** It surrounds us on the earth up to a height of around 15 kilometers. The troposphere contains a mixture of gases of varying composition, mainly consisting of Nitrogen-78%, Oxygen-20%, Argon- 0.9%, Carbon dioxide- 0.03% and other gases such as helium, hydrogen etc

B) **Stratosphere:** The layer of atmosphere above the Troposphere is called Stratosphere. It consists of a thick blanket of Ozone stretched to a length of about 40 kilometers. Ths layer is also called Ozonosphere. It protects all the living beings on earth from the dangerous ultraviolet rays emitting from the sun. Ozone in the ozone layer absorbs the ultraviolet radiation.

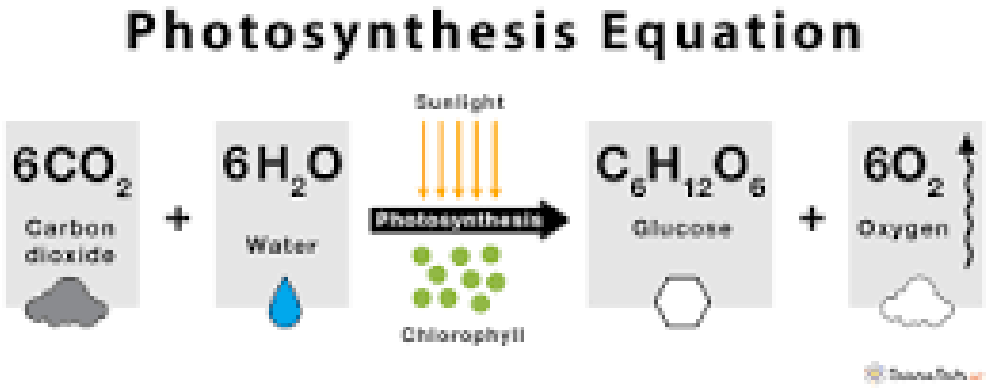
C) **Mesosphere or Ionosphere:** The layer of atmosphere up to about 100 Km above the ozonosphere is called the Ionosphere. It is named so because any neutral atom or molecule is stripped off its electrons by the ultraviolet rays to form ions here. The temperature in the Ionosphere is very low and goes down to about -110°C.

D) **Thermosphere:** The region above the Ionosphere is called Thermosphere, rightly so as temperature in this zone increases gradually up to 1200°C above 100 Km. The region above the thermosphere is called Exosphere. It rarely contains any atoms, molecules or ions.



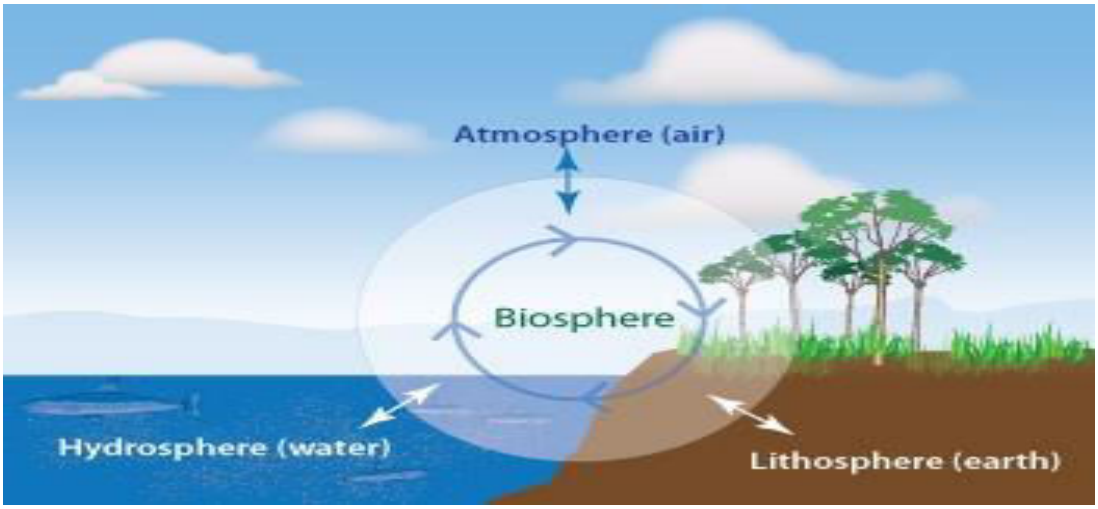
3. **Biosphere:** All the living organisms of plants or animal origin constitute the Biosphere. Besides these two, the Biosphere also contains very small living organisms invisible to naked eye called the microbes. There are more than one million known animal species on the earth. Similarly there are more than 1 Lakh plant species. Biosphere maintains the oxygen cycle, carbon dioxide cycle and nitrogen cycle constant i.e., Biosphere helps to maintain the quantities of nitrogen (78%), oxygen (21%), and carbon dioxide (0.03%) constant in the atmosphere.

   For Example: Animals and plants utilize oxygen in the respiration process where organic wastes are oxidized to carbon dioxide. Plants also take part in the photosynthesis in which carbohydrates are produced by the reaction between carbon dioxide and water in the presence of sunlight and chlorophyll. Thus respiration and photosynthesis are mutually opposite processes which may be represented by the following chemical equation.



4. **Hydrosphere:** Hydrosphere forms a very prominent part of the environment as water is an essential item required for all the living beings. Three fourth of the earth is covered with water in the form of oceans. The salinity of oceans is due to the dissolution of the several mineral salts in sea water. Salinity makes it unfit for consumption as the oceans contain 35% of dissolved salts is mainly Sodium chloride. Scientists have established that "life" originated in the oceans. Oceans play an important role in maintaining the water cycle of the earth.

As explained above the four components of the environment thus play an important role in serving for the sustenance of **LIFE** on this earth and help for the well being of man. Any damage to the balance of these four components destroys the nature. The responsibility now rests on "Man" who is intelligent and judicious to restore and maintain the ecological balance and preserve life on this unique planet.



Public awareness about Environment: Students and the educated people should make the illiterate public to understand about the dangers of polluting the environment and strive to provide the living beings with a friendly environment and problem free ecosystem.

The following are certain "DO's and Don'ts" for the public to live in a pollution free environment. There are reasons for all these DO's and Don'ts.

DO's: (i.e. what to do)

1) Grow as many green plants as possible.
2) Use water in a economical manner.

3) Educate the farmers about the judicious use of fertilizers, pesticides and chemicals.
4) Educate the masses about keeping good health, about the dangers of communicable diseases and the precautions to be taken to prevent the spread of infection.
5) Prevent soil pollution.
6) Prevent air pollution.
7) Protect natural water resources like lakes, rivers and ponds.
8) Conserve forests and wild life.
9) Use eco friendly materials.
10) Reduce the usage, reuse, repair and recycle materials for better environment.
11) Be a responsible citizen give respect to environmental laws.

Don'ts: (i.e. what not to do)

1. Resort to cutting of trees and deforestation.
2. Do not waste water especially drinking water.
3. Do not dump pesticides and poisonous chemicals in dwelling places.
4. Do not abuse fire, electricity and other important forms of energy.
5. Proper care should be taken to prevent the spread of communicable and diseases among public.
6. Do not pollute lakes, rivers and soil with industrial wastes.
7. Do not pollute the environment by the abuse of vehicles with smoky exhausts and unbearable noise from the engines**.**
8. Do not use Ozone depleting sprays or aerosols or chemicals.
9. Do not obstruct the drains by dumping your domestic waste.
10. Do not pollute your surroundings by burning plastic, rubber and other toxic materials.
11. Do not use wild life products in any form and do not kill animals.
12. Do not throw toxic materials openly.

To bring awareness about environmental sciences, Supreme Court of India recently directed all the State Governments and Universities to make it a subject of compulsory study at school and college level.

To promote awareness about protection of an environment Central Government is spending a lot of money through Ministry of Forests and Environment in organizing eco clubs and to run National Green Core (N.G.C).

The Central Government is also funding several Non Governmental Organizations (N.G.O's) to organize public awareness programmes on important issues like plastic and solid waste, conservation of water for future, public health and hygiene, need of Non-Ozone Depleting Sustenance (Non O.D.S).

The responsibility now rests on the younger generations to educate the illiterate about the dangers of pollution and suggest methods to eradicate pollution and to bring back a happy, healthy and bounty environment.

MULTIPLE CHOICE QUESTIONS

1. Conditions that surrounds the living organisms called as

   (a) Ecosystem (b) Biosphere **(C) Environment** (d) Ecotype

2. Soil formation can be understood by study of

   (a) Botany **(b) Geology** (c) Zoology (d) Hydrology

3. Ozone layer is present in

   (a) Thermosphere **(b) Stratosphere** (c) Mesosphere (d) Troposphere

4. The concept of rocks and rock formation can be understood by the study of

   (a) Petrology (b) Meteorology (c) Agriculture (d) Geology

5. Ozone shields the surface of earth from

   (a) Infra red rays (b) X-rays **(c) Ultraviolet rays** (d) All of the above

6. Environmental education is compulsory study at

   (a) Primary school stage (b) Secondary school stage (c) College level **(d) All stages**

7. Weather occurs in the Earth's

   (a) Troposphere (b) Mesosphere (c) Ionosphere (d) Thermosphere

8. Biosphere is a term used to represent the

   (a) Entire atmosphere consisting of troposphere , stratosphere , Mesosphere and Thermosphere

   (b) Entire hydrosphere representing the entire collection of water over the earth as well as inside the earth

   (c) **A small zone of earth , where lithosphere, hydrosphere and atmosphere come in contact with one another**

   (d) Entire lithosphere – representing the soil earth and its interior

9. The study of climatic conditions of the environment is known as

   (a) Agriculture **(b) Meteorology** (c) Bio-Technology (d) Geology

10. The part in which life can exist

    (a) Biosphere (b) Atmosphere (c) Lithosphere (d) Hydrosphere

Short Answer Questions

1. What is Environment?
2. What are the major components of environment?
3. Define Environmental science?

Long Answer Questions

1. Define environmental science and its importance? Discuss its scope and necessity?
2. Discuss the multidisciplinary nature of Environment?
3. Write an essay on need for public awareness about Environment?
4. Describe the important components of the Environment?

MODULE NO 2- NATURAL RESOURCES: RENEWABLE AND NON-RENEWABLE RESOURCES

A resource may be defined as a material that is of value and useful to the living beings. A resource may also be defined as an abstract entity such as intelligence, skill and labour useful to the living beings. Material resources can be obtained from nature (Eg: water, minerals and forests are tangible resources and skills, labour and intelligence are intangible). Resources can be classified as Renewable and Non-renewable.

Renewable resources: Renewable resources are the resources that are permanent and perennial. Forests, water and power are some of the examples of renewable resources.

Non-Renewable resources: Non-renewable resources are fuels such as coal and petroleum which are available in limited quantities and cannot be replaced. Abstract resources such as skills, labour and intelligence are also non-renewable as they are limited in supply.

Natural Resources: Anything required by us for living and provided by nature is known as natural resource.

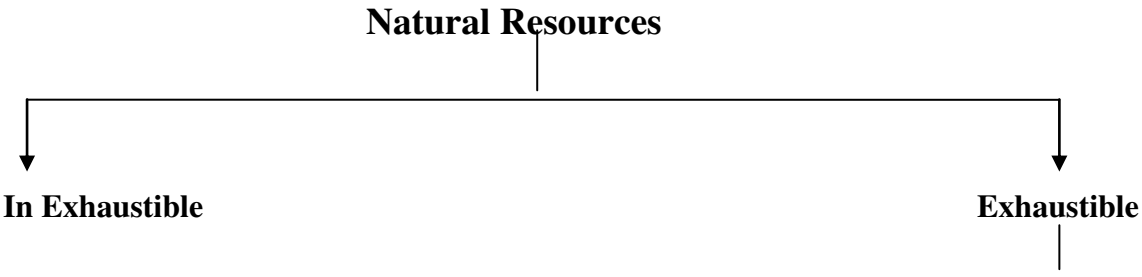
Classification of Natural Resources: Natural resources are classified into exhaustible and inexhaustible on the basis of their ability and abundance.

A. **Exhaustible Resources:** The resources which will decreases on use are called exhaustible resources and further classified into exhaustible renewable resources and exhaustible non-renewable resources.

1. **Exhaustible renewable resources:** The resources which regain their original quantities are called exhaustible renewable resources.
   Eg: Water, Soil, Plant, Wild life, Animals.
2. **Exhaustible Non-renewable resources:** The resources which do not regain their original quantities once used up are called exhaustible non-renewable resources.
   Eg: Biological species, oil, coal etc .

B. **In exhaustible Resources:** The resources which will not decrease on use are called in exhaustible resources.

   Eg: Rainfall, Solar energy, Hydro power etc.



A) Solar Energy
B) Wind Energy
C) Rain fall
D) Tidal Power
E) Hydro-Power
F) Geo-Thermal Power

Renewable

1. Water
2. Soil fertility
3. Natural vegetation
4. Wild life
5. Aquatic animals
6. Humans

Non-Renewable

1. Biological species
2. Minerals

I. Forest Resources:

Forest: Community formed by trees, shrubs and woody climbers are limited by canopy is called a Forest.

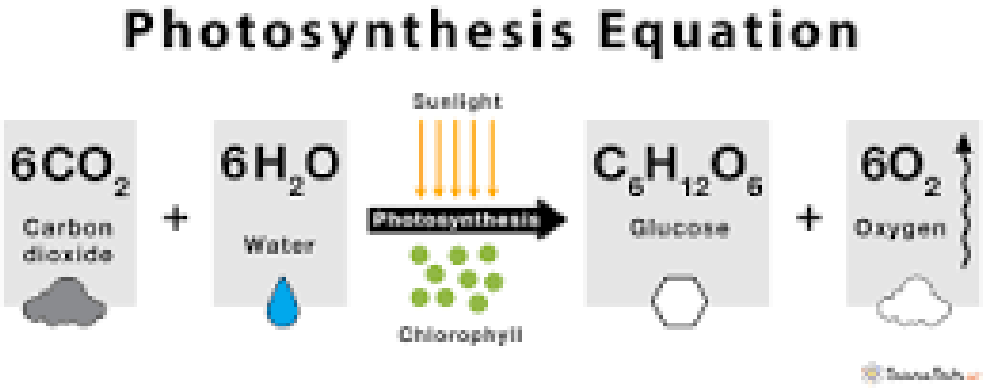
Forest resources: One of the important components of the environment is the forests which constitute renewable form of resources. Forests are spread over nearly 35% of the earth all over the world including India. Forest resources are classified as:

a) **Evergreen Forests:** Evergreen forests which are spread over cooler mountain regions. **Eg:** Kashmir Valley and Assam.

b) **Semi Evergreen Forests:** Moderately hot valleys such as those in western ghats.

c) **Tropical Forests:** Tropical forests such as those in the states of Madhya Pradesh and Orissa In India. The tropical forests are also green forests but shed their leaves once in a year.

Green trees are the sources of carbohydrates and oxygen which are formed by photosynthesis. Photosynthesis and respiration are two opposite processes. They may be represented by the following chemical equation.



Uses of Forest Resources:

1. Carbohydrates, especially glucose and oxygen are essential for life
2. Another use of the forest resources is the use of wood as fuel for producing fire and cooking food. Even today, in developing countries nearly 70% of the people use wood for making furniture. The forest resources are gradually dwindling by these activities.

Man should do the following inorder to conserve the forest resources.

1. Unjudicious felling of trees should be stopped.
2. Deforestation should be stopped forthwith.

Dangers of Deforestation: Now a days forests are destroyed inorder to build homes for the growing population. The consequence of deforestation is the increase in the atmosphere and decrease in the quantity of oxygen. Increase of carbon dioxide causes global warming. This is also known as "Green House Effect".

The world has large reserves of forests, but man started abusing the forests and even destroying them for his wrongful gains. Industries and residential colonies of houses are replacing the forests and making the most valuable resources become extinct. The destruction of the forest treasure will not only lead to the disturbance of the oxygen, carbondioxide and nitrogen cycles but also make the wild life end. There are more than 75,000 species of animals and about 50,000 species of plants. All these will become extinct due to the unjudicious felling of trees and destruction of forests. Global warming results and the evil effects of global warming such as melting of ice in the polar regions causing, rise of the levels in the seas, shifting of the fertile agricultural areas and converting some of the land into deserts. To prevent these disastrous consequences by planting and growing as many green trees as possible. More importantly, the illiterate masses should be educated about the impending dangers of deforestation.

II. Water Resources: Water resources form an important renewable part of environment. Water exists as 1) Oceans 2) Lakes and Rivers 3) Glaciers 4) Ground water. These may be described as follows

1. **Oceans:** The oceans are believed to have been formed along with the earth according to the " Big Bang Theory". Oceans cover nearly 70% of the total surface area of the earth (i.e., 363000000 Sq.Km). The oceans contain about 3 to 3.5% of dissolved salts, mainly sodium chloride and hence the water is rendered unfit for consumption. The oceans are very deep (upto about 10 Km deep in some areas) and form treasures of several sea animals. Life is believed to have been originated in the oceans.
2. **Lakes and Rivers:** Lakes and rivers form the sources of water on the earth's surface. They form good sources of potable water. The abundance of water in these depends upon the rainfall of the region. Some of the rivers form perennial sources of water. An example for this is the river Ganges or Ganga in India. All most all the rivers originate in the mountains and flow down according to direction of slope and finally flow into the ocean. Man has understood the use of rivers well and has been attempting to save the water from flowing down into the sea by constructing dams and reservoirs. Man also started producing electricity from the flowing river water by planning hydro electric projects. Rivers gives rise to many irrigation projects for agriculture.
3. **Glaciers:** A glacier is a moving mass of ice. Glaciers occur in very cold regions, high in mountains and in the far North and South polar regions, ice covers about 15 million square kilometers, nearly one tenth of earth land surface. The largest glacier in the world is Antarctica's lambert glacier which is nearly more than 500 Km long. The world's largest perennial rivers originate from these glaciers only for example in India, Ganga, Brahmaputra etc.
4. **Ground water:** The earth has plenty of ground water in its interior layers ranging from a few meters to a few kilometers depth. Ground water contains some dissolved salts depending upon the region of availability and needs purification before consumption. It must be stated that not all parts of

the earth are having ground water resources, especially some islands. About 97% of the total water of the earth is in the form of oceans. 2% of the water is in the form of glaciers and solid ice in polar regions. Only the remaining 1% of the available water is potable. All the living beings need water for their survival. Human and animal bodies contain 70% of water. Water thus forms an essential resource.

Benefits and problems concerned with Dams: A "Dam" is a construction across a river to store water and regulate the flow and divert into the channels of needy areas for irrigation purposes. Dams are thus intended for the increased distribution and utilization of the excess water flowing through the rivers and avoiding wastage of water. India has many perennial rivers such as the Ganga, Sindhu Godavari, Krishna Kaveri etc., distributed all over India.

The following are the advantages of "Dams":

1. Prevention of water wastage
2. Irrigate those areas on the land which otherwise are not in the path of the water flow of the rivers.
3. Use the water reservoirs for the production of electricity.
4. Create more fertile areas of the land and make the people in those areas occupied and employed.

Today we have close to 2000 dams in India.

Some of the important Dams and Projects are:

1. **Bhakra Nungal Dam:** Raised on the river Sutlez the dam is useful to the people of the 5 States Delhi, Himachal Pradesh, Punjab, Haryana and Rajasthan produces power.
2. **Hirakud Project:** Raised on the river Mahanadi, the dam is useful to the states of Orissa, Madhya Pradesh produce power.
3. **The Mettur Dam:** Raised on the river Kaveri is useful to the state of Tamilnadu and irrigates several hectares of land in Tamilnadu produces power.
4. **The Nagarjuna Sagar Dam:** Raised on the river Krishna irrigates several hectares of land. Produces power.

Effects on forests and Tribal people:

1. People residing in the dam site and nearby villages are displaced.
2. Forests and fertile areas near the dams are also destroyed. The environment near the dam site where the power generation plants are constructed is adversely affected. The plausible solutions suggested to cover the drawbacks due to the raising of dams are:
   a. Rehabilitation of the people displaced from the dam site.
   b. Provide alternative areas for living and agriculture to the affected people.
   c. Reduce pollution and raise forests at different places where there is deforestation.
   d. Solve the disputes between states, arising due to the construction of dams.

   A few examples of dams which have become controversial due to the objections raised by the affected states are:

1. **Sardar Sarovar project on the river Narmada:** Gujarat, Maharashtra and Madhya Pradesh – Intends to provide water for irrigation, drinking and electricity generation.

2. **Alamatti dam on the river Krishna in Karnataka:** Affected state in Andhra Pradesh. Disputes on these dams are still going on.

Advantages and Disadvantages of construction of dams across rivers:

Enormous increase of the human population over the decades has resulted in the culmination of water conflicts among people.

There are permanently flowing rivers all over the world. These rivers, even though originate at a particular region flow through several States or even Countries before they finally ending in the sea. Depending on the climatic conditions the rivers , flood and over flow. For example the rivers "Ganga"and "Brahmaputhra" originate in the Himalayas, and overflow with water during summer due to the melting of ice. Rivers such as "Godavari" and "Kaveri" originate in the Western Ghats and overflow due to rains in the rainy season. To control the wastage of water due to overflow and inundation of low lying areas, building of dams over the rivers was taken up inorder to stock the water in reservoirs and regulate the flow and utilize the excess water for agriculture. The construction of dams across the rivers has the following advantages.

1. Wastage of water is prevented. Floods can be prevented.
2. The water in the dams may be utilized for the production of power.
3. Water may be diverted through channels for irrigation.
4. Employment may be provided for people to work on the dams, power projects and irrigation canals.

There are some disadvantages also in the construction of dams.

1) As the rivers pass through different States and Countries, disputes arise between the utilizing states or countries. Some of these disputes which are still going may be listed as follows:
   a) **The Krishna water dispute:** The river Krishna originates in the western ghats of the Karnataka State and flows through Andhra Pradesh. The Karnataka government had built a dam on Krishna at "Almatti" which resulted in the restriction of water supply to Andhra Pradesh.
   b) **The "Kaveri" water dispute:** This is again between the states of Tamilnadu and Karnataka. The river Kaveri is originated in Karnataka and flows through Tamilnadu. The flow of Krishna water through Tamilnadu is restricted by the dams on Krishna in Karnataka.
   c) **The SYL conflict:** The conflict is between States of Punjab and Haryana. Inter linking of Sutlej river and Yamuna river through a canal. The dispute arose between Punjab and Haryana over the use of water of the inter linking canal.
2) Another disadvantage of dams is that the areas where the dams are built may inundated.

III. Mineral Resources:

Minerals: Minerals are naturally occurring inorganic, crystalline solids with definite chemical composition and particular physical properties.

Minerals are non-renewable natural resources. There are 110 elements discovered till today. Out of these, about twenty are radioactive elements or unstable elements which constantly dissociate. All the elements are believed to have been formed from the sun when the "Super Nova" or the gigantic blast occurred in the sun

resulting in the spilling of the hot vapours of elements which travelled far from the sun and solidified into the planets. The earth is one of such solidified bubbles containing the elements, and many compounds which formed as a result of reaction between the elements. Elements such as Iron, Nickel, Calcium, Silicon and Magnesium combined with non- metallic elements such as oxygen, sulphur, halogens and carbon to form chemical compounds. These compounds or mixtures of these compounds are called "Minerals". Gold, Silver and Platinum precious metals have assumed importance to measure the wealth of the countries. The development of science has resulted in the preparation of many **Alloys** such as Steel, Brass and Bronze which possess better qualities and strength than that of single metals. The development of science and the increasing needs of people culminated in the setting up of several industries for the extraction of metals and manufacture of alloys such as steel.

Types of Minerals:

i) Non-metallic minerals like diamond, graphite, quartz etc.

ii) Metallic minerals like Bauxite, Laterite etc.

Uses: Minerals are mainly used as:

1) For development of industrial plants and machinery.

2) Coal, Lignite and Uranium are used for generation of energy.

3) Used in defence systems weapons and ornaments.

4) Used in communication system like cables and telephone wires.

5) Used in many medicines.

6) Gold, Silver, Platinum, Diamond are used as jewellery.

7) Silver is used in photography, electronics.

8) Minerals are used in the form of fertilizers and many fungicides in agriculture.

Effects of extraction of mineral resources: Extraction of mineral resources from the earth is called Mining or Quarrying. Mining of minerals, coal and petroleum from the soil results in the damage to the natural texture and composition there by bringing a major ecological change of nature. Depending on the nature of the material extracted and the various metallurgical processes the effluents contaminate the atmosphere and cause pollution.

Environmental affects of mineral extraction: Mining or extraction and processing of minerals and their disposal pollutes the soil, air and water

Ill effects of Mining in India:

1) People residing near the (Uranium mine), Jharkhand are exposed to nuclear hazards.

2) High sulphur contamination of groundwater is taking place in North eastern coal fields (Assam).

3) River pollution is cause of concern due to Kudremukh iron ore in Karnataka.

4) Health hazards in mines due to appearance of diseases black lung disease, asbestosis etc.

5) Disappearance of vegetation.

6) Defacing land scope and subsidence of land.

IV. Food Resources:

Food is essential for growth and development of living organisms. These essential materials are called nutrients and these nutrients are available from variety of animals and plants. There are thousands of edible plants and animals over the world, out of which only about three dozen types constitute major food of humans.

Food sources: The majority of people obtain food from cultivated plants and domesticated animals. Although some food is obtained from oceans and fresh waters, but the great majority of food for human population is obtained from traditional land-based agriculture of crops and livestock.

Food Crops: It is estimated that out of about 2,50,000 species of plants, only about 3,000 have been tried as agricultural crops. Under different agro-climatic condition, 300 are grown for food and only 100 are used on a large scale.

Some species of crops provide food, whereas others provide commercial products like oils, fibres, etc. Raw crops are sometimes converted into valuable edible products by using different techniques for value addition .At global level; only 20 species of crops are used for food. These, in approximate order of importance are wheat, rice, corn, potatoes; barley, sweet potatoes, cassavas, soybeans, oats, sorghum, millet, sugarcane, sugar beets, rye, peanuts, field beans, chick-peas, pigeon- peas, bananas and coconuts. Many of them are used directly, whereas other can be used by changing them by using different techniques for enhancing calorific value.

Livestock: Domesticated animals are an important food source. The major domesticated animals used as food source by human beings are 'ruminants' (e.g. cattle, sheep, goats, camel, reindeer, llama, etc.).

Ruminants convert indigestible woody tissue of plants (cellulose) which are earth's most abundant organic compound into digestible food products for human consumption. Milk, which is provided by milking animals, is considered to be the complete food. Other domestic animals like sheep, goat, poultry and ducker can be used as meat.

Aquaculture: Fish and seafood contributes 17 million metric tonnes of high quality protein to provide balance diet to the world. Presently aquaculture provides only small amounts for world food but its significance is increasing day by day.

World Food Problems: As per estimates of Food and Agriculture Organization (FAO), about 840 million people remain chronically hungry and out of this 800 million are living in the developing world. In last decade, it is decreasing at the rate of 2.5 million per year, but at the same time world's population is increasing. Target of cutting half the number of world's chronically hungry and undernourished people by 2015 will difficult to meet, if the present trend continues. Due to inadequate purchasing power to buy food, it is difficult to fulfil minimum calorific requirement of human body per day. Large number of people are in India are poor which can

be attribute to equitable distribution of income. Food insufficiency can be divided into two categories into under-nourishment and malnourishment. Both of these insufficiencies are global problems.

Changes Caused by Agriculture and Overgrazing: From centuries, agriculture is providing inputs to large number of industries involved in production, processing and distribution of food. Accordingly, agriculture has significant effect on environment. The effects of agriculture on environment can be classified as local, regional, and global level. The agriculture also makes impact on the usage of land generally as follows:

1. Deforestation
2. Soil Erosion
3. Depletion of nutrients
4. Impact related to high yielding varieties (HYV)
5. Fertilizers related problems include micronutrient imbalance, nitrite pollution and eutrophication.
6. Pesticide related problems include creating resistance in pests and producing new pests, death of non-target organisms, biological magnification.
7. Some other problems include water logging, salinity problems and such others.

The carrying capacity of land for cattle depends upon micro climate and soil fertility. If carrying capacity is exceeded than land is overgrazed. Because of overgrazing the agricultural land gets affected as follows,

- Reduction in growth and diversity of plant species
- Reduce plant cover leads to increased soil erosion
- Cattle trampling leads to land degradation

Effects of Modern Agriculture: For sustainable production modern techniques are used to enhance productivity of different cropping systems under different agro-eco-zones. Adoption of modern agricultural practises has both positive and negative effects on environment. Effects of modern agriculture are briefly discussed under different heads as under:

Soil erosion: Raindrops bombarding bare soil result in the oldest and still most serious problem of agriculture. The long history of soil erosion and its impact on civilization is one of devastation. Eroded fields record our failure as land stewards.

Irrigation: Adequate rainfall is never guaranteed for the dry land farmer in arid and semiarid regions, and thus irrigation is essential for reliable production. Irrigation ensures sufficient water when needed and also allows farmers to expand their acreage of suitable cropland. In fact, we rely heavily on crops from irrigated lands, with fully one-third of the world's harvest coming from that 17% of cropland that is under irrigation. Unfortunately, current irrigation practices severely damage the cropland and the aquatic systems from which the water is withdrawn.

Agriculture and the loss of genetic diversity: As modern agriculture converts an ever-increasing portion of the earth's land surface to monoculture, the genetic and ecological diversity of the planet erodes. Both the conversion of diverse natural ecosystems to new agricultural lands and the narrowing of the genetic diversity of crops contribute to this erosion.

Fertilizer-pesticide problems: For photosynthesis apart from water, sunshine and CO_2, plants need micro and macro nutrients for growth. These nutrients are supplied in the shape of fertilizers. There is lot of potential to increase food productivity by increasing fertilizer use. On one hand application of artificial chemical fertilizers increases the productivity at faster rate as compare to organic fertilizers, on the other hand application of fertilizers can be a serious problem of pollution and can create number of problems. Excessive level of nitrates in ground water has created problems in developed countries. These are:

a. Accumulated phosphorous as a consequence of use of phosphoric fertilizer are posing serious threat as residues in domestic water supply and for ecology of river and other water bodies. Increased level of phosphates in different water results in eutrophication.

b. Effect of chemical fertilizer is long term, therefore leads to net loss of soil organic matter.

To control insects, pests, diseases and weeds which are responsible for reduction in productivity different chemicals are used as insecticides, pesticides and herbicides. Successful control of insects, pests and weeds increases productivity and reduces losses and provide security for harvest and storage. Applications of these synthetic chemicals have great economic values and at the same time cause number of serious problems such as:

a. Affects human health which includes acute poisoning and illness caused by higher doses and accidental exposes

b. As long term effect, cause cancer, birth defects, Parkinson’s disease and other regenerative diseases.

c. Long term application of pesticides can affect soil fertility.

d. Danger of killing beneficial predators.

e. Pesticides resistance and pest resurgence

Water Logging: High water table or surface flooding can cause water logging problems .Water logging may lead to poor crop productivity due to anaerobic condition created in the soil. In India, deltas of Ganga, Andaman and Nicobar Islands and some areas of Kerala are prone to frequent water logging.

Salinity: Due to adoption of intensive agriculture practices and increased concentration of soluble salts leads to salinity. Due to poor drainage, dissolved salts accumulate on soil surface and affects soil fertility. Excess concentration of these salts may form a crust on the surface which may injurious to the plants. The water absorption process is affected and uptake of nutrient is disturbed. According to an estimate, in India, 7 million

hectare of land is saline and area is showing in increasing trends due to adoption of intensive agriculture practises**.**

V. Energy Resources: There are two types of energy resources

1) Renewable resources: The resources that are being continuously consumed by man but renewed by nature are called renewable resources.

These resources are inexhaustible, these may be also called as non-conventional sources of energy.

Eg: Solar energy, wind energy, tidal energy, wood, bio-mass energy, bio-fuels, geo thermal energy etc.

1) **Solar Energy:** It is the energy obtained from the solar radiation, the solar radiation falling on the surface of the earth is equal to 170 trillion kilowatts. Solar energy is the biggest source of non-conventional source of energy. The devices like, Photo voltaic panels, cookers, heaters, solar battery, solar refrigerator, air conditioning and portable solar driers use solar energy.
2) **Wind Energy:** Wind energy can be used for water pumping and power generation. Wind power is converted into mechanical energy and then to electrical energy. Wind speed is very high in coastal areas like Kutch, Okha (Gujarat), Puri (Orissa), Tuticorn (Tamilnadu) have wind turbines. These turbines are used for electricity generation. Wind mills are used for water pumping.
3) **Tidal Energy:** The energy from the tides of seas and oceans is called tidal energy. The flexibility of generating tidal energy is being studied in " The Ronn of Kutch" in Gujarat and Sunder bans in West Bengal. The world's only major tidal power station is in France.
4) **Hydro Power:** The potential energy of stored water in a dam is then converted into kinetic energy of water by allowing it fall through pipes. From top of the dam to its bottom, this floating water rotates the turbines as a result of which the armature coil of the generator rotates producing electricity. This power produced from water is called hydro electric power.
5) **Geo Thermal Energy:** The energy from hot rocks present inside earth is called geo thermal energy. In places like Kullu (H.P) and Sohna (Haryana), hot water comes out from the soil. Hot water coming out with pressure can be used to run turbines of a generator to produce electricity.
6) **Bio-mass Energy:** Energy from organic matter like wood, cattle dung, sewage, agricultural wastes produced by plants is called biomass energy.
7) **Bio-gas:** The gas produced by action of bacteria on biomass is called biogas.
8) **Bio-fuels:** Ethanol and Methanol can be formed due to fermentation of biomass. Sugarcane can be used for production of ethanol. These are used as Bio-fuels.
9) **Hydrogen:** It is non-polluting, high calorific value fuel and can be easily produced by thermal dissociation and by photolysis or electrolysis of water.

2) Non- Renewable resources of energy: These are not renewable. They are not replenished by nature if exhausted.

E.g.: Fossil fuels like coal, petroleum, nuclear fuels like Uranium and Thorium are non- renewable.

1) **Coal:** About 6000 billion tonnes of coal lies under earth, but by now over 200 billion tonnes has been used. Coal is a major source of power and industrial fuel of great importance. The production of energy by burning coal in thermal electric plants and industries causes severe air pollution.
2) **Petroleum:** The burning of fossil fuels like petrol, diesel, kerosene etc., also give energy, but it produces Green House Gases (GHG) causing Green House Effect and global warming.
3) **LPG (Liquified Petroleum Gas):** Petroleum gas is converted into liquid under pressure to form LPG, it is used as household gas in kitchens.
4) **Natural Gas:** It is mainly composed of methane with small quantities of propane and ethane. It can be used as a energy source and also as industrial raw material in petro chemical industry. This is also used for fertilizer plants it burns without smoke.
5) **CNG (Compressed Natural Gas):** It is used to run vehicles to reduce air pollution it is widely used in Delhi and soon in other parts of country.
6) **SNG (Synthetic Natural Gas):** It is prepared by combination of carbon monoxide and hydrogen. Low quality coal is converted into synthetic gas.
7) **Nuclear Energy:** The energy produced from radioactive material is called nuclear energy. Small amount of radioactive substance produce large amount of energy by nuclear reactions. This energy is used for production of electricity, for running submarines, space crafts etc. the handling, manufacture, extraction, transport of nuclear materials is highly risky and polluting. The energy produced from nuclear plants is cheaper in cost.

VI. Land Resources: Soil may be defined as the portion of earth's surface suitable for growing plants and for agriculture. When the earth formed billions of years ago, it was only a ball of solidified minerals or rocks. As time passed, these rocks are sudden freezing along with fast flowing water and high winds and transformed into what the land looks like today. Not only the mineral rocks crumbled into powder but also added some extra materials such as organic matter, air and water. The average composition of ideal soil is minerals 45-50%, organic matter 5-10%, water 20-25%, air 20-25%. It is experimentally proved that the entire top soil of the earth suitable for growing plants is composed of all the four ingredients mentioned above. This texture of the top soil extends upto a few meters depth and is loose and porous. The loose texture makes the soil prone to 'Soil Erosion". Thus soil erosion is defined as the process of loss of top soil under the influence of certain external factors some of which are natural and some are man made.

1. Weather and climatic conditions (For example high temperature and pressure).
2. Heavy rains
3. Erosion due to the action of the waves of the sea.
4. High winds. All these are natural factors.

Some causes of erosion are man made for example:

1. Diversion of the natural course of river flow.
2. Faulty agricultural activity and faulty procedures.
3. Unusually fast flow if irrigating water due to non levelling of soil.
4. Extensive mining of soil.

The following precautions should be taken in order to prevent Soil Erosion:

1. River and canal flows should be controlled with proper bunds and reinforced edges.
2. Check dams should be constructed in pre determined areas to control the flow rate of rivers.
3. Growing grass or deep rooted plants on the coastal line or along the river bunds to prevent soil erosion.

Desertification: The process of rendering once fertile lands into waste lands is called desertification. Sometimes fertile lands are rendered useless due to the following reasons.

1. Irregular monsoon and improper temperature and pressures on land causing drought.
2. Heavy rains and heavy floods causing depletion of soil nutrients or water clogging and flooding.
3. High tides and cyclones causing layering of fertile lands with salts and sand thus rendering the soil unfit for cultivation.
4. Green house effect and global warming creating conditions unfit for agriculture.

Desertification may be avoided by taking the following precautions:

1. Using ground water for irrigation during dry seasons.
2. Arranging proper drainage system in agricultural soils to avoid water logging and over irrigation.
3. If there is deposition of salts and sand on fertile soils the deposits should be removed by human effort or man power.
4. When the weather conditions change against the requirement for certain crops, alternate crops should be selected to suit the weather conditions.
5. Now a days there is no dearth of technical expertise. Hence the services of experts should be needed to achieve best results.

MULTIPLE CHOICE QUESTIONS

1. Which of the following activities will prove to be effective in preventing floods
   (a) Removing the top soil (b) Cutting of trees (**c) Afforestation & Construction of dams** (d) None
2. Sardar Sarovar dam is situated on river
   (a) Ganga **(b) Narmada** (c) Yamuna (d) Godavari
3. Which of the following is a non – renewable

(a) Water (b) Soil (c) Wild life **(d) Coal**

4. Which of the following is an inorganic natural resource

   (a) Water (b) Fossil fuels (c) Plants (d) Animals

5. Which of the following is a renewable resource of energy

   (a) Petroleum (b) Nuclear fuel **(c) Trees** (d) Coal

6. Fossil fuels include

   (a) Coal & Metals **(b) Coal , Natural gas & Oil** (c) Oil & Minerals (d) Oil , Minerals & Metals

7. Soil erosion can be prevented by

   (a) Afforestation (b) Over grazing (c) Removal of vegetation (d) Increasing birds population

8. The oceans Covers..... percentage of earth's surface

   (a) 50% (b) 60% **(c) 70%** (d) 90%

9. The resources that can be replaced by natural ecological cycle is called

   (a) Renewable (b) Non- renewable (c) Exhaustible (d) Natural

10. The main energy source for the environment is

    (a) Chemical energy **(b) Solar energy** (c) Bio electrical energy (d) Electrical energy

SHORT ANSWER QUESTIONS

1. What is deforestation?
2. Name a few inexhaustible natural resources?
3. Name a few alternative sources of energy other than conventional fossil fuels?
4. Define soil erosion and Desertification?

LONG ANSWER QUESTIONS

1. Define the term resource and classify the world's natural resources?
2. Describe the water resources available in nature? What are the benefits and problems concerned with dams?
3. What are mineral resources? Describe the effects of extracting mineral resources?
4. What are renewable and non- renewable energy resources? Discuss the use of alternate energy resources?

Department	Biology
Year	E1,E2,E3,E4
Semester	S1/S2
Course Name	Environmental Studies
Course Code	BE3101/BE1201/BE4101/BE2101
Course Credit	Mandatory Course
Name of the Faculty	Dr.B.Hemavathi

Module – 3

Concept - structure and function of an ecosystem – producers, consumers and decomposers

Objectives

- To understand important ecological processes.
- To describe about how the organisms interact with other organisms and with their physical environment.

Ecosystem

The branch of science which deals with the relationship of organisms with their environment is known as Ecology. Today, ecology has become one of the most important branches of biology it deals with the consequences of inter relationship between organisms and environment.

The term ecosystem was coined by a British ecologist, A.G. Tanslay in 1935, **"Ecosystem is a basic functional unit of Ecology consisting of abiotic and biotic factors which interact with each other and exchange materials".** They are inseparably interrelated.

The ecosystem may be natural (Operating under natural conditions without any major interference by man) eg: terrestrial – grass land, desert, forest etc., and aquatic – fresh water (eg. Ponds, lakes and streams) and marine (eg: open sea, coastal and estuarine) ecosystems or artificial (man – made ecosystems eg: croplands, space – ecosystems etc). An important feature of an ecosystem is that it is capable of self maintenance and self regulation. It has a tendency to resist change and to remain in a state of equilibrium.

Concept of an ecosystem

The concept of ecosystem can be well explained that the organisms and the environment are interrelated and interdependent with each other. Holozoic animals cannot synthesize their food material; hence they have to depend upon plants either directly or indirectly. Even plants which are capable of synthesizing their own food depend upon the abiotic environment from which they receive light, water, CO_2 and mineral salts, other inorganic and organic substances of absolute necessity for the synthesis of food. After the death of animals their dead bodies undergo putrification with the help of micro organisms and convert into inorganic and organic substances.

The inorganic substances are added to the soil by the excretory substances of animals. These substances are absorbed by plants through their root system which are necessary for the existence of plant community. Thus a dynamic and delicate balance exists between the biotic and abiotic environments and this system of interaction and their dependence is termed as ecosystem.

Structure and Function of an Ecosystem

The two major aspects of an ecosystem are, the structure and function.

- By structure we mean

1. The composition of biological community including species, number, biomass, life history and distribution in space etc.
2. The quantity and distribution of the non-living materials such as nutrients, water etc. and
3. The range of conditions of existence, such as temperature, light etc.

- By function we mean

1. The rate of biological energy flow i.e., the production and respiration rates of the community
2. Rate of materials or nutrient cycles and
3. Biological or ecological regulation including both regulation of organisms by environment (photoperiodism etc) and regulation of environment by the organism (nitrogen fixing organism etc). Thus, in any ecosystem structure and function are studied together.

- Functional aspects of an ecosystem will be discussed in other modules in details.

Structure of Ecosystem: (Components of an Ecosystem)

The ecosystem comprises two major components

1. Abiotic component and
2. Biotic component

I. A biotic component: All non-living factors of ecosystem is called abiotic component, which includes

- **a. Organic substances:** These are proteins, carbohydrates, lipids, amino acids etc present either in the biomass or in the environment.
- **b. Inorganic substances:** These include elements like C, H, O, N, P, Mg, Fe, Cd, Cu, Na, H_2O, CO_2 etc. They are present either in free state or in the form of compounds dissolved in water and present in the soil.
- **c. Climatic Regime:** It comprises of physical factors such as light, temperature, atmospheric pressure etc.

II. Biotic Components: All living organisms constitute of biotic components.

They are

1. **Producers:** These are autotrophic green plants and some photosynthetic bacteria. The producers fix radiant energy of the sun light and with the help of minerals derived from the water and mud, they manufacture complex organic substances. Only green plants are capable of trapping the solar energy which is the ultimate source of energy for all the organisms of an ecosystem. Only producer are capable of absorbing the essential elements from the soil and making them available to animals for their growth and development.
2. **Consumers:** (Macro consumers) These are heterotrophic organisms. All the animals which directly or indirectly depend upon plants for their food are called consumers.

   Consumers are of three types

   a. **Primary Consumers:** These are Herbivorous animals. They feed on green plants. Ex: Deer, Sheep, Goat, Horse, Rabbit, cattle, insects etc.
   b. **Secondary Consumers:** These are Carnivorous animals. They feed on Primary consumers. Ex: Wolves, Dogs, Cats, frog, fox etc.
   c. **Tertiary Consumers:** They feed on both Primary and Secondary consumers. Ex: Lion, Vultures, Eagle, Hawks etc.

3. **Decomposers:** (Micro consumers or reducers)Micro organisms such as bacteria, and fungi, secrete

enzymes to decompose the dead bodies of plants and animals (producers and consumers), into smaller bits or molecules. They bring about the degradation of the complex compounds of dead protoplasm into simpler a biotic compounds. Decomposers use some of the products for their maintenance and release the rest to the environment. Some bacteria and fungi bring about the transformation of decomposed products into basic biotic substances (ex: C, O, H, N, P, Fe, Na, etc.)

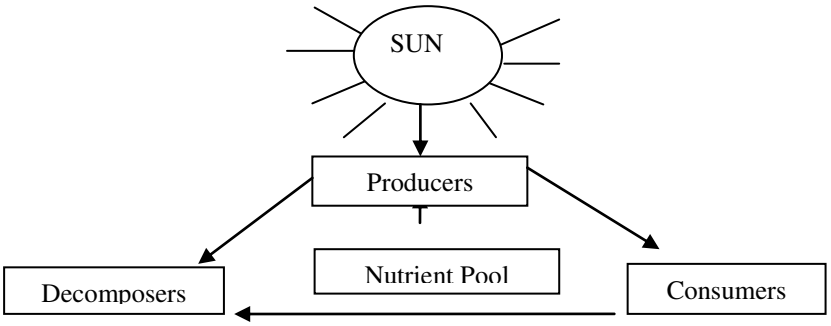


Fig: A Scheme of the structure of a unit of typical ecosystem

Ecosystems

Natural Ecosystems

Artificial Ecosystems

(Man – made ecosystem

Crop fields etc)

Terrestrial Ecosystem

1. Forest Ecosystem
2. Grassland Ecosystem
3. Desert Ecosystem

Aquatic Ecosystem

Fresh Water Ecosystem

Marine Ecosystem

1. Oceanic Ecosystem
2. *Estuaries

Lotic Ecosystem

(Flowing Water)

1. River Ecosystem
2. Stream Ecosystem
3. Spring Ecosystem

Lentic Ecosystem

(Stagnant Water)

1. Lake Ecosystem
2. Pond Ecosystem

*Estuaries: Transition zone between river environment and marine environment.

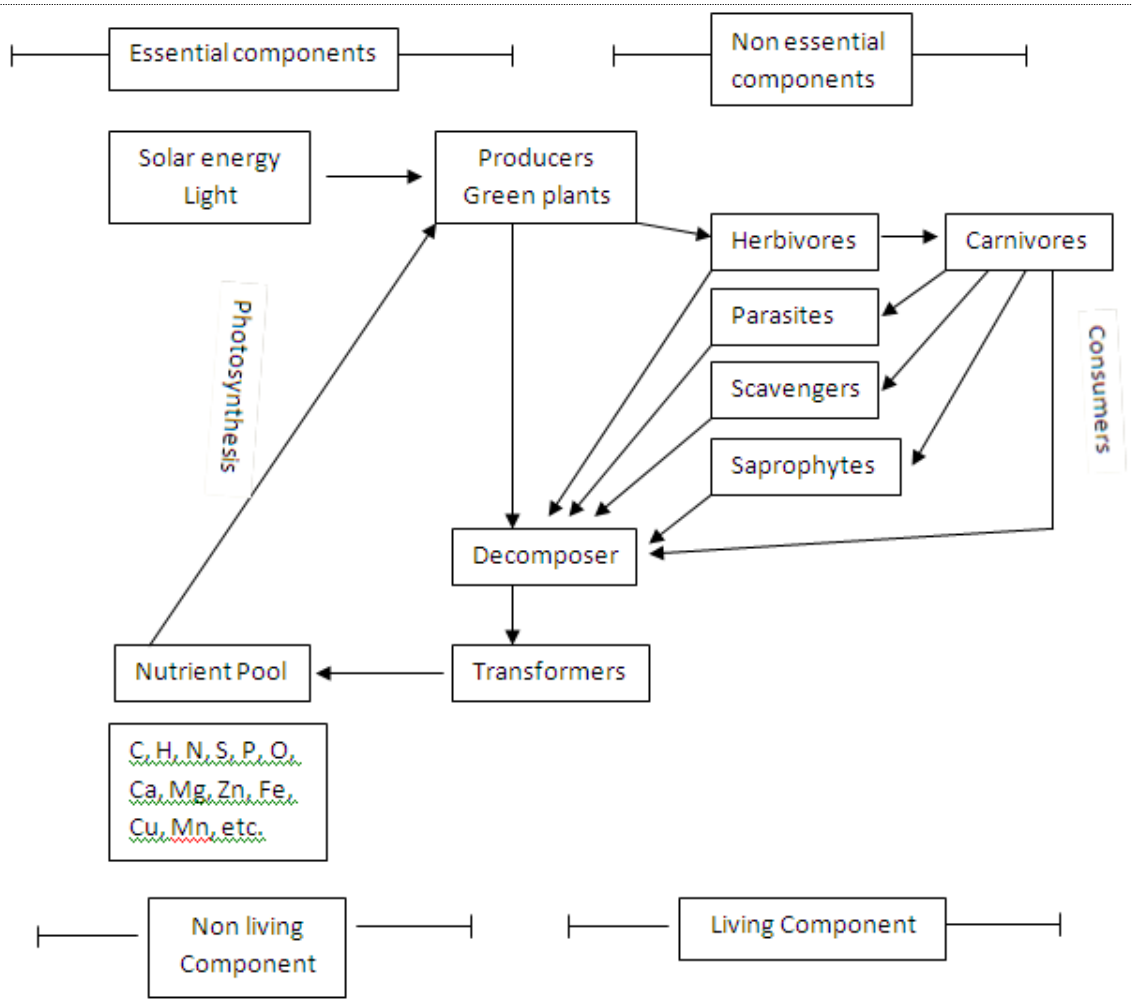


Fig: Principal steps and components in a self sufficient ecosystem

Descriptive Questions

01	What is ecosystem?
02	Describe the concept of an ecosystem?
03	Describe the abiotic component of ecosystem?
04	What are Consumers?
05	Explain the role of decomposers in an ecosystem?

Multiple Choice Questions

01	Which of the following is an abiotic component of the ecosystem
	a) Bacteria b) Plants c) Fungi

	d) Inorganic elements	
	Answer	(D)
02	In an ecosystem bacteria are considered as	
	a) Primary consumer b) Secondary consumer c) Tertiary consumer d) Decomposers	
	Answer	(D)
03	Lion in an ecosystem acts a	
	a) Primary consumer b) Secondary consumer c) Tertiary consumer d) Decomposers	
	Answer	(C)
04	Biological equilibrium is found between	
	a) Producers and consumers b) Producers and decomposers c) Producers and light d) Producers, consumers and Decomposers	
	Answer	(D)
05	A rabbit feeding on potato tuber is	
	a) Producer b) Primary consumer c) Secondary consumer d) Decomposers	
	Answer	(B)
06	Ecosystem has two components	
	a) Plants and animals b) Weeds and trees c) Biotic and abiotic d) Producers and consumers	
	Answer	(C)
07	The frog that feeds on an insect is a	
	a) Tertiary consumer b) Decomposer c) Primary consumer d) Secondary consumer	
	Answer	(D)
08	Which are the biotic components of an ecosystem	
	a) Producers b) Consumers c) Decomposer d) All of these	

	Answer	(D)
09	In a biotic community, the primary consumers are	
	a) Herbivores b) Carnivores c) Omnivores d) Detrivores	
	Answer	(A)
10	The term ecosystem was coined by	
	a) Tanslay b) Aristotle c) Kherana d) Brown	
	Answer	(A)
11	Energy enters ecosystem through	
	a) Decomposers b) Producers c) Herbivores d) Carnivores	
	Answer	(B)

Video links

01	https://byjus.com/biology/ecosystem/
02	https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-introduction-to-ecology/v/ecology-introduction
03	https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-introduction-to-ecology/v/ecosystems-and-biomes

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03	https://www.rajras.in/index.php/ecosystem-structure-functions-components/
04	Environmental Ecology by Bill Freedman
05	Encyclopedia of ecology-Elseveir

Department	Biology
Year	E1,E2,E3,E4
Semester	S1/S2
Course Name	Environmental Studies
Course Code	BE3101/BE1201/BE4101/BE2101
Course Credit	Mandatory Course
Name of the Faculty	Dr.B.Hemavathi

Module – 4

Energy flow in the ecosystem

Objectives

- To understand the energy flow in the ecosystem.
- To understand how the flow of energy within the ecosystem sustains and nurtures the nature.

Energy

Energy can be defined as the capacity to do work. The existence of living world depends upon the flow of energy and circulation of materials through the ecosystem. The energy is required for the performance of all the life activities. The source of energy in the atmosphere is the solar energy.

The expenditure and storage of energy is described by two laws of thermodynamics. The first law of thermodynamics called law of conservation of energy states that “energy is neither created nor destroyed and is converted from one form to another. For example, solar energy changes into energy of food and heat. The second law of thermodynamics states that “whenever energy is transformed from one kind to another, there is an increase in entropy and a decrease in the amount of useful energy”. For example, when energy in the form of food is transferred from one organism to the next, some energy is lost at every step as heat.

Plants store the energy in the form of potential energy in food stuff by producers. When an herbivore animal eats a plant and these organic compounds are oxidized, the energy liberated is just equal to the amount of energy used in synthesizing the substances (first law of Thermodynamics), but some of the energy is heat and not useful energy (second law of Thermodynamics).

If this animal in turn is eaten by another one, along with transfer of energy from a herbivore to carnivore, a further decrease in useful energy occurs. As the second animal (Carnivore) oxidizes the organic substances of the first (Herbivore) to liberate energy to synthesize its own cellular constituents. It is evident that at each step in the transfer of energy from one trophic level to another a large amount of energy is converted into heat and never returns back to the ecosystem. Such transfer of energy from organism to organism sustains the ecosystem. From the above factors it is clear that energy flows in a single direction, and keeps on decreasing at every level.

Food Chain

The transfer of food energy from the producers, through a series of organisms (herbivore to Carnivores to decomposers) with repeated eating and being eaten is known as a food chain.

Plant → herbivore → carnivore

This is one form of trophic relationship in which plants are producers, herbivores are primary consumers and the carnivores secondary consumers. There may exist tertiary consumers also. The plants are said to be at the first trophic level. The herbivores represent second trophic level. Similarly, primary carnivores (animals those feed on herbivore) constitute the third trophic level where as secondary carnivores (eg: Large fish, man etc) constitute the fourth trophic level in an ecosystem. Thus the energy is transferred through series of stages in an ecosystem and this is explained as Food chain.

T_1 Producers → T_2 Herbivores → T_3 Primary Carnivores → T_4 Secondary Carnivores → T_5 Tertiary Carnivores

The transfer of energy from the source in plants through a series of organisms by eating and being eaten constitutes food chains. At each transfer, a large proportion of energy is lost in the form of heat. These food chains are not isolated sequences, but are interconnected with each other. This interlocking pattern is known as the food web. Each step of the food web is called a trophic level. Hence green plants occupy the first level, herbivores the second level, carnivores the third level and secondary carnivores the fourth level. These trophic levels together form the ecological pyramid.

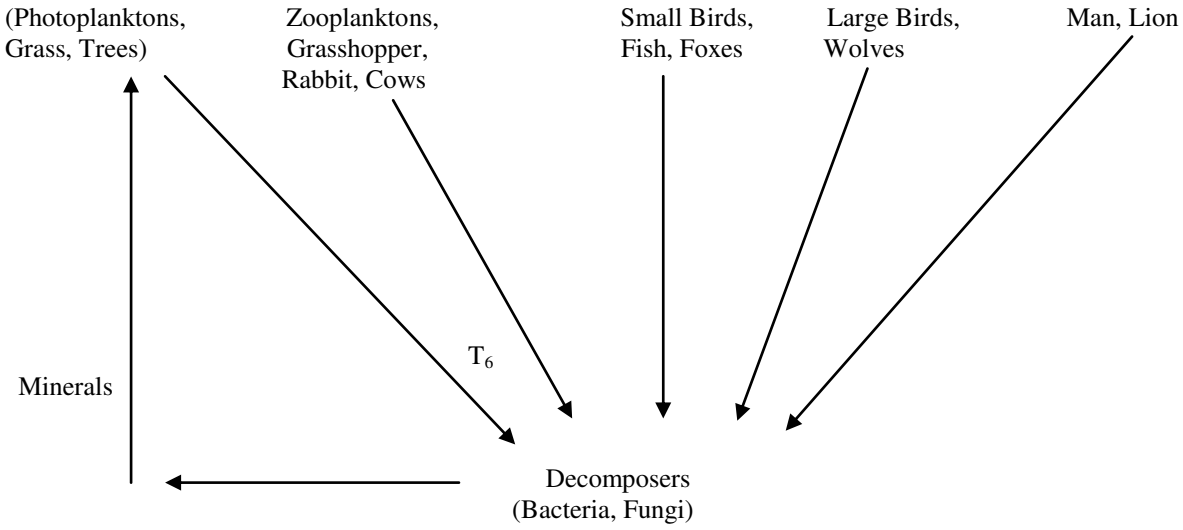


Fig: Trophic Levels

There are two types of food chains found in terrestrial ecosystem. They are

a) Grazing food chain and
b) Detritus food chain

a) Grazing food chain: This food chain begin with a green plant which is the original source of

all food and goes through smaller to larger animals, i.e., grazing herbivores to carnivores. Ecosystems with such type of food chains are directly dependent on an influx of solar radiation. Most of the ecosystems in nature follow this type of food chain. Few examples of grazing food chain are as follows.

Type of Ecosystem	Producer	Herbivores	Primary Consumer	Secondary Consumer	Tertiary Consumer
A. Grassland Ecosystem	1.Grasses →	Insects →	Frogs →	Snakes →	Predatory Birds
	2. Grasses →	Rats and Mice	→	Snakes →	Predatory Birds
	3. Grasses →	Rabbit →	Fox →	Wolf →	Lion
B. Pond Ecosystem	Phytoplankton →	Zooplanktons →	Small Fishes →	Large Fishes →	Predatory Birds
C. Forest Ecosystem	Trees →	Phytophagous insects, Herbivore Mammals →	Lizards Birds Foxes →	Lion Tiger etc.	

Fig: Grazing type Food Chain

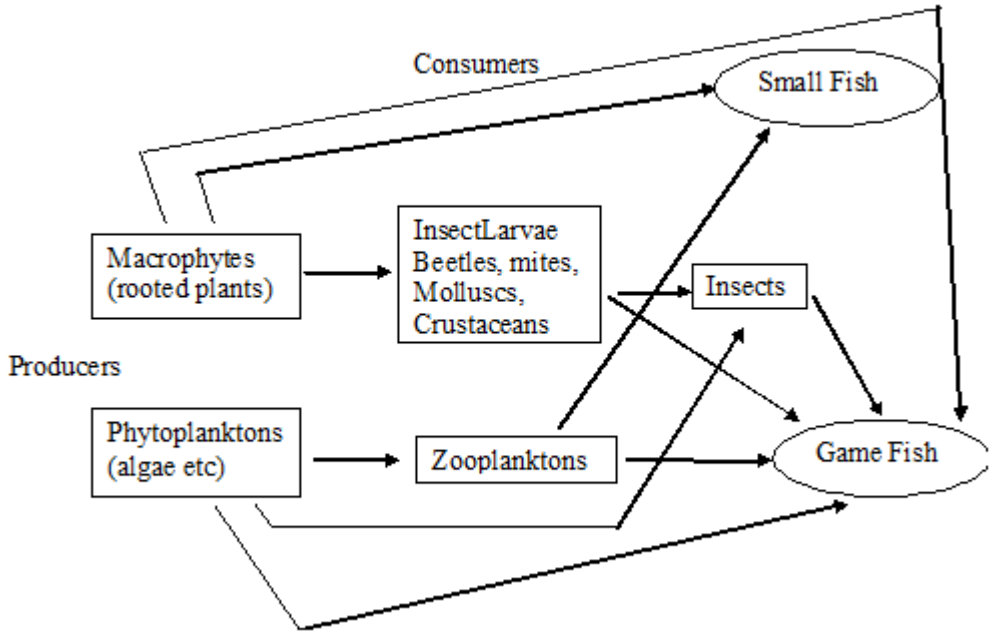
b). Detritus food Chain: The organic wastes, disintegrated dead bodies of plants and animals are called detritus. The detritus eating organisms are detritivores. The detritivores are bacteria, algae, fungi, protozoans, nematodes, annelids, arthropods, molluscs, ducks etc. This type of food chain goes from dead organic matter into microorganisms and then to organisms. Such ecosystems are thus less dependent on direct solar energy.This can be represented as follows.

Detritus	Detritivores	Detritivore Consumers	small Carnivores	Large Carnivores
Mangrove Fallen Leaves And Dead bodies	Fungi, bacteria and Protozoans	InsectLarvae Certain Crustaceans Molluscs and Fishes	Minnows small game Fish etc.	Large Fish Fish eating Birds

Fig: Detritus Food Chain

Food web

We have studied in food chain that in an ecosystem various food chains appear in a simple linear sequence. But in an ecosystem it is not so simple. Usually each organism feeds on two or more different kinds of organisms and is in turn eaten by two or more different animals. This means that there is an interaction and inter connection between different food chains. This interconnection of number of food chains forms a food web. So a food web can be defined as a network of food chains which becomes inter connected at different trophic levels so as to form a number of feeding connections amongst different organisms of a biotic community. Food webs are very important in maintaining the stability of an ecosystem in nature.

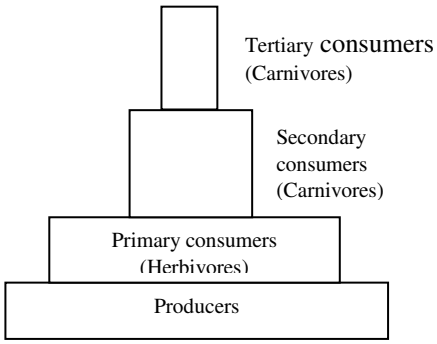


Ecological Pyramids

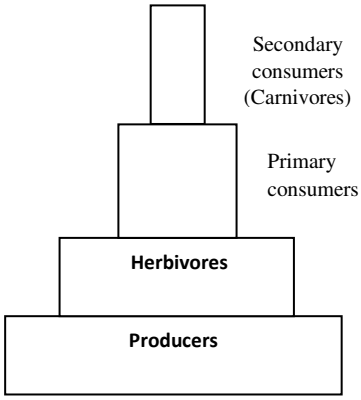
An ecological pyramid is a graphic representation of an ecological parameter like number, biomass or energy at different trophic levels in a food chain in an ecosystem. Pyramid is a conical structure and in ecological pyramid the first trophic level forms the base and the successive trophic levels above the base makes up the apex. Ecological pyramids are classified into three types depending upon their nature.

1. Pyramid of number
2. Pyramid of biomass
3. Pyramid of energy

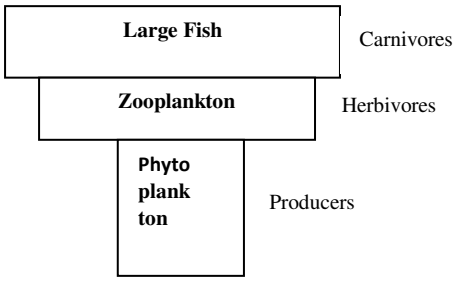
1. Pyramid of number: It is graphic representation showing the arrangement of number of individuals of different trophic levels in a Food chain in an ecosystem. We find that the largest number is of producers and the number keeps on decreasing as we move forward in the food chain. For example in a grass land ecosystem, the producers which are mainly grasses, are always maximum in number. This number then shows a decrease towards the apex, as the primary consumers (herbivores) like rabbits, mice etc, are lesser in number than the grasses; the secondary consumers, snakes and lizards are lesser in number than the rabbit and mice. Finally, the top (tertiary) consumer's hawks or other birds are less in number. Thus, the pyramid becomes upright.



2. Pyramids of biomass: Biomass may be defined as the total weight of dry matter present in the ecosystem at any one time. By using the weight of organisms in the different trophic levels a pyramid of biomass results. Pyramid of biomass is a graphic representation of biomass present per unit area in different trophic levels. In grass land and forest ecosystem, there is a gradual decrease in biomass of organisms at successive trophic levels from the producers to the carnivores. Thus the pyramid is upright. But in pond ecosystem, producers are small organisms therefore, biomass shows an increasing tendency. Thus making the pyramid



Grass Land



Pond

3. Pyramid of Energy: It is a graphic representation of amount of energy trapped per unit time and area in different trophic levels of a food chain. This pyramid represents the number of calories transferred from one trophic level to the next. This pyramids is always upright as the energy that flows always decreases with every trophic level. It is maximum in producers and least in carnivores.

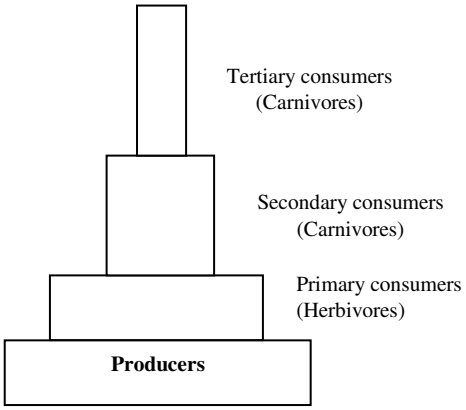


Fig: Pyramid of energy(Kcal per unit area within unit time, season or years in any ecosystem).

Descriptive Questions

01	What is Food web?
02	Describe different types of food chains?

03	Describe Pyramid of energy?
04	What are Pyramids?
05	Describe the energy flow in an ecosystem?
06	Describe Ecological pyramids?

Multiple Choice Questions

01	Green plants constitute
	a) 1st trophic level b) 2nd trophic level c) 3rd trophic level d) 4th trophic level
	Answer (A)
02	The pyramid of numbers in a grass land ecosystem is
	a) upright b) linear c) inverted d) irregular
	Answer (A)
03	Inverted pyramid of biomass is generally found in
	a) grassland b) forest c) pond d) all
	Answer (C)
04	Inter locking network of food chains is called
	a) pyramid b) biomass c) food web d) none
	Answer (C)
05	Graphic representation of trophic structure is called
	a) food chain b) food web c) pyramid d) ecosystem
	Answer (C)
06	The simple chain of eating and being eaten away is known as
	a) food chain b) food web

	c) ecosystem d) pyramids
Answer	(A)
07	The tip of ecosystem is occupied by
	a) producers b) herbivores c) carnivores d) All
Answer	(C)
08	Pyramid of biomass is
	a) showing the total dry weight of living matter b) showing the number of individual organisms at each level c) showing the rate of energy flow at successive trophic levels d) none of the above
Answer	(A)
09	In a food chain, the graph showing the amount of living matter in different trophic levels is called
	a) pyramid of energy b) pyramid of biomas c) pyramid of numbers d) none of these
Answer	(B)
10	The pyramid of energy is always
	a) inverted b) upright c) spindle shaped d) cup shaped
Answer	(B)
11	The flow of energy among various trohic levels of an ecosystem is
	a) unidirectional b) bidirectional c) multidirectional d) circular
Answer	(A)
11	Detritus food chain starts from
	a) algae b) bacteria c) protozoans d) viruses
Answer	(B)
12	The flow of energy in an ecosystem can be explained with the help of
	a) Hardy-weinberg law b) Law of thermodynamics c) Law of conservation of energy

	d) Blackman's law of limiting factors	
	Answer	(B)

Video links	
01	https://byjus.com/biology/energy-flow-in-ecosystem/
02	https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/energy-flow-primary-productivity
03	https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/v/flow-of-energy-and-matter-through-ecosystems
04	https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/e/food-chains-and-food-webs

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01	https://ncert.nic.in/ncerts/l/lebo114.pdf
02	https://openoregon.pressbooks.pub/envirobiology/chapter/3-1-energy-flow-through-ecosystems/
03	https://www.britannica.com/science/energy-flow
04	https://www.ck12.org/earth-science/flow-of-energy-in-ecosystems/lesson/Flow-of-Energy-in-Ecosystems-HS-ES/
05	Environmental Ecology by Bill Freedman
06	Encyclopedia of ecology-Elseveir

Department	Biology
Year	E1,E2,E3,E4
Semester	S1/S2
Course Name	Environmental Studies
Course Code	BE3101/BE1201/BE4101/BE2101
Course Credit	Mandatory Course
Name of the Faculty	Dr. A. Job Roger Binny

Module-5

Objectives

- To provide knowledge about biodiversity and its Conservation
- Able to define biodiversity
- Understanding of types of biodiversity and levels

Biodiversity and Conservation

Introduction, Definition, Levels, Hotspots, Biodiversity in India and Threats

Introduction:

The term biodiversity was coined by W.G. Rosen (1985). The term biodiversity refers to the variety of life forms and habitats found in a defined area. The year 2010 has been declared as the International year of Biodiversity. Govt. of India passed Biodiversity Bill in December 2003. It seeks checking of biopiracy. India has a great wealth of biodiversity in its forests, wetlands and marine areas. It has a great diversity in climate, topography and geology hence very rich in biodiversity. In understanding biodiversity, the most common question that arises in our mind is how many different plant and animal species are there on earth? There can be no definite answer to this question. At present the conservation scientists have identified over 8.7 million species worldwide. Of this only about 2 million are known to us ranging from microorganisms to giant mammals and reptiles. New species are being discovered while many species are also disappearing from the face of the earth. The Ministry of Environment and Forests, Govt. of India (2000) recorded 47,000 species of plants and 81000 species of animals. This is about 7% and 6.5% respectively of global flora and fauna.

Definition:

Biodiversity can be defined as **"The Variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part, this includes diversity within species, between species and of ecosystems".** In short it refers to the whole variety of life on earth. Biodiversity represents the totality of genes, species and ecosystems of a region.

Levels of Biodiversity:

Biodiversity can be identified at three levels:

1. Genetic diversity
2. Species diversity and
3. Ecosystem diversity

1. **Genetic Diversity:**
   It refers to the total number of genetic characteristics in the genetic makeup of a species. Example: Each human being is very different from others. Genetic diversity helps the population to adapt to changes in the environment or adapt to different environments. Domestication of dogs can be taken as a common example.
2. **Species Diversity:**
   It is the number of different species of plants and animals that are present in a region. A community with more number of species enjoys species richness. Naturally undisturbed forests have greater species richness than reforested areas or plantations.There are three types of Species:
   - **Endemic species:** It is one whose habitat is restricted only to a particular area because of which it is often endangered. It differs from "indigenous," or "native," which although it occurs naturally in an area, is also found in other areas.
   - **Exotic Species:** It is any species intentionally or accidentally transported and released by man into an environment outside its original range. These are often the most severe agents of habitat alteration and degradation, and a major cause of the continuing loss of biological diversity throughout the world.
   - **Cosmopolitan Species:** It is a species that is found to be distributed over most regions of the earth example: cats, dogs, human beings. The killer whale is considered as the most cosmopolitan species in the world.
3. **Ecosystem Diversity:** It refers to the variety of life forms in a prescribed ecosystem. Ecosystems may be both terrestrial and aquatic. Distinctive terrestrial ecosystems include forests, grasslands, deserts, etc. while aquatic ecosystems are rivers, lakes, oceans etc.

Biodiversity Hot Spots:

Hot Spots of biodiversity are areas that are extremely rich in species have high endemism (species confined to a particular region) and are constant threat. Concepts of hot spots of biodiversity were developed by Norman Myers (1988). He identified them priority areas for *Insitu* conservation. According to **Conservation International** (CI), to qualify as a hotspot a region must meet two strict criteria:

(i) It must contain at least 1,500 species of endemic plants, and
(ii) It must have lost at least 70% of its original habitat.

In 1999, CI's book 'Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions', identified 34 biodiversity hotspots in the different countries of the world. India has 4 **biodiversity hotspots**:

The Western Ghats, The Himalayas, The Indo-Burma region and The Sundaland [includes Nicobar group of Islands].

Two important hot spots found in India are:

1. Eastern Himalayan hot spot
2. Western Ghat hot spot

1. **Eastern Himalayan Hot Spot:**
   Its boundry extends from North Eastern India to Bhutan. It is specially rich in some endemic plants. Many primitive families like Magnoliaceae and winteraceae are

represented here. Some plants of interest found here are Magnolia and Betula. Here temperate forests are found at height of 1780-3500 meters. Many deep valleys are also present here.

2. **Western Ghats Hot Spot:**
   Western Ghats is a mountain chain running from the north to south and is isolated by the Arebian sea to the west, the arid Deccan Plateu to the East and the vindhya-satpura ranges to the North. They have different vegetation types: Scrub jungles and grass lands at low altitudes, dry and moist deciduous forests, montane grass lands and shoals, and the precious tropical ever green and semi evergreen forests. Complex topography, high rainfall and relative in accessibility have helped the region retain its biodiversity. Of the 15000 flowering plant species in India, thee are an estimated 4780 species in Western Ghats region. There is also great diversity of traditional crop plants and an equal diversion of animal life. A large number of amphibians, fresh water fishes and invertebrate groups are endemic to western Ghats.

Biodiversity of India:

India is exceptionally rich in biodiversity. India has a great wealth of biodiversity in its forests, wetlands and marine areas. It has wide range of habitats ranging from tropical rain forests to alpine vegetation and from temperate forests to coastal wet lands.

India contributes significantly to latitudinal biodiversity trend, with a mere 2.4% of the world's area but its contribution to world's biodiversity is approximately 8% of the total number of species. India accounts for 7.31% of the global faunal total with faunal species count of 89,451 species.

India is one of 12 mega biodiversity countries of the world. The country is divided into 10 bio-geographic zones and 25 biotic provinces representing all the major ecosystems. India is recognized as a country rich in biodiversity because of its tropical location, varied physical features and climate. These factors altogether have resulted in a diversity of ecological habitats like forests, grass lands, wetlands, coastal, marine and desert ecosystems which harbour immense biodiversity. India is one of the 12 centers of orgin of cultivated plants. India has 5 world heritage sites, 12 biosphere reserves and 6 Ramsar wetlands. Among the protected areas, India has 88 national parks and 490 sanctuaries covering an area of 1.53 lakh sq. kms.

The ministry of Environment and forests, Govt. of India (2000) records 47,000 species of plants and 81,000 species of animals. This is about 7% and 6.5% respectively of global flora and fauna. About 5000 species of flowering plants have their origin in India.

India's record in agro biodiversity is equally impressive. There are 167 crop species and 320 wild relatives. India is considered to be the center of origin of 30,000-50,000 varieties of rice, pigeon-pea, mango, turmeric, ginger, sugar cane, gooseberries etc, and ranks seventh in terms of contribution to world agriculture.

As per Global biodiversity assessment of UNEP of 1995 described number of species so far is 1.75 million of these 1,26,188 have been described in India. The species recorded includes flowering plants, mammals, fish, bird, reptiles and amphibians constitute 17.3% of the total. The biodiversity of India is yet to be fully known. Approximately, 65 percent of the total geographical area has been surveyed so far. Indian biodiversity consists of approximately 850 bacteria 25000 algae, 23000 fungi, 1600 lichens, 2664 bryophytes, 1022 pteridophytes, 64 gymnosperms, 15000 angiosperms. India has 372 different mammals (rated eighth highest in world), 1228 species of birds (eighth in world), 456 species of reptiles (fifth in world). 2546 fishes, 5050 molluscs, 204 amphibians. India has 53,430 species of insects including 13,000 butterflies and moths. The list is not constant. The list is being upgraded by identifying a new species, especially in respect of lower plants and invertebrate animals. Based on the available data, India ranks 10th in the world and fourth in Asia in plant diversity and ranks tenth in the number of endemic species of higher vertebrates in the world.

Threats to Biodiversity

There are number of causes which are known to cause extinction of Biodiversity. Some important causes are

1. **Destruction of habitats (Habitat loss):**
   It is the most serious threat to wildlife because it decreases the hiding places of animals and it increases the chances of their predation.
2. **Pollution:**
   It is one of the major reasons of wildlife decline. Pollution causes adverse breeding potential and increases struggle for existence.
3. **Deforestation:**
   Forests are the home of wild animals. Wildlife is suffering a lot due to deforestation for establishing industrial estates and housing projects. In order to get more timber, charcoal and firewood man has cut and destroyed many wild plants which form the main food of these animals. Food is one of the major factors of the habitat which controls distribution and numbers of wild animals.
4. Soil erosion
5. Agricultural expansion
6. Overgrazing
7. Increasing Urbanization
8. Forest Fires – Due to human activities or by chance
9. Development works like dams, reservoirs, roads, railway lines, croplands, industries, mines etc.,
10. Fragmentation is the process of reduction of habitat into smaller and scattered areas. Animals like elephants, lions, bears and large cats require bigger areas to survive and move. Few birds can reproduce only in deep forests. Due to habitat Fragmentation 1) Barriers are created which limit the potential of species for proper dispersal and colonization 2) Leads to formation of smaller populations which are not able to sustain 3) Migratory birds do not move scattered seasonal patches 4) Species become more vulnerable to wind, fire and predators.

11. **Poaching of wildlife:** Killing of wild life for commercial uses is termed as poaching. Indiscriminate hunting for various uses of animals like food, hide, musk, tusk, horn, fur, plumage, recreation etc. Excessive hunting is known to cause extinction.

12. **Man-Wildlife Conflicts:**
    According to the 2003 IUCN (International Union for Conservation of Nature and Natural Resources) world Park congress, Human – Wildlife Conflict (HWC) occurs when wildlife requirements overlap with those of human populations, creating costs both to residents and wild animals, HWC has been in existence for as long as humans have existed and wild animals and people have shared the same landscapes and resources.

    Today, there is no corner of this earth where HWC does not exist in one form or another. In terms of the scale of their impact on humans, it is the smaller animals, occurring in vast number, that have created the greatest impact. However, the larger herbivores (Elephant, Buffalo and Hippopotamus), large mammalian carnivores (Lion, Leopard, Cheetah, Spotted hyena, Wild dog), and the Crocodile are traditionally defined as problem causing animals and are responsible for most of the human – wildlife conflicts. The impact of the activities of large mammals on farmers and their livelihood is enormous and even traumatic when people are killed.

    Large feline predators (Tiger, Leopard, Lion, Snow leopard) and elephants are the principal sources of conflict. In India, for instance, in the state of Himachal Pradesh, around Kibber wild life sanctuary, wild carnivores, mainly Snow leopard, killed 18% of the total livestock holding in1995.

    In the state of Gujarat, in the proximity of Gir National Park and sanctuary, the Asian lion and the leopard hunt preys such as buffalos, cows, pigs and dogs. In the southern state of Karnataka, the overall annual loss due to large tigers and leopards depredation around the Bhadra Tiger Reserve, is reported to be approximately 12% of the total family live stock holding. In addition, elephant damage to crops accounted for the average loss of 14% of the total annual production.

    Humans deaths and injuries, although less common than crop damage, are the most severe manifestations of the HWC and are universally regarded as intolerable. Large mammalian carnivores are also responsible for numerous fatal attacks on human.

    Primary reason for all these conflicts is fragmentation of the wild habitat. Crop damage is the most prevalent form of HWC. A wide variety of vertebrate pests come into conflict with farming activity including birds, rodents, primates, antelopes, buffaloes, hippopotamus, bush pigs and elephants. Elephants are able to destroy a field in a single night raid. Elephants can damage infrastructures like ponds or tracks in national parks. Another adverse effect of HWC is the killing of domestic animals by wildlife. Important diseases are known to be transmitted by wildlife to domestic livestock or possibly by man

(i.e., rabies). A set of global trends regards human population, habitat evolution animal distribution and behaviour has contributed to the escalation of HWC worldwide.

Drought, floods, civil unrest, natural disasters or war disrupt the normal production and distribution of food, resulting in famines. These factors spur the continuing migration of rural people into areas where resources could be obtained and which are frequently occupied by wildlife. The resultant occupation of the habitat of wildlife animals by humans leads to conflicts.

The growing loss of habitat has led to increasing conflict between humans and wildlife. As wildlife range becomes more and more fragmented and as wildlife gets confined into smaller pockets of suitable habitat, humans and wildlife are increasingly coming into contact and in conflict with each other.

Killing of wild animals in retaliation for HWC is a very common reaction.

Possible Solutions to the problem include:

People management (Spatial, temporal and behavioural) Wild life management in the sense of modifying wildlife behavioral responses to certain recreational activities and habitat modification to affect the spatial distribution of wild life. These approaches can be used individually or in combination. Considering the current human population growth rate, the increasing demand for natural resources and the growing pressure for access to land, it is clear that the human wildlife conflict will not be eradicated in the near future and on the opposite, will grow continuously.

Multiple Choice Questions		
01	Who introduced the term biodiversity?	
	a) Edward Wilson b) Walter Rosen c) Norman Myers d) Alice Norman	
	Answer	(b)
02	Number of Biodiversity Hotspots in India	
	a) 3 b) 12 c) 4 d) 10	
	Answer	(c)
04	Which of the following is a hot-spot of biodiversity in India?	
	(a) Western Ghats (b) Indo-gangetic plain	

	(c) Eastern Ghats (d) Aravalli Hills
Answer	(a)
05	Number of Biodiversity Hotspots in India
	e) 3 f) 12 g) 4 h) 10
Answer	(c)

Descriptive Questions	
01	What is a biodiversity?
02	What is a biodiversity hotspot?
03	What are the levels of Biodiversity?
04	Write brief notes on ma-wildlife conflicts.
05	What kinds of threats to the Biodiversity may lead to its loss?

References	
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02	https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

Department	Biology
Year	E1,E2,E3,E4
Semester	S1/S2
Course Name	Environmental Studies
Course Code	BE3101/BE1201/BE4101/BE2101
Course Credit	Mandatory Course
Name of the Faculty	Dr. A. Job Roger Binny

Module-06

Objectives

- To provide knowledge about biodiversity and its Conservation
- Able to understand the methods of conservation of biodiversity
- Able to recognise the endangered species of India

Conservation of Biodiversity

Aims, Strategies, Methods of Conservation; Red Data Book and Endangered Species of India

Biodiversity conservation involves the management of not only the living organisms but also the abiotic factors of the environment so as to maintain the life supporting systems of the wild life.

Aims of Biodiversity Conservation:

1. To maintain the balance of ecosystem
2. To protect, preserve and help in rapid reproduction of the rare species to save them from extinction.
3. To preserve the breeding stock
4. To prevent deforestation and encourage afforestation
5. To study the ecological relations of the plants and animals in natural habitat.
6. Conservation of wildlife is essential because they carry many useful genes which are lost in domesticated animals.

Conservation Strategies:

1. Protection of useful animals and plants and their wild relatives both in their natural habitat (*In situ)* and in zoological and Botanical gardens (*Ex situ).*
2. Preservation of critical habitats such as the feeding, breeding, nursery and resting areas of the plant and animal species to promote their growth and multiplication.
3. Priority should be given in wild life conservation programme to an endangered species over a vulnerable species and to a vulnerable species over a rare species.
4. The management of life – supporting systems like air, water, land of the wild life.
5. Hunting of threatened species should be banned.
6. The habitats of migratory animals should be protected.
7. International trade in useful products of wild plants and animals should be regulated.
8. Educating the people about the importance of wild life and its conservation.
9. Over – Exploitation of useful products of wild life should be avoided.
10. National parks and Sanctuaries should be setup to protect wild life. This will safeguard the genetic diversity of species and their continuing evolution.

11. The Indian wildlife (Protection) Act, 1992 provides legal measures for the protection of wild animals.

Methods for the Conservation of Biodiversity:

There are basically two main types of conservation options *In situ* Conservation and 2) *Ex situ* Conservation. *In situ* is usually seen as the ideal conservation strategy. *Ex situ* conservation can provide a backup solution to *In situ* Conservation projects.

***In situ* Conservation (On – site conservation):**

It mains "On – site conservation". It is the process of protecting an endangered species in its natural habitat. *In situ* approach includes protection of a group of ecosystems through a network of protected areas like natural parks, and Sanctuaries, biosphere reserves and sacred forests.

1. National Parks and Sanctuaries:

In India at present there are 75 National parks and 247 wildlife sanctuaries covering nearly 4.2 percent of the country's geographical area.

A National park is an area which is strictly reserved for the betterment of the wild life and where activities like forestry, grazing or cultivation are not permitted. In these parks, even private ownership rights are not allowed.

A sanctuary is a protected forest area which is reserved for the conservation of only animals and human activities like harvesting of timber, collection of minor forest products and private ownership rights are allowed so long as they do not interfere with the well being of animals. In sanctuaries killing and capturing of any animal is prohibited except under orders of the authorities concerned.

Names of some important National parks and sanctuaries are given below.

Some National Parks of India:

1. Kaziranga National Park (Assam)
2. Sundarbans (West Bengal)
3. Hazaribagh National Park (Bihar)
4. Corbett National Park (Uttarkhand)
5. Gir National Park (Gujrat)
6. Kanha National Park (Madhya Pradesh)
7. Tandoba National Park (Maharashtra)
8. Bandipur National Park (Karnataka)
9. Desert National Park (Rajasthan)
10. Guindy National Park (Tamil Nadu)

Some Important Sanctuaries of India:

1. Annamalai Sanctuary (Tamil Nadu)
2. Jaldapara Sanctuary (West Bengal)
3. Keoladeo Ghana Bird Sanctuary (Rajasthan)
4. Sultanpur Lake Bird Sanctuary (Haryana)
5. Bir Moti Bagh Wild life Sanctuary (Punjab)
6. Shikari Devi Sanctuary (Himachal Pradesh)
7. Dachigam Sanctuary (Jammu and Kashmir)
8. Mudumalai Wild life Sanctuary (Tamil Nadu)
9. Nagarjuna Sagar Sanctuary (Andhra Pradesh)

10. Periyar Sanctuary (Kerala)
11. Chilka Lake Bird Sanctuary (Orissa)

2. Biosphere Reserves:-

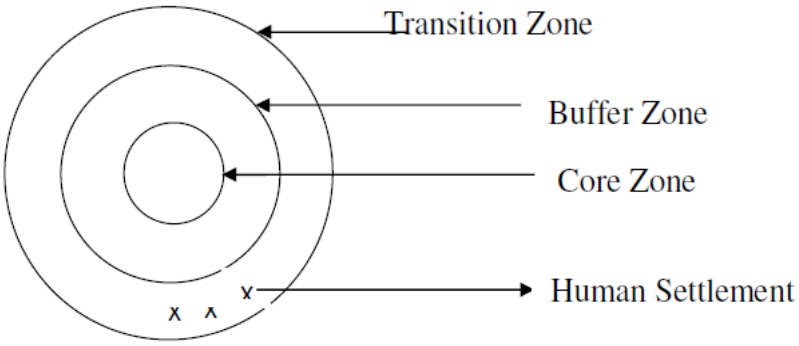
A biosphere reserve is a specified area in which multiple use of the land is permitted by dividing it into certain zones, each zone being specified for a particular activity.

A biosphere reserve is divided into three zones

a) Core Zone:- It lies at centre where no human activity is allowed. It is legally protected.

b) Buffer zone:- It surrounds core area. In this zone limited human activities are allowed.

c) Transition Zone:- It is the outermost part of biosphere reserve. In this zone multiple human activities are allowed but ecology is not permitted to be disturbed.



Zones of Biosphere Reserve

In India there are 14 biosphere reserves. The purpose of declaration of biosphere reserve is to conserve biodiversity *in situ* along with its supporting system.

The concept of Biosphere Reserve is of immense value for conserving the gene- pool resources of flora and fauna in the country and to serve as bench – marks for future studies.

The concept of Biosphere Reserve has the following objectives.

a) To conserve for present and future human race use, the diversity and integrity of biotic communities of plants and animals within natural ecosystems and to safeguard the genetic diversity of species on which their continuing evolution depends

b) To provide areas for ecological and environmental research

c) To provide facilities for education and training

d) To promote economic development

Some important Biospheres reserves found in India are

1. Nilgiri
2. Nanda Devi
3. Nokrek
4. Manas
5. Sunderbans
6. Gulf of Mannar
7. Great Nicobar
8. Similpal
9. Panchmarhi
10. KanchanJanga etc.

3. Sacred forests and sacred lakes:

Some forest regions are being protected by tribal's due to religious sanctity are called sacred forests. Such forests have been found to be most undisturbed. Such sacred forests in India are present in states like Karnataka, Maharashtra, Kerala and Meghalaya. In Sikkim, Khecheopalri lake is declared sacred lake by people, thus protecting the aquatic flora and fauna.

II. *Ex – situ* Conservation (Off – site Conservation)

In involves the conservation of genetic resources of species away from their area of origin or development. This includes off site collection and gene banks.

1. Off – site Collection:

Collection of wild and domesticated organisms in botanical gardens and zoos etc. Many botanical gardens have the facilities of seed banks, tissue culture and other latest *ex – situ* technologies.

2. Gene Banks:

Ex-situ Conservation occurs mainly in gene banks, which are mainly four types: a) Seed gene banks b) Field gene banks c) In vitro Preservation d) Cryo preservation.

Gene Banks are maintained by institutes. Seed banks are orthodox seed banks and recalcitrant seed banks. In orthodox seed banks orthodox seeds (eg, Cereals and legumes) are preserved. In recalcitrant seed banks recalcitrant seeds (hard to preserve) are stored (eg. Coconut, cocoa seeds, tee, jackfruit etc.,). Recalcitrant plants are maintained in field gene banks. In invitro preservation (in labs) tissue culture is used to develop embryoids, pollen grains, shoot tips for plants without visible seeds. Cryo preservation is the technique in which embryos, animal cells, spermatozoa etc. are preserved at -1960 C.

Endangered Species of India:

Species on the verge of extinction if the casual factors continue to be operating is known as endangered species. There are many species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. IUCN (International union for Conservation of Nature and Natural Resources) is maintaining a Red Data Book which contains a record of animals which are known to be in danger. It is considered that about 81 species of mammals, 38 species of birds and 18 species of amphibians and reptiles are endangered in India. Data regarding all endangered plant and animal species of the country are also not complete. In India, nearly 450 plant species have been identified as endangered, threatened or rare.

Red Data Book and Endangered species:

The IUCN (International Union for the conservation of Nature and Natural resources) maintains an international list, published as the Red Data Book, which contains a record of animals which are known to be in danger. They are now being published in many different countries.

Definition: "A catalogue formerly published by the IUCN, listing species which are rare or in danger of becoming extinct." The information is now available in a searchable data base.

The term "Red Data Book" came into existence in the early 1960s. In 1963, International Red Data Book was conceived by the late Sir Peter Scott as "a register of

threatened wild life that includes definition of degree of threat".

The Red Data Book is the state document established for documenting rare and endangered species of animals, plants and fungi as well as some local sub species that exist within the territory of the state or country. This book provides central information for studies and monitoring programmes on rare and endangered species and their habits. Each Red Data Book deals with a specific group of animals or plants (ex. Reptiles, insects, mosses etc).

The IUCN Red list of threatened species is the best known worldwide conservation status listing and ranking system. The system divides threatened species into three categories.

1. Critically endangered (CR)
2. Endangered (EN)
3. Vulnerable (Vu)

(These are those species whose populations are still abundant but their home range has been adversely affected, so these may become endangered if these factors continued). Also listed are the documented extinction that have occurred since AD1500 and taxa that are extinct in the wild. They usually deal with specific groups of organisms and /or geographical areas, and provide information on the populations of the species concerned with an indication of the level of threat (as threatened, critically endangered etc).

Information on the legal protection given to the species, and anything that is being done to help protect them may also be included. You will need to do a web search for the type of organisms (vascular plants, mammals, dragon flies etc) and /or area (country, state etc), that you are interested in to find details list.

The major uses of Red List are

1. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction.
2. To bring awareness about significance of threatened species.
3. Identification and documentation of endangered species.
4. To bring out conservation priority at local level and directing conservation action.
5. To provide a global index of decline in biodiversity.

The IUCN red list categories on the basis of threat

On the basis of degree of threat 8 red list categories have been identified.

S.No	Red list category	Character
1	Extinct	When there is no reasonable doubt that the last individual has died
2	Extinct in the wild	When extensive surveys in known and /or expected habitats, have not recorded an individual
3	Critically Endangered	When it is facing an extremely high risk of extinction in the wild in the near future
4	Endangered	When it is not critically Endangered, however is facing a very high risk of disappearance in the wild in the immediate future
5	Vulnerable	When it is not critically Endangered or Endangered, but is facing a high risk of disappearance in the wild in the medium-

		term future
6	Lower Risk	When it has been evaluated and does not satisfy the criteria for critically Endangered, Endangered or vulnerable
7	Data Deficient	When there is not sufficient information to make a direct or indirect, assessment of its risk of extinction
8	Not Evaluated	When it has not yet been assessed against any of the above criteria.

Endangered Species:

An endangered species is a population of organisms which is at risk of becoming extinct because it is either few in numbers or threatened by changing environmental or predation parameters. These are those species whose numbers have been reduced to a critical level or whose natural habitats have been adversely affected. So these are near extinction and may become extinct if these causal factors continue operating. There are many species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Under IUCN categories and criteria, endangered species is between critically endangered and vulnerable. The IUCN has calculated the percentage of endangered species as 40 percent of all organisms based on the sample of species that have been evaluated through 2006. It is estimated that about 25,000 species of plants and 1000 vertebrate species and sub species are threatened with extinction.

Data regarding all endangered plant and animal species of our country are also not complete. In India, the wild life (Protetion) Act, 1972 provides four schedules categorising the fauna of India based on their conservation status. Schedule 1 lists the rare and endangered species which are provided legal protection. It is considered that about 81 species of mammals; 38 species of birds and 18 species of amphibians and reptiles are endangered in India.

Some endangered species:

Mammals: Tiger, Muskdeer, Leopard, Dophines, Panda, Hoolock Gibbon, Indian Pangolin, Indian Wolf, Jackal, Indian Fox, Himalayan Brown Bear, Sloth Bear, India Lion, Rhinoceros etc

Birds: Whooping Crane, Bustard, Geese, Swans, White Winged Wood Duck etc

Reptiles: Python, Turtle , Sphenodon, Tortoise, Terrapin, Crocodile, Alligator, Gavialis etc

Amphibia: The Vivi Parous Toad, Indian Salamander

Crustacea: Robber Crab (A Large Hermit Crab)

Insects: Some Dragon Flies, Butterflies, Moths And Beetles.

The basic reasons for extinction of wild life as follows:

1. Destruction of their natural habitats due to expanding agriculture, urbanization and Industrialisation
2. Over grazing by domestic animals that convert the area into deserts
3. Poaching for meat, skin, fur, ivory, rhino horns etc
4. Export of some species

Due to continuous increase in the number of endangered species of flora and fauna of wild life, steps have been taken to protect and manage the wild life of the country. Non-governmental voluntary organizations as well as governmental organizations at state and central levels have been set up to protect the wild life.

Summary:

- The main aim of conservation of biodiversity is to maintain the balance of ecosystem and to protect and preserve the rare species from extinction.
- Protecting an endangered species in its natural habitat is called *In-situ* conservation.
- The conservation of components of biological diversity outside their natural habitats is called *Ex – situ* conservation.
- National parks are protected areas aimed at betterment of wildlife but where human activities are not permitted.
- Sanctuaries are protected areas aimed at conservation of only animals and where certain human activities are also permitted.
- Biosphere reserves are protected areas where multiple use of the land is permitted by dividing into certain zones.
- Endangered species are the species which are in danger of extinction and whose survival is unlikely, if casual factors continue operating
- Book containing a record of the threatened animal species is called Red Data Book.

Descriptive Questions	
01	What is in-situ conservation of Biodiversity?
02	What is ex-situ conservation of Biodiversity?
03	Name some important National Parks of India?
04	Name some important Wild Life Sanctuaries of India?
05	What are Biodiversity Reserves? Explain in brief?
06	What is IUCN? What are the threat categories?
07	Write an brief account on Endangered Species of India?

References	
01	Erach Bharucha, “Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education” University Grants Commission, New Delhi. 2004.
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Environmental issues: Causes, effects and control measures

Water pollution

Water pollution:

Water pollution may be defined as the "Alteration in physical, chemical, and biological characteristics of water which may cause harmful effects on human and aquatic biota".

Or

Water pollution can be defined as the addition of some substances (organic, inorganic, biological or radiological) or factor (heat, pH) which degrades the quality of water so that it either becomes health hazard or unfit for use.

Water is one of the most essential things for survival of living organisms. Water pollution adversely changes the quality of water and makes it unsuitable for the living being. It disturbs or destroys the balance of ecosystems and cause hazards to public health.

Sources of water pollution:

1. Sewage and other waste: Sewage is the water borne waste derived from home (domestic waste) and animal or food processing plants. It includes human excreta, paper, cloth, soap, detergents, organic matter in the form of food residue etc. These are a major proportion of the pollutants entering our water. Phosphates are the major ingredients of most detergents. The organic matter increases the biological productivity. Bacteria and fungi grow fast using oxygen of water rapidly

and making the medium unsuitable for other organisms due to the absence of oxygen.

Biological oxygen Demand (BOD): It is the amount of O_2 required for biological oxidation by microbes in any unit volume of water. The test is done at 20^0C for at least five days. BOD value generally approximates the amount of oxidisable organic matter, and is therefore, used as a measure of degree of water pollution and waste level. Thus BOD value is proportional to the amount of organic waste present in water.

2. Industrial effluents: A wide variety of both inorganic and organic pollutants are present in effluents from chemical, fertilizer and pesticide manufacturing units, breweries, tanneries , dying textiles, paper and pulp mills , steel industries, mining operations etc. The pollutants include oils, greases, plastics, metallic wastes, suspended solids, phenols, toxins, acids, salts, dyes, cyanides, DDT etc. These effluents are acted upon by the bacteria and they are degraded into simpler substances. This process is called biodegradation. These biodegraded substances or metabolites may be more toxic than the substances from which they are degraded. Most of the organophosphorus groups of compounds are biodegradable.

3. **Agricultural discharges:** Today use of fertilizers and biocides has become a compulsion to grow more vegetables, fruits and crops. Fertilizers mainly consist of nitrogen, phosphorus and potassium. Excess quantity of these fertilizers drained into ponds, rivers or lakes. This causes increase in growth of algae and the process is known as **algal bloom or eutrophication**. Dead algae are decomposed by bacteria. During the process of decomposition the bacteria uses much of the O_2 present in water. This leads to suffocation and death of aquatic life.

Biocides (insecticides, fungicides, herbicides) are composed of chlorinated hydrocarbons, thiocarbamates etc. Organo chlorine compounds (B.H.C. & DDT etc) have very long life and are more stable. They are lipophilic and soluble in fats. Hence they are highly toxic to aquatic organisms. These pesticides find their way to ground water and upset the aquatic ecosystem. They pass through food chains and accumulate mainly in the fatty tissues of animals. Their concentration continuously increases in successive trophic levels in a food chain. This phenomenon is known as **biomagnification** or biological accumulation.

4**. Marine Pollution:** All pollutants (Garbage, sewage, industrial effluents) are ultimately discharged into sea. The other sources of marine pollution are navigational discharge of oil, grease and petroleum products. Radioactive isotopes enter into the body of aquatic life (fish, etc). When man consumes affected animals, these isotopes find their way into man's body causing many disorders of the body including mutation, cancer etc.

5. Thermal pollution: Electric power plants and nuclear power stations use water as a coolant. These units release hot water into the rivers, lakes, sea etc raising its temperature. Such hot effluents kill both plants and animals.

6. Silt pollution: Dust and dirt together is called silt. It is one of the components of soil with particle size 0.002 mm diameter. Silt is carried with water and choke irrigation channels. It affects adversely the aquatic life.

7. Oil pollution: Oil is a source of pollution in sea water. Oil pollution is due to ship accidents, loading and discharging oil at the harbour, oil refineries and off shore oil production. It is extremely toxic and immediately affects living organisms.

8. Radioactive wastes: In a nuclear reactor, water is used as a coolant. This water usually becomes radioactive due to radioactive matter leaking from the reactor. It can find its way to river and sea. These radioactive isotopes cause serious effects on plants and animals that live in water. It causes chromosomal aberration and gene mutation. When these aquatic animals are consumed by man, these isotopes find their way in their body.

9. Heavy Metals: Heavy metals are added to water resources from the waste water effluents of industries. Almost all metals are toxic. Toxic metals change the biological structures and systems leading to deformity in the body or finally death.

Effects of water pollution:

1. The waters polluted with domestic sewage spread a number of epidemic diseases, **such as cholera, typhoid, dysentery, diarrhea, Paratyphoid fever, schistosomiasis, infection hepatitis, jaundice** etc.
2. Due to industrial pollution there is oxygen depletion in water which kills the living fishes and other aquatic animals.
3. Heavy metallic ions such as **mercury, can cause irreversible brain damage, mental disorder, blurring vision and numbness of limbs and even death in man who may have consumed fish containing mercury (Minamita disease).**
4. Arsenic causes lung and skin cancer and diarrhoea. Chronic exposure to arsenic causes **black foot disease.**
5. Water contaminated by cadmium causes **Itai-Itai disease**. Fluorides cause skeletal fluorosis or **knock knee disease**.
6. Nitrates cause **blue babies**. The insecticides which accumulate in the body of fish and other aquatic organisms are a source of potential danger to

man. Their consumption may cause cancer, nerve disorders, leukemia and other serious diseases in man.

7. Radioactive materials also cause damage to aquatic plants and animals and a number of diseases in man.

Control of water pollution:

1. **Reutilisation and recycling of waste:** Various kinds of wastes which include industrial effluents (as paper pulp or chemicals), sewage, thermal pollutants (waste water etc) may be recycled to beneficial use.
2. **Removal of pollutants:** Various pollutants (radioactive, chemical biological) present in water body can be removed by appropriate methods such as adsorption, electro dialysis, ion exchange, reverse-osmosis etc.
3. **Treatment of waste waters:** Both industrial and sewage water is treated in effluent treatment plant (ETP), before it is discharged in the water bodies.
4. Cooling towers should be used in industries to control thermal pollution.
5. Bleaching powder in required quantities should be used to disinfect the drinking water.
6. Ammonia could be removed from waste waters by ion exchange technique.
7. Phenolics could be removed from waste water of paper mills, petroleum refineries, tanneries by use of polymeric absorbents.
8. Waste water from printing and sari dying industries could be decolourised by an electrolyte decomposition technique.

Check Points

- The presence of any foreign substance other than the natural constituents of water can be the source of pollution.

- Sewage wastes, Industrial effluents, agricultural discharges, radio active wastes, heavy metals, oil, grease, petroleum products, silt etc cause water pollution.
- Biological Oxygen Demand (BOD) is used as a measure of degree of water pollution. Higher the amount of oxygen used greater is the amount of pollutants.
- Excessive accumulation of nutrients leads to Eutrophication.
- Polluted water spreads a number of epidemic diseases.

Object Type Questions:

1. The urbon soild wastes are known as

   A. **Refuge** B. Garbage C. Silt D. None
2. BOD of a lake is high it means the

   A. Lake does not have decomposers **B. Lake is polluted** C. Lake does not get enough light D. Lake is not polluted
3. The increase of concentration of biocides in successive trophic levels of the food chain is called

   A. Eutrophication B. BOD **C. Bio magnification** D. Multiplication
4. Silt is

   A. Dust B. Dirt C. Oil **D. A & B**
5. Itai-Itai disease is caused by

   A. **Cadmium** B. Fluorides C. Arsenic D. Nitrates
6. Skeletal fluorosis or knock knee disease is caused by

   A. **Fluorides** B. Cadmium C. Arsenic D. Nitrates
7. Increase in growth of algae due to pollution is called

   A. Bio magnification **B. Eutrophication** C. BOD D. Bioconcentration
8. Water polluted with domestic sewage causes

A. Typhoid B. Diarrhoea C. Cholera **D. All**

9. One of the following method is employed to control water pollution
   A. Use of effluent treatment plants
   B. Polymeric absorbents
   C. Electrolyte decomposition technique **D. All**
10. Match the terms in column A with suitable diseases in column B

Column - A	Column - B
i) Arsenic	a) Minimata disease
ii) Nitrate	b) Itai - itai
iii) Mercury	c) Blue baby syndrome
iv) Cadmium	d) Skeletal fluorosis
v) Flouride	e) Black foot disease

Ans: i (e), ii (c), iii (a), iv (b), v (d)

Short Answer Questions:

1. Describe control measures of water pollution?
2. What is BOD?
3. Explain Eutrophication?

Long Answer Questions:

1. Explain the sources and effects of water pollution?

Soil Pollution:

The Soil pollution may be defined as “the presence of any substance which is foreign to the soil system and adversely affects the productivity of the soil.” The soil pollution can be distinguished into 2 types- Positive soil pollution and negative soil pollution. The positive soil pollution includes the introduction of toxic substances such as industrial pollutants and pesticides. The negative soil pollution is caused by soil erosion.

Source and effects of Soil pollution:

1. The major sources of land pollution are the industries. These are paper mills, textiles, oil refineries, power plants, chemical and fertilizer manufactures, iron and steel plants, plastic and rubber producing companies etc. These industries produce countless pollutants causing soil pollution. These pollutants affect and alter the chemical and biological properties of soil and lead to serious effects on living organisms.
2. Modern agricultural practices pollute the soil to a large extent through the non judicious use of chemical fertilizers and biocides. Most of these are stable chemicals and remains in the soil for long periods. Due to the continuous use chemical fertilizers the soil micro organisms lose their ability of nitrogen fixation and also kill earthworms which are living fertilizer factories. This adversely affects the fertility of soil.
3. The excretory matter and faecal products of man and live stock pollute the soil by adding pathogens to soil which causes serious health problems to man and their domestic animals.

4. Disposal of domestic refuge, garbage of building materials, empty bottles, wastes of automobiles, plastics etc are causing serious soil pollutions.
5. Acid rain changes the soil pH and makes the soil infertile.
6. Radioactive substances resulting from explosions of nuclear devices, atmospheric fallout from nuclear dust and radioactive wastes penetrate the soil and accumulate there creating land pollution.
7. Increasing population of cows, cattle, pigs and poultries have resulted in considerable soil pollution. Animal wastes contain several pathogenic bacteria and viruses which enter into plant metabolism and ultimately to man.

Control of soil pollution:

1. The solid wastes have to be collected from various streets and cities to the disposal area.
2. Dumping of solid waste is a popular and inexpensive way of getting rid of wastes. Land fill operation, which is a biological method of treatment, involves the depositing of refuse, compacting and covering it with a soil.
3. Recycling and recovery of materials (paper, glass, plastic, rubber, metals etc) is the best solution for reducing soil pollution.
4. Converting waste into biogas.
5. Biological methods of pest control help in minimizing the soil pollution.
6. Restoring forests and grass land (Afforestation) to check soil erosion and floods.
7. Shifting cultivation can be replaced by crop rotation, which will improve the fertility of land.

8. Proper law should be made and enforced. Public awareness should be generated.

1. Silt is

   A. Dust B. Dirt C. Oil **D. A & B**

2. One of the following is responsible for soil pollution

   A. Industries

   B. Modern Agricultural practices

   C. Increasing animal population **D. All**

Short Answer Questions:

1. How soil pollution is controlled?

Long Answer Questions:

1. Explain the sources, effects and control measures of soil pollution?

Noise Pollution

Noise pollution is defined as the production of unwanted high pitch sound. Sound is a normal feature of our life. Noise is the sound which produces unpleasant effects on the ears. Sound is measured in decibel (dB). During ordinary conversation it is between 30 to 60dB. Critical level for ear damage is 85dB. Jet airplane creates a sound of more than 120dB at take off and this is the threshold of pain and this is hazardous and can damage the ear. A decibel value above 80dB causes noise pollution.

Sources of Noise pollution:

1. **Transport vehicles:** It includes noise of road traffic, rail traffic and air craft.
2. **Industries:** It includes noise caused by industrial machines, such as textile mills, printing presses, engineering establishments, defence equipments etc.
3. **Modern Domestic Gadgets:** It includes noise produced by domestic appliances such as T.V. sets, Tape recorder, radio set, food blender, exhaust fan etc.
4. **Loud speakers:** In India use of loud speakers is very frequent. It is played day – night during festival, religious gathering, elections etc.
5. Crackers, Dynamiting of mountains etc.

Effects of Noise pollution: Noise pollution causes

(1)Fatigue (2) Nervousness (3) Hearing loss (4) Hypertension (5) Headache (6) Unwanted noise increase heart beat (7) Dilation of the pupil of the eye (8) Memory is affected and concentration power is

lowered (9) Develops sleep less ness. (10) Too much of noise affects the nervous system. (11) Physiological and psychological disorders

Control of Noise pollutions:

1. Designing, fabricating and using quieter machines to replace the noisy ones.
2. Minimizing the noise at source by proper lubrication and better maintenance of machines.
3. Using ear covers or cotton plugs to reduce occupation exposure.
4. Removing the noisy industries away from residential areas.
5. Restricting the use of public address system in urban areas.
6. Green plants must be planted around the road side to check the noise pollution.
7. Airports should be away from residential areas.
8. Laws should be made and strictly enforced.

Check points:

- Noise is the unwanted sound.
- Critical level of sound for ear damage is 85dB.
- Vehicles, industries, modern domestic gadgets, loud speakers, etc cause sound pollution.
- Noise pollution causes both physiological and psychological problems.

Object Type Questions:

1. Sound becomes hazardous noise pollution if its level goes above

   A. 30dB **B. 120dB** C. 50dB D. 85dB
2. What is the intensity of sound in normal conversation

A. 10 – 20 dB **B. 30 – 60 dB** C. 70 – 90 dB D. 120 – 150 dB

Short Answer Questions:

1. List out the effects of Noise pollution?
2. What are the control measures of Noise pollution?

Long Answer Questions:

1. Explain sources, effects and control measures of Noise pollution?

Environmental issues: Causes, effects and control measures

Thermal pollution and Nuclear hazards

Increase or decrease in the temperature of water, air and land by human activity is called Thermal pollution.

Temperature is one of the most vital environmental factors for organisms. Temperature fluctuation influences all metabolic process for organisms. Heated effluents, either from natural or man made sources, contaminated with water supplies may be harmful to life because of their toxicity, reduction in normal oxygen level of water, aesthetically unsuitable and spread diseases. Thermal pollution reduces the number of aquatic species and destroys the balance of life in streams.

Sources of Thermal pollution:

Following sources contribute to thermal pollution

1. Electric power plants and nuclear power stations use water as a coolant. These units release hot water to the original source of water such as River, Lake, Sea etc., raising its temperature. Such hot effluents kill both plants and animals resulting in decreased primary production.
2. Some thermal power plants utilize coal as fuel. Coal-fired power plants constitute the major source of thermal pollutants. Their condenser coils are cooled with water from nearby lake or river and discharge the hot water back to the stream increasing the temperature of nearby water.
3. The municipal sewage normally has a higher temperature than the receiving water. This discharged sewage not only raises the stream temperature but also creates numerous deleterious effects on aquatic biota.

4. In addition to electric power industries, various factories with cooling requirement contribute to thermal pollution.

Effects of Thermal pollution:

1. A rise in temperature changes the physical and chemical properties of water. Concentration of dissolved oxygen decreases with increase in temperature, which seriously affect the aquatic organisms.
2. The rising temperature increases the toxicity of the poison present in water.
3. Increase of temperature interferes with the biological activity of the aquatic organisms. Temperature is considered to be vital significance to physiology, metabolism and bio chemical process in controlling respiratory rates, digestion, excretion and overall development of aquatic organisms. The temperature changes totally disrupt the entire ecosystem.
4. Activities of several pathogenic micro organisms are accelerated by higher temperature.
5. High water temperatures promote blue-green algal blooms which disrupt the aquatic food chain.
6. High temperature of water may induce increase in activity, which exhausts the organism and shorten its life.

Control of Thermal Pollution:

1. Factories and power stations should have provisions for storing and cooling hot water. The hot water should not be released into rivers directly. They should be stored in cooling towers and spray ponds for reuse.

Nuclear Hazards

Radio active pollution poses a serious threat to the environment and future generation. A number of nuclear explosions have already been made during recent past in different parts of world. During atmospheric nuclear explosion tests, a large quantity of long-lived radio nuclides is released to the atmosphere which gets distributed all over the world. Generally the test including nuclear fission and fusion processes uses uranium (U^{235}) and Plutonium (Pu^{239}) as fission material. A study reveals that radio nuclides formed in explosion test include fission fragments such as Strontium (Sr-90), Caesium (Cs-137), Barium (Ba-141) and Iodine (I-131) along with unused explosives and activation products. The radioactive dust that falls to the earth after atomic explosion is called radioactive fallout. Nuclear weapons testing had added greatly to radio activity.

There are two main radio-active elements in the nuclear fallout – Iodine-131 and Strontium-90. Since Iodine participates in the formation of Thyroxine, so it is an essential requirement in animals for the proper functioning of their Thyroid glands. Plants contain little Iodine and animals obtain their iodine requirement through plants. The normal stable iodine – 127 and its unstable radio isotope I – 131, are chemically indistinguishable by biological system. Therefore I – 131 is taken by the organisms indiscriminately. Thus I – 131 gets entry into the food chain. Man being the top consumer, gets I – 131 in his body. In man it can damage WBC, bone marrow, spleen, lymph nodes, thyroid gland, and can induce lung tumours and sterility.

Strontium – 90 can replace calcium in plants and animals. Plants require calcium for the formation of cell wall where the animal calcium is used in bone formation. Radio-active strontium enters the human body through food chain and gets concentrated in human beings. Sr – 90 reaches daily products through

vegetation and the use of it by cattle, then to man by consumption of contaminated food, meat, milk, dairy products. In humans, most strontium becomes concentrated in bones, where damage to bone cells and marrow-blood cell-producing tissues occurs. It can cause bone cancer and tissue degeneration in man and animals.

The radioactive wastes from nuclear plants may be in the form of gases, liquids or solids. The power plants are designed in a way that there is no leakage of radioactive materials in any form. However, no nuclear plant is contamination proof. Leakage from several points may result in wastes that are radioactive. Three Mile Island nuclear power plant leakage in USA in 1979, and “melt down” of Chernobyl nuclear power plant in USSR in 1986 are the examples of nuclear plant accidents causing escape of radio nuclides in atmosphere. Dissolved and suspended materials enter water bodies and contaminate them. These substances eventually are conveyed to humans from water supplies to food chain. Dissolved radioactive substances in the waste water also enter the atmosphere. Thus radioactive wastes in the effluent from nuclear power plants can eventually become widely distributed in air, water, soil, plants, animals and humans.

Radio active substances are among the most toxic substances known. The harmful effect of radiation upon human beings is due to its ability to ionize and ultimately destroy the organic molecules of which body cells are composed of.

The radiation destroys the body’s immune response. Delayed effects of radiation include eye cataracts, leukemia, malignant tumors, cardio vascular disorders, premature ageing, mental retardation, congenital malformation, retarded growth, and reduced life span. Radiation can also produce mutations in plants and animals by bringing about changes in chromosomes.

Control measures:

1. Radiation pollution can be controlled by strict enforcement of safety measures during mining, transport and use of radioactive substances.

2. Ban on tests of nuclear weapons is a must, to check radiation pollution. Peaceful uses of atomic energy or nuclear energy for electricity, treatment of diseases, agricultural and industrial purposes may be essential but its use for war purposes will finish life on this planet.

3. Radioactive wastes should be dumped in deep sea in sealed stainless steal container surrounded by concrete.

4. Regular monitoring through frequent sampling and quantitative analysis has been ensured in the risk areas.

5. Nuclear devices should never be exploded in air. Production of radio isotopes should be minimized.

6. Minimum number of nuclear installations should be commissioned. Extreme care should be exercised in the disposal of industrial wastes contaminated with radio nuclides.

MCQ:

1. Which of the following contribute to thermal pollution
    A. Nuclear power plants
    B. Coal fired power plants
    C. Industrial effluents
    D. All the above
2. Which of the following is the major source of thermal pollution
    A. Coal fired power plants
    B. Domestic sewage
    C. Automobiles
    D. All the above
3. With the increase in temperature of receiving water

A. **Dissolved oxygen content decreases**

B. Dissolved oxygen content increases

C. Physical and chemical properties will not alter

D. Decreases the toxicity of the poison present in water

4. The ionizing radiation can cause

   A. Leukemia

   B. Malignant tumors

   C. Cardio vascular problems

   D. **All the above**

5. Important nuclear fuels used in nuclear reactor are

   A. U^{235} B. Sr – 90 C. Pu^{239} **D. A and C**

6. Chernobyl, the world's worst nuclear disaster took place in the year

   A. 1982 B. 1979 **C. 1986** D. 1983

7. Radio nuclides formed in explosion tests include

   A. Sr – 90 B. Cs – 137 C. I – 131 **D. All**

8. In humans strontium – 90 can cause

   A. Bone cancer

   B. Tissue degeneration

   C. Damage bone cells

   D. All

Short answer questions:

1. What is thermal pollution
2. How to control thermal pollution
3. Describe the effect of strontium – 90 on man
4. How Iodine – 131 effect the human beings

Long answer questions:

1. What is thermal pollution? Describe the sources and effects of Thermal pollution
2. Describe various nuclear hazards?

Disaster management-Floods, Earthquakes, Cyclones and Landslides

Disaster Management is a strategic planning and procedure that is administered and employed to protect critical infrastructures from severe damages when natural or human made calamities and catastrophic even occur.

The Indian subcontinent is very vulnerable to droughts, floods, cyclones, earthquakes, landslides, avalanches and forest fires. Among the 36 states and Union territories in the country, 22 are prone to disasters. Floods are the most frequently occurring natural disaster than any other. Major floods are mainly caused in the Ganga-Brahmaputra-Meghna basin which carries 60 percent of the total river flow of our country.
India has a long coastline of 5700 kms, which is exposed to tropical cyclones arising in the Bay of Bengal and the Arabian sea. The Indian Ocean is one of the six major cyclone prone regions of the world. In India, cyclones occur usually between April and May and also between October and December. The eastern coastline is more prone to cyclones as it is hit by about 80 percent of the total cyclones generated in the region.
Droughts are a perennial feature in some states of India. Sixteen percent of the country's total area is drought prone. Drought is a significant environmental problem as it is caused by a lower than average rainfall over a long period of time. Most of the drought prone areas identified by the Government lie in the arid and semi-arid areas of the country.
Earthquakes are considered to be one of the most destructive natural hazards. The impact of this phenomenon occurs with so little warning that it is almost impossible to make preparations against damages and collapse of buildings. About 50 to 60 percent of India is vulnerable to seismic activity of varying intensities. Most of the vulnerable areas are located in the Himalayan and sub-Himalayan regions.

Causes:
It is evident today that human activities are responsible for accelerating the frequency and severity of natural disasters. Natural occurrences such as floods, earthquakes, cyclones, etc. will always occur. They are a part of the environment that we live in. However destruction from natural hazards can be minimized by the presence of a well functioning warning system combined with preparedness on part of the community that will be affected. Thus though traditionally disaster management consisted primarily
of reactive mechanisms, the past few years have witnessed a gradual shift towards a more proactive, mitigation based approach.

Disaster management is a multidisciplinary area in which a wide range of issues that range from forecasting, warning, evacuation, search and rescue, relief, reconstruction and rehabilitation are included. It is also multi-sectoral as it involves administrators, scientists, planners, volunteers and communities. These roles and activities span the pre-disaster, during disaster and post disaster plans. Since their activities are complementary as well as supplementary to each other there is a critical need for coordinating these activities.
Today we have a range of early warning systems for a range of natural hazards. Although they are more accurate than before and can help in prediction it is not enough to ensure communities are safe from disasters. This is where disaster mitigation can play an important role. Mitigation

means lessening the negative impact of the natural hazards. It is defined as sustained action taken to reduce long term vulnerability of human life and property to natural hazards. While the preparatory, response and the recovery phases of emergency management relate to specific events, mitigation activities have the potential to produce repetitive benefits over time.

Certain guidelines if followed can result in an effective mitigation program.

• Pre-disaster mitigation can help in ensuring faster recovery from the impacts of disasters.

• Mitigation measures must ensure protection of the natural and cultural assets of the community.

• Hazard reduction methods must take into account the various hazards faced by the affected community and their desires and priorities

Any mitigation program must also ensure effective partnership between Government, scientific, private sector, NGOs and the community. The main elements of a mitigation strategy are as follows:

Risk assessment and Vulnerability analysis:

This involves identification of hot spot areas of prime concern, collection of information on past natural hazards, information of the natural ecosystems and information on the population and infrastructure. Once this information is collected a risk assessment should be done to determine the frequency, intensity, impact and the time taken to return to normalcy after the disaster. The assessment of risk and vulnerabilities will need to be revised periodically. A regular mechanism will therefore have to be established for this. The use of Geographical Information Systems (GIS) a computer program can be a valuable tool in this process as the primary data can be easily updated and the corresponding assessments can be made.

Applied research and technology transfer:

There is a need to establish or upgrade observation equipment and networks, monitor the hazards properly, improve the quality of forecasting and warning, disseminate information quickly through the warning systems and undertake disaster simulation exercises. Thus space technologies such as remote sensing, satellite communications and Global Positioning Systems have a very important role to play. Government organizations like ISRO (Indian Space Research Organization) can play a vital role. Similarly Government organizations the National Building Research Organization, the Meteorological Department, Irrigation Department, etc. can undertake applied research for devising locale specific mitigation strategies in collaboration with educational institutions or Universities.

Public awareness and training:

One of the most critical components of a mitigation strategy is the training to be imparted to the officials and staff of the various departments involved at the state and the district level. This enables sharing of information and methodology. The success of a mitigation strategy will depend to a large extent on the inter-sectional, inter-departmental coordination and efficient teamwork. Thus a training program that is designed after assessment of gaps in knowledge, skills and attitude with respect to the various tasks that need to be undertaken is a vital component.

Institutional mechanisms:

The most important need at the National level is to strengthen or develop the capacity to undertake disaster mitigation strategies. There is a need to emphasize on proactive and pre-disaster measures rather than post disaster response. It is thus essential to have a permanent administrative structure which can monitor the developmental activities across departments and provides suggestions for necessary mitigation measures. The National Disaster Management Center (NDMC) can perform such a task. Professionals like architects, structural engineers,

doctors, chemical engineers who are involved with management of hazardous chemicals can be asked to form groups that can design specific mitigation measures.

Incentives and resources for mitigation:
To a very large extent the success of mitigation programs will depend upon the availability of continued funding. There is thus a need to develop mechanisms to provide stable sources of funding for all mitigation programs. This will include incentives for relocation of commercial and residential activities outside the disaster prone areas. Housing finance companies should make it mandatory for structures in such hazard prone areas to follow special building specifications. The introduction of disaster linked insurance should be explored and should cover not only life but also household goods, cattle, structures and crops.
Landuse planning and regulations:
Long term disaster reduction efforts should aim at promoting appropriate land-use in the disaster prone areas. Separation of industrial areas from residential areas, maintaining wetlands as buffer zones for floods, creation of public awareness of proper land practices and formation of land-use policies for long term sustainable development is imperative.
Hazard resistant design and construction:
In areas that are prone to disasters protection can be enhanced by careful selection of sites and the way the buildings are built. Thus it is essential to promote the knowledge of disaster resistant construction techniques and practices among engineers, architects and technical personnel.
Structural and Constructional reinforcement of existing buildings:
It is also possible to reduce the vulnerability of existing buildings through minor adaptations or alterations thereby ensuring their safety. This can be done by insertion of walls on the outside of the building, buttresses, walls in the interior of the building, portico fill-in-walls, specially anchored frames, covering of columns and beams, construction of new frame system, placing residential electrical equipment above flood level, designing water storage tanks to be able to withstand cyclonic winds, earthquakes and floods, etc.

Floods and mitigation measures:
The lower plain regions of India in particular Bihar, Uttar Pradesh and West Bengal in respect of the Ganga and Assam in respect of the Brahmaputra suffer from the adverse effects of floods every year. The Ganga Brahmaputra basin receives maximum run off within the three monsoon months. Based on hydrological studies carried out, it is estimated that only 18 percent of the rainwater can be stored in dams, reservoirs, etc. while 82 percent of the rainwater flows through rivers ultimately into the sea. Floods are therefore a recurring phenomenon in our country.
Floods can be caused by natural, ecological or anthropogenic factors either individually or as a combined result. Anthropogenic activities such as deforestation and shifting cultivation can also contribute to floods. Forests on the hill slopes normally exert a sponge effect soaking up the abundant rainfall and storing it before releasing it in small amounts over a period of time. However when the forests are cleared the rivers turn muddy and swollen during the wet monsoon season and run dry later on in the year during the drier periods. An increasing proportion of the rainfall is therefore released shortly after precipitation in the form of floods.
The mitigation measures for floods include both structural and non-structural measures. The structural measures include:
• Reservoirs for impounding monsoon flows to be released in a regulated manner after the peak flood flow passes.

• Prevention of over-bank spilling by the construction of embankments and floodwalls.
• Improvement of flow conditions in the channel and anti-erosion measures.
• Improved drainage.
The non-structural measures include:
• Flood plain management such as Flood Plain Zoning and Flood Proofing including Disaster Preparedness
• Maintaining wetlands
• Flood forecasting and warning services
• Disaster relief, flood fighting and public health measures
• Flood insurance

Earthquakes and mitigation measures
It has been several years since the earthquake struck Gujarat on January 26, 2001. In these years rehabilitation has been done on a massive scale. Gujarat's experience has taught that building shelters with less vulnerability to earthquakes should also take into consideration the specific needs of the victims instead of being a top down approach. The role of NGOs in this is very important. Their strength lies in their manpower, informality in operations and valuable human resources. Their ability to reach out to the community and sensitivity to local traditions is an asset in such situations. A report on the various initiatives in Gujarat reported in Down to Earth (Vol 12, No. 2) by Mihir Bhatt throws light on the various developments that have taken place after the earthquake. According to the report the initiatives of the International Fund for Agriculture Development in supporting the Self Employed Women's Association and the Government's initiative in community based livelihood security for earthquakes and drought victims have the potential to shape future disaster response and development projects in Gujarat.
Similarly the Gujarat Woman's Economic Development Corporation initiative in reviving women's businesses after the calamity also provides many practical lessons in regenerating local economies and artisan markets. This project supported by the Asian Development Bank, puts premium on investments in income generation and asset building after a natural disaster. The farming kits provided to affected farmers by Gujarat's agriculture ministry is also showing promising results after two seasons. The author however states that coordination between Government, local NGOs and local community initiatives both for rescue as well as rehabilitation needs to be strengthened as this can cause delays, overlaps and waste of relief material and efforts.

Cyclones and mitigation measures:
Tropical cyclones are the worst natural hazards in the tropics. They are large revolving vortices in the atmosphere extending horizontally from 150 to1000 km and vertically from the surface to 12 to 14 km. These are intense low-pressure areas. Strong winds spiraling anti clockwise in the Northern Hemisphere blow around the cyclone center at the lower level. At the higher levels the sense of rotation is just opposite to that at the lower level. They generally move 300 to 5000 km per day over the ocean. While moving over the ocean they pick up energy from the warm water of the ocean and some of them grow into a devastating intensity. On an average about 5 to 6 tropical cyclones form in the Bay of Bengal and the Arabian Sea every year out of which 2 to 3 may be severe. More cyclones form in the Bay of Bengal than in the Arabian Sea. The main dangers from cyclones are very strong winds, torrential rains and high storm tides. Most of the causalities are caused by coastal inundation by storm tides. This is often followed by heavy

rainfall and floods. Storm surges cause the greatest destruction. Although one cannot control cyclones, the effects of cyclones can be mitigated through effective and efficient mitigation policies and strategies. A brief description of the same is given below.

Installation of early warning systems:

Such systems fitted along the coastlines can greatly assist forecasting techniques thus helping in early evacuation of people in the storm surge areas.

Developing communication infrastructure:

Communication plays a vital role in cyclone disaster mitigation and yet this is one of the first services that get disrupted during cyclones. Amateur Radio has today emerged as a second line unconventional communications system and is an important tool for disaster mitigation.

Developing shelter belts:

Shelter belts with plantations of trees can act as effective wind and tide breakers. Apart from acting as effective windbreakers and protecting soil crops from being damaged they prevent soil erosion.

Developing community cyclone shelters:

Cyclone shelters at strategic locations can help minimizing the loss of human life. In the normal course these shelters can be used as public utility buildings.

Construction of permanent houses:

There is a need to build appropriately designed concrete houses that can withstand high winds and tidal waves.

Training and education:

Public awareness programs that inform the population about their response to cyclone warnings and preparedness can go a long way in reducing causalities.

Landuse control and settlement planning:

No residential and industrial units should be ideally permitted in the coastal belt of 5 km from the sea as it is the most vulnerable belt. No further growth of settlements in this region should allowed. Major settlements and other important establishments should be located beyond 10 km from the sea.

Landslides and mitigation measures:

Landslides are recurring phenomena in the Himalayan region. In the recent years however intensive construction activity and the destabilizing forces of nature have aggravated the problem. Landslides occur as a result of changes on a slope, sudden or gradual, either in its composition, structure, hydrology or vegetation. The changes can be due to geology, climate, weathering, land-use and earthquakes.

A significant reduction in the hazards caused by landslides can be achieved by preventing the exposure of population and facilities to landslides and by physically controlling the landslides. Developmental programs that involve modification of the topography, exploitation of natural resources and change in the balance load on the ground should not be permitted. Some critical measures that could be undertaken to prevent further landslides are drainage measures, erosion control measures such a bamboo check dams, terracing, jute and coir netting and rockfall control measures such as grass plantation, vegetated dry masonry wall, retaining wall and most importantly preventing deforestation and improving afforestation.

Disasters cannot be totally prevented. However early warning systems, careful planning and reparedness

on part of the vulnerable community would help in minimizing the loss of life and property due to these disasters.

Module No: 09
Environmental Ethics:
Issues and possible Solutions: Climatic Change & Global Warming and Green house effect

Introduction:

The term "Green House Effect" was first coined by J. Fourier in 1827. The effect is also called as "Atmospheric Effect", Global warming or "Carbon dioxide problem". The normal level of CO_2 in atmosphere is 0.03%. In normal concentration CO_2 is not a pollutant. But higher concentration of CO_2 in the atmosphere causes serious health problems to air breathing animals. Major amount of carbon dioxide is released in the atmosphere from burning of fossil fuels (Coal, Oil etc) for domestic cooking, heating, mobile combustion, industrial processing etc.

High concentration of CO_2 causes suffocation, nausea and vomiting. The high concentration of CO_2 content is increasing the global temperature due to the green house effect. When there is an increase in CO_2 concentration, the thick layer of this gas prevents the heat from being re-radiated out. This thick CO_2 layer thus functions like the glass panels of a green house, allowing the sunlight to filter through but preventing the heat from being re-radiated in outer space. This is so called Green house effect.

Definition:

The Green house effect may therefore be defined as **"The progressive warming up of the earth's surface due to blanketing effect of manmade CO_2 in the atmosphere".**

The four major green house gases, which cause adverse effects are carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O) and Chloro fluro carbons (CFCs). Among these CO_2 is the most common and important green house gas. Here it should also be noted that Ozone and SO_2 also act as serious pollutants in causing global warming.

Sources of Green house gases:

1. Factories which burn Coal, Oil and Natural gases.
2. Power stations based on fossil fuels.
3. A large fleet of automobiles.

4. Burning of fire wood and deforestation.
5. Forest fire.
6. The reductions of forest cover due to industrial expansion and urbanization.

How the green house effect is produced:

Under normal concentrations of CO_2, the temperature of the earth's surface is maintained by the energy balance of the sun rays that strike the planet and the heat that is radiated back into the outer space. However, when concentration of CO_2 in the atmosphere increases, the thick envelop of this gas prevents the heat from being re-radiated out. Thus the thick CO_2 layer acts like the glass panels of a green house or the window glass of a closed car, allowing the sun rays to filter through but preventing the heat from being escaping in the outer space, there by warming the troposphere (lowest layer of the atmosphere) of the atmosphere.

Impact of Green house effect:

1. Due to the rise of temperature, the ice caps of the North and South Pole is melting. Melting ice is increasing the sea levels. Many islands and low lying areas are submerging under sea water.
2. Due to increase in temperature the land will become drier and this will affect the crop production.
3. Desert areas will increase and forest areas will decrease.
4. In temperate regions, the winter will be shorter and warmer and the summer will be longer and hotter.
5. The plants and animals will also be affected resulting in the disruption of the whole ecosystem.
6. Because of increased concentration of CO_2 and due to much warmer tropical oceans, there may occur more cyclones and hurricanes, and early snow melt in mountains will cause more floods during monsoon.

Control and Remedial measures of Green house effect:

1. Reducing the consumption of fossil fuels such as coal and petroleum. This can be achieved by depending more on non-conventional renewable sources of energy such as wind, solar, nuclear and bio-gas energies.
2. Disposal of the green house gases as they are formed elsewhere than in the atmosphere.

3. Recovering green house gases present already in the atmosphere and disposing off them elsewhere.
4. Learn to adapt and accept the changing climate.
5. International co-operation for attempting the reduction of green house gases.

Summary

- Green house effect is the phenomenon due to which the earth retains heat.
- Four major green house gases are CO_2, Methane, Nitrous oxide, and chloro fluoro carbons.
- CO_2 is the most common and important green house gas.
- Green house gases act like a blanket, trapping heat close to the surface of the earth leads to global warming.
- Burning of fossil fuels, cooking, heating, mobile combustion, industrial processing etc leads to rise in the levels of CO_2.
- Increase of global temperature leads to melting of polar ice caps. Flooding of low lying coastal areas as the level of water increases in seas and oceans.
- To overcome this effect it is required that global emissions are significantly lowered.

Object Type Questions:

1. Green house effect is related to
   A. Global warming
   B. Co_2 Problem
   C. Atmospheric effect
   D. **All**

2. As a result of combustion
   A. O_2 concentration in atmosphere increases
   B. **CO_2 concentration increases**
   C. CO_2 concentration decreases
   D. D. None

3. Which among the following causes global warming
   A. CO_2
   B. N_2O
   C. CH_4
   D. **All**

4. The green house gas is
   A. CO_2
   B. CH_4
   C. N_2O
   D. **All**

5. Fossil fuel is
   A. Coal
   B. Petroleum
   C. **Both A & B**
   D. None

6. Green house effect causes
   A. Rise in temperature of the earth
   B. Continuous rain fall
   C. Lowering in temperature of the earth
   D. Continuous snowing on the earth

7. Which is not a green house gas
   A. CH_4
   B. Chlorofluorocarbons
   C. CO_2
   D. **Co**

8. Green house effect is increasing due to
   A. Increasing Co2 Conc.
   B. Increasing So2 Conc.
   C. Ozone hole
   D. Increasing CFCs concentration

9. Green house effect with respect to global climate refers to
   A. Cooling of earth
   B. Warming of earth
   C. Increased rainfall and greenery
   D. Desertification

Short Answer Questions:

1. What is Global warming?
2. How Green house effect is produced?
3. What are the control measures of Green house effect?

Long Answer Questions:

1. Explain the Green house effect?

Module No: 11
Environment and Human Health:
Rights, Value Education, Women and Child Welfare

11.1 Introduction

It is an established fact that environment has a direct impact on the physical, mental and social well-being of those living in it. The environmental factors range from housing, water supply and sanitation, psychosocial stress and family structure through social and economic support systems, to the organization of health and social welfare services in the community.

In fact the occurrence, prevention and control of disease lies in the environment. If the environment is favorable to the individual, he or she can make full use of his or her physical and mental capabilities. On the contrary, if the environment is polluted it can affect the human health and his susceptibility to illness.

Thus, protection and promotion of 'environment health' is one of the major global issues today. It includes the issues of urban environmental health, water quality and health, air quality and health, industry and health, and energy and health.

11.2 Urban Environment Health:

Environmental degradation is especially serious around crowded urban centers. In cities around the world, the living conditions of hundreds of millions of people (especially poor people in developing nations) threaten their health, impose misery, have potentially catastrophic social consequences and contribute to illness, accidents and crime. The crises in the urban environment are causing more immediate effects on human health than the current changes in the natural environment.

In the developing nations, the current rural exodus has led to a rapid increase in the pre-urban populations living in overcrowded conditions with inadequate provisions of infrastructure and services. Though average rate of disease and death for many cities are lower than those of surrounding rural areas because of the presence of a high proportion of the nation's middle- and upper-income classes who enjoy a relatively good standard of health; but, in contrast, the poor in urban areas usually suffer the same or even high rates of disease and death as their rural counterparts.

Good housing and suitable physical and social environments promote good mental and physical health. The most serious psychosocial health problems are depression, alcohol and drug abuse, suicide, child and spouse abuse, delinquency and target violence (e.g. rape, teacher assault, etc.). However, strong social networks and a sense of community organization can have a mitigating effect on the level of psychosocial health problems. Studies have shown a higher prevalence of mental illness in low-income, rundown areas. Deteriorating inner city areas or urban area with declining economies are characterized by social disorganization and disintegration. They are inhabited by high- risk populations such as migrants, the homeless and street children. It has now been recognized that the environment plays an important role in violent behavior and that the public health sector has a legitimate role within the justice, social and education sectors in reducing the problem or urban environmental health.

11.3 Human Rights:

The term 'Human Rights' refers to those basic rights which are essential for the development of human personality such as the right to life, liberty, property and security of an individual. The 'Universal Declaration of Human Rights' adopted by the United Nations on December10, 1948, states that-"the inherent dignity of all members of the human family is the foundation of freedom , justice and peace in the world". This is possible only when each and every human being enjoys fundamental rights, which include:

- The right to life, liberty and security of persons;
- The right to own property;
- The right to freedom of opinion and expression;
- The right to an adequate standard of living;
- The right to seek and to enjoy in other countries asylum from persecution.
- The right to education, freedom of thought, conscience and religion; and
- The right to freedom from torture and degrading treatment, etc.

11.4 Problem of Human Rights:

Alarmed by the horrors of the holocausts, the United Nations had adopted 'Universal Declaration on Human Rights' in 1948, motivated by the desire to recognize that the same rights belong to all people and every individual. And since then, the UN has been actively monitoring human rights violations in various parts of the world.

But many countries have protested against the UN declaration saying that it is discriminatory in nature as it is used to condemn underdeveloped countries. Many of the developing countries have even accused the West of practicing double-standards. For instance, the US is quite willing to forget China's human rights violations (e.g., political dissidents are detained, and freedom of speech and expression are kept under considerable restraint in China) in return for a lucrative market. The US has even given China the status of 'Most Favoured Nation'.

The Malaysian former Prime minister, Dr. Mahathir Mohammad, has even launched a campaign for a review of the 'Universal Declaration on Human Rights'. He is of the opinion that the Declaration should take into account the Asian cultures in which the interests of the nation and society take precedence over those of the individuals.

11.5 Value Education

Undoubtedly man is related with environment and solely dependent on nature.over exploitation of natural resources has disturbed the environment. Increased population and higher consumption per head greatly effects the environment . The success of environmentally sound development depends on proper understanding of social needs,opportunities and of environmental characteristics. The human ambition for a higher living standard has made them to over use natural resources. Here comes the need for the environmental ethics to protect the deteriorating environment.

The following are the most important steps to be undertaken:

1. Environmental education is required to improve understanding among general public about the environment.
2. The awareness must be given to understand the relationship between human and their environment. Understanding of basic ecological concept and current environmental issues will help in solving environmental problems.

3. Make the people understand environmental protection and resource conservation are the main advantages to lead a better life.

11.6 Women and Child Welfare

Introduction:
The social welfare services of the government of India are intended to carter to the special needs of persons and groups such as women, children, handicapped, aged and infirm, Scheduled castes and Scheduled Tribes etc. Social welfare activities in the country find their inspiration in constitution through article 38 of the constitution. It encourages the states to ensure that the health and strength of men and women, childhood and youth are protected against exploitation and against moral and material abandonment.

The programmes of social welfare have been included in various five year plan

1. Women Welfare:
To protect the privileges of women and children and to receive directly the benefits extended by the government, specific programmers' have been initiated for the welfare of women. These programmes include prohibition of dowry, functional literacy for adult women, working women's' hostels and mahila mandals etc.

2. Child Welfare:
All the programmes of social welfare took care of the child. They include establishment of Balwadis, grants for organizing holiday groups for school going children of low income families ,establishment of ashram school, rehabilitation of handicapped children, services, care and protection for children, provision for both institutional non institutional services like establishment of postal schools, children's home to tackle the problems of juvenile delinquency.
Some of the following are accepted by many countries regarding child welfare.

b. All children have the right to love understanding.
c. Childrens welfare depends pon providing nutritious food to them for good growth and health.
d. Clean, ventilated, hygienic surroundings should be given to them.
e. Proper medical care should be provided for all children.
f. Proper educational facilities should be provided for them.
g. Proper play facilities should be provided for them in every country. Under the scheme a package Sof services consisting of supplementary nutrition, immunization, health check up referral services, health education is delivered.

Short Answer Questions

1) Write about the urban environment health?
2) Write a note on human rights?
3) Write a note on value of education?
4) Write about the women and child welfare?

MODULE NO 12

HIV/AIDS

12.1 Introduction

AIDS, the Acquired immune-Deficiency Syndrome is a fatal illness caused by a retrovirus known as the Human Immuno-Deficiency Virus (HIV) which breaks down the body's immune system, leaving the victim vulnerable to a host of life-threatening opportunistic infections, neurological disorders or unusual malignancies. Once a person is infected with HIV, it is probable that the person will be infected for life. Strictly speaking, AIDS refers only to the last stage of the HIV infection. There are two types of HIV- the most common HIV 1 and HIV 2 (commonly found in West Africa). The high risk groups include male homosexuals and bisexuals, hetero-sexual partners (including prostitutes), clients of STD, intravenous drug abusers, transfusion recipients of blood and blood products, haemophiliacs, and medical and paramedical staff. Since the first clinical evidence of AIDS in USA in 1981, the disease has become a more devastating disease than any other disease humankind has ever faced. It has acquired epidemic like proportion as more than 60 million people all over the world have been infected with the HIV (Africa-13.2%, Americans-13.6%, Asia-60.7%, Europe-12.0% and Oceania-0.5%).

Estimates of HIV infection cases in India are about 3.5 million. HIV sentinel surveillance data shows Maharashtra as the most affected state followed by Tamil Nadu, Andhra Pradesh,

Karnataka and Manipur.

12.2 Sources of HIV Infection

The greatest concentration of HIV has been found in blood, semen and CSF (cerebo-spinal-fluid). Further, lower concentrations have been detected in tears, saliva, breast-milk, urine, and cervical and vaginal secretions. But, till date, only blood and semen have been conclusively shown to transmit the virus.

12.2.1 Mode of transmission

12.2.*1.1 Sexual transmission*

AIDS is first and foremost a sexually transmitted disease. Recent researchers have found that deep kissing where saliva is exchanged can also infect the partner.

12.2.1.2 Blood contact

AIDS is also transmitted by transfusion of contaminated blood. Intravenous drug users are at a high risk because they often share needles and syringes. Any skin piercing (including injections, ear-piercing, tattooing or acupuncture) can also transmit the virus via infected instruments.

12.2.1.3 Maternal-foetal transmission

An AIDS-infected mother can transmit virus to her child during pregnancy (through the placenta) or during birth or via breast-feeding.

12.2.2 HIV/AIDS is not spread by

- Drinking water or eating food from the same utensils (glasses, cups, plates, etc.) used by infected person.
- Shaking hands.
- Hugging or facial kissing.
- Working with people who are HIV infected.
- Swimming in pools used by infected people.
- Sharing toilets.
- Mosquitoes or any other insects.
- Casual social contact with infected persons even within households. That is, HIV is not spread by sitting next to someone who is infected, coughing or sneezing; but if person has any cuts or sores on his/her hands then make sure they are covered with plasters (band-aids or bandages).

12.2.3 Major precautions to avoid AIDS

The three major precautions to avoid AIDS are:

- Use condoms
- Use disposable syringes.
- Avoid multiple partners.

12.2.4 Control of AIDS

There are four basic approaches to control AIDS

12.2.4.1 Health education

Until a vaccine or cure for AIDS is found, the only means available at present is health education so as to enable people to make life-saving choices (for example, avoiding indiscriminate sex, using condoms). However, there is no guarantee that the use of condoms will give full protection. People should also avoid the use of shared razors and tooth brushes. Women suffering from AIDS or who are at high risk of infection should avoid becoming pregnant since infection can be transmitted to the unborn or new born. Intravenous drug users should avoid sharing of needles and syringes. Educational material and guidelines for prevention should be made widely available. All mass media channels should participate in educating the people on AIDS, its nature, transmission and prevention.

12.2.4.2 Prevention of blood borne HIV transmission

People in high-risk group should be asked to refrain themselves from donating blood, body organs, sperm and other tissues. All donated blood should be screened for AIDS before transfusion. Strict sterilization practices should be ensured in hospitals and

clinics. Pre-sterilized disposable syringes and needles should be used as far as possible.

12.2.4.3 Treatment

There is no vaccine or cure for AIDS. However, there are certain medicines like ‘Zidovudine (Azt), Lamivudine (3TC) and Saquinavir (SQR) which can delay the onset of AIDS after HIV infection. Strictly speaking-these medicines cannot cure; they can only control/delay the onset of AIDS.

Questions

1) Write a essay on HIV/AIDS?
2) Write about the mode of transmission?