



KIIT POLYTECHNIC

LECTURE NOTES ON EVS

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Unit-1

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

The word environment is derived from the French word '**environner**' which means to 'encircle or surround'.

Definition :-Environment literally means Surrounding in which we are living. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non living component like soil, air water.

Environmental Protection Act (1986) defined "Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living beings and property."

SEGMENTS OF ENVIRONMENT

1. Atmosphere- The Atmosphere is theProtective blanket of gases surrounding the earth. It sustains life on the earth and saves it from the hostile environment of outer space.

2. Hydrosphere- The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reservoir, polar icecaps, glaciers, and ground water

3. Lithosphere- Lithosphere is the outer mantle of the solid earth. It Contains various types of soils and rocks on the earth.

4. Biosphere- Biosphere composed of all living organisms and their interactions with the environment.

SCOPE OF ENVIRONMENT:

Environmental studies as a subject has a wide scope. It includes a large number of areas and aspects, which may be summarized as follows:

- Natural resources- their conservation and management
- Ecology and Biodiversity
- Environmental pollution and control
- Human population and environment
- Social issues in relation to development and environment

Several career options have emerged in these fields that are broadly categorized as:

- Research and development in environment
- Green advocacy
- Green marketing
- Green media
- Environmental consultancy

IMPORTANCE OF ENVIRONMENTAL STUDIES

Environmental factors greatly influence every organism and their activities.

The environment studies enlighten us, about the importance of protection and conservation of our natural resources, indiscriminate release of pollution into the environment etc. Environment studies have become significant for the following reasons:

1. **Environment Issues are being global:** It has been well recognized that environment issues like global warming, ozone depletion, acid rain, marine pollution and loss of biodiversity are not merely national issues but are global issues and hence require international efforts to solve them.
2. **Problems Cropped in The Wake of Development:** Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world.
3. **Explosively Increase in Pollution:** World census reflects that one in every seven persons in this planet lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land.
4. **Need for An Alternative Solution:** It is essential, specially for developing countries to find alternative paths to an alternative goal. (1) A goal, which ultimately is the true goal of development an environmentally sound and sustainable development. (2) A goal common to all citizens of our earth.
5. **Need For Wise Planning of Development:** Our survival and sustenance depend. Resources withdraw, processing and use of the product have all to be synchronized with the ecological cycles in any plan of development. Our

actions should be planned ecologically for the sustenance of the environment and development.

NEED FOR PUBLIC AWARENESS

- Increasing population, urbanization and poverty have generated pressure on the natural resources and lead to a degradation of the environment.
- To prevent the environment from further degradation, the supreme court has ordered and initiated environment protection awareness through government and non government agencies to take part in protecting our environment.
- Environmental pollution cannot be prevented by laws alone. Public participation is equally important with regard to environmental protection.
- Environmental education is a process of learning by giving an overall perspective of knowledge and awareness of the environment.
- It sensitizes the society about environmental issues and challenges interested individuals to develop skills and expertise thereby providing appropriate solutions.
- Climate change, loss of diversity, ozone layer depletion, illegal trade of endangered species, destruction of habitats, land degradation, environmental pollution, storm water pose a serious threat to ecosystem in forest, rural, urban and marine ecosystem.
- Both formal and informal education on the environment will give the interested individual the knowledge, values, skills and tools needed to face the environmental challenges on a local and global level.

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

- The Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc.
- It is the science of physical phenomena in the environment. It studies about the sources, reactions, transport, effect and fate of physical and biological species in the air, water, soil and the effect of from human activity upon these.
- As the environment is complex and actually made up of many different environments like natural, constructed and cultural environments, environmental studies is interdisciplinary in nature including the study of

biology, geology, politics, policy studies, law, religion engineering, chemistry and economics to understand the humanity's effects on the natural world.

- This subject educates the students to appreciate the complexity of environmental issues and citizens and experts in many fields.
- By studying environmental science, students may develop a breadth of the interdisciplinary and methodological knowledge in the environmental fields that enables them to facilitate the definition and solution of environmental problems

UNIT-2

NATURAL RESOURCES

Natural resources can be defined as 'variety of goods and services provided by nature which are necessary for our day-to-day lives'.

Eg: Plants, animals and microbes (living or biotic part), Air, water, soil, minerals, climate and solar energy (non- living or abiotic part).

TYPES OF NATURAL RESOURCES

They are of two types of resources namely Renewable and Non-Renewable Resources.

1. **Renewable resources:** The resources that can be replenished through rapid natural cycles are known as renewable resource. Ex: Plants, (crops and forests) and animals.
2. **Non renewable resources:** The resources that cannot be replenished through natural processes are known as non-renewable resources. These are available in limited amounts, which cannot be increased. . Ex: These resources include fossil fuels (petrol, coal etc.), metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.).Once a non-renewable resource is consumed, it is gone forever.

NATURAL RESOURCES AND ASSOCIATED PROBLEMS:

The main problem associated with natural resources is unequal consumption. A major part of natural resources are consumed in the 'developed' world. The 'developing nations' also over use many resources because of their greater human population. However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times greater than in most developing countries.

FOREST RESOURCES

A forest can be defined as a biotic community predominant of trees, shrubs or any other woody vegetation usually in a closed canopy.

USES OF FOREST

1. Commercial uses
2. Ecological uses

Commercial uses:

Wood – used as a fuel ii. Supply wood for various industries – Raw materials as pulp, paper, furniture timber etc. iii. Minor forest products – gum, dyes, resins iv. Many plants – Medicines v. Supply variety of animal products – honey. Ivory, horns etc. vi. Many forest lands are used for - Mining, grazing, for dams and recreation.

Ecological uses:

- Production of oxygen: Photosynthesis produces large amount of oxygen which is essential for life.
- Reducing global warming: Carbon dioxide is one of the main green house gas. It is absorbed by plants for photosynthesis. Therefore the problem of global warming caused by CO₂ is reduced.
- Wild life habitat: Forest is the home of millions of wild animals and plants.
- Pollution moderators: Forest can absorb many toxic gases and noises and help in preventing air and noise pollution.

OVER EXPLOITATION OF FOREST: Due to over population, there is an increased demand for medicine, shelter, wood and fuel. Hence exploitation of forest materials is going on increasing.

Cause of over exploitation:

1. Increasing agricultural production.
2. Increasing agricultural activities.
3. Increase in demand of wood resources.

DEFORESTATION:

It is process of removal of forest resources due to natural or manmade activities (i.e.) destruction of forests.

Causes of deforestation:

1. Developmental projects: Developmental projects causes deforestation through two ways.
 - Through submergence of forest area.
 - Destruction of forest area.
- Ex: big dams, hydro electric projects, road construction etc.
2. Mining operations: It reduces forest areas. Ex: Mica, coal, Manganese and lime stone.
3. Raw materials for industries: Wood is an important raw material for various purposes. Ex: Making boxes, furniture and paper etc.
4. Fuel requirement: Wood is the important fuel for rural and tribal population.
5. Shifting cultivation: Replacement of natural forest ecosystem for mono specific tree plantation. Ex: Teak

Forest fires: Forest fire destructs thousands of acres of forest.

Over grazing: Over grazing by cattle reduces the cultivation land.

Consequences of deforestation (or) impacts of deforestation:

1. Economic loss
2. Loss of biodiversity
3. 3. Destructs the habitats of various species
4. Increases the rate of global warming
5. Disruption of weather patterns and global climate
6. Degradation of soil and acceleration of the rate of soil erosion.
7. Induces and accelerates mass movement / land slides.
8. Increases flood frequency, magnitude / severity.

PREVENTIVE MEASURES (OR) AVOID OF DEFORESTATION (OR) METHODS OF CONSERVATION OF FORESTS

1. New plants of more or less of the same variety should be planted to replace the trees cut down for timber
2. Use of wood for fuel should be discouraged.
3. Forest pests can be controlled by spraying pesticides by using aero planes
4. Forest fire must be controlled by modern techniques.
5. Over grazing by cattle must be controlled.
6. Steps should be taken by the government to discourage the migration of people into the islands from mainland.
7. Education and awareness programmes must be conducted.
8. Strict implementation of law of Forest conservation Act.

Case study:

Deforestation in the Himalayan region, involves clearing of natural forests and plantation of monoculture like Eucalyptus. Nutrient in the soil is poor; therefore soil losing their fertility, hence, Himalayan area facing the serious problem of desertification.

TIMBER EXTRACTION

Wood used for engineering purposes like building houses, making furniture is called timber. The products derived from timber have been important to many civilizations, and thus it has acquired value within these civilizations. Timber extraction results in deforestation and in the fragmentation of the last remaining forests. It harms valuable species of trees, birds and wild animals.

Effects of Timber Extraction

1. Poor logging results in a degraded forest.
2. Floods may be intensified by cutting of trees or upstream watersheds.
3. Loss of biodiversity.
4. Climatic changes such as less rains.
5. Exploitation of tribal people by the contractors.
6. Soil erosion especially on slopes occurs extensively

Case Study-Chipko Movement

The world famous Chipko Movement, pioneered by Dasohli Gram Swarajya Mandal in Gopeshwar brought about a general awareness about conservation of forests. Environmental Science 14 AITT & H&S The first Chipko Movement dates back to 1731, when a village woman named Amrita Bai led the Bishnoi women against the Maharajas men to prevent them from cutting trees. In this attempt to save the trees, she sacrificed her life along with the lives of her husband, three daughters and 363 people. The movement was given this name because the village women embraced or hugged the trees to stop them from being cut.

DAMS

Today there are more than 45,000 large dams around the world, which play an important role in communities and economies that harness these water resources for their economic development.

Effects of dams on forest:

1. Thousands of hectares of forest will be cleared.
 2. Killing of wild animals and destruction of aquatic life.
 3. Spreading of water borne diseases.
 4. Water logging increases the salinity of the soil.
- Ex: Narmadha Sagar project it has submerged 3.5 lakhs hectares of forest.

Effects of dam on tribal people

1. Construction of big dams lead to the displacement of tribal people.
2. Displacement and cultural change affects the tribal people both mentally and physically.
3. They do not accommodate the modern food habits and life style.
4. Tribal people are ill treated by the modern society.
5. Many of the displaced people were not recognised and resettled or compensated.

Case study- Sardar Sarovar Project:

The World Bank's withdrawal from the Sardar Sarovar Project in India in 1993 was a result of the demands of local people threatened with the loss of their livelihoods and homes in the submergence area. This dam in Gujarat on the Narmada has displaced thousands of tribal folk, whose lives and livelihoods were linked to the river, the forests and their agricultural lands. While they and the fishermen at the estuary, have lost their homeland, rich farmers downstream will get water for agriculture.

MINING

The process of extracting mineral resources and fossil fuels like coal from the earth is called as mining. Types of mining

1. Surface mining: Mining of minerals from shallow deposits
 2. Underground mining: Mining of minerals from deep deposits .
1. Pollute soil, water and air.
 2. Destruction of natural habitat.
 3. Continuous removal of minerals leads to the formation of trench where water is logged which contaminates the ground water.
 4. Vibrations cause earth quakes.
 5. Produces noise pollution
 6. Reduces shape and size of the forest.
 7. Increased risk of landslides.

WATER RESOURCES

Water claims to be an important resource. An important use of water in our country is for irrigation. Besides, water is also required in large amounts for industrial and domestic consumption.

USES

- Is essential for all forms of life.
- Many uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually, all of these human uses, require fresh water.

Effects of over utilization of water**1. Decrease of ground water:**

i. Increased usage decreases the ground water. ii. Insufficient rain fall iii. Building construction activities sealing the permeability of the soil.

2. Ground subsidence: If ground water withdrawal is greater than it's recharge rate, then the sediments in the aquifers get compacted. As a result shrinkage of land surface takes place.

Problems: a. Structural damages to the buildings b. Fracture in pipes. c. Reversing the flow of canals.

3. Lowering of water table: Over utilization of ground water in arid and semi arid regions for agriculture disturbs the state of equilibrium of the hydrological cycle.

4. Over utilization of water causes earth quakes, landslides and famines.

5. Drying up of wells: Due to over utilization, ground water level decreases much faster than can be regenerated. It leads to drying up of dug well and bore wells.

6. Pollution of water: Near the agricultural land ground water decreases therefore water containing nitrogen enters into the ground and pollute the ground water.

Problem: Water which contains excess nitrate content is not suitable for drinking

FLOOD

It is an over flow of water. It happens when the magnitude of flow of water exceeds the carrying capacity of the channel within its bank.

CAUSES OF FLOOD

1. Heavy rainfall, melting of snow and sudden release of water from dams. (Flash floods)
2. Reduction in the carrying capacity of the channel.

3. Deforestation, mining and over grazing increase the runoff from rains and the level of flood raises.

EFFECT OF FLOOD

Water spreads in the surrounding area and submerges them.

2. Cultivated land gets affected.
3. Extinction of civilization.

FLOOD MANAGEMENT

1. Floods can be controlled by dams.
2. Channel management control flood.
3. Flood hazards reduced by forecasting or flood warning.
4. Flood may also be reduced by reduction of run off by increasing infiltration through appropriate afforestation in the catchment area.

DROUGHT

Drought is nothing but scarcity of water, which occurs due to

1. Inadequate rain fall
2. Late arrival of rain fall
3. Excessive withdrawal of ground water.

CAUSES OF DROUGHT

When annual rain fall is below normal and less than evaporation, drought is created.

2. High population.
3. Intensive cropping pattern

Ex: Maharashtra - There has been no recovery from drought for the last 30 years due to over exploitation of water by sugarcane crop.

EFFECTS OF DROUGHT

1. Drought causes hunger, malnutrition and scarcity of drinking water an also changes the quality of water
2. Drought causes widespread crop failure leading to acute shortage of food and adversely affects human and live stock population.
3. Worst situation of drought causes desertification.
4. Raw materials of agro based industries are critically affected during drought time, hence industrial and commercial growth decreases.
5. Drought increases the degradation of natural resources.

DROUGHT MANAGEMENT

1. Indigenous knowledge is essential.
2. Rain water harvesting system.
3. Construction of reservoirs to improve ground water level.
4. Modern irrigation technology (drip irrigation) very useful to conserve water.
5. Afforestation activities also improve the potential of water in the drought area.
6. Crop mixing and dry forming are the suitable methods which minimize the risk of crop failures in dry area.

DAMS

Dams made significant contributions to human development and the benefits derived from them have been considerable. Large dams are designed to control floods and to help the drought prone areas, with

supply of water. But large dams have proved to cause severe environmental damage. Hence an attempt has been made to construct small dams. Multiple small dams have less impact on the environment.

Benefits:

Dams ensure a year round supply of water for domestic use and provide extra water for agriculture, industries and hydropower generation.

Problems:

- Dam construction and submersion leads to significant loss of farmland and forest and land submergence
- Siltation of reservoirs, water logging and salination in surrounding lands reduces agricultural productivity
- Serious impacts on ecosystems - significant and irreversible loss of species and ecosystems, deforestation and loss of biodiversity, affects aquaculture
- Socio economic problems for example, displacement, rehabilitation and resettlement of tribal people. Fragmentation and physical transformation of rivers
- Displacement of people - People living in the catchment area, lose property and livelihood
Impacts on lives, livelihoods
- cultures and spiritual existence of indigenous and tribal people .

SUSTAINABLE WATER MANAGEMENT

- Building several small reservoirs instead of few mega projects
- Developing small catchment dams and protecting wetlands
- Soil management, micro-catchment development and afforestation permits recharging of underground aquifer, thus reducing the need for large dams
- Treating and recycling municipal waste water for agricultural use.
- Preventing leakages from dams and canals and loss in municipal pipes
- Effective rainwater harvesting in urban environments
- Water conservation measures in agriculture, such as using drip irrigation, control of growing water intensive cash crops ; control of water logging.
- Pricing water at its real value makes people use it more responsibly and efficiently and reduces wastage
- In deforested areas where land has been degraded, appropriate soil management practices, making bunds along the hill-slopes and making nalla plugs can help retain moisture and make it possible to revegetate degraded areas
- Use waste water for activities that does not need fresh water – Recycling
- Adopt mini water harvesting models for domestic usage.
- Protect existing tanks
- Develop systematic water management and adopt strict water auditing
- “Save water Campaigns” for public awareness on water scarcity
- Through rainwater harvesting, community based participatory initiatives and holistic watershed management.
- Responsible water usage can only be achieved by empowering local communities and creating local accountability.

- The government should develop policies that protect water resources, promote sustainable watershed management and invest in technologies that will increase efficiency in irrigation, industrial usage and improve water harvesting techniques.

WATER CONFLICTS

Conflict through use: Unequal distribution of water led to interstate and international disputes.

National conflicts:

- Sharing of cauvery water between Karnataka and TamilNadu.
- Sharing of Krishna water between Karnataka and Andrapradesh.
- Siruvani – TamilNadu and Kerala

International conflicts:

Indus – India and Pakistan & Colorado river – Mexico and USA

MINERAL RESOURCES

Naturally occurring inorganic crystalline solids with uniform chemical composition are called as minerals. **USES AND EXPLOITATION OF MINERALS**

1. Development of industrial plants and machinery. - Fe, Al & Cu
2. Construction work – Fe, Al & Ni
3. Generation of energy - coal, lignite, uranium
4. Designing defense equipments like weapons and ornaments
5. Agricultural purposes – fertilizers and fungicides – Zn & Mn
6. Jewellery –Au, Ag & Pt
7. Making alloys for various purposes
8. Communication purposes – telephone, wires, cables and electronic devices
9. Medicinal purposes, particularly in ayurvedic system

ENVIRONMENTAL DAMAGES CAUSED BY MINING ACTIVITIES

1. Devegetation:
 - Topsoil and vegetation get removed
 - Deforestation leads to several ecological losses
 - Land scape gets badly affected
2. Ground water contamination: Mining pollutes ground water; sulphur is converted into sulphuric acid which enters into the soil.
3. Surface water pollution: Radioactive wastes and other acidic impurities affect the surface water, which kills many aquatic animals.
4. Air pollution: Smelting and roasting are done to purify the metal which emits air pollutants and damage the nearby vegetation. It causes many health problems.
5. Subsidence of land: Mainly underground mining results in cracks in houses, tilting of buildings and bending of rail tracks.

EFFECTS OF OVER EXPLOITATION OF MINERALS

1. Rapid depletion of mineral deposits
2. Wastage
3. Environmental pollution
4. Needs heavy energy requirements.

CASE STUDIES-MINING AND QUARRYING IN UDAIPUR

200 open cast mining and quarrying in Udaipur. But 100 mines are illegal. 150 tons of explosives are used per month. It pollutes air, soil and water. It affects irrigation and wild life.

FOOD RESOURCES

Food is an essential requirement for survival of life. Main components are carbohydrates, fats, proteins, minerals and vitamins

TYPES OF FOOD SUPPLY

1. Crop plants: Grains mostly constitute about 76% of the world's food. Ex: Rice, Wheat and Maize
2. Range lands: Produces 17% of world's food from trees and grazing animals. Ex: Fruits, milk and meat
3. Ocean: Fisheries – 7% of world's food

WORLD FOOD PROBLEM

1. In the earth's surface, 79% is water out of total area. 21% land (forest, desert, mountain and barren land) . Less % cultivated land, at the same time population explosion is high therefore world food problem arises.
2. Environmental degradation like soil erosion, water logging, water pollution, salinity affects agricultural land.
3. Urbanization affects agricultural land. Hence production of rice, wheat, corn and other vegetable is difficult.

OVER GRAZING

It is a process of eating the forest vegetation without giving a chance to regenerate.

EFFECTS OF OVER GRAZING

1. Land degradation
 - Over grazing removing the cover of vegetation
 - Exposed soil gets compacted
 - Soil moisture reduces.
 - Desertification - OG leads to poor, dry and compacted soil.
 - Land cannot be used for further cultivation.
2. Soil erosion: When the grasses are removed the soil becomes loose and gets eroded by the action of wind and rain fall.
3. Loss of useful species: OG affects the plant population and their regenerating capacity. OG replace the plant of high nutritive value with plant of low nutritive value.

AGRICULTURE

Agriculture is an art, science and industry of managing the growth of plants animals for human use. It includes cultivation of the soil, growing and harvesting crops, breeding and raising livestock, dairying and forestry.

TYPES OF AGRICULTURE

1. Traditional agriculture
2. Modern (or) industrialised agriculture

Traditional agriculture

Small plot, simple tools, surface water, organic fertilizer and a mixture of crops constitute traditional agriculture. They produce enough food to feed their family and to sell it for their income.

Modern agriculture

Hybrid seeds of single crop variety, high tech equipments, lot of fertilisers, pesticides and water to produce large amount of single crops.

EFFECTS OF MODERN AGRICULTURE

1. Problems in using fertilizers

- a. Excess of fertilizers causes micronutrient imbalance. (e.g) Punjab and Haryana deficiency of nutrient zinc in the soil affect the productivity of the soil.
- b. Blue baby syndrome (nitrate pollution): Nitrate present in the fertilizer causes blue baby syndrome, when the amount exceeds the limit leads to death.
- c. Eutrophication: Nitrogen and phosphorus in the crop fields washed out by runoff water in the water bodies, which increases the nourishment of the lakes called eutrophication. Hence algal species increases rapidly. Life time of the species is less and they decompose easily and pollute the water which affects the aquatic life.

2. Problems in using pesticides

Death of non target organism.

Producing new pest – super pest

Bio magnification – Most of the pesticides are non bio degradable, keep on concentrating in the food chain and it is harmful to human beings.

Risk of cancer: a. It directly acts as carcinogen b. It indirectly supports immune system.

3. Water logging: Land where water stand for most of the year.

Causes of water logging:

1. Excessive water supply
2. Heavy rain
3. Poor drainage

Remedy:

1. Preventing excessive irrigation
2. Subsurface drainage technology
3. Bio drainage like trees like Eucalyptus

4. SALINITY

Water not absorbed by soil, is evaporated leaving behind a thin layer of dissolved salts in the top soil. This is called salinity of the soil. Saline soils are characterized by accumulation of soluble salts like sodium chloride, calcium chloride, magnesium chloride, sodium sulphate, sodium carbonate and sodium bicarbonates. Saline conditions are exhibited when pH is greater than 8.0

PROBLEMS IN SALINITY

1. Saline soils yield less crop

In order to remedy the condition of saline soils the following two techniques may be used:

1. Salt deposit is removed by flushing with good quality water
2. By using a sub-surface drainage system, the salt water is flushed out slowly.

CASE STUDY- PESTICIDES IN INDIA

In Delhi the accumulation of pesticide in the body of mother causes premature delivery and low birth weight infant.

Pesticides in Pepsi and Coca Cola India has reported that Pepsi and coca cola companies are selling soft drinks with pesticide content 30-40 times higher than EU limits. This damages the nervous system,

ENERGY RESOURCES

ENERGY DISTRIBUTION IN THE WORLD

Developed countries like USA and Canada constitute only 5% of the world's population but consume 25% of the world's available energy.

Energy consumed by a person in a developed country for a single day is equal to energy consumed by a single person in a poor country for one year.

TYPES OF ENERGY RESOURCES:

1. Renewable energy resource (or) Non conventional energy resources
2. Non renewable energy resources (or) Conventional energy resources

RENEWABLE ENERGY SOURCES: Energy which can be regenerated.

Types of renewable energy resources:

1. Solar energy: Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy.
 - a. Solar cell (or) Photovoltaic cell (or) PV cell: Solar cell consists of p- type semi conductor (Si doped with B) and n-type semi conductor (Si doped with P). P-type forms top layer and n-type forms bottom layer.
Uses: It is used in calculators, electronic watches, street light, water pumps etc.
 - b. Solar battery: Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem.
 - c. Solar water heater: It consists of insulated box painted with black paint with glass lid. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is heated up and flows out into a storage tank from which water is supplied through pipes.
2. Wind energy: Moving air is called wind. The energy recovered from the force of the wind is called wind energy .It's speed is high.
 - a. Wind mills: When a blowing wind strikes the blade of the wind mill, it rotates continuously. And rotational motion of the blade drives number of machines like water pump, flour mills and electric generators.
 - b. Wind farms: When a large number of mills are installed and joined together in a definite pattern – it forms wind farm. It produces large amount of electricity.
Advantages: 1. It does not cause air pollution 2. Very cheap
3. Ocean energy: Tidal energy (or) Tidal power: Ocean tides are due to gravitational force of sun and moon which produce enormous amount of energy. High tides – rise of water in the ocean. Low tides – fall of water in the ocean. Tidal energy can be used by constructing a tidal barrage. During high tides sea water enters into the reservoirs and rotates the turbine, produce electricity. During low tides water from reservoir enters into the sea rotate the turbine produce electricity.

4. Geo thermal energy: Temperature of the earth increases at a of 20 –750C per/km when we move down the earth. The energy utilised from the high temperature present inside the earth is called geo thermal energy.
5. Bio mass energy: Bio mass: Organic matter produced by plants or animals used as source of energy Bio gas: Mixture of methane, carbondioxide and hydrogen sulphide. Methane is the major constituent.

NON RENEWABLE ENERGY SOURCES:

Energy which cannot be regenerated is called as non-renewable.

1. Coal: It is a solid fossil fuel.
Disadvantages: When coal is burnt large amount of CO₂ is released which causes global warming. S, N produces toxic gases during burning.
2. Petroleum: Crude oil is a liquid consists of more than hundreds of hydrocarbons and small amount of impurities. The petroleum can be refined by fractional distillation. In the world level 25% of oil reserves are in Saudi Arabia. At present rate of usage, the world crude oil reserves are expected to get exhausted in just 40 years.
3. Natural gas: These are found above oil in oil wells. It is a mixture of methane and other hydrocarbons. Calorific value is high. There are two types. Dry gas and wet gas.
4. Liquefied petroleum gas (LPG): Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colorless and odorless gas.
5. Nuclear energy: Dr.H.Bhabha is a father of nuclear power development in India. 10 nuclear reactors are present in India. It produces 2% of India's electricity. Nuclear energy can be produced by two types of reactions. Nuclear fission and nuclear fusion.

CASE STUDY:

Wind energy in India: India generating 1200 MW electricity using the wind energy. Largest wind farm situated near Kanyakumari in Tamilnadu. It produces 380 MW electricity.

Hydrogen fuel car: General motor company of china discovered a experimental car (fuel H₂) can produce no emission only water droplets and vapors come out of the exhaust pipe. This car will be commercially available by 2010.

LAND RESOURCES

Land is a very valuable resource. It provides food, fibre, wood, medicine and other biological materials needed for food. Soil is a mixture of inorganic materials and (rocks and minerals) and organic materials (dead materials and plants). Top soil is classified as a renewable resource as it is continuously regenerated by natural processes at a very slow rate. However, if the rate of erosion is faster than the rate of renewal, the soil becomes a non-renewableresource.

LAND DEGRADATION

Land degradation is the major consequences of direct interference of human activities in the natural phenomenon.

Land degradation means:

1. Loss of natural fertility of soil because of loss of nutrients.
2. Less vegetation cover
3. Changes in the characteristic of soil.
4. Pollution of water resources from the contamination of soil through which water sweeps into ground or runoff to the water bodies.
5. Changes in climatic conditions because of unbalanced created in the environment.

Causes of Land Degradation:

(a) Deforestation:

Deforestation is taking place at a faster rate due to increasing demands of timber, fuel and forest products which results into degradation of land resources.

(b) Overgrazing:

Overgrazing refers to excessive eating of grasses and other green plants by cattle. It results into reduced growth of vegetation, reduced diversity of plant species, excessive growth of unwanted plant species, soil erosion, and degradation of land due to cattle movement.

(c) Agricultural practises:

The modern agricultural practises, excessive use of fertilizers and pesticides has adversely degraded the natural quality and fertility of the cultivation land.

(d) Industrialization:

Development of industries for the economic growth of the country leads to excessive deforestation and utilization of land in such as way that it has lost its natural up gradation quality.

(e) Urbanization:

Increasing growth of population and demand for more residential areas and commercial sectors is also one of the reasons for land degradation.

Prevention and Control Measures for Land Degradation:

Following are some practises for controlling land degradation:

1. Strip farming:

It is & practice in which cultivated crops are sown in alternative strips to prevent water movement.

2. Crop Rotation:

It is one of the agricultural practice in which different crops are grown in same area following a rotation system which helps in replenishment of the soil.

3. Ridge and Furrow Formation:

Soil erosion is one of the factors responsible for lad degradation. It can be prevented by formation of ridge and furrow during irrigation which lessens run off.

4. Construction of Dams:

This usually checks or reduces the velocity of run off so that soil support vegetation.

5. Contour Farming:

This type of farming is usually practiced across the hill side and is useful in collecting and diverting the run off to avoid erosion.

LANDSLIDES

Landslides are the downward movement of a slope composed of earth materials such as rock, soil or artificial fills. Landslides are also called rock-slide, debris-slide, slump, earth-flow or soil-creep.

During construction of roads and mining activities huge portions of mountainous fragile areas are cut down and thrown into adjacent areas and streams. These land masses weaken the already fragile mountain slopes leading to man-induced landslides.

EFFECTS OF LANDSLIDES:

Landslides increase the turbidity of nearby streams, thereby reducing their productivity

Destruction of communicative links

Loss of habitat and biodiversity

Loss of infrastructure and economic loss

CAUSES OF LANDSLIDES

Removal of vegetation - Deforestation in slopes creates soil erosion leading to landslides

Underground mining activities cause subsidence of the ground

Movement of heavy vehicles in areas with unstable slopes causes landslides.

Addition of weight by construction on slopes causes landslides.

Over exploitation of groundwater also leads to landslides.

SOIL-EROSION

Soil erosion is the process of removal of superficial layer of soil. Soil erosion removes Soil components.

HARMFUL EFFECTS OF SOIL EROSION

Soil fertility is lost

Loss of soil ability to hold water and sediment

Sediment runoff can pollute water courses and kill aquatic life

TYPES OF SOIL EROSION

Normal erosion: This is caused by the gradual removal of topsoil by natural processes. The rate of erosion is slow.

Accelerated erosion: This is caused by man made activities. In this case, the rate of erosion is much faster than the rate of formation of soil.

CAUSES OF SOIL EROSION

Water: Water affects soil erosion in the form of rain, run-off, rapid flow or wave action

Wind: Wind is an important climate agent that carries away the fine particles of soil thereby contributing to soil erosion.

Biotic agents: Overgrazing, mining and deforestation are the major biotic agents causing soil erosion. These processes disturb the top soil thereby exposing the soil to various physical forces inducing erosion

Landslides cause soil erosion

Construction of dams, buildings and roads removes the protective vegetal cover leading to soil erosion

DESERTIFICATION

“Desertification is a type of land degradation in which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife. It is caused by a variety of factors, such as climate change and human activities. Desertification is a significant global ecological and environmental problem.”

Causes of Desertification

Overgrazing: Animal grazing is a huge problem for many areas that are starting to become desert biomes. If there are too many animals that are overgrazing in certain spots, it makes it difficult for the plants to grow back

Deforestation: When people are looking to move into an area, or they need trees in order to make houses and do other tasks, then they are contributing to the problems related to desertification. Without the plants (especially the trees) around, the rest of the biome cannot thrive.

Farming Practices: Some farmers do not know how to use the land effectively. They may essentially strip the land of everything that it has before moving on to another plot of land. By stripping the soil of its nutrients, desertification becomes more and more of a reality for the area that is being used for farming.

Urbanization and other types of land development. As mentioned above, development can cause people to go through and kill the plant life. It can also cause issues with the soil due to chemicals and other things that may harm the ground. As areas become more urbanized, there are less places for plants to grow, thus causing desertification.

Climate Change: Climate change plays a huge role in desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent. Unless climate change is slowed down, huge areas of land will become desert; some of those areas may even become uninhabitable as time goes on.

Stripping the land of resources. If an area of land has natural resources like natural gas, oil, or minerals, people will come in and mine it or take it out. This usually strips the soil of nutrients, which in turn kills the plant life, which in turn starts the process toward becoming a desert biome as time goes on.

Natural Disasters: There are some cases where the land gets damaged because of natural disasters, including drought. In those cases, there isn't a lot that people can do except work to try and help rehabilitate the land after it has already been damaged by nature.

Effects of Desertification

Farming becomes next to impossible. If an area becomes a desert, then it's almost impossible to grow substantial crops there without special technologies. This can cost a lot of money to try and do, so many farmers will have to sell their land and leave the desert areas.

Hunger: Without farms in these areas, the food that those farms produce will become much scarcer, and the people who live in those local areas will be a lot more likely to try and deal with hunger problems. Animals will also go hungry, which will cause even more of a food shortage.

Flooding: Without the plant life in an area, flooding is a lot more eminent. Not all deserts are dry; those that are wet could experience a lot of flooding because there is nothing to stop the water from gathering and going all over the place. Flooding can also negatively affect the water supply, which we will discuss next.

Poor Water Quality: If an area becomes a desert, the water quality is going to become a lot worse than it would have been otherwise. This is because the plant life plays a significant role in keeping the water clean and clear; without its presence, it becomes a lot more difficult for you to be able to do that.

Overpopulation: When areas start to become desert, animals and people will go to other areas where they can actually thrive. This causes crowding and overpopulation, which will, in the long run, end up continuing the cycle of desertification .

Poverty: All of the issues that we've talked about above (related to the problem of desertification) can lead to poverty if it is not kept in check. Without food and water, it becomes harder for people to thrive, and they take a lot of time to try and get the things that they need.

Role of an Individual in Conservation of Natural Resources

'Environment protection' means limiting the impairment of environment and it includes conservation of resources. It has three main objectives:

1. To prevent damage and discomfort
2. To improve productivity and pleasure and,
3. To maintain balance of the ecosystem.

Conservation

Conservation is sustainable use of natural resources, such as soils, water plants, animals and minerals. To conserve natural resources an individual can do these things.

1. Turn off the lights when you leave a room.

2. Replace energy-hungry incandescent lights with fluorescent lighting.
3. Check with your utility company for energy conservation tips.
4. Use a programmable thermostat that automatically turns off the air conditioner or heater when you don't need them.
5. Use a fan instead of air-conditioning.
6. Choose recycled products.
7. Have your gas appliances and heaters regularly inspected and maintained.
8. Walk or use on a bike.
9. Be within the set speed limit.
10. Replace your car's air filter.
11. Ensure that the tires are adequately inflated.
12. Report smoking vehicles.
13. Improve the quality of landscapes, which includes soils, water, etc.
14. Maintain the production of 'clean' food.
15. Don't waste water.
16. Stop hunting and over-exploitation, mainly for commercial and often illegal purposes.
17. Stop improper use of agro-chemicals, and reduce the pollution.
18. Plant trees. Stop illegal cutting of trees.

Equitable use of resources for sustainable lifestyles

Standard of living refers to the consumption of goods and services by an individual. It relates directly to the economic development whereas the well-being or quality of life of a population refers to a combination of attributes that provide physical, mental, spiritual and social wellbeing.

•Sustainable Development (SD) implies economic growth together with the protection of environmental quality, each reinforcing the other. Sustainable Development, thus, is maintaining a balance between the human needs to improve lifestyles and feeling of

well-being on one hand, and preserving natural resources and ecosystems, on which we and future generations depend.

A desirable human condition : a society that people want to sustain because it meets their needs. An ecosystem that maintains its capacity to support human life and others.

A balance between present and future generations; and within the present generation.

SUSTAINABLE CONSUMPTION Sustainable consumption is related to production and distribution, use and disposal of products and services and provides the means to rethink our lifecycle. The aim is to ensure that the basic needs of the entire global community are met, excess is reduced and environmental damage is avoided

UNIT 3

Ecosystem

Concept of an Ecosystem:

Living organisms cannot live isolated from their non-living environment because the latter provides materials and energy for the survival of the former i.e. there is interaction between a biotic community and its environment to produce a stable system; a natural self-sufficient unit which is known as an ecosystem.

An ecosystem is, therefore, defined as a natural functional ecological unit comprising of living organisms (biotic community) and their non-living (abiotic or physio chemical) environment that interact to form a stable self-supporting system. A pond, lake, desert, grassland, meadow, forest etc. are common examples of ecosystems.

Structure and Function of an Ecosystem:

Each ecosystem has two main components:

- (1) Abiotic
- (2) Biotic

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

Abiotic components are mainly of two types:

(a) Climatic Factors:

Which include rain, temperature, light, wind, humidity etc.

(b) Edaphic Factors:

Which include soil, pH, topography minerals etc.

The functions of important factors in abiotic components are given below:

Abiotic components are the physical and/or the chemical factors that act on the living organisms at any part of their life. These are also called as the ecological factors. The physical and chemical factors are characteristic of the environment. Light, air, soil, and nutrients etc. form the abiotic components of an ecosystem.

The abiotic factors vary from ecosystem to ecosystem. In an aquatic ecosystem, the abiotic factors may include water pH, sunlight, turbidity, water depth, salinity, available nutrients and dissolved

oxygen. Similarly, abiotic factors in terrestrial ecosystems can include soil, soil types, temperature, rain, altitude, wind, nutrients, sunlight etc.

Here, the sun is the energy source. Producers/plants use this energy to synthesize food in the presence of carbon dioxide and chlorophyll. The energy from the sun, through several chemical reactions, turns into chemical energy.

(2) Biotic Components:

The living organisms including plants, animals and micro-organisms (Bacteria and Fungi) that are present in an ecosystem form the biotic components.

On the basis of their role in the ecosystem the biotic components can be classified into three main groups:

(A) Producers

(B) Consumers

(C) Decomposers or Reducers.

(A) Producers:

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds namely water and carbon dioxide. This process is known as photosynthesis. As the green plants manufacture their own food they are known as Autotrophs (i.e. auto = self, trophos = feeder)

The chemical energy stored by the producers is utilised partly by the producers for their own growth and survival and the remaining is stored in the plant parts for their future use.

(B) Consumers:

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

The consumers are of four types, namely:

(a) Primary Consumers or First Order Consumers or Herbivores:

These are the animals which feed on plants or the producers. They are called herbivores.

Examples are rabbit, deer, goat, cattle etc.

(b) Secondary Consumers or Second Order Consumers or Primary Carnivores:

The animals which feed on the herbivores are called the primary carnivores. Examples are cats, foxes, snakes etc.

(c) Tertiary Consumers or Third Order Consumers:

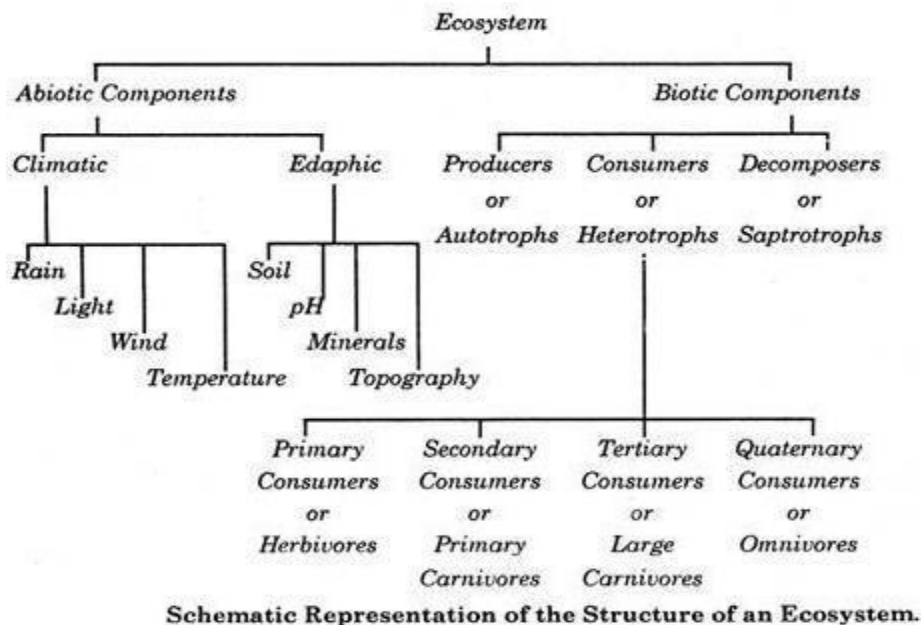
These are the large carnivores which feed on the secondary consumers. Example are Wolves.

(d) Quaternary Consumers or Fourth Order Consumers or Omnivores:

These are the largest carnivores which feed on the tertiary consumers and are not eaten up by any other animal. Examples are lions and tigers.

(C) Decomposers or Reducers:

Bacteria and fungi belong to this category. They breakdown the dead organic materials of producers (plants) and consumers (animals) for their food and release to the environment the simple inorganic and organic substances produced as by-products of their metabolisms.



FUNCTION OF ECOSYSTEM

An ecosystem is a discrete structural, functional and life sustaining environmental system. The environmental system consists of biotic and abiotic components in a habitat. Biotic component of the ecosystem includes the living organisms; plants, animals and microbes whereas the abiotic component includes inorganic matter and energy.

Abiotic components provide the matrix for the synthesis and perpetuation of organic components (protoplasm). The synthesis and perpetuation processes involve energy exchange and this energy comes from the sun in the form of light or solar energy.

Thus, in any ecosystem we have the following functional components:

- (i) Inorganic constituents (air, water and mineral salts)
- (ii) Organisms (plants, animals and microbes), and
- (iii) Energy input which enters from outside (the sun).

These three interact and form an environmental system. Inorganic constituents are synthesized into organic structures by the green plants (primary producers) through photosynthesis and the solar energy is utilized in the process. Green plants become the source of energy for renewals (herbivores) which, in turn become source of energy for the flesh eating animals (carnivores). Animals of all types grow and add organic matter to their body weight and their source of energy is complex organic compound taken as food.

They are known as secondary producers. All the living organisms whether plants or animals in an ecosystem have a definite life span after which they die. The dead organic remains of plants and animals provide food for saprophytic microbes, such as bacteria, fungi and many other animals. The saprobes ultimately decompose the organic structure and break the complex molecules and liberate the inorganic components into their environment.

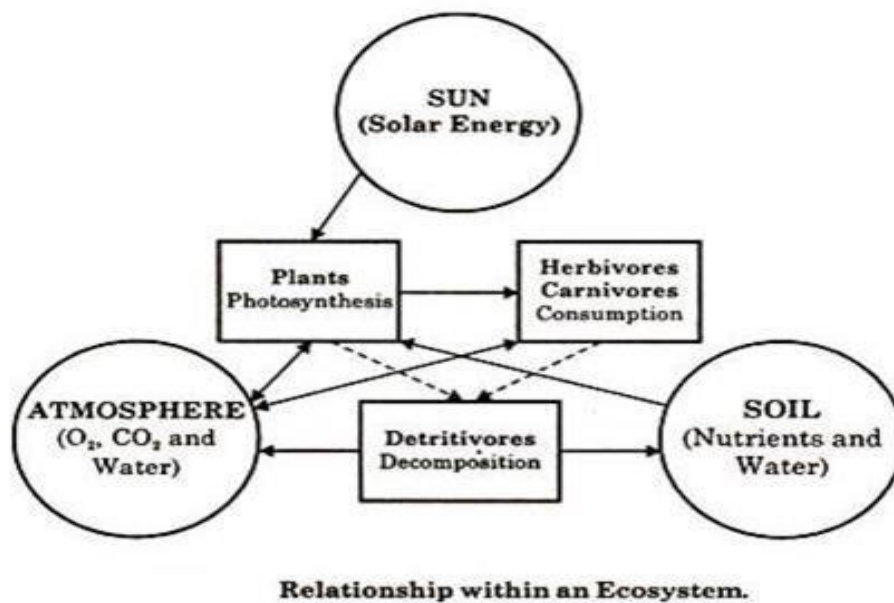
These organisms are known as decomposers. During the process of decomposition of organic molecules, the energy which kept the inorganic components bound together in the form of organic molecules gets liberated and dissipated into the environment as heat energy. Thus in an ecosystem energy from the sun, the input is fixed by plants and transferred to animal components.

Thus the principal steps in the operation of ecosystem are as follows:

- (1) Reception of radiant energy of sun,
- (2) Manufacture of organic materials from inorganic ones by producers,
- (3) Consumption of producers by consumers and further elaboration of consumed materials; and
- (4) After the death of producers and consumers, complex organic compounds are degraded and finally converted by decomposers and converters into such forms as are suitable for reutilization by producers.

The principal steps in the operation of ecosystem not only involve the production, growth and death of living components but also influence the abiotic aspects of habitat. It is now clear that there is transfer of both energy and nutrients from producers to consumers and finally to decomposers and transformers levels. In this transfer there is a progressive decrease of energy but nutrient component is not diminished and it shows cycling from abiotic to biotic and vice versa.

The flow of energy is unidirectional. The two ecological processes—energy flow and mineral cycling which involve interaction between biotic and abiotic components lie at the heart of ecosystem dynamics. The principal steps and components of ecosystem are given below through diagram:



ENERGY FLOW IN AN ECOSYSTEM

Each organism living in an ecosystem plays an important role in the flow of energy within the food web. Ecologists have defined three ways that living creatures use energy and interact with one another. Organisms are defined as producers, consumers, or decomposers. Here is a look at each of these roles and their place within an ecosystem.

Producers

The main role of producers is to capture the energy from the sun and convert it into food. Plants, algae, and some bacteria are producers. Using a process called photosynthesis, producers use the sun's energy to turn water and carbon dioxide into food energy. They earn their name, because - unlike the other organisms in an ecosystem - they can actually produce their own food. Producers are the original source of all food within an ecosystem.

In most ecosystems, the sun is the source of energy that producers use to create energy. But in a few rare cases - such as ecosystems found in rocks deep beneath the ground - bacterial producers can use the energy found in a gas called hydrogen sulfide, that is found within the environment, to create food even in the absence of sunlight!

Consumers

Most organisms in an ecosystem cannot make their own food. They depend upon other organisms to meet their food needs. They are called consumers - because that is what they do - consume. Consumers can be broken down into three classifications: herbivores, carnivores, and omnivores.

- *Herbivores*. Herbivores are consumers that only eat plants. Deer and caterpillars are herbivores found commonly in a number of environments.
- *Carnivores*. Carnivores are consumers that only eat other animals. Lions and spiders are examples of carnivores. There is a special category of carnivore called *scavengers*. Scavengers are animals that eat only dead animals. Catfish and vultures are examples of scavengers.
- *Omnivores*. Omnivores are consumers that eat both plants and animals depending upon the season and availability of food. Bears, most birds, and humans are omnivores.

Decomposers

Consumers and producers can live together nicely, but after some time, even the vultures and catfish would not be able to keep up with all of the dead bodies that would pile up of the years.

That's where decomposers come in. Decomposers are organisms that break down and feed off of the waste and dead organisms within an ecosystem.

Decomposers are nature's built-in recycling system. By breaking down materials - from dead trees to the waste from other animals, decomposers return nutrients to the soil and create another food source for herbivores and omnivores within the ecosystem. Mushrooms and bacteria are common decomposers.

Every living creature in an ecosystem has a role to play. Without producers, consumers and decomposers would not survive because they would have no food to eat.

Without consumers, the populations of producers and decomposers would grow out of control. And without decomposers, producers and consumers would soon become buried in their own waste.

ECOLOGICAL SUCCSSION

Ecological succession is a process through which ecosystems tend to change over as period of time. Succession can be related to seasonal environmental changes which create changes in the community of plants and animals living in the ecosystem. Other succession events may take much longer periods of time, extending to several decades. If a forest is cleared it is initially colonised by a certain group of species of plants and animals. The most frequent example of succession changes occur in a pond ecosystem where it fluctuates from a dry terrestrial habitat to the early colonisation stage by small aquatic species after the monsoon which gradually passes through to a mature aquatic ecosystem and the reverts back to its dry stage in summer and at that time as a result the aquatic life remains dormant.

FOOD CHAINS, FOOD WEBS AND ECOLOGICAL PYRAMID

FOOD CHAIN:- It is the sequence of transfer of matter and energy in the form of food and energy from organism to organism. In other words the most obvious aspect of nature is that energy must pass from one living organism to another. For example, plants which convert solar energy to food by photosynthesis are the primary food source. When herbivores animal feed on plants,

energy is transferred from the plants to the animals. In all ecosystem some of the animals feed on other living organisms while some feed on dead organic matter.

Producer→primary consumer→secondary consumer→tertiary consumer→quaternary consumer.

FOOD WEB :-

Food web is an important ecological concept. Basically, food web represents feeding relationships within a community. It also implies the transfer of food energy from its source in plants through herbivores to carnivores. Normally, food webs consist of a number of food chains meshed together. Or in other words A food chain is natural interconnection of food chain and a graphical representation of what—eat—what in an ecological community. A food chain is a linear network of links in a food web starting from producer organisms and ending at predator species.

Producer→primary consumer→secondary consumer→tertiary consumer→quaternary consumer.

Plant→Rabbit, Goat, Deer→cats, fox, snakes. jackal→wolves→Lion, Tiger

Difference between food chain and food web- :

- Food chain is a single linear pathway through which food energy and nutrients travels in the ecosystem while food web is number of interconnected food chains through which energy and nutrients travels in the ecosystem.
- In food chains, usually member of high tropic level feed upon a single type of organism of lower tropic level while in food web members of higher tropic level feed upon many organisms of lower tropic level.
- In food chains, separate and isolated food chains increases the instability of the ecosystem. In food web, stability of the ecosystem increases by the presence of complex food webs.

- Food chains have no effect on improving the adaptability and competitiveness of the organisms while more complex food webs improves the adaptability and competitiveness of the organisms.

Ecological Pyramid

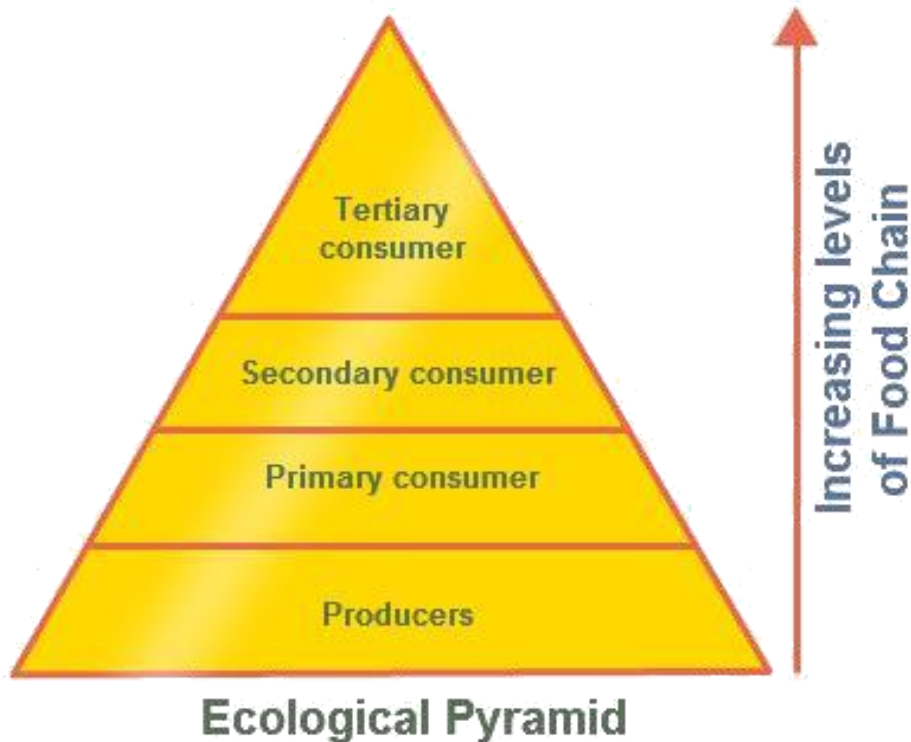
The concept of ecological pyramid was developed by Charles Elton. These pyramids are also known as Eltonian pyramids. The pyramids are a graphical representation which depicts the number of organisms, biomass and productivity at each trophic level. All ecological pyramids begin at the bottom with the producers and processed through different trophic level.

It is a graphic representation of the relationship between organisms at various trophic levels in a food chain. The basis of an ecological pyramid is the biomass, energy, and number. The bottom of an ecological pyramid is the broadest and is occupied the producers, which form the first trophic level. Producers are at the lowest level. Just as in a food chain, the producers are consumed by the primary consumers, in an ecological pyramid; the next level is occupied by the primary consumers. The next level of the pyramid is occupied by the secondary consumers and the last, by the tertiary consumers. It is graphically represented to show the biomass or productivity at each trophic level in an ecosystem.

Types of Ecological Pyramids

Depending on the factors that we use to represent an ecological pyramid, there are three types. They are:

- *Pyramid of numbers*– Here the factor that is taken into account is the number of organisms in each trophic level. As we go up the levels of the pyramid, the number of organisms decreases. The producers form the largest number and hence are at the bottom of the pyramid.
- *Pyramid of energy*– This is an upright pyramid that represents the flow of energy from the producers to the final consumers.
- *Pyramid of biomass* – This pyramid represents the amount of biomass of the organisms present at each trophic level. Biomass is nothing but the weight of the organisms.



Forest Ecosystem: Types, Characteristic Features and Structure

Types and Characteristic Features:

(a) Temperate Forest Ecosystem:

The temperate forest ecosystem is very important on Earth. Temperate forests are in regions where the climate changes a lot from summer to winter. Tropical rain forests are in regions where the climate stays constant all year long. Temperate forests are almost always made of two types of trees, deciduous and evergreen. Deciduous trees are trees that lose their leaves in the winter.

Evergreens are trees that keep them all year long, like pine trees. Forests can either be one or the other, or a combination of both. A fourth kind of forest is a temperate rain forest. These are found in California, Oregon and Washington in the United States.

(b) The Tropical Rain Forest Ecosystem:

Tropical rain forests are one of the most important areas on Earth. These special ecosystems are homes to thousands of species animals and plants. Contrary to popular belief, rain forests are not only densely packed plants, but are also full of tall trees that form a ceiling from the Sun above.

This ceiling keeps smaller plants from growing. Areas where sunlight can reach the surface are full of interesting plants.

(i) Insects of the Tropical Rain Forest:

The most feared and well known spider(Tarantulas), butterflies in the world resides in the jungle .Most species of tarantula have poisonous fangs for killing prey and for protection.

(ii) Tropical Rain Forest Birds:

The birds of the rain forest are the most beautiful in the world. Hundreds of species of parrot, Toucans live in the rain forest.

(iii) Tropical Rain Forest Reptiles:

The tropical rain forests of the world are full of reptiles. Reptiles are cold blooded, which means their body temperature depends on their environment. So, it is important for them to stay in warm climates. Snakes are reptiles, and the rain forests are home to many. The mamba family is the most poisonous of all. They kill their prey by injecting poison with their sharp fangs. Anacondas make up another snake family. They are some of the longest creatures in the world, as they can reach 30 feet in length.

(iv) Tropical Rain Forest Primates:

Monkeys and their cousins are all primates. Humans are also primates. There are many species of monkeys in the tropical rain forests of the world. Monkeys can be divided into two groups: new world monkeys and old world monkeys. New world monkeys live only in South and Central America. Spider monkeys live in the rain forests in the Andes Mountains.

(c) Boreal or Taiga Forests:

The boreal forest ecosystem is the contiguous green belt of conifer and deciduous trees that encircles a large portion of the Northern Hemisphere. In North America, the boreal forest stretches across most of northern Canada and into Alaska. It has long been identified as one of the world's great forest ecosystems.

Structure of Forest Ecosystems:

Different organisms exist within the forest layers. These organisms interact with each other and their surroundings. Each organism has a role or niche in sustaining the ecosystem.

Some provide food for other organisms; others provide shelter or control populations through predation:

Producers:

All living organisms' intake energy in order to survive. In a forest ecosystem, trees and other plants get their energy from sunlight. Plants produce their own food, in the form of carbohydrates. Plants are, therefore, called the primary producers, since they produce the basic foodstuffs for other organisms within food chains and food webs. Photosynthesis is the chemical reaction that allows plants to produce their own food.

Consumers:

Animals cannot produce their own food. They must consume food sources for the energy they need to survive. All animals, including mammals, insects, and birds, are called consumers. Consumers rely on plants and other animals as a food source. Details of these animals in a forest ecosystem have been given earlier.

Primary consumers only eat plants and are referred to as herbivores. Secondary consumers are referred to as carnivores and feed on herbivores. Tertiary consumers are carnivores that feed on other carnivores. Omnivores eat both plant and animal matter.

Decomposers:

Leaves, needles, and old branches fall to the forest floor as trees grow. Eventually all plants and animals die. So what happens to all of this plant and animal material? Does it sit on the forest floor forever? Thankfully no. These materials are decomposed by worms, microbes, fungi, ants, and other bugs.

Decomposers break these items down into their smallest primary elements to be used again.

Decomposers are important in that they sustain the nutrient cycle of ecosystems.

Humans are part of Forest Ecosystem:

Humans are consumers. We get food and materials from forests. Because of this, we are a part of the forest ecosystem. Human consumption alters forest ecosystems. Human intervention may be necessary to sustain forest communities under the increased pressure of human use.

Aquatic Eco system

An aquatic ecosystem is an ecosystem that is water based. The word 'aquatic' comes from the Latin word for water. An ecosystem is a distinct community of organisms in a specific environment.

So, we can say that an aquatic ecosystem is a community of organisms that live together, interact, and to an extent depend on each other in a water based environment.

There are various different types of aquatic ecosystem and this article explains all about four main types of aquatic habitats for animals. So, read on to find out all about them. Characteristics of aquatic ecosystems.

Characteristics of aquatic ecosystems include:

- Being underwater, or
- Being based around water.
- Being a community of organisms.
- **Being a distinct community that is more or less self contained.**

Types of aquatic ecosystems.

The following are the different types of ecosystem : marine ecosystem and freshwater ecosystem – pond ecosystems, lake eco-system, river ecosystems, stream ecosystem, ocean ecosystem and estuaries..

A. Marine ecosystems – salty water.

Marine is a word that comes from the Latin word for sea – mar. So, a marine ecosystem is any ecosystem that exists within the sea. Our seas and oceans are vast bodies of salt water and so – while it may be argued that the whole ocean is one giant ecosystem – it may be also argued that several different ecosystems can coexist within a single ocean. A whole host of different organisms live in marine ecosystems. When it comes to plant life, for example, we have seaweeds and marine algae. Invertebrates that live in the marine ecosystem include jellyfish and crustaceans. Meanwhile, there are fish such as sharks and eels, and mammals such as whales and seals. There are also various sea birds in all parts of the sea: they feed off the fish and other organisms that live there. Humans may also form part of the marine ecosystem if they fish in the sea for food.

B. Freshwater ecosystems.

Contrary to the marine water ecosystem that contains salty water, freshwater ecosystem has little or no salt. The major types of freshwater ecosystem includes pond ecosystem, lake ecosystem and river ecosystem.

Pond ecosystems.

Many different plants, fish and animals can live in these types of ecosystems. Frogs, newts, water weeds and water lilies are all examples of pond creatures. In addition, various types of fish can live in a pond. Ponds can be natural or human made ecosystems; if human

made, it is not uncommon for goldfish or ornamental carp (such as koi carp) to live in a pond ecosystem. In addition, certain birds and insects may visit the pond ecosystem with regularity. For example, we might see dragonflies or herons around the pond. It may be up for debate whether these visitors are truly part of the ecosystem as they may also visit other ecosystems. But, A pond ecosystem refers to the freshwater ecosystem where there are communities of organism dependent on each other with the prevailing water environment for their nutrients and survival. Ponds are shallow water bodies with a depth of 12-15 feet in which the sun rays can penetrate to the bottom permitting the growth of plants there.

On the basis of the depth of water, penetration of light and the types of plants and animals in the pond, the pond is divided into different zones. They are: Littoral

It is a peripheral shallow water zone in which light can reach up to the bottom. It contains warm and oxygen rich circulating water. So, this zone includes abundant rooted vegetations and different types of consumers.

Limnetic

The limnetic zone is a central part of a pond up to where there is penetration of effective light. The associated organisms are small crustaceans, rotifers, insects and their larvae and algae. The water level, oxygen content, and temperature in this zone varies time to time.

Decomposers are almost absent here.

Profundal

This is the deep-water region where there is no effective light penetration. There the microscopic plants and decomposers are present. So it is called Hypolimnion.

e ecosystem – and that it has an impact on them.

Lake ecosystems.

Because they tend to be physically enclosed by the earth, rock or mountains around them, freshwater lakes are also identifiable as a distinct habitat that is inhabited by a distinct community of organisms. In a freshwater lake ecosystem, we can find all kinds of different organisms, including crustaceans (such as shrimp and crayfish), fish (like carp, trout and pike) and many birds, reptiles and amphibians. Freshwater lakes can be home to some beautiful plant life, such as tall purple irises, and the flora and fauna that abound within them may also change with the seasons. Some animals may only use lakes for looking after

their offspring in, such as frogs that may leave frogspawn in a lake before leaving to inhabit other ecosystems.

Freshwater river ecosystems.

River ecosystems are slightly different to ponds and lakes because whilst the latter two ecosystems offer stagnant (static) water, river water is always flowing. That means that these river ecosystems are the homes of animals and plants that are best adapted to living in flowing water. Salmon are a key example, as they use the flowing motion of a river to help them with their annual migration. And, in general, organisms that prefer to migrate – whether to seek food or to seek a partner – are often to be found in freshwater river ecosystems because the motion of the river suits their style of life (whilst they, in their turn, have evolved to suit a flowing environment). Rivers tend to flow into the sea, and in this way river ecosystems and marine ecosystems meet each other. It may well, therefore, be up for debate to what extent river ecosystems are closed systems. But it is definitely clear that these are distinct types of fresh water ecosystems. **Ocean**

The earth has five major oceans: Pacific Ocean, Indian Ocean, Arctic Ocean, Atlantic Ocean and Southern (Antarctic) Ocean. Although the oceans are connected, each of them has unique species and features. According to Barbara A. Somerville (Earth's Biomes: Oceans, Seas, and Reefs), the Pacific is the largest and deepest ocean and the Atlantic is second in size.

Oceans are home to different species of life. The waters of the Arctic and Southern Oceans are very cold, yet filled with life. The largest population of krill (small, shrimp-like marine creatures) lies under the ice of the Southern Ocean. **Estuaries**

Estuaries are places where rivers meet the sea and may be defined as areas where salt water is diluted with fresh water. River mouths, coastal bays, tidal marshes and water bodies behind barrier beaches are some examples of estuaries. An estuary is an area where a freshwater river or stream meets the ocean. In estuaries, the salty ocean mixes with a freshwater river, resulting in brackish water. Brackish water is somewhat salty, but not as salty as the ocean. An estuary may also be called a bay, lagoon, sound ocean or slough.

In estuaries, water level and salinity rise and fall with the tides. These features also rise and fall with the seasons. During the rainy season, rivers may flood the estuary with freshwater. During the dry season, the outflow from rivers may slow to a trickle. During a storm season, storm surges and other ocean waves may flood the estuary with saltwater. Most estuaries, however, are protected from the ocean's full force. Geographical features such as reefs, islands, mud, and sand act as barriers from ocean waves and wind.

TYPES-OF-ESTUARY

There are four different kinds of estuaries, each created a different way: 1) coastal plain estuaries; 2) tectonic estuaries; 3) bar-built estuaries; and 4) Coastal plain estuaries.

Stream Ecosystem

The plants, the animals, and the stream itself are all part of a small ecosystem, a community of living and nonliving things. Fish, insects, birds, and other living things that are part of this community depend on the stream and one another to survive. Every part of the ecosystem has a role to play. Even the sunlight that filters through the trees is important

The importance of Marine ecosystem

The health of aquatic ecosystems is crucial to the health of the planet as a whole. Our earth is not called the blue planet for nothing: the seas with their fish, weeds, invertebrates and mammals and the rivers, lakes, streams, swamps and ponds of this world are all precious repositories of biodiversity. The seas help to regulate the world's temperature, too, and to lock carbon away from the atmosphere. Though we should all try and cut down on fish as a food source, there is no denying that fish and other aquatic organisms are irreplaceable links in the food chain for many terrestrial animals (i.e. animals that live on earth) as well.

GRASSLAND ECOSYSTEM

Grasslands (also called Greenswards) are areas where the vegetation is dominated by grasses and other herbaceous (non-woody) plants. Grasslands occupy about 24% of the earth's surface. They occur in regions too dry for forests and too moist for deserts. A grassland consists of large rolling fields of grasses, flowers and herbs. Grasslands ecosystems emerge due to low levels of sporadic precipitation that is only substantial enough to support smaller plants. Grass survives in these

arid conditions because of its deep and highly elaborate root system that enables it to access moisture hidden deep in the soil.

The annual rainfall ranges between 25- 75 cm, usually seasonal. The principal grasslands includes Prairies (Canada, USA), Pampas (South America), Steppes (Europe and Asia), and Veldts (Africa).

The highest abundance and greatest diversity of large mammals are found in these ecosystems. The dominant animal species include wild horses, asses and antelope of Eurasia, herds of Bison of America; and the antelope and other large herbivores of Africa.

Biotic Components:

1. Producer Organisms:

In grassland, producers are mainly grasses; though, a few herbs and shrubs also contribute to primary production of biomass. Some of the most common species of grasses are: Brachiaria sp., Cynodon sp., Desmodium sp., Digitaria sp.

2. Consumers:

In grassland, consumers are of three main types:

a)Primary Consumers:

The primary consumers are herbivores feeding directly on grasses. These are grazing animals such as Cows, Buffaloes, Sheep, Goats, Deer, and Rabbits etc. Besides them, numerous species of insects, termites, etc. are also present.

(b) Secondary Consumers:

These are carnivores that feed on primary consumers (Herbivores). These include;-Frogs, Snakes, Lizards, Birds, Foxes, Jackals etc.

(c) Tertiary Consumers:

These include hawks etc. which feed on secondary consumers.

3. Decomposers:

These include wide variety of saprotrophic microorganism like: Bacteria; Fungi; Actinomycetes.

A-biotic Components:

These include basic inorganic and organic compounds present in the soil and aerial environment. The essential elements like C, H, N, O, P, S etc. are supplied by water, nitrogen, nitrates, sulphates, phosphates present in soil and atmosphere.

There are two main types of grasslands -- tropical and temperate -- with several subcategories within each type.

Tropical Grasslands

Tropical grasslands are warm all year round with established rainy and dry seasons. During the rainy season, tropical grasslands receive between 50 and 130 centimeters of rain. Most notable of the tropical grasslands is the African savanna, which has an occasional tree and is home to many of the world's most spectacular species, such as elephants, giraffes, lions and zebras. Savanna grass is usually quite short, making for excellent grazing and hunting grounds.

Temperate Grasslands

Temperate grasslands also have two seasons, growing and dormant. During the dormant season, no grass or crops grow because it's too cold. These grasslands make for excellent farming because of their deep and nutrient-rich soils. Temperate grasslands receive between 25 and 75 centimeters of rain a year. The most notable temperate grasslands are the North American prairies, which are home to a wide variety of wildlife, including pronghorn antelope, mice, jack rabbits, foxes, snakes and coyotes. Grass here can grow quite tall, reaching up to seven meters in height. Trees are restricted to where there is a large concentration of water such as a river or lake.

UNIT-4

Biodiversity and its Conservation

Biodiversity - Genetic, Species and Ecosystem diversity

Biodiversity or Biological diversity is a term that describes the variety of living beings on earth. In short, it is described as degree of variation of life. Biological diversity encompasses microorganism, plants, animals and ecosystems such as coral reefs, forests, rainforests, deserts etc.

Biodiversity is classified into three types:

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

Genetic diversity - A species with different genetic characteristics is known genetic diversity. Within individual species, there are varieties, that are slightly different from one other. These differences are due to differences in the combination of genes. Genes are the basic units of hereditary information transmitted from one generation to the other. **Ex: (i) Rice varieties** -There are thousands of rice varieties that show variation at the genetic level in the form of different size, shape and colour.

(ii) Teak wood varieties: The various teak wood varieties available are - Indian teak, Burma teak, Malaysian teak etc.

Species diversity - A discrete groups of organisms of the same kind is known as species. Species diversity is the diversity between different species. The sum of varieties of all living organisms at the species level is known as species diversity. The biotic component is composed of a large number of species of plants, animals and microorganisms which interact with each other and with the abiotic component of the environment. **Plant species like Apple, mango, grapes. Animal species like Tiger, Lion and Elephant.**

Community or Ecosystem diversity - Ecosystem diversity is a type of biodiversity. **It** is the variation in the ecosystems found in a region or the variation in ecosystems over the whole planet. Biodiversity is important because it clears out our water, changes out climate, and provides us with food. Ecological diversity includes the variation in both terrestrial and aquatic ecosystems. Ecological diversity can also take into account the variation in the complexity of

a biological community, including the number of different niches, the number of trophic levels and other ecological processes. An example of ecological diversity on a global scale_would be the variation in ecosystems, such as deserts, forests, grasslands, wetlands and oceans.

Biogeographical classification of India

India has different climate and topography in different parts and hence is termed as a mega diversity country. India occupies **10th place among plant rich countries of the world**. It is essential to acquire knowledge about the distribution and environmental interaction of flora and fauna of India.

Biogeographers have classified India into ten biogeographic zones with each zone having characteristic climate, soil and biodiversity. These zones are described below:

Trans-Himaylavas The trans-himalayas is an extension to the Tibetan plateau. This region harbors the high-altitude cold desert in Ladakh (Jammu and Kashmir) and Lahaul Spiti (Himachal Pradesh). It accounts for 5.7% of the country's landmass.

1. **Himalayas** The Himalayas are the northern boundaries of India. The entire mountain chain is running from Kashmir in the North-west to Assam in the north-east. The Himalayas comprise of a diverse range of biotic provinces and biomes. The Himalayas cover 7.2% of the country's landmass

2. **Desert** The extremely dry area west of the Aravalli hill range, is comprising both the salty desert of Gujarat and the sandy desert of Rajasthan. Deserts occupy around 6.9% of the country's land mass. The kinds of deserts found in India are:

1. The desert of western Rajasthan
2. The desert of Gujarat
3. The high-altitude cold desert of Jammu & Kashmir and Himachal Pradesh. The Indian deserts have more diversified fauna.

3. **Semi-arid** This zone lies between the desert and the Deccan plateau. It includes the Aravalli hill range. It covers approximately 15.6% of the country's landmass.

4. **Western Ghats** The western ghats are a mountain range that runs along the western coast of India. They are a range extending north-south from southern tip of Gujarat in the north to Kanyakumari in the south. The mountains cover an area of about

160,000 sq. km. This ghat section covers an extremely diverse range of biotic provinces and biomes. It covers about 5.8% of the country's landmass.

5. **Deccan plateau** It is a large triangular plateau south of the Narmada valley. Three sides of the plateau are covered by mountains slopes towards east. Satpura mountains cover the north while western ghats cover the west side and eastern ghats cover the eastern side of the plateau. It is the one of largest zones covering the southern and south-central plateau with mostly deciduous trees. It covers 4.3% of the country's land mass.

6. **Gangetic plain** This plain covers the area between the south himalayyas to the tropic of cancer. These plains were formed by the Ganges river system and are relatively homogeneous. This region experience 600 mm rainfall annually. *SUNDERBANS* forests are located in this region and it covers 11% of the country's land mass.

7. **North-east India** These are pains and non-himalayan ranges of northeastern India and have a wide variety of vegetation. It covers around 5.2% of the country's land mass.

8. **Islands** The Andaman and Nicobar Islands in the Bay of Bengal has almost 300 big and small islands. Among these, only five islands are inhabited. Only tribes are found in the island of Nicobar. These islands have a highly diverse set of biomes and occupy 0.03% of the country's biomass.

9. **Coasts** India has a large coastline distributed both to the east and west with distinct differences between the two. The Lakshwadeep islands are included in this but the area of these islands is negligible.

INDIA IS A MEGA-BIODIVERSITY NATION.

1. India is rich in biodiversity from north to south and from east to west. India contains many species that world's have. It has 14 major numerous rivers. The annual rainfall varies from less than 37 mm in Rajasthan to 1500mm in Cherapunji. The country experiences three different seasons – winter, summer, and monsoons. It has two global terrestrial biodiversity hot spots – the North-eastern States and the Western Ghats. The Western Ghats have moist deciduous forests and rainforests. This region shows high species diversity as well as high levels of endemism. Around 62% of reptile and 77% of amphibians are found in here. The North-eastern States depicts high altitudinal variations. This area has at least 163 globally threatened species like one-horned rhinoceros and the wild Asian water buffalo.

2. India has 15,000 species of flowering plants, 53,430 species of insects; 5050 species of mollusks, 6,500 species of other invertebrates; 2,546 species of fishes; 1228 species of birds, 446 species of reptiles, 372 species of mammals and 204 species of amphibians have been identified. India's biodiversity is estimated to be over 45,000 plant species representing about 7% of the world's flora and India stands tenth in 25 most plant-rich countries of the world. Its variety of animal life represents 6.5 per cent of world's fauna. Being one of the oldest and largest agriculture societies, India has at least 166 species of crop plants and 320 species of wild relatives of cultivated crops

3. To preserve the rich biodiversity, nine biosphere reserves have been set up in specific biogeographic zones: the biggest being in the Deccan Peninsula in the Nilgiris covering Tamil Nadu, Andhra Pradesh, and Karnataka. Others include the Nanda Devi in Uttarakhand in the Western Himalayas, the Nokrek in Meghalaya, Manas, and Dibru Saikhowa in Assam, the Sunderbans in the Gangetic plain in West Bengal, Similipal in Orissa, the Great Nicobar and the Gulf of Mannar in Tamil Nadu. As per satellite imaging, about 19 percent of the land area of the country comprise of forests. It has 80 national parks at present, which houses the largest number of tigers and one-horned rhinos found in the world, Asiatic lions and a large percent of elephants.

1.HOT SPOT BIODIVERSITY

Very rich in species and highly endangered - that are the two criteria that make a place a biodiversity hotspot. Of course, there are many places where lots of species grow and live. But to qualify as a hotspot, a place needs to host more than 0.5 percent (that is 1,500) of the world's vascular plant species as "endemics". Species are endemic to a region, when they naturally grow/live only within that region instead of being artificially introduced by agriculture or humans for example.

VALUE OF BIODIVERSITY

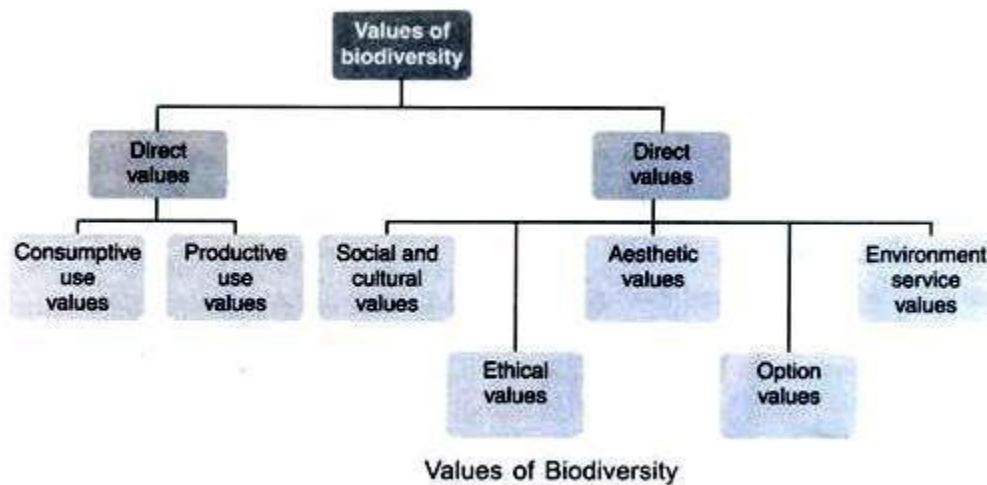
Some of the major values of biodiversity are as follows: 1. Environmental Value 2. Social Value 3. Ecosystem Services 4. Economic Value 5. Consumptive use value 6. Productive Use Value 7. Ethical and Moral Value 8. Aesthetic Value.

Biodiversity is the most precious gift of nature mankind is blessed with. As all the organisms in an ecosystem are interlinked and interdependent, the value of biodiversity in the life of all the organisms including humans is enormous.

The role of biodiversity in providing ecosystem services is twofold.

Firstly, biodiversity is directly used as a source for food, fibre, fuel and other extractable resources. Secondly, biodiversity plays an important role in ecosystem processes providing the regulating, cultural and supporting services.

Biodiversity has a fundamental value to humans because we are so dependent on it for our cultural, economic, and environmental well-being. Elements of biodiversity can contribute to cultural identity, and many ecosystem characteristics are frequently incorporated into cultural traditions.



1. Environmental Value:

The environmental value of biodiversity can be found by examining each ecosystem process and identifying the ecosystem services that result. For instance, in wetlands the vegetation captures water-carried sediment and the soil organisms break down a range of nutrients and pollutants washed into the area. These processes provide the ecosystem service of purifying water. Wetlands also act as spawning and nursery grounds for some fish and provide a refuge for animals in times of drought. Water tables have raised carrying dissolved salts which then concentrate in the soil. Forests regulate the amount of carbon dioxide in the air by releasing oxygen as a by-product during photosynthesis, and control rainfall and soil erosion.

2. Social Value:

The social value of biodiversity includes aesthetic, recreational, cultural and spiritual values. To this can be added health benefits resulting from recreational and other activities. While traditional societies which had a small population and required less resources had preserved their biodiversity as a life supporting resource, modern man has rapidly depleted it even to the extent of leading to the irrecoverable loss due to extinction of several species.

The life of the indigenous people in many parts of the world still revolves around the forests and environment, even in these modern times, many of them still live in the forests and meet their daily requirements from their surroundings.

The biodiversity in different parts of the world has been largely preserved by the traditional societies. Since the indigenous people always protect the forests for their own benefit. In ancient times, especially in India, the environment in totally i.e., flora, fauna, etc., were held in high esteem.

Trees like Peepal, Banyan and Tulsi are still worshipped. Ladies offering water to Tulsi daily is considered good and there are festivals when ladies tie sacred threads around Peepal and Banyan trees and pray for the welfare of their families.

3. Ecosystem Services:

These services also support human needs and activities such as intensely managed production ecosystems.

Ecosystem service includes:

- a. The production of oxygen by land based plants and marine algae;
- b. The maintenance of fresh water quality by vegetation slowing run off, trapping sediment and removing nutrients and by soil organisms breaking down pollutants;
- c. The production and maintenance of fertile soil as a result of many interacting processes;
- d. The provision of foods such as fish, pastures for cattle and sheep, timber, fire wood and harvested wildlife such as kangaroos and native cut flowers;
- e. The provision of native species and genes used in industry research and development, for instance, in traditional breeding and biotechnology applications in agriculture, forestry, horticulture, mariculture, pharmacy, chemicals production and bioremediation;
- f. Pollination of agricultural crops, forest trees and native flowering plants by native insects, birds and other creatures;

- g. Pest control in agricultural land by beneficial native predators;
- h. Flood mitigation by vegetation slowing run off and trapping sediment;
- i. Breakdown of pollutants by micro-organisms in soil and aquatic ecosystems and sequestration of heavy metals in marine and fresh water sediments;
- j. Greenhouse gas reduction by, for instance, sequestering atmospheric carbon in wood and marine calcium carbonate deposits;
- k. Maintenance of habitats for native plants and animals; and
- l. Maintenance of habitats that are attractive to humans for recreation, tourism and cultural activities and that has spiritual importance.

4. Economic Value:

The economic potential of biodiversity is immense in terms of food, fodder, medicinal, ethical and social values. Biodiversity forms the major resource for different industries, which govern the world economy.

The salient features regarding the economical potential of biodiversity are given below:

1. The major fuel sources of the world including wood and fossil fuels have their origin due to biodiversity.
2. It is the source of food for all animals and humans.
3. Many important chemicals have their origin from the diverse flora and fauna, used in various industries.
4. Diverse group of animals are used for medical research during the testing of new drugs.

5. Consumptive use value:

This is related to natural products that are used directly for food, fodder, timber, fuel wood etc. Humans use at least 40,000 species of plants and animals on a daily basis. Many people around the world still depend on wild species for most of their needs like food, shelter and clothing. The tribal people are completely dependent on the forests for their daily needs.

6. Productive Use Value:

This is assigned to products that are commercially harvested and marketed. Almost all the present date agricultural crops have originated from wild varieties. The biotechnologists continuously use the wild species of plants for developing new, better yielding and disease resistant varieties. Biodiversity represents the original stock from which new varieties are being developed.

7. Ethical and Moral Value:

It is based on the principle of 'live and let others live'. Ethical values related to biodiversity conservation are based on the importance of protecting all forms of life. All forms of life have the right to exist on earth. Man is only a small part of the Earth's great family of species.

Don't plants and animals have an equal right to live and exist on our planet which is like an inhabited spaceship? Morality and ethics teach us to preserve all forms of life and not to harm any organism unnecessarily.

Some people take pleasure in the hunting of animals. People also sometimes degrade and pollute the environment by their unethical actions. Through proper education and awareness, the people's conscience against such practices must be raised.

8. Aesthetic Value:

The beauty of our planet is because of biodiversity, which otherwise would have resembled other barren planets dotted around the universe. Biological diversity adds to the quality of life and provides some of the most beautiful aspects of our existence. Biodiversity is responsible for the beauty of a landscape.

People go far off places to enjoy the natural surroundings and wildlife. This type of tourism is referred to as eco-tourism, which has now become a major source of income in many countries. In many societies, the diversity of flora and fauna has become a part of the traditions and culture of the region and has added to the aesthetic values of the place.

Option value

There are many plants and animals which have not yet been discovered or even if they have been discovered we do not know if they can be of any use to us. This untapped potential is referred to as option value. For example, there might be a plant or animal which we can use in the future to find a cure for cancer. If we destroy biodiversity then we lose this chance of finding a cure for cancer. Thus biodiversity has great potential of being useful to us in the future.

Biodiversity at Global, National and Local

Levels *Global Level:*

Conservative estimates of the existing biodiversity is ten million species, but if estimates for insects are correct then it could be around 30 million species, we have till now enlisted about 1.4 million species.

It includes among others about 98% birds, 95% reptiles and amphibians, 90% fish and about 85% higher plants known to exist on this Earth (Table 4.1)

National and Local Level:

India has over 108,276 species of bacteria, fungi, plants and animals already identified and described (Table 4.2). Out of these, 84 percent species constitute fungi (21.2 percent), flowering plants (13.9 percent), and insect (49.3 percent). In terms of the number of species, the insecta alone constitute nearly half of the biodiversity in India

These species occur on land, fresh and marine waters, or occur as symbionts in mutualistic or parasitic state with other organisms. In the world as a whole, 16, 04,000 species of Monera, Protista, Fungi, Plantae and Animalia have been described so far. However, it is estimated that at least 179, 80,000 species exist in the world, but as a working figure 122, 50,000 species are considered to be near reality. Percentage of Different Biota in India

Table 4.2 : Number of Species of Bacteria, Fungi, Plants and Animals

Taxon	Number of Species	Percentage
Bacteria	850	0.8
Fungi	23,000	21.2
Algae	2,500	2.3
Bryophyte	2,564	2.4
Pteridophyta	1,022	0.9
Gymnosperms	64	0.1
Angiosperms	15,000	13.9
Insecta	53,430	49.3
Mollusca	5,050	4.7
Pisces	2,546	2.4
Amphibian	204	0.2
Reptilia	446	0.4
Aves	1,228	1.1
Mammalian	372	0.3
Total	108,276	100.00

India is 10th among the plant rich countries of the world, fourth among the Asian countries, eleventh according to the number of endemic species of higher vertebrates (amphibia, birds and mammals), and tenth in the world as far as richness in mammals is concerned. Out of the 10 'Hot

spots' identified in the world, India has four. These are Eastern Himalaya, North East India, Western Ghats and Andaman & Nicobar Islands.

The crops which first grew in India and spread throughout the world include rice, sugarcane, Asiatic vignas, jute, mango, citrus, and banana, several species of millets, spices, medicinal, aromatics and ornamentals. India ranks sixth among the centres of diversity and origin in terms of agro-biodiversity.

Threats of Biodiversity

1. Extinction of many species: The biodiversity of earth's surface has now been faced with mass extinction of many species on a global scale. Rising sea levels, warmer temperatures and melting ice caps destroy animals' habitats.

Every type of organism such as microorganisms, fungi, plants, and animals all are threatened with dire consequences.

Many of the animal's species have already been lost. Moreover nearly 650 mammals, 210 reptiles and 1100 birds are threatened with extinction.

2. Massive destruction of forest land: humans cutting down precious forests for agriculture, fuel or to build houses. The eco-system has been highly disturbed as a result of massive destruction of forests. Many forests have been destroyed:

- to extract wood and other precious herbs,
- for expansion of agricultural land,
- for expansion of habitable area,
- for industrialization.

3. Industrialization: In many cases the production (usually industrial) and release of wastes acting as pollutants have completely destroyed the habitat of many species. Excessive release of greenhouse gases and the resultant global warming and climate are real threats to biodiversity.

4. Shrinking habitat: The habitat areas in most cases have got shrunk due to many reasons and stand as isolated patches or islands. The smaller the area of the habitat, the lower would be the number of species.

5. Urbanization: humans building over animals' habitats.

6. Shortages of water: not enough water for certain species to survive.

7. Pollution: Poisonous gases in the air causing respiratory problems in many species. Plastics, oil and other water contaminants making it difficult for fish and sea birds to thrive in our rivers, lakes and oceans.

HABITAT LOSS

Habitat destruction is damage to an area that certain species live in, to the extent that the species can no longer survive in that area. The causes of habitat destruction can be either man-made or natural in origin. Large scale damage to an area can have obvious implications on the habitat.

Man-made causes of habitat destruction include construction of both previously undeveloped areas as well as new construction on the fringe of developed areas. Deforestation for construction can have a huge impact on many different animal species. A wetland area may be filled in to build a structure or road on. A field may be mowed to make the area more aesthetically pleasing, or to purposely discourage the presence of wildlife from a developed area.

Agriculture is another man-made cause of habitat destruction. Again, land cut clear of trees or natural grassland mowed to provide farmland can destroy the habitat of mammals, insects, or birds. In addition, efforts to irrigate farmland and provide water for farm animals can impact habitat, either by taking water from an area, or adding water to an area that was previously dry.

Global warming is a process that human activity has contributed to. Burning fossil fuels and deforestation have both contributed to increased carbon dioxide in the atmosphere. The increased carbon dioxide in the atmosphere keeps solar heat in the atmosphere. Global warming is an important cause of habitat destruction for polar bears as the sea ice of the Arctic Ocean is melting.

Fire is another culprit that can fall under man-made or natural causes of habitat destruction. Human error or intent can result in forest fires. Lightning strikes can also result in serious fires. Either way, the end result can be devastating to species that live in grasslands or forests that are damaged by fire.

Natural disasters can be causes of habitat destruction. Examples of natural disasters that can be devastating include earthquakes, floods, and tornadoes. Earthquakes can physically move the land, and may be associated with subsequent tsunamis. Floods can destroy the vegetation and cause erosion of the land. Tornadoes can physically rip trees out of the ground and crush vegetation with debris that is strewn about.

POACHING OF WILD LIFE

Poaching is the illegal hunting, killing or capturing of animals. People poach because animal products, such as hide, ivory, horn, teeth and bone, are sold to dealers who make clothes, jewelry and other materials from them. The poaching causes various effects, its most direct impact is extinction, either globally or within a given locality.

Poachers catch Indian tigers with steel traps. This is against the law. After trapping a tiger, they kill it and sell the body parts for money. Like the rhino, the tiger is a very endangered species. If the killing does not end, they both face extinction (all of that type of animal dies). Extinction means that someday there may be no Indian tigers or rhinos left on earth.

Effects on poaching wild life

1. Effects on Local Communities

The extinction of a species can have a negative economic effect on a local community's tourism industry. Furthermore, a tourist boycott due to local poaching is a real threat. A boycott could have a detrimental effect on a community's economy since restaurants, hotels, rentals, and other attractions would suffer.

2. Effects on the Environment

Poaching is also dangerous to the environment. Our ecosystems are sensitive and must be preserved. The economic challenges of a community can lead to poaching, which in turn can lead to endangerment (and in the worst cases, extinction) of different species. We need various species of flora and fauna in our environmental ecosystems so that it can maintain healthy and balanced. The survival of our own species depends on it.

Human-wildlife conflict

It refers to the interaction between wild animals and people and the resultant negative impact on people or their resources, or wild animals or their habitat. It occurs when growing human populations overlap with established wildlife territory, creating reduction of resources or life to some people and/or wild animals. The conflict takes many forms ranging from loss of life or injury to humans, and animals both wild and domesticated, to competition for scarce resources to loss and degradation of habitat.

Effects of conflict

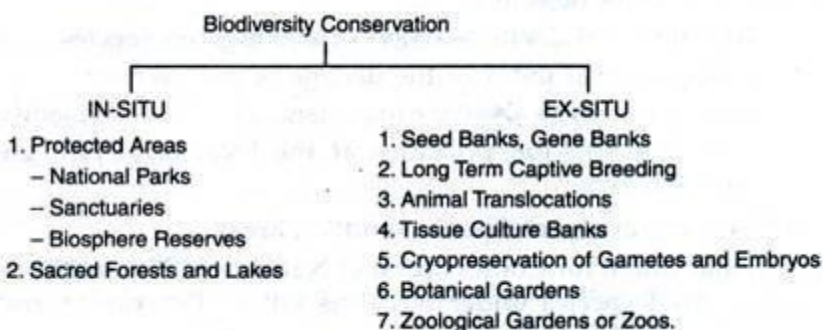
- Injury and loss of life of humans and wildlife
- Crop damage, livestock depredation, predation of managed wildlife stock.
- Damage to human property.
- Destruction of habitat.
- Collapse of wildlife populations and reduction of geographic ranges

Conservation is the protection, preservation, management, or restoration of wildlife and natural resources such as forests and water. Through the conservation of biodiversity and the survival of many species and habitats which are threatened due to human activities can be ensured. There is an urgent need, not only to manage and conserve the biotic wealth, but also restore the degraded ecosystems.

Types of Conservation:

Conservation can broadly be divided into two types:

1. In-situ conservation
2. Ex-situ conservation



In-situ Conservation:

In-situ conservation is on site conservation or the conservation of genetic resources in natural populations of plant or animal species, such as forest genetic resources in natural populations of tree species. It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or cleaning up the habitat itself, or by defending the species from predators. It is applied to conservation of agricultural biodiversity in agro forestry by farmers, especially those using unconventional farming practices. In-situ conservation is being done by declaring area as protected area.

In India following types of natural habitats are being maintained:

1. National parks
2. Wildlife sanctuaries
3. Biosphere reserves

INDIA has over 600 protected areas, which includes over 90 national parks, over 500 animal sanctuaries and 15 biosphere reserves.

1. National Parks:

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

Their boundaries are well marked and circumscribed. They are usually small reserves spreading in an area of 100 Sq. km. to 500 sq. km. In national parks, the emphasis is on the preservation of a single plant or animal species.

2. Wildlife Sanctuaries:

A sanctuary is a protected area which is reserved for the conservation of only animals and human activities like harvesting of timber, collecting minor forest products and private ownership rights are allowed as long as they do not interfere with well-being of animals. Boundaries of sanctuaries are not well defined and controlled biotic interference is permitted, e.g., tourist activity.

3. Biosphere Reserves:

It is a special category of protected areas where human population also forms a part of the system. They are large protected area of usually more than 5000 sq.km. A biosphere reserves has 3 parts- core, buffer and transition zone.

1. Core zone is the inner zone; this is undisturbed and legally protected area.
2. Buffer zone lies between the core and transition zone. Some research and educational activities are permitted here.
3. Transition zone is the outermost part of biosphere reserves. Here cropping, forestry, recreation, fishery and other activities are allowed.

Advantages of in-situ conservation:

1. The flora and fauna live in natural habitats without human interference.
2. The life cycles of the organisms and their evolution progresses in a natural way.

3. In-situ conservation provides the required green cover and its associated benefits to our environment.
4. It is less expensive and easy to manage.
5. The interests of the indigenous people are also protected.

Ex-Situ Conservation:

Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats. This involves conservation of genetic resources, as well as wild and cultivated or species, and draws on a diverse body of techniques and facilities. Such strategies include establishment of botanical gardens, zoos, conservation strands and gene, pollen seed, seedling, tissue culture and DNA banks.

i. Seed gene bank:

These are cold storages where seeds are kept under controlled temperature and humidity for storage and this is easiest way to store the germ plasma of plants at low temperature. Seeds preserved under controlled conditions (minus temperature) remain viable for long durations of time.

ii. Gene bank:

Genetic variability also is preserved by gene bank under normal growing conditions. These are cold storages where germ plasm are kept under controlled temperature and humidity for storage; this is an important way of preserving the genetic resources.

iii. Cryopreservation:

This is the newest application of technology for preservation of biotic parts. This type of conservation is done at very low temperature (-196°C) in liquid nitrogen. The metabolic activities of the organisms are suspended under low temperature, which are later used for research purposes.

iv. Tissue culture bank:

Cryopreservation of disease free meristems is very helpful. Long term culture of excised roots and shoots are maintained. Meristem culture is very popular in plant propagation as it's a virus and disease free method of multiplication.

v. Long term captive breeding:

The method involves capture, maintenance and captive breeding on long term basis of individuals of the endangered species which have lost their habitat permanently or certain highly unfavorable conditions are present in their habitat.

vi. Botanical gardens:

A botanical garden is a place where flowers, fruits and vegetables are grown. The botanical gardens provide beauty and calm environment. Most of them have started keeping exotic plants for educational and research purposes.

vii. Zoological Gardens:

In zoos wild animals are maintained in captivity and conservation of wild animals (rare, endangered species). The oldest zoo, the Schonbrunn zoo which exists today also, was established in VIENNA in 1759.

In India, the 1st zoo came into existence at BARRACKPORE in 1800. In world there are about 800 zoos. Such zoos have about 3000 species of vertebrates. Some zoos have undertaken captive breeding programmes.

Advantages of ex-situ preservation:

1. It is useful for declining population of species.
2. Endangered animals on the verge of extinction are successfully bred.
3. Threatened species are bred in captivity and then released in the natural habitats.
4. Ex-situ centres offer the possibilities of observing wild animals, which is otherwise not possible.
5. It is extremely useful for conducting research and scientific work on different species

- *IN-SITU* conservation is done in the natural habitats of the biodiversity components while *EX-SITU* conservation is done outside of their natural habitats.

- *IN-SITU* conservation is more dynamic, whereas *EX-SITU* conservation is more static.

- *IN-SITU* conservation involves designation, management, and monitoring of target taxa in their natural habitats, whereas *EX-SITU* conservation involves sampling, transfer, and storage of target taxa from their natural habitats.

- **In** *IN-SITU* conservation, populations remain within the ecosystem involving the process of evolution whereas, in *EX-SITU* conservation, they are not involving the natural evolution process.

- *IN-SITU* conservation is time consuming but more sustainable while *EX-SITU* conservation methods are aimed to use in conserving genetic components, in immediate occasions.

UNIT-5

Environmental Pollution

Air Pollution – Causes, effects and control measures

WHO defines air pollution as the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. It is an atmospheric condition in which certain substances are present in concentrations which can cause undesirable effects on man and his environment. These substances include gases, particulate matter, radioactive substances etc.

Sources of Air Pollution

The sources of air pollution are natural and man-made (anthropogenic).

Man-made causes includes :

Burning-fossil-fuels

Burning of wood, charcoal and other fossil fuels causes air pollution by the release of carbon dioxide (CO₂), carbon sulphur dioxide etc.

Emissions-from-automobiles

Vehicles are a major source of air pollution. The major pollutants released from automobiles, locomotives, aircraft etc., include CO, unburnt hydrocarbons and nitrogen oxide.

Industries

Factories pollute the air through fossil fuel emissions. These emissions include carbon dioxide, methane, and nitrous oxide. While all of these are naturally-occurring substances, it is the high levels of emissions which are of concern.

Agricultural-activities

Spraying of insecticides and weedicides also cause air pollution. These, when inhaled create severe problems to both animals and man.

Wars

Various forms of explosives used in war pollute the air by releasing poisonous gases. This greatly disturbs the ecology of the area. Nuclear explosions pollute air by radioactive rays.

Natural causes include:

- Volcanic eruption
- Forest fires
- Marsh gas emission

- Deflation of sand and dust
- Micro-organisms such as algae, fungi, bacteria, yeast, moulds, spores are transported by wind to distant places causing air pollution.

Effects of air pollution :

Air pollution has adverse effects on living organisms and materials.

- **Effect on plants**
 - Oxides of nitrogen and fluorides reduce crop yield.
 - Ozone damages cereals, fruits, and cotton crop.
 - Smoke and dust cover the leaf surface and reduce photosynthetic capacity of plants.
 - SO₂ causes chlorosis and also results in the death of cells and tissues.
- **Effect on Human health**
 - SO₃, CO and NO₂ diffuse into blood stream and reduce oxygen transport. CO damages cardiovascular system. Hydrocarbons and other pollutants act, as carcinogens and lead to different cancers.
 - Ozone has been reported to produce chromosomal aberrations.
 - Cotton dust leads to respiratory disorders e.g. bronchitis and asthma.
- **Effects on Aquatic life**
 - Air pollutants mixing up with rain can cause high acidity (lower pH) in fresh water lakes. This affects aquatic life especially fish. Some of the freshwater lakes have experienced total fish death.
- **Change in Climate**
 - Concentration of various Green House Gases into the atmosphere leads to increase in temperature.
 - Thinning of ozone layer would permit more of the harmful ultraviolet rays to reach the earth.
- **Aesthetic loss**
 - Dust and smoke spoils the beauty of nature. Especially the mountain environments, which serve as a great attraction for tourists.
 - Foul odours emitted by industries, automobiles, dirty drains and garbage heaps in cities are a great nuisance.

Control of Air pollution

Air pollution can be minimized by the following methods:

1. Some gases, which are more soluble in a particular liquid than air, for example, ammonia in water, can be separated by dissolving in it.
2. Particles larger than 50 mm are separated in gravity settling tanks. Using cyclone collectors or electrostatic precipitators separates fine particles.
3. The height of chimneys should be increased to the highest possible level to reduce pollution at the ground level.
4. SO₂ pollution can be controlled by extracting sulphur from the fuel before use.
5. Pollution control laws should be enforced strictly.
6. Trees should be planted on the roadside, riverbanks, parks and open places as they keep the environment fresh.
7. Population growth, which is the main cause of pollution should be checked.
8. Nuclear explosions should be restricted.

Water Pollution – Causes, effects and Control measures

Water pollution can be defined as alteration in physical, chemical or biological characteristics of water making it unsuitable for designated use in its natural state.

Sources of Water Pollution

- **Domestic sewage**
This includes household's wastes like food wastes, synthetic detergents used for washing clothes and cleaning bathrooms and latrines and water based paints.
- **Industrial effluents**
Industrial wastes containing toxic chemicals, acids, alkalis, metallic salts, phenols, cyanides, ammonia, radioactive substances, etc. are discharged in the adjoining rivers and streams through flush lines of factories.
- **Agricultural source**
Agrochemicals like fertilizers (containing nitrates and phosphates) and pesticides (insecticides, fungicides, herbicides etc.) washed by rain-water and surface run-off pollute water.

- **Thermal pollution**

Waste heat from industrial discharges increases the temperature of water bodies and affects distribution and survival of sensitive species.

- **Pathogenic organisms**

Sewage and domestic waste from houses introduces pathogenic organisms viz., protozoa, worms-eggs and bacteria into water. This contaminated water if consumed causes jaundice, typhoid, dysentery, cholera, tuberculosis etc.

- **Mineral oils**

Oil from oil spills and washing of automobiles finds way into river water through sewers.

Effect of water pollution

- Pesticides in drinking water ultimately reach humans and are known to cause various health problems.
- Industrial effluents containing iron, free chlorine, phenol, manganese, oils, hydrocarbons, ammonia, algae and microorganisms impair the taste and odour of water.
- The nitrates and phosphates dissolved in water accelerate the growth of microorganisms, which consume much of the dissolved oxygen depriving fish and other aquatic life (Eutrophication).
- Nitrate when present in excess in drinking water causes blue baby syndrome.
- Excess of fluoride in drinking water causes defects in teeth and bones called fluorosis.
- Some heavy metals like lead, mercury and cadmium cause various types of diseases like – Minamata, Itai Itai etc.
- Soap, detergents and, alkalis result in foam formation, which in turn affects aquatic life.

Control of Water Pollution

- Domestic sewage and industrial wastes should be treated before discharging them into drains.
- In towns where sewage facilities are not available, septic tanks should be made in the houses.

- Use of pesticides, insecticides and fertilizers should be done judiciously. Rapid biodegradable substitutes for pesticides should be employed.
- Separate ponds and tanks to be used for cattle and animals.
- Prevent run-off of manure. Divert such run-off to basin for settlement. The nutrient rich water can be used as fertilizer in the fields.

Soil Pollution – Causes, effects and control measures

Soil pollution is defined as the presence of toxic chemicals (pollutants or contaminants) in soil, in high enough concentrations to pose a risk to human health and the ecosystem.

Sources of soil pollution

- Pesticides are used to kill pests that damage crops. These pesticides ultimately reach the soil and persist there for a long time. Residues of these pesticides in the soils have long term effects especially under the temperate conditions.
- Industrial wastes also contain some organic and inorganic compounds that are refractory and non-biodegradable.
- Soil also receives excreta from animals and humans. The sewage sludge contains many pathogenic organisms, bacteria, viruses and intestinal worms which cause pollution in the soil.
- Thermal power plants generate a large quantity of ‘Fly ash’. Huge quantities of these wastes are dumped on soils, thus contaminating them.
- Many radio active substances like Uranium, radium, caesium etc. are discharged from industries as wastes. These elements reach the soil and persist there for a long time and keep on emitting radiations.

Effects of Soil Pollution

- Chemicals and pesticides affect the structure and fertility of soil by killing the soil microorganisms.
- Pesticides are absorbed by the plants and then transferred to other organism. Hence, they affected food chains and food webs.
- Pathogens present in the wastes and excreta contaminate the soil and vegetable crops causing diseases in man and domesticated animals.

- Radioisotopes which attach with the clay become a source of radiations in the environment.

Control of Soil Pollution

- Effluents should be properly treated before discharging them on the soil.
- Solid wastes should be properly collected and disposed off by appropriate method.
- Metals should be recovered from scrap and disposed materials.
- Materials like paper, glass and plastics can be recycled.
- Use of pesticides can be reduced by adopting biological control of pests.
- Use of cattle dung and agricultural wastes in biogas plants should be encouraged.

Write a short note on salination of soil.

Soil salinity is the salt content in the soil; the process of increasing the salt content is known as salinization.

It takes place in two ways:

- accumulation of salts dissolved in irrigation water on the soil surface due to intensive farming and poor drainage, and
- deposition of salts as white crust during summer months drawn by capillary action from the lower surface to the top surface.
- detrimental effects on plant growth and yield
- damage to infrastructure (roads, bricks, corrosion of pipes and cables)
- reduction of water quality for users, sedimentation problems
- soil erosion ultimately, when crops are too strongly affected by the amounts of salts.

Salinity of soil can be checked by adopting these methods :

- Drainage is the primary method of controlling soil salinity. Once good drainage is assured, the **soil** can be irrigated with clean water.
- Run-off should be avoided to prevent erosion.
- Adopting proper irrigation techniques.

Marine Pollution – Causes, effects and control measures

Marine pollution can be defined as the introduction of substances to the marine environment directly or indirectly by man resulting in adverse effects such as hazards to human health, obstruction of marine activities and lowering the quality of sea water.

Sources of marine pollution

The main sources of marine pollution are

- Rivers, which bring pollutants from their drainage basins
- Catchment area i.e. coastline where human settlements in the form of hotels, industry, agricultural practices have been established
- Oil drilling and shipment.

Effects of marine pollution

- The pollutants in sea may become dispersed by turbulence and ocean currents and finally becomes a part of food chain.
- Hydrocarbons and benzpyrene gets accumulated in food chain and consumption of such fish by man may cause cancer.
- Bioaccumulation in food chain also result in loss of species diversity.
- Oil pollution causes damage to marine fauna and flora including algae, fish, birds, and invertebrates.
- Detergents used to clean up the spill are also harmful to marine life.

Control of marine pollution

- Toxic pollutants from industries and sewage treatment plants should not be discharged in coastal waters.
- Run off from non-point sources should be prevented to reach coastal areas.
- Sewer overflows should be prevented by having separate sewer and rain water pipes.
- Dumping of toxic, hazardous wastes and sewage sludge should be banned.
- Developmental activities on coastal areas should be minimized.
- Oil and grease from service stations should be processed for reuse.
- Oil ballast should not be dumped into sea.
- Ecologically sensitive coastal areas should be protected by not allowing drilling.

Noise Pollution – Causes, effects and control measures

Noise pollution or **noise disturbance** is the disturbing or excessive noise that may harm the activity or balance of human or animal life. A decibel value greater than 80 decibels causes noise pollution. Noise becomes troublesome above 140 decibels.

Sources of noise pollution

The major sources of noise are :

- various modes of transportation (like air, road, rail-transportation)
- industrial operations
- construction activities
- celebrations (social/religious functions, elections etc)
- electric home appliances.

Effects of noise pollution

Noise causes the following effects :

- **Interferes with man's communication:** In a noisy area communication is severely affected.
- **Hearing damage:** Noise can cause temporary or permanent hearing loss. It depends on intensity and duration of sound level. Auditory sensitivity is reduced with noise level of over 90 dB in the mid high frequency for more than a few minutes.
- **Physiological and Psychological changes:** Continuous exposure to noise affects the functioning of various systems of the body. It may result in hypertension, insomnia (sleeplessness), gastro-intestinal and digestive disorders, blood pressure changes, behavioural changes, emotional changes etc.

Control of Noise pollution

Following methods can control noise pollution:

- Limited use of loudspeakers and amplifiers.
- Exercising control over noise producing vehicles.
- Industrial workers should be provided with ear plugs.
- Delocalisation of noisy industries far away from dwelling units
- Plants and trees having broad leaves should be planted all around the hospitals, libraries and schools and colleges.

- Through Law: Legislation can ensure that sound production is minimized at various social functions. Unnecessary horn blowing should be restricted especially in vehicle-congested areas.

Thermal Pollution – Causes, effects and control measures

Thermal pollution is defined as the degradation of water quality by any process that changes ambient water temperature.

Causes of Thermal pollution

1. Water used as coolant & ejected back into water bodies – Mainly, the water that is used as coolant and transferred back to natural water bodies is the chief reason for thermal pollution. This kind of activity is mostly done by production; manufacturing and power plants. These plants use water to cool down their machines and eject back the hot water into water bodies. Thus, the natural water goes through a sudden rise in temperature.

2. Release of cold water – Just as we mentioned before, many industries liberate very cool water from their reservoirs. This water when mixed up with warm water rivers, lakes or ponds creates a disbalance in the flora and fauna of affected water bodies.

3. Growing industrial activities – It gives a repenting feeling to know that thermal pollutants are increasing day by day because of the growing industrial activities. Therefore, thermal pollution is also growing each day.

4. Chemical pollutants discharged into water – There are copious factories that discharge their chemical waste directly into natural water bodies. This does not only causes thermal pollution but also makes the water poisonous.

5. Livestock waste mixed into water – This is another major cause of thermal pollution. Many industries dispose their livestock waste into water without analyzing upon the hazardous consequences of this act.

6. Water discharged from urban areas – Many urban areas like parking places, roads, etc., deposit rain water and discharge the heated water back into water bodies. The heated water disturbs the normal temperature of natural water bodies.

7. Human waste, household & personal care products – These products go into sewage water which pollutes the water in ponds, seas and other water bodies.

8. Deforestation & soil erosion – Soil erosion makes natural water bodies to rise beyond their normal level. Thus, they get more exposed to sunlight. Hence, the temperature of water rises.

Forests absorb much of sun rays and save water bodies from getting too much heat. However, deforestation disturbs this cycle and provides augmented temperature of water.

9.Natural Geo-thermal activities – Natural geothermal activities can stimulate lava and can cause a rise in water temperature, making way for thermal pollution.

10.Unawareness among people – Growing thermal pollution is also the result of unawareness among people. Even after knowing the hazardous effects of thermal pollution on environment, there are abundant industries which are continuously using ways that encourage this pollution.

Effects of Thermal pollution

1.Thermal shock resulting in rise in temperature of water bodies – When industries and factories dispose the water, used as coolant, back into water bodies the temperature suddenly raises to an abnormal level. The sudden and abnormal temperature level acts as a thermal shock for aquatic life,

2.Depleted level of oxygen in natural water – When warm water discharged by industries enters the natural water bodies, they get heated up. The warm water causes an unusual growth of plants and expansion of algae. The algae expansion in water reduces the level of oxygen in water.

3.Contamination of water – Thermal pollution also results in contamination of water because various chemicals and other wastes get mixed up with the water that is disposed off back to rivers, ponds, lakes, etc., by various factories. If this contamination of water keeps on increasing, humans can suffer from shortage of water.

4.Reduced solubility of oxygen – Reduced solubility of oxygen in water bodies is another disappointing effect of thermal pollution. This less solubility of oxygen in water mainly affects the metabolism of water animal.

5.Adverse effect on water plants – Change in temperature levels is extremely harmful for the aquatic plants. These plants cannot cope up with the sudden alteration in water temperature. Hence, more and more aquatic plants are depleting each day because of thermal pollution

6.Adverse effects on water animals – The whole marine life gets disturbed because of thermal pollution. The contaminated water makes the natural water poisonous and has an adverse effect on animals living in it. Also, the reduced level of oxygen makes it difficult for water animals to survive.

7.Effect on population of water animals – When the temperature in natural water bodies gets disturbed because of thermal pollution, the cycle of animal population gets disturbed too. For example, sometimes the fish start laying eggs too soon and sometime they do it too late. The whole productivity of river gets disturbed too.

8.Unexpected Migration of Water Animals – When water animals find it difficult to survive in the changed water because of thermal pollution, they start for an unexpected migration, making way for a disturbed ecosystem.

Control of Thermal pollution

The following methods can be employed for control of thermal pollution:

1.Use less electricity – All of us know that power plants are the main reasons behind growing thermal pollution. This is so because power plants use water as a cooling agent for cooling down their machines. This used water, which is much higher in temperature, is discharged back into the rivers, seas or lakes. We can make a significant contribution in controlling thermal pollution by consuming less electricity,. The use of less electricity will lead to less workload on power plants and these plants will not have to use their machines too much, meaning controlled use of water as coolant.

2.Use of Better Technologies – Science has gifted us with plentiful inventions, discoveries, techniques and knowledge. Incorporating good techniques ensure a good lifestyle for human race. Use of better technologies is strongly recommended for solving the problem of thermal pollution.

3.Holding back the water for good – If factories or plants cannot stop using water as a coolant, there is another option available for them. After using the water as coolant, they should store that water somewhere else for a temporary period. Instead of discharging back the heated water into water bodies, the temporarily collected heated water can be used for various other purposes too. Storing the heated water for a particular time will help in bringing back the high temperature of water to a normal level.

4.Plantation of more trees upon the banks of rivers, seas & other water bodies – This is also a good way to control thermal pollution. The trees around sources of water help in absorbing the harsh sun rays and prevent them from falling directly upon the water. This helps in prevention of heating of water bodies. Planting more trees also helps in controlling the problem of soil erosion

5.Artificial Lakes – Industries, factories or plants which are serious about storing and reusing the heated water, used as coolant, can work out on artificial lakes. These are artificial lakes where the heated water can be stored easily. These lakes are very helpful for normalizing the temperature of hot water. This way, the hot water will not be disposed back to the lakes, rivers, etc., and will be used in other suitable tasks.

6.Recycling used water – Smart people always find intelligent solutions for even the most difficult of problems. If people start working upon the ideas of recycling the used water in plants and factories, the problem of thermal pollution will definitely be lessened to a significant extent.

7.Spreading awareness among people – Environment can be made better with a united effort. Making more and more people aware about the problem of thermal pollution will be very beneficial in the long run. Groups of people can initiate a discussion with different plants and industries. These groups can discuss the

Nuclear Hazards – Causes, effects and control measures

Nuclear hazard can be defined as the Risk or danger to human health or the environment posed by radiation emanating from the atomic nuclei of a given substance, or the possibility of an uncontrolled explosion originating from a fusion or fission reaction of atomic nuclei.

Sources of Nuclear Hazards :

The sources of radioactivity are both natural and man-made.

The natural sources include:

- Cosmic rays from outer space. The quantity depends on altitude and latitude; it is more at higher latitudes and high altitudes.
- Emissions from radioactive materials from the Earth's crust.

Man-made sources include:

- Mining and processing of radioactive ores.
- Use of radioactive material in nuclear power plants.
- Use of radioactive isotopes in medical, industrial and research applications.
- Use of radioactive materials in nuclear weapons.

Effects of Nuclear Hazards

Ionization radiations can affect living organisms by causing harmful changes in the body cells and also changes at genetic level.

- **Genetic damage** is caused by radiations, which induce mutations in the DNA, thereby affecting genes and chromosomes. The damage is often seen in the offsprings and may be transmitted upto several generations.
- **Somatic damage** includes burns, miscarriages, eye cataract and cancer of bone, thyroid, breast, lungs and skin.

Control of Nuclear Hazards

Following measures can help in controlling the radioactive pollution:

- Workers in nuclear plants should be provided with nuclear gadgets and safety measures against accidents.
- Leakage of radioactive elements from nuclear reactors, laboratories, transport, careless handling and use of radioactive fuels should be checked.
- There should be regular monitoring and quantitative analysis through frequent sampling in the risk areas.
- Preventive measures should be followed so that background radiation levels do not exceed the permissible limits.
- Waste disposal must be careful, efficient and effective.

Solid waste management - sources, effects and methods of disposal

Solid waste management

Rapid population growth and urbanization in developing countries has led to people generating enormous quantities of solid waste and consequent environmental degradation. The waste is normally disposed in open dumps creating nuisance and environmental degradation. Solid wastes cause a major risk to public health and the environment. Management of solid wastes is important in order to minimize the adverse effects posed by their indiscriminate disposal. **Types of solid wastes:** Depending on the nature of origin, solid wastes are classified into

1. URBAN OR MUNICIPAL WASTES
2. INDUSTRIAL WASTES and
3. HAZARDOUS WASTES

SOURCES OF URBAN WASTES

Urban wastes include the following wastes:

Domestic wastes containing a variety of materials thrown out from homes

Ex: Food waste, Cloth, Waste paper, Glass bottles, Polythene bags, Waste metals, etc.

Commercial wastes: It includes wastes coming out from shops, markets, hotels, offices, institutions, etc.

Ex: Waste paper, packaging material, cans, bottle, polythene bags, etc.

Construction wastes: It includes wastes of construction materials.

Ex: Wood, Concrete, Debris, etc.

Biomedical wastes: It includes mostly waste organic materials

Ex: Anatomical wastes, Infectious wastes, etc.

Classification of urban wastes

Urban wastes are classified into:

Bio-degradable wastes - Those wastes that can be degraded by micro organisms are called bio-degradable wastes

Ex: Food, vegetables, tea leaves, dry leaves, etc. **Non-biodegradable wastes:** Urban solid waste materials that cannot be degraded by micro_organisms are called non-biodegradable wastes.

Ex: Polythene bags, scrap materials, glass bottles, etc.

SOURCES OF INDUSTRIAL WASTES

The main source of industrial wastes are chemical industries, metal and mineral processing industries.

Ex: Nuclear plants: It generated radioactive wastes

Thermal power plants: It produces fly ash in large quantities

Chemical Industries: It produces large quantities of hazardous and toxic materials.

Other industries: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.

SOURCES OF HAZARDOUS WASTE

Source of Hazardous Waste Hazardous waste is generated from many sources, ranging from industrial manufacturing process wastes to batteries and may come in many forms, including liquids, solids gases, and sludges. It includes ♣ Clinical wastes; ♣ Waste oils/water, hydrocarbons/water mixtures, emulsions; ♣ Wastes from the production, formulation and use of resins, latex, plasticizers, glues/adhesives; ♣ Wastes resulting from surface treatment of metals and plastics; ♣ Residues arising from industrial waste disposal

operations; ♣ Wastes which contain certain compounds such as: copper, zinc, cadmium, mercury, lead and asbestos. ♣ Household waste; or Residues arising from the incineration of household waste .

EFFECT OF IMPROPER SOLID WASTE MANAGEMENT

1. Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors.
2. Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil. Toxic substances may percolate into the ground and contaminate the groundwater.
3. Burning of industrial or domestic wastes (cans, pesticides, plastics, radioactive materials and batteries) produce furans, dioxins and polychlorinated biphenyls that are harmful to human beings.
4. Contaminates water and air, resulting into diseases and dysentery in Human beings.
5. Mosquitoes breed in the stagnant water, blocked due to waste choked in the drains.
6. Decomposition of solid waste spreads obnoxious odour in the air, thus polluting it.
7. Burning of waste, especially plastic adds up obnoxious fumes in the air.
8. Garbage dumps and decomposed waste helps many harmful species to breed in them.
9. The infected water supply also leads to large scale epidemics.

STEPS INVOLVED IN TO CONTROL SOLID WASTE MANAGEMENT:

Two important steps involved in solid waste management are:

Landfills

Throwing daily waste/garbage in the [landfills](#) is the most popularly used method of waste disposal used today. This process of waste disposal focuses attention on burying the waste in the land. [Landfills are commonly found](#) in developing countries. There is a process used that eliminates the odours and dangers of waste before it is placed into the ground.

Incineration/Combustion

Incineration or combustion is a type disposal method in which municipal solid wastes are burned at high temperatures so as to convert them into residue and gaseous products. The biggest advantage of this type of method is that it can reduce the volume of solid waste

to 20 to 30 percent of the original volume, decreases the space they take up and reduce the stress on [landfills](#).

Recovery and Recycling

Resource recovery is the process of taking useful discarded items for a specific next use. These discarded items are then processed to extract or recover materials and resources or convert them to energy in the form of useable heat, electricity or fuel.

[Recycling](#) is the process of converting waste products into new products to prevent energy usage and consumption of fresh raw materials. [Recycling](#) is the third component of [Reduce, Reuse and Recycle waste hierarchy](#). [The](#) idea behind recycling is to reduce energy usage, reduce volume of landfills, reduce air and [water pollution](#), reduce [greenhouse gas emissions](#) and preserve natural resources for future use.

Plasma gasification

Plasma gasification is another form of [waste management](#). Plasma is a primarily an electrically charged or a highly ionized gas. Lighting is one type of plasma which produces temperatures that exceed 12,600 °F . During the treatment solid waste by plasma gasification, the waste's molecular bonds are broken down as result of the intense heat in the vessels and the elemental components. Thanks to this process, destruction of waste and dangerous materials is found. This form of waste disposal provides [renewable energy](#) and an assortment of other fantastic benefits.

Composting

[Composting](#) is a easy and natural bio-degradation process that takes organic wastes i.e. remains of plants and garden and kitchen waste and turns into nutrient rich food for your plants. Composting, normally used for [organic farming](#), occurs by allowing organic materials to sit in one place for months until microbes decompose it. Composting is one of the best method of waste disposal as it can turn unsafe organic products into [safe compost](#). On the other side, it is slow process and takes lot of space. and turns it to

Avoidance/Waste Minimization

The most easier method of waste management is to reduce creation of waste materials thereby reducing the amount of [waste going to landfills](#). Waste reduction can be done

through recycling old materials like jar, bags, repairing broken items instead of buying new one, avoiding use of disposable products like plastic bags, reusing second hand items, and buying items that uses less designing.

Role of individual in prevention of pollution

- **Individuals should minimize wastage of resources such as electricity. Every unit of electricity saved is equivalent unit of electricity produced as it not only saves the fuel that would be used to produce that electricity, but also help to prevent** pollution that is accompanied by burning of that fuel. Therefore, person should always switch off appliances when not in use.
- Individuals should prefer walking or use cycles instead of using motor vehicles, especially when distances to be travelled are small.
- Individuals can make considerable contribution by using mass transport (buses, trains, etc) instead of using personal vehicles.
- When going to workplace, colleagues from nearby localities should pool vehicles instead of going in individual personal vehicles.
- Taking personal vehicles for periodic pollution checks at centres approved by authorities.
- Individuals should reuse items whenever possible.
- Products that are made of recycled material should be given preference.
- Use gunny bags made of jute instead of plastic bags.
- Take part in environment conservation drives such as tree planting drives.
- Use water resources efficiently.
- Use renewable resources by installing equipment such as solar heaters and using solar cookers.
- Dispose potentially harmful products such as cells, batteries, pesticide containers, etc properly.
- Use of refrigerators should be minimised wherever possible as they are main source of CFC, which is responsible for Ozone layer depletion.
- Follow and promote family planning, as more population means more resources utilized and more resources utilized imply more pollution.
- Avoid making noise producing activities such as listening to loud music.
- Use handkerchiefs instead of paper tissues.

- Organize drives to clean streets and clean drains with help of other people of locality.
- Spread awareness and inspire other people to prevent pollution. Individuals should be encouraged to acquire information and innovations from world over and implement them locally.

DISASTER MANAGEMENT

Disaster management is a collective term encompassing all aspects of planning for and responding to emergencies and disasters, including both pre- and post-event activities. It refers to the management of both the risk and the consequences of an event. The actions taken by an organization in response to unexpected events that are adversely affecting people or resources and threatening the continued operation of the organization.”

Disasters are mainly of 2 types,

1. Natural disasters. Example – earthquakes, floods, landslides, cyclones etc.
2. Man made disasters. Example – war, bomb blasts, chemical leaks, etc.

Goals of disaster management

- Proactive plans to mitigate various business risks
- Minimizing loss via more effective preparedness and response
- Creating more effective and durable recovery

Taking Earthquake Precautions

There is no effective warning system for earthquakes, which makes preliminary precautions even more critical. At the same time, knowing how to behave when a quake strikes and what to do after the event is just as important to staying safe.

Before an Earthquake

There are many things families and individuals can do to prepare for an earthquake, including the following:

- Install latches on cupboard doors to prevent them from opening during a quake.
- Use non-skid shelf liners for kitchen and bathroom cupboards, medicine cabinets, and closet shelves.
- Store heavy items or glassware in lower cabinets so they do not become dangerous projectiles.
- Update home insurance policies to adequately cover building costs, possession replacement, and injury deductibles.

- Secure large appliances such as refrigerators, water heaters, air conditioners, and other bulky items with straps, bolts, and other stabilizing methods.
- Be sure both old and new buildings meet earthquake construction requirements.
- Do not put heavy artwork, mirrors, or shelves over beds.
- Firmly secure bookcases, artwork, mounted televisions and other objects to withstand as much shaking as possible.
- Take clear photos of valuables as a record for insurance purposes.
- Prepare an earthquake emergency kit with non-perishable food, bottled water, copies of important documents (birth certificates, prescriptions, insurance papers, etc.), flashlights, first aid materials, blankets, spare glasses, and other essential items and store it where it will be easily accessible in case of a quake.
- Keep cell phones charged and replace emergency kit supplies as necessary to keep them usable.
- Plan alternative commuting routes in case an earthquake damages roads.
- Set up a family meeting location in a safe area.
- Teach all family members basic first aid, how to behave during a quake, and what to do after a quake.

During an Earthquake

Earthquakes can last just a few seconds or as long as several minutes, and knowing how to react during the quake can help prevent injuries:

- Immediately seek a safe location such as in a doorway (if you live in an old, adobe house that is not reinforced), beneath a table or desk, or along an interior wall away from windows or hazardous objects.
- Cover the back of your head and your eyes to minimize injury from flying debris.
- Do not take elevators during an earthquake.
- If cooking, turn off heating elements immediately.
- If outdoors, stay in open areas away from buildings, power lines, trees, and other potential hazards.
- If driving, stop quickly but safely and stay in the vehicle. Do not stop near power lines, bridges, overpasses, or other potentially dangerous locations.
- Stay calm and brace yourself to keep your balance, sitting if possible.

After an Earthquake

Quick thinking after an earthquake hits can minimize immediate dangers. Proper earthquake safety precautions after a tremor include the following:

- Be prepared for aftershocks, which may be stronger than the initial jolt.
- Tend injuries immediately and summon emergency assistance if necessary.
- Check for structural damage, but do not enter a building that shows damage or has visible cracks in the walls or foundation.
- Wear shoes at all times to avoid stepping on broken glass.
- Turn off gas, [electricity](#), and water if damage is suspected or if advised to do so by authorities.
- Be cautious opening cabinets, cupboards, and closets in case items may be poised to fall.
- Keep phone lines clear for emergency use.
- Be patient: It may take hours or days to restore all services depending on the severity of the quake.

BEFORE A FLOOD

- **Avoid building in a [floodplain](#).**
- **Construct barriers (levees, beams, floodwalls) to stop floodwater from entering your home.**
- **Seal walls in basements with waterproofing compounds to avoid seepage.**
- **If a flood is likely in your area, listen to the radio or television for information.**
- **Know the difference between a flood watch and a flood warning. A watch means flooding is possible. A warning means flooding is occurring or will occur soon.**

WHEN A FLOOD IS IMMINENT

- **Be prepared! Pack a bag with important items in case you need to evacuate. Don't forget to include needed medications.**
- **If advised to evacuate your home, do so immediately.**
- **If there is any possibility of a [flash flood](#), move immediately to higher ground.**
- **If possible, bring in outdoor furniture and move essential items to an upper floor.**
- **Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances.**

DURING A FLOOD

- **Do not walk through moving water. As little as 6 inches (15 centimeters) of moving water can make you fall.**
- **If you have to walk in water, wherever possible, walk where the water is not moving.** Use a stick to check the firmness of the ground in front of you.
- **Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely.**
- **Do not touch electrical equipment if you are wet or standing in water.**

AFTER A FLOOD

- **Listen for news reports** to learn whether the community's water supply is safe to drink.
- **Avoid floodwaters; water may be contaminated by oil, gasoline, or raw sewage.** Water may also be electrically charged from
- **Avoid moving water.**
- **Be aware of areas where floodwaters have receded.** Roads may have weakened and could collapse under the weight of a car.
- **Stay away from downed power lines, and report them to the power company.**
- **Return home only when authorities indicate it is safe.**
- **Stay out of any building if it is surrounded by floodwaters.**
- **Service damaged septic tanks, cesspools, pits, and leaching systems as soon as possible.** Damaged sewage systems are serious health hazards.
- **Clean and disinfect everything that got wet. Mud left from floodwater can contain sewage and chemicals.**

Safety Precautions and Timely Actions to Reduce Damage:

Cyclone is 24 hours away:

- i. Fill water buckets and cover them.
- ii. Top up your car's fuel tank.
- iii. Ensure you have fresh batteries for your radio.
- iv. Make sure you have adequate supplies of prescribed medicines.
- v. Stock up on non perishable food items if required.
- vi. Ensure your neighbours are aware of the issued warning.

Cyclone is 16 hours away:

ADVERTISEMENTS:

- ii. Ensure your children are home.
- ii. Gather tools that will be needed for emergency repairs, e.g. hammer, nails, rope, and tarpaulins.
- iii. If you live in a caravan, identify a solid structure to which you can move if required.

Cyclone is 9 hours away:

- i. Prepare the safest part of your house (usually the bathroom) and place emergency stores there.
- ii. Account for and lock up your pets.
- iii. Gather protective gear and place in shelter.

When the Cyclone has passed:

- i. Listen to the media for regular updates.
- ii. Do not make unnecessary demands on the emergency services.
- iii. Do not touch wet switches, and beware of fallen power lines, treat them as if they are live.
- iv. Stay at home resist the urge to go sightseeing. The water surge caused by your vehicle can send flood water into people's homes.

UNIT-6

Social Issues and the Environment

FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT:-

Sustainable development is defined as “meeting the needs of the present without compromising the ability of the future generation to meet their own needs”. Our natural resources are just dividing due to over exploitation. if growth continuous in the same way, very soon we will be facing a doom’s day These are the key aspects for sustainable development.

(a) **Inter-generational equity:-**This emphasize that, we should minimize adverse impacts on resources and environment for future generation i.e. ,we should hand over a safe , healthy & resourceful environment to our future generation. This can be possible only if we stop over exploitation of resources, reduce waste discharge and emission & maintain ecological balance.

(b) **Intra-generational equity :-** This emphasize that, the development process should seek to minimize the wealth apps within and between nation. The technology should address to the problems of the developing countries, producing drought tolerant varieties for uncertain climates, vaccines for infectious diseases, clean fuels domestic and industrial use. This type of technological development will support economic growth of the poor and help in narrowing the wealth gap and lead to sustainability.

MEASURES FOR SUSTAINABLE DEVELOPMENT:-

A. USING APPROPRIATE TECHNOLOGY:- It is one which is locally adaptable, eco-friendly resource efficient and culturally suitable indigenous technologies are more useful, cost effective and sustainable. Nature is often taken as a model, using the natural conditions of that region as its components. This concept is knows as design with nature. The technology should use less of resources and should produce minimum waste.

B. REDUCE, REUSE, RECYCLE APPROACH:- The 3-R approach advocating of resource using them again and again instead of passing it on to the waste stream and recycling the materials goes a long way in achieving the goal of sustainability. It reduces pressure on or resources as well as reduces waste generation and population.

C.PROMPTING ENVIRONMENTAL EDUCATION AND AWARENESS:- 1.making environmental

education the centre of all learning process will greatly help In changing the thinking and attitude of people towards our earth and environment. 2. introducing the subject right

from the school stage will in calculate a feeling of belongingness to earth in the small children.

D.RESOURCE UTILIZATION AS PER CARRYING CAPACITY Any system can have a certain limited number of organism on a long turn bases which is known as its carrying capacity. Human beings not only need food to live , but need so many other things to maintain the quality of life. Sustainability of a system depends largely upon the carrying the capacity. Carrying capacity has two basic components 1.supporting capacity i.e, the capacity to generate. 2.Assimilative capacity i.e. the capacity to tolerate different stresses.

URBAN PROBLEMS RELATED TO ENERGY

1. Cities are the major centres of economic growth, trade, education innovations & employments.
2. A big majority of human population lived in rural areas & their economic activities centred around agriculture, cattle rearing fishing, hunting or some cottage industry.
3. 50% of the world population in urban area & there is movement of rural folk to cities in search for employment.
4. So, urban growth is so fast than it is becoming difficult to accommodate all the industrial commercial and residential facilities with in a limited municipal boundary spreading of the cities into the sub-urban or rural areas
5. In developing countries urban(growth) population is very fast and in most of the cases it is un-contractible and un planned growth.
6. In contrast, to the rural set up urban set up Is densely populated, consumers a lot of energy and material and generators a lot of waste.

Energy requirement of urban population are much higher than that of rural ones b/c urban people have a higher standard life and there life style demand more energy inputs in every sphere of life. These includes:

- a. Residential and commercial lighting.
- b. Transportation means including auto mobiles and public transport for moving from residency to work place.
- c. Modern lifestyle using large number of electrical gadgets in everyday life.
- d. Industrial plans using a big proportion of energy.
- e. A large amount of waste generation which has to be disposed properly using energy based techniques.

- f. Control and prevention air and water pollution which need energy dependent technologies. Due to high population density and high energy demanding activities the urban problem and related to energy or much more magnified as compared to rural population

Water conservation

Now a days water is a very major factor for the society. So for that water conservation is necessary for the future use. So it is the responsibility of each and every human being to store the water. The following are control measure for water conservation which is very necessary:-

- Turn Off the Water tap after each activity.
- Minimize Use of Kitchen Sink Garbage Disposal Units
- When Washing Dishes by Hand, Don't Leave the Water Running for Rinsing
- Don't Let the Faucet Run While You Clean Vegetables
- Check Faucets and Pipes for Leaks
- Use Your Water Meter to Check for Hidden Water Leaks
- Reuse Wastewater Where Possible
- Use Clothes Washer for Only Full Loads
- Consider a High Efficiency Washing Machine
- Check Your Toilets for Leaks
- Don't Run the Hose pipe While Washing Car

Rainwater harvesting

It is the process of collecting rainwater and putting it to good use. There are different ways in which this task can be accomplished.

Rainwater harvesting refers to the trapping and storing of rainwater so that it can be used at a later time when the need arises. As the rain falls, water is directed to a suitable collection point. It can also mean collecting rainwater before it infiltrates into the ground and becomes underground water. Harvesting mainly entails gathering something from its natural source.

Methods of Rainwater Harvesting

There are many ways in which rainwater can be harvested. Some of these methods are. These are the common methods of rainwater harvesting:

1. Surface Water Collection Systems: Surface water is simply water that accumulates on the ground's surface. When rainwater falls on the surface of the earth, it usually flows down slopes

as it moves towards a point of depression where the moving water can collect. Surface water collection systems enable the collection of ground surface rainwater before it flows to other locations. Examples of such systems include rivers, ponds, and wells.

2. Rooftop system: These can also be used to harvest rainwater. They can be used to direct rainwater that falls on the roof of a building into containers or tanks. These tanks are usually elevated so that when the tap is opened, water flows at a high pressure. This method of rainwater harvesting is good because the accumulated water is mostly clean and usually requires no further treatment to make it fit for human use.

3. Dams: These are barriers that are designed to trap water. Rainwater can accumulate directly in them or drainage systems can be created to direct water into them. Water collected in dams is mostly used for irrigation purposes or treated and then distributed for domestic use.

4. Underground Tanks: These are also ideal for collecting rainwater. They are constructed by digging into the ground and creating a space which is then cemented to reduce water infiltration. The top is also sealed and water is obtained through pipes directed into the tank. To get water out, pumps are used.

5. Water Collection Reservoirs: Water collected through this method is not really clean and may be contaminated. However, it can still be used for crop irrigation.

6. Barrage: A barrage is a dam that has several openings which can be closed or opened to control the quantity of water that passes through it. It is usually large and can be used to collect a lot of water.

7. Trenches: This is another great way to harvest rainwater for irrigation. When it rains, the water is directed to the farm using trenches. It is one of the traditional methods of rainwater harvesting that is still very much in use today.

8. Rain Barrels: These are also used for rainwater harvesting. They are specifically designed for this purpose and can be purchased from retail stores. Rain barrels are used for harvesting rainwater that falls on rooftops.

Advantages of Rainwater Harvesting

1. Water For Domestic Use: Rainwater harvesting is beneficial because it provides a source of water for domestic use. The collected water can be used for house cleaning purposes, washing laundry and for cooking. When treated, rainwater is good for drinking. It is an easy way of obtaining water for use in the home.

2. Water For Industrial Use: Industries can also harvest rainwater for use in some of their processes. Rainwater meant for industrial use is normally harvested in large scale. Such companies can construct their own dams or have underground tanks to store rainwater.

3. Cost Effective: We basically harvest rainwater for free because it is naturally occurring. If you store enough water during the rainy season, you may never have to pay for water services again because you'll have enough supply to last you through the summer. This saves you money by cutting down your monthly expenditure on water bills.

4. Mitigates/Reduces The Impacts of Floods: Harvesting rainwater plays a key role in mitigating or reducing the impacts of floods. When rainwater is directed to farms through trenches or collected in dams, its movement is controlled.

5. Building and Construction: Collected rainwater can be used for building and construction. The process of building a house requires a lot of water. Harvesting rainwater would thus avail water for this activity.

6. Helps In Preventing Water Pollution: Rainwater flowing on the ground surface can carry with it a lot of impurities and toxic substances. When it drains into water bodies, it pollutes them because of these impurities. Harvesting rainwater, therefore, prevents pollution of water bodies.

7. Irrigation: Rainwater is good for farming because once harvested, it can be used for irrigation especially during the summer. One can, therefore, have a thriving farm and realize a bumper harvest.

8. Saves Potable Water: Instead of using clean and treated water for other purposes such as washing and in the toilet, rainwater can be used. This saves potable water which would

Disadvantages of Harvesting Rainwater

1. Additional Expenditure: Treating rainwater to make it fit for human consumption will see you incurring additional expenses. This would not happen when you use water supplied to you by the local council because it's already treated.

2. Huge Efforts and Resources Required: Constructing a dam or an underground tank is no mean feat. Before you begin harvesting rainwater, you'll have spent a considerable amount of resources. There are other cheap means but then you'll not collect a reasonable amount of water.

3. Dependent On Rainfall: You can't harvest rainwater when it does not rain. This process is therefore solely dependent on the availability of rain which can sometimes be very unreliable.

What then happens when the dry spell is prolonged and you don't have an alternative source of water?

- 4. Limited Storage:** Even if it rains for three months straight, you cannot harvest all that water even if you wanted to. This is because there is limited storage to keep the rainwater.
- 5. Risk of Contamination:** If not preserved with care, rainwater can be contaminated. This can cause several health problems especially when the water is used without first being treated. Waterborne diseases are so many and treating them is very costly.
- 6. Cleaning and Maintenance:** The storage facilities have to be occasionally cleaned and maintained. Cleaning an underground water tank is not easy and maintaining a dam is very expensive. This makes the thought of harvesting rainwater unattractive.
- 7. Roof Tops That Contain Chemicals:** Some rooftops contain chemicals and impurities that mix with the rainwater. When consumed, this water can affect human health by causing illnesses and other health conditions.

WATERSHED MANAGEMENT

A **watershed** is simply the geographic area through which water flows across the land and drains into a common body of water, whether a stream, river, lake, or ocean.

Watershed is defined as a geo-hydrological unit draining to a common point by a system of drains. All lands on earth are part of one watershed or other. Watershed is thus the land and water area, which contributes runoff to a common point.

A watershed is an area of land and water bounded by a drainage divide within which the surface runoff collects and flows out of the watershed through a single outlet into a larger river (or) lake. Watershed technology is used in Rain fed areas.

Watershed management implies an effective conservation of soil and water resources for sustainable production with minimum non point resources (NPS) pollutant losses. It involves management of land surface and vegetation so as to conserve the soil and water for immediate and long term benefits to the farmers, community and society as a whole.

Catchment area is the water collecting area. "All the areas from which water flows out into a river or water pool".

TYPES OF WATERSHED

Watersheds is classified depending upon the size, drainage, shape and land use pattern.

Macro watershed (> 50,000 Hect)

Sub-watershed (10,000 to 50,000 Hect)

Milli-watershed (1000 to 10000 Hect)

Micro watershed (100 to 1000 Hect)

Mini watershed (1-100 Hect)

Objectives of watershed management

- a. Production of food, fodder, fuel.**
- b. Pollution control**
- c. Over exploitation of resources should be minimized**
- d. Water storage, flood control, checking sedimentation.**
- e. Wild life preservation**
- f. Erosion control and prevention of soil, degradation and conservation of soil and water.**
- g. Employment generation through industrial development dairy fishery production.**
- h. Recharging of ground water to provide regular water supply for consumption and industry as well as irrigation.**
- i. To control damaging runoff and degradation and thereby conservation of soil and water.**
- j. To manage and utilize the runoff water for useful purpose.**
- k. To protect, conserve and improve the land of watershed for more efficient and sustained production.**
- l. To protect and enhance the water resource originating in the watershed.**
- m. To check soil erosion and to reduce the effect of sediment yield on the watershed.**
- n. To rehabilitate the deteriorating lands.**
- o. To moderate the floods peaks at down stream areas.**
- p. To increase infiltration of rainwater.**
- q. To improve and increase the production of timbers, fodder and wild life resource.**
- r. To enhance the ground water recharge, wherever applicable.**

Watershed Management Programmes:

(i) Drought Prone Area Programme (DPAP):

Year of start: 1970-71

Objectives: Area development programme through restoration of ecological balance and optimum utilization of land, water, livestock and human resources to mitigate the effect of drought.

(ii) Desert Development Programme

(DDP): Year of start: 1977-78

Objectives: Mitigate the effect of drought in the desert area and restore ecological balance.

(iii) National Watershed Development Programme for Rain fed Agriculture (NWDPA):

Year of start: 1986-87

Objectives: To conserve and utilize rain water from both arable and non arable lands on watershed basis. To increase the productivity of crops and to increase the fuel, fodder and fruit resources through appropriate alternate land use system.

(iv) Control of Shifting Cultivation:

Year of start: 1986-87

Objectives: Restoring ecological balance in hilly areas and improving socioeconomic conditions.

(v) World Bank Assisted Integrated Watershed Development

Project: Year of start: 1990

Objectives: To arrest the problems of environmental degradation and promote sustainable increase in agriculture production and to enhance vegetative technology of soil and water conservation for rain water conservation and for increasing crop, forage, fuel wood and timber yield of the area.

Hazardous waste is [waste](#) that has substantial or potential threats to [public health](#) or the [environment](#).^[1] Hazardous wastes may be found in different physical states such as gaseous, liquids, or solids. The examples are paints, batteries, cleaning materials and pesticides.

Resettlement and Rehabilitation of People: Problems and Concerns!

It is a well-known fact that both natural and human made disasters force people to move out of their land. For example. Tsunami in South Asia in December 2004, Latur and Gujarat earthquake, the Orissa super-cyclone and scores of floods and droughts in other parts of our country have rendered thousands of people homeless and jobless. Disasters, like the Bhopal gas tragedy in Union carbide factory, derailment of trains, are examples of human made disaster.

Control Measure

Firstly, strategies should be made for rehabilitation of thus displaced people are in the first place by way of preventive action. For instance, care is taken to build earthquake proof houses, gather advance information about cyclones and arrange for timely evacuation, build appropriate bunds in flood prone areas, maintain bridges that take regular up and down passing of trains/ road transport vehicles on them in order to avert likely disasters.

Secondly, advance preparation on the part of administration and local communities are made to face the consequences of sudden calamities. For both these remedial steps, the primary necessity is that of building awareness among the people in general and among administrative personnel in particular.

Thirdly, advance planning should be made in the cases of natural and human made calamities is however quite limited and in comparison the Govt. we can certainly plan better in the cases of development projects which are planned in advance.

Fourthly the Govt. has developed many development projects to take care of people those who are affected by natural calamities. But the problem is that the in-charge should pay little attention to the processes of resettlement and rehabilitation of displaced people.

Fifthly, there are some institutional measure have been taken by the government by way of constituting committees at various levels. They exist on paper and their immediate response to the actual events is yet to come in any significant manner.

Finally, It is the responsibility of each human being and Govt. that they Should take some initiative relief measure for the disaster victim through resettlement and rehabilitation.

Environmental ethics: issue and possible solutions

- **Resource consumption patterns and the need for equitable utilization:** It deals with how we utilize and distribute resources. There is a difference between the individuals, communities and countries in usage of resources. The educated urban people consumes much larger quantities of resources and energy than the traditional rural individual. This unequal distribution of wealth and access to land and its resources is a serious environmental concern. An equitable sharing of resources forms the basis of sustainable development for urban, rural communities.
- **Equity-disparity in the northern and southern countries:** It is concerned with who owns resources and how they are distributed. People living in the economically-advanced

nations use greater amounts of resources and energy per individual and also waste more resources. This is at the cost poor people who are resource-dependent and live in developing nations.

- ☐ **Urban-rural equity issues:** The common property of rural communities has increasingly been used to supply the needs of the urban and industrial sectors. As the rural sector supplies food and a part of the energy needs (mainly fuel wood) to most towns and cities in India, the common lands of the rural sector are being depleted of their resources.
- ☐ **The need for gender equity:** All over India, especially in the rural sector, women work longer hours than men. They are involved in collection and sale of fuel wood, collection of fodder, fruits, medicinal products, trekking several kilometres to fetch potable water, cooking meals in smoky unhealthy atmosphere etc. On an average they spend 10-12 hrs a day of very hard work, every day of the year. Unfortunately, it is the men who play a decisive role in managing the village common and their resources while women have not been given an equal opportunity to develop and improve their status which is due to a lower access to education and health care than that of men. This has deep implications for the rate of utilization of natural resources and their conservation.
- **Preserving resources for future generations:** This ethical issue must be considered when we use resources unsustainably. If we overuse and misuse resources and energy from fossil fuels, our future generations will find survival very difficult.

The rights of animals: The plants and animals that share the Earth with us too have a right to live and share the Earth's resources and living space. We have no right to push a species that has taken millions of years to evolve towards extinction. Cruelty to animals is a crime that must be regarded seriously and action must be taken against offenders.

- **The ethical basis of environment education and awareness:** . The Supreme Court of our country has ordered that every young individual at school and college level be exposed to a course on environment.
- **The conservation ethic and traditional value systems of India:** During olden days, people have always valued mountains, rivers, forests, trees and several animals. Thus, much of nature was venerated and protected. Certain species of trees have been protected as they are valued for their fruit or flowers. Traditions held the animals/species as an

important aspect of nature were the basis of local life-support systems and were integral to bring about a harmonious life.

CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) defines it as a change of climate that is attributed directly or indirectly to human activity, altering the composition of the global atmosphere.

Human activity includes the pollution that arises from industrial activity and other sources that produce greenhouse gases. These gases, such as carbon dioxide, have the ability to absorb the spectrum of infrared light and contribute to the warming of our atmosphere. Once produced, these gases can remain trapped in the atmosphere for tens or hundreds of years.

Global warming

Global warming is defined as the increase in the temperature on earth's surface due to various reasons. The reasons include both by human and natural but the major contribution towards the global warming is from human and his activities. The natural causes include volcanic eruptions and other natural hazards. Due to volcanic eruption there is a production large amount of heat and this heat will transmitted to the atmosphere and there will be a increase in the atmospheric temperature. The other reasons are the activities of human that lead to the global warming. They are listed below:

Exhaust from vehicles

The exhaust from vehicles are mainly compounds of carbon including carbon dioxide, carbon monoxide etc. The incomplete or partial combustion of fossil fuel will release more harmful gases to the atmosphere and these gases increase heat in the atmosphere this also results in the global warming.

Exhaust from jet plane and other commercial planes

The exhaust from the jet planes directly enter to the atmosphere because they are flying in the high altitudes which is near to the ozone layer. These exhausts are by-product of burned fossil fuel.

Exhaust from industries

Many industries exhaust their exhaust gas directly to the atmosphere these gasses are very harmful and capable of producing holes in the ozone layer. These gasses include sulfur dioxide, carbon monoxide, carbon dioxide etc.

Exhaust from various power plants mainly non conventional

Non conventional power plants are power plants use non conventional power source such as fossil fuel, coal etc for their energy source. These power plants emits a lot of gasses to the atmosphere which is very harmful to the ozone layer.

Green house gasses

Carbon dioxide, methane, water vapour, nitrous oxide, etc are collectively called green house gas. Water vapour are released when the surface water bodies become hot and the water evaporates to the atmosphere. The methane is formed from the dead and decay of organic materials.

Gasses released from mines

Gasses released from mines also a make good contribution to the ozone depletion many greenhouse gasses are release from the mines which released to atmosphere and make serious damage on the Ozone layer.

Effects of global warning

1. Rise in sea level world wide

Scientists predict an increase in sea levels worldwide due to the melting of two massive ice sheets in Antarctica and Greenland, especially on the East coast of the U.S. However, many nations around the world will experience the effects of rising sea levels, which could displace millions of people.

2. Severe storms

The severity of storms such as hurricanes and cyclones is increasing and it may destroy the population and the habitat of the animals.

3. Massive crop failures due to climate change.

“Climate change is expected to have the most severe impact on water supplies. Shortages in future are likely to threaten food production, reduce sanitation, hinder economic development and damage ecosystems.

4. Widespread extinction of species

“Climate change now represents at least as great a threat to the number of species surviving on Earth as habitat-destruction and modification

5. Disappearance of coral reefs

Due to prolonged rise in sea temperature causes severe danger for ocean ecosystems, and many other species in the oceans rely on coral reefs for their survival.

Remedial measures

1. Plant maximum number of trees as they releases oxygen and absorbs CO₂ present in atmosphere. In this way a tree balance the temperature of air and reduces the amount of CO₂ present in air.
2. Vehicles release many harmful gases in the air. Hence try to drive those cars which run on gas or electricity. If possible minimize the use of personal vehicle and travel by public transport. This way we can also control the problem of pollution.
3. Use fans more than air conditioners to use less energy. Hot air releases from air conditioner is one of the major factor behind global warming.
4. Avoid to use water heater or use that on temperature lesser than 120 F.
5. Instead of dryers take an advantage of sun light to dry wet cloths.
6. Unplug all the electrical appliances if they are not in use.
7. For less amount of carbon emission we can also use renewable energy like wind power which generate negligible amount of harmful gases.
8. Use recyclable materials instead of disposable materials. This is good to control on waste.

ACID RAIN

Acid rain means the presence of excessive acids in rain water. Thermal power plants, industries and vehicles release nitrous oxide and sulphur dioxide into the atmosphere by burning of coal and oil. When these gases react with water vapour in the atmosphere, they form acids and descend on Earth as "acid rain" through rain water.

Causes of Acid Rain

Both natural and man-made sources are known to play a role in the formation of acid rain. But, it is mainly caused by combustion of fossil fuels which results in emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x).

1. Natural Sources

The major natural causal agent for acid rain is volcanic emissions. Volcanoes emit acid producing gases to create higher than normal amounts of acid rain or any other form of precipitation such as fog and snow to an extent of affecting vegetation cover and health of residents within the surrounding.

Man-made sources

Human activities leading to chemical gas emissions such as sulphur and nitrogen are the primary contributors to acid rain. The activities include air pollution sources emitting sulphur and nitrogen gases like factories, power generations facilities, and automobiles. In particular, use of coal for electrical power generation is the biggest contributor to gaseous emissions leading to acid rain. Automobiles and factories also release high scores of gaseous emissions on daily basis into the air, especially in highly industrialized areas and urban regions with large numbers of car traffic.

Effects of Acid Rain

Acid rain has significant effects on the world environment and public health.

- **Effect on Aquatic Environment:** Acid rain puts affect on aquatic environment. The aquatic plants and animals need a particular pH level of about 4.8 to survive. If the pH level falls below that the conditions become hostile for the survival of aquatic life.
- **Effect on Forests:** It makes trees vulnerable to disease, extreme weather, and insects by destroying their leaves, damaging the bark and arresting their growth.
- **Effect on Soil:** Acid rain highly impacts on soil chemistry and biology. It means, soil microbes and biological activity as well as soil chemical compositions such as soil pH are damaged or reversed due to the effects of acid rain.
- **Vegetation Cover and Plantations:** The damaging effects of acid rain on soil and high levels of dry depositions have endlessly damaged high altitude forests and vegetation cover since they are mostly encircled by acidic fogs and clouds.
- **Effect on Architecture and Buildings:** Acid rain on buildings, especially those constructed with limestone are affected severely. Modern buildings, cars, airplanes, steel bridges and pipes are all affected by acid rain. Irreplaceable damage can be caused to the old heritage buildings.
- **Effect on Public Health:** When in atmosphere, sulphur dioxide and nitrogen oxide gases and their particulate matter derivatives like sulphates and nitrates, degrades visibility and can cause accidents, leading to injuries, deaths and other health problems.

Solutions to Acid Rain

1 Alternative Energy Sources

Besides fossil fuels, there is a wide range of alternative energy sources that can generate electrical power. These include wind energy, geothermal energy, solar energy, hydropower, and nuclear power.

2 Individual, National/State, and International Actions

Millions of people directly and indirectly contribute to SO₂ and NO_x emissions. Mitigation of this challenge requires individuals to be more informed about energy conservation and ways of reducing emissions such as: turning off lights or electrical appliances when not using them; use public transport; use energy efficient electrical appliances; and use of hybrid vehicles.

OZONE LAYER DEPLETION

There are different layers of the atmosphere. The earth's atmosphere is composed of many layers, each playing a significant role. The first layer stretching approximately 10 kilometers upwards from the earth's surface is known as the troposphere. A lot of human activities such as gas balloons, mountain climbing, and small aircraft flights take place within this region.

The stratosphere is the next layer above the troposphere stretching approximately 15 to 60 kilometers. The ozone layer sits in the lower region of the stratosphere from about 20-30 kilometers above the surface of the earth. The thickness of the ozone layer is about 3 to 5 mm, but it pretty much fluctuates depending on the season and geography.

Ozone layer is a deep layer in earth's atmosphere that contain ozone which is a naturally occurring molecule containing three oxygen atoms. These ozone molecules form a gaseous layer in the Earth's upper atmosphere called stratosphere. This lower region of stratosphere containing relatively higher concentration of ozone is called Ozonosphere. The Ozonosphere is found 15-35 km (9 to 22 miles) above the surface of the earth.

CAUSES OF OZONE LAYER DEPLETION

Natural causes of depletion of ozone layer: Ozone layer has been found to be affected by certain natural phenomena such as Sun-spots and stratospheric winds. But this has been found to cause not more than 1-2% depletion of the ozone layer and the effects are also thought to be only temporary. It is also believed that the major volcanic eruptions has also contributed towards ozone depletion.

Man-made causes of depletion of ozone layer: The main cause for the depletion of ozone is determined as excessive release of chlorine and bromine from man-made compounds such as chlorofluorocarbons (CFCs). CFCs (chlorofluorocarbons), halons, CH₃CCl₃ (Methyl

chloroform), CCl₄ (Carbon tetrachloride), HCFCs (hydro-chlorofluorocarbons), hydro-bromofluorocarbons and methyl bromide are found to have direct impact on the depletion of the ozone layer.

Serious Effects of Ozone Depletion

1.Damage to human health

If the ozone layer is depleted, it means humans will be overly exposed to strong UV light. Overexposure to strong UV light causes skin cancer, cataracts, sunburns, weakening of immune system and quick aging.

2.Devastation to environment

Many crops species are vulnerable to strong UV light and overexposure may well lead to minimal growth, photosynthesis and flowering. Some of the crop species vulnerable to UV light include barley, wheat, corn, oats, rice, broccoli, tomatoes, cauliflower just to name a few. Forests equally also effected by ozone depletion.

3.Threat to marine life

Certain marine life, especially planktons, is greatly impacted by exposure to strong ultraviolet rays. In the aquatic food chain, planktons appear high up. If planktons decrease in number due to ozone layer destruction, the marine food chain would be disrupted in many ways. Also, overexposure of sun rays could reduce the fortunes of fishers.

4.Effect on animals

In domesticated animals, too much Ultraviolet radiation could also lead to skin and eye cancer.

5.Impacts certain materials

Materials like plastics, wood, fabrics, rubber are massively degraded by too much ultraviolet radiation.

Solutions to Ozone Depletion

- Desist from using pesticides

Pesticides are the concentration of many chemicals materials and causes for ozone layer depletion. So it is advised to use alternative eco-friendly chemicals instead of pesticides.

- Discourage driving of private vehicles

The easiest technique to minimize ozone depletion is to limit the number of vehicles on the road. These vehicles emit a lot of greenhouse gases that eventually form smog, which is the main cause of the depletion of ozone layer.

- Utilize environmentally friendly cleaning products

Most household cleaning products are loaded with harsh chemicals that find way to the atmosphere, eventually contributing to degradation of the ozone layer. Use natural and environmentally friendly cleaning products to arrest this situation.

- Nitrous oxide, which is a known harmful chemical that can destroy the ozone layer. Nitrous oxide is still in use today. Governments must take action now and outlaw nitrous oxide use to reduce the rate of ozone depletion.

NUCLEAR ACCIDENTS AND HOLOCAUST

A nuclear and radiation accident is defined by the International Atomic agency as an “event that has led to significant consequences to people, the environment or the facility”. Examples include lethal effects to individuals, large radioactivity release to the environment, or “reactor core melt.” The prime example of a “major nuclear accident” is one in which a reactor core is damaged and significant amounts of radiation are released, such as in the Chernobyl Disaster in 1986. The impact of nuclear accidents has been a topic of debate practically since the first nuclear reactors were constructed. It has also been a key factor in public concern about nuclear facilities.

Two of the major nuclear accidents are as follows:

(i) Chernobyl Nuclear Disaster:

26th of April 1986 witnessed one of the world’s worst Nuclear Disaster ever in Chernobyl. Chernobyl is approximately 80 miles (which is 120 kilometers) north of the capital city of the Ukraine, Kiev. The accident took lives of 30 people immediately and vast evacuation of 135000 people within 20 mile radius of the power plant was carried out after the accident.

Causes of the Accident:

There was not one cause of this accident, there were several which all contributed to it. This accident happened while testing an RBMK reactor. A chain reaction occurred in the reactor and got out of control, causing explosions and a huge fireball which blew off the heavy concrete and steel lid on the reactor.

These are the causes:

1. Design fault in RBMK reactor
2. A violation, of procedures
3. Breakdown of communication
4. Lack of a ‘Safety Culture’ in the power plant

Consequences of the Accident:

1. Environmental consequences:

The radioactive fallout caused radioactive material to deposit itself over large areas of ground. It has had an effect over most of the northern hemisphere in one way or another. In some local ecosystems within a 6 mile (10 km) radius of the power plant the radiation is lethally high especially in small mammals such as mice and coniferous trees. Luckily within 4 years of the accident nature began to restore itself, but genetically these plants may be scarred for life.

2. Health effects:

Firstly, there was a huge increase in Thyroid Cancer in Ukrainian children (from birth to 15 years old). From 1981-1985 there was an average of 4-6 patients per million but between 1986 and 1997 this increased to an average of 45 patients per million.

It was also established that 64% of Thyroid Cancer patients lived in the most contaminated areas of the Ukraine (Kiev province, Kiev city, provinces of Rovno, Zhitomir, Cherkassy and Chernigov).

3. Psychological consequences:

There has been an increase in psychological disorders such as anxiety, depression, helplessness and other disorders which lead to mental stress. These disorders are not a consequence of radiation, but a consequence from the stress of evacuation, the lack of information given after the accident and the stress of knowing that their health and their children's health could be affected.

4. Economic, political and social consequences:

The worst contaminated areas were economically, socially and politically declining as the birth rate had decreased and emigration numbers had substantially risen which had caused a shortage in labour force. These areas could not evolve industrially or agriculturally because of strict rules that were introduced because the area was too contaminated.

(ii) Fukushima Daiichi Nuclear Disaster:

The Fukushima Daiichi nuclear disaster was a series of equipment failures, nuclear meltdowns, and releases of radioactive materials at the Fukushima I Nuclear Power Plant, following the Tohoku earthquake and tsunami on 11 March, 2011. It is the largest nuclear disaster since the Chernobyl disaster of 1986.

The plant comprises six separate boiling water reactors originally designed by General Electric (GE), and maintained by the Tokyo Electric Power Company (TEPCO). At the time of the

quake, Reactor 4 had been de-fuelled while 5 and 6 were in cold shutdown for planned maintenance. The remaining reactors shut down automatically after the earthquake, and emergency generators came online to control electronics and coolant systems. The tsunami resulted in flooding of the rooms containing the emergency generators. Consequently those generators ceased working, causing eventual power loss to the pumps that circulate coolant water in the reactor. The pumps then stopped working, causing the reactors to overheat due to the high decay heat that normally continues for a short time, even after a nuclear reactor shut down.

WILDLIFE PROTECTION ACT (1972) OF INDIA!

The Wildlife Act was passed in 1972 to protect the wildlife and their habitats. The habitat destruction due to agriculture, industries, urbanisation and other human activities had led to the erosion of the country's wildlife.

The major activities and provisions in the act can be summed up as follows:

1. It defines the wildlife related terminology.
2. Enactment of an All India Wildlife Protection Act (1972).
3. It provides for the appointment of wildlife advisory Board, Wildlife warden, their powers, duties etc.
4. Becoming a party to the Convention of International Trade in Endangered Species of Fauna and Flora (CITES, 1976).
5. Launching a “national component of UNESCO’s ‘Man and Biosphere Programme’ (1971).
6. Under the Act, comprehensive listing of endangered wildlife species was done for the first time and prohibition of hunting of the endangered species was mentioned.
7. Protection to some endangered plants.
8. The Act provides for setting up of National Parks, Wildlife Sanctuaries etc.
9. The Act provides for the constitution of Central Zoo Authority.
10. There is provision for trade and commerce in some wildlife species with license for sale, possession, transfer etc.
11. The act imposes a ban on the trade or commerce in scheduled animals.
12. It provides for legal powers to officers and punishment to offenders.

It provides for captive breeding programme for endangered species. Several Conservation Projects for individual endangered species like Lion (1972), Tiger (1973), Crocodile (1974) and

Brown antlered Deer (1981) were stated under this Act. The Act is adopted by all states in India except J & K, which has its own Act.

Some of the major drawbacks of the Act include mild penalty to offenders, illegal wildlife trade in J & K, personal ownership certificate for animal articles like tiger and leopard skins, no coverage of foreign endangered wildlife, pitiable condition of wildlife in mobile zoos and little emphasis on protection of plant genetic resources.

ENVIRONMENTAL POLLUTION ACT--1986

This Act has been brought into force from November, 1986. Its salient features are:

(a) Conferring powers on the Central Government to:

(i) Take all necessary measures for **protecting** quality of **environment**,

(ii) Co-ordinate actions of States, officers and other authorities under this Act,

(iii) Plan and execute a nationwide programme for prevention, control and abatement of environmental pollution,

(iv) Lay down standards for discharge of environmental pollutants,

(v) Empower any person to enter, inspect, take samples and test,

(vi) Establish or recognise environmental laboratories,

(vii) Appoint or recognise government analysts, (viii) lay down standards for quality of environment,

(ix) Restrict areas in which any industries, operations or processes may not be carried out subject to certain safeguards,

(x) Lay down safeguards for prevention of accidents and take remedial measures in case of such accidents,

(xi) Lay down procedures and safeguards for handling hazardous substances,

(xii) Constitute an authority for exercising powers,

(xiii) Issue directions to any person, officer or authority including the power to direct closure, prohibition or regulation of any industry, operation or process,

(xiv) Require any person, officer or authority to furnish any prescribed information and

(xv) Delegate powers to any officer of a state or authority;

(b) It confers powers on persons to complain to courts regarding any violation of the provisions of the Act, after a notice of 60 days to the prescribed authorities;

- (c) The Act makes it obligatory for the person in charge of a place to inform the prescribed authorities regarding any accidental discharge of any pollutant in excess of prescribed standards. The concerned authorities, on receipt of such information, shall take remedial measures to prevent or mitigate pollution caused by such accidents and expenses incurred by the authorities in respect of remedial measures are recoverable with interest from the polluter;
- (d) It prescribes stringent penalties for violation of the provisions of the Act; and
- (e) Jurisdiction of civil courts is barred under the Act.

A comprehensive Environment (Protection) Act came into being in 1986 to remedy the lacunae noticed in the earlier laws and to serve as a single legislation on the subject.

The Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974 were amended to bring their provisions at par with those of The Environment (Protection) Act, 1986 and to give more powers to the implementing agencies.

AIR PREVENTION AND CONTROL OF POLLUTION ACT (1981) OF INDIA!

It makes provisions, interlaid, for Central and State Boards, power to declare pollution control areas, restrictions on certain industrial units, authority of the Boards to limit emission of air pollutants, power of entry, inspection, taking samples and analysis, penalties, offences by companies and Government and cognizance of offences etc..

The Act specifically empowers State Government to designate air pollution areas and to prescribe the type of fuel to be used in these designated areas. According to this Act, no person can operate certain types of industries including the asbestos, cement, fertilizer and petroleum industries without consent of the State Board.

The Government passed this Act in 1981 to clean up our air by controlling pollution. It states that sources of air pollution such as industry, vehicles, power plants, etc., are not permitted to release particulate matter, lead, carbon monoxide, sulfur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level. To ensure this, Pollution Control Boards (PCBs) have been set up by Government to measure pollution levels in the atmosphere and at certain sources by testing the air. The particulate matter and gases that are released by industry and by cars, buses and two wheelers is measured by using air-sampling equipment. However, the most important aspect is for people themselves to appreciate the dangers of air pollution and reduce their own potential as polluters by seeing that their own vehicles or the industry they work in reduces levels of emissions. This Act is created to take

appropriate steps for the preservation of the natural resources of the Earth which among other things includes the preservation of high quality air and ensures controlling the level of air pollution.

The main objectives of the Act are as follows:

- (a) To provide for the prevention, control and abatement of air pollution.
- (b) To provide for the establishment of central and State Boards with a view to implement the Act.
- (c) To confer on the Boards the powers to implement the provisions of the Act and assign to the Boards functions relating to pollution.

Powers and Functions of the Boards:

Central Pollution Board:

The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country.

The-Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provides technical assistance and guidance to State Boards and lays down standards for the quality of air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

State Pollution Control Boards:

The State Boards have the power to advise the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equipment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution. They are expected to inspect air pollution control areas at intervals or whenever necessary. They are empowered to provide standards for emissions to be laid down for different industrial plants with regard to quantity and composition of emission of air pollutants into the atmosphere. A State Board may establish or recognize a laboratory to perform this function. The State Governments have been given powers to declare air pollution control areas after consulting with the State Board and also give instructions to ensure standards of emission from automobiles and restriction on use of certain industrial plants.

Penalties: The persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution.

WATER PREVENTION AND CONTROL OF POLLUTION ACT,1974

This act aims to prevent and control water pollution and to maintain/restore of water by establishing central and state pollution control board to monitor and enforce the regulations. Water (Prevention & Control of Pollution) Act, 1974 is a comprehensive legislation that regulates agencies responsible for checking on water pollution and ambit of pollution control boards both at the centre and states. The Water (Prevention & Control of Pollution) Act, 1974 was adopted by the Indian parliament with the aim of prevention and control of Water Pollution in India. Some of the important features for regulating the prevention of water pollution as per the act are as discussed below.

The Central Board may perform all or any of the following functions, namely,-

- advise the Central Government on any matter concerning the prevention and control of water pollution;
- co-ordinate the activities of the State Boards and resolve disputes among them;
- provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution;
- plan and organise the training of persons engaged or to be engaged in programmes for the prevention, control or abatement of water pollution on such terms and conditions as the Central Board may specify;
- organise through mass media a comprehensive programme regarding the prevention and control of water pollution;
- collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control and prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and disseminate information connected therewith;
- lay down, modify or annul, in consultation with the State Government concerned, the standards for a stream or well;
- plan and execute a nation-wide programme for the prevention, control or abatement of water pollution;
- perform such other functions as may be prescribed.

- Water Act 1974 aims to prevent and control water pollution.
- Under Water Act, 1974, pollution control boards were created, who are responsible for implementation of its provisions.
- Under Water Act 1974, Sewage or pollutants cannot be discharged into water bodies including lakes and it is the duty of the state pollution control board to intervene and stop such activity.
- Anyone failing to abide by the laws of under is liable for imprisonment under Section 24 & Section 43 ranging from not less than one year and six months to six years along with monetary fines.

WASTE LAND RECLAMATION

Waste land reclamation refers to the process of making land useful by restoring it from wetlands, seas, lakes, deserts or mines, through drainage or irrigation. It also refers to the restoration of land that is damaged by natural phenomena, such as erosion, or impaired by industrial and urban processes. In other words Reclamation of waste land means re-claiming it or to use it for productive purposes.

1. Afforestation:

It means growing the forest over cultivable wasteland.

2. Reforestation:

Growing the forest again over the lands where they were existing and was destroyed due to fires, overgrazing, and excessive cutting. Reforestation checks water logging, floods, soil erosion and increase productivity of land.

3. Providing surface cover:

The easiest way to protect the land surface from soil erosion is of leave crop residue on the land after harvesting.

4. Mulching:

Here also protective cover of organic matter and plants like stalks, cotton stalks, tobacco stalks etc. are used which reduce evaporation, help in retaining soil moisture and reduce soil erosion.

5. Changing Ground Topography on Downhill's:

Running water erodes the hill soil and carries the soil along with it. This can be minimized by following alternation in ground topography:

(a) Strip farming:

Different kinds of crops are planted in alternate strip along the contour.

(b) Terracing:

In this arrangement, the earth is shaped in the form of levelled terraces to hold soil and water.

The terrace edges are planted with such plant species which anchor the soil.

(c) Contour ploughing:

In this arrangement, the ploughing of land is done across the hill and not in up and down style.

6. Leaching:

In salt affected land, the salinity can be minimized by leaching them with more water.

7. Changing agricultural practices:

Like mixed cropping, crop rotation and cropping of plants are adopted to improve soil fertility.

8. Ecological Succession:

This refers to the natural development or redevelopment of an ecosystem which help in reclaiming the minerally deficient soil of wasteland.

Public Awareness

1. Government should organize Environmental Education campaign programmes for children, youth, men and women. The state government should establish appropriate funding mechanisms for raising public awareness of environmental education.
2. Government officials can make significant contributions to improve public awareness of environmental education.
3. NGOs (at national and community levels) should initiate and help by awareness campaigns to save environment.
4. Ban the littering of polythene cannot be successful until the public understands the environmental implications of the same.
5. Proper methods of disposal and its treatment should be applied otherwise they can be the causes of chronic diseases. When sewage is applied continuously on a part of land, the pores or voids of the soil are clogged and free circulation of air is prevented.
6. Humans are responsible for depletion of the natural resources; degradation of the vital life-supporting systems (like air, water, soil, etc.); ecological imbalance; deteriorated environment, etc. By exercising following actions, humans can protect global environment for sustainable development:

- i. Preserve forest cover: Humans should minimize cutting of trees and using timber for aesthetic pleasure such as decoration of drawing rooms.
- ii. Preserve natural resources: Human should not extract unnecessarily and exhaustively the natural resources such as mineral resources, water resources, etc.
- iii. Conserve energy: Human should not harness too much energy from burning of fossil fuels. iv. Maintain ecological balance: Human should exploit synergy between green revolution and industrial evolution by compulsory growing green belts around industrial areas, maintaining wild life sanctuaries and national parks.
- v. Practice green technology: Everyone from a farmer in the village to a policy planner in the government should use green technology that incorporates: treatment of air emissions, treatment of waste waters, waste reduction, waste or emission management, use of non-conventional, renewable energy resources like solar energy on priority, etc.

UNIT-7

Human Population and the Environment

Our global human population, 6 billion at present, will cross the 7 billion mark by 2015. The needs of this huge number of human beings cannot be supported by the Earth's natural resources, without degrading the quality of human life. In the near future, fossil fuel from oil fields will run dry. It will be impossible to meet the demands for food from existing agro systems. Pastures will be overgrazed by domestic animals and industrial growth will create ever-greater problems due to pollution of soil, water and air. Seas will not have enough fish.

Degradation of ecosystems will lead to extinction of thousands of species, destabilizing natural ecosystems of great value. These are only some of the environmental problems related to an increasing human population and more intensive use of resources that we are likely to face in future. These effects can be averted by creating a mass environmental awareness movement that will bring about a change in people's way of life.

Increase in production per capita of agricultural produce at a global level ceased during the 1980's. In some countries, food shortage has become a permanent feature. Two of every three children in South Africa are underweight.

In other regions famines due to drought have become more frequent. Present development strategies have not been able to successfully address these problems related to hunger and malnutrition. On the other hand, only 15% of the world's population in the developed world is earning 79% of income! Thus the disparity in the extent of per capita resources that are used by people who live in a 'developed' country as against those who live in a 'developing' country is extremely large. Similarly, the disparity between the rich and the poor in India is also growing.

The increasing pressures on resources place great demands on the in-built buffering action of nature that has a certain ability to maintain a balance in our environment. However, current development strategies that essentially lead to short-term gains have led to a breakdown of our Earth's ability to replenish the resources on which we depend.

Global population growth

The world population is growing by more than 90 million per year, of which 93% is in developing countries. This will essentially prevent their further economic 'development'. In the past, population growth was a gradual phenomenon and the Earth's ability to replenish resources was capable of adjusting to this increase. In the recent past, the escalation in growth of human numbers has become a major cause of our environmental problems.

It is not the census figures alone that need to be stressed, but an appreciation of the impact on natural resources of the rapid escalation in the rate of increase of human population in the recent past. The extent of this depletion is further increased by affluent societies that consume per capita more energy and resources, that less fortunate people. This is of great relevance for developing a new ethic for a more equitable distribution of resources.

POPULATION EXPLOSION – FAMILY WELFARE PROGRAM

In response to our phenomenal population growth, India seriously took up an effective Family Planning Program which was renamed the Family Welfare Program. Slogans such as '*Hum do hamare do*' indicated that each family should not have more than two children. It however has taken several decades to become effective

Informing the public about the various contraceptive measures that are available is of primary importance. This must be done actively by Government Agencies such as Health and Family Welfare, as well as Education and Extension workers. It is of great importance for policy makers and elected representatives of the people – Ministers, MPs, MLAs at Central and State levels – to understand the great and urgent need to support Family Welfare. The media must keep people informed about the need to limit family size and the ill effects of a growing population on the world's resources.

Human populations will inevitably expand from farm lands into the remaining adjacent forests. Many such encroachments in India have been regularised over the last few decades. But forest loss has long-term negative effects on water and air quality and the loss of biodiversity is still not generally seen as a major deterrent to human well-being. The extinction of plant and animal species resulting from shrinking habitats threatens to destroy the Earth's living web of life.

Methods of sterilization

India's Family Welfare Program has been fairly successful but much still needs to be achieved to stabilize our population. The most effective measure is the one most suited to the couple once they have been offered all the various options that are available. The Family Welfare Program advocates a variety of measures to control population. Permanent methods or sterilisation are done by a minor surgery. Tubectomy in females is done by tying the tubes that carry the ovum to the uterus. Male sterilization or vasectomy, is done by tying the tubes that carry the sperm. Both are very simple procedures, done under local anesthesia, are painless and patients have no post operative problems. Vasectomy does not cause any loss in the male's sexual ability but only arrests the discharge of sperm.

There are several methods of temporary birth control. Condoms are used by males to prevent sperms from fertilizing the ovum during intercourse. Intrauterine devices (Copper Ts) are small objects which can be placed by a doctor in the uterus so that the ovum cannot be implanted, even if fertilized. They do not disturb any functions in the

woman's life or work. Oral contraceptive tablets (pills) and injectable drugs are available that prevent sperms from fertilizing the ovum.

There are also traditional but less reliable methods of contraception such as abstinence of the sexual act during the fertile period of the women's cycle and withdrawal during the sexual act.

Urbanization

In 1975 only 27% of the people in the developing world lived in urban areas. By 2000 this had grown to 40% and by 2030 well informed estimates state that this will grow to 56%. The developed world is already highly urbanized with 75% of its population living in the urban sector.

Urban population growth is both due to migration of people to towns and cities from the rural sector in search of better job options as well as population growth within the city. As a town grows into a city it not only spreads outwards into the surrounding agricultural land or natural areas such as forests, grasslands and wetlands but also grows skywards with high rise buildings. The town also loses its open spaces and green cover unless these are consciously preserved. This destroys the quality of life in the urban area.

Good urban planning is essential for rational land use planning, for upgrading slum areas, improving water supply and drainage systems, providing adequate sanitation, developing effective waste water treatment plants and an efficient public transport system.

Small urban centers too will grow rapidly during the next decades and several rural areas will require reclassification as urban centers. India's urban areas will grow by a projected 297 million residents. In India people move to cities from rural areas in the hope of getting a better income. This is the 'Pull' factor. Poor opportunities in the rural sector thus stimulates migration to cities. Loss of agricultural land to urbanisation and industry, the inability of governments to sustainably develop the rural sector, and a lack of supporting infrastructure in rural areas, all push people from the agricultural and natural wilderness ecosystems into the urban sector. As our development strategies have focused attention mostly on rapid industrial development and relatively few development options are offered for the agricultural rural sector, a shift of population is inevitable.

Urban poverty is even more serious than rural poverty, as unlike the rural sector, the urban poor have no direct access to natural resources such as relatively clean river water, fuelwood and non wood forest products. The urban poor can only depend on cash to buy the goods they need, while in the rural sector they can grow a substantial part of their own food. Living conditions for the urban poor are frequently worse than for rural poor. Both outdoor and indoor air pollution due to high levels of particulate matter

and sulphur dioxide from industrial and vehicle emissions lead to high death rates from respiratory diseases. Most efforts are targeted at outdoor air pollution. Indoor air pollution due

to the use of fuel wood, waste material, coal, etc. in 'chulas' is a major health issue. This can be reduced by using better designed 'smokeless' chulas, hoods and chimneys to remove indoor smoke. With the growing urban population, a new crisis of unimaginable proportions will develop in the next few years. Crime rates, terrorism, unemployment, and serious environmental health related issues can be expected to escalate. This can only be altered by stabilizing population growth on a war footing.

ENVIRONMENT AND HUMAN HEALTH

Environment related issues that affect our health have been one of the most important triggers that have led to creating an increasing awareness of the need for better environmental management. Changes in our environment induced by human activities in nearly every sphere of life have had an influence on the pattern of our health. The assumption that human progress is through economic growth is not necessarily true. We expect urbanization and industrialization to bring in prosperity, but on the down side, it leads to diseases related to overcrowding and an inadequate quality of drinking water, resulting in an increase in waterborne diseases such as infective diarrhoea and air borne bacterial diseases such as tuberculosis.

CASE STUDY

Bhopal Gas Tragedy

The siting of industry and relatively poor regulatory controls leads to ill health in the urban centers. Accidents such as the Bhopal gas tragedy in 1984 where Union Carbide's plant accidentally released 30 tones of methyl isocyanate, used in the manufacture of pesticides, led to 3,330 deaths and 1.5 lakh injuries to people living in the area.

Climate and health

Human civilizations have adapted mankind to live in a wide variety of climates. From the hot tropics to the cold arctic, in deserts, marshlands and in the high mountains. Both climate and weather have a powerful impact on human life and health issues.

Other diseases were not known to science earlier and seem to have suddenly hit our health and our lives during the last few decades. AIDS, due to the Human Immunodeficiency Virus (HIV) caused through sexual transmission and Severe Acute Respiratory Syndrome (SARS) are two such examples. While these cannot be directly related to environmental change, they affect the environment in which we live by forcing a change in lifestyles and behaviour patterns. For example the SARS outbreak prevented people from several countries from traveling to other countries for months, severely affecting national economies, airline companies and the tourism industry.

With increasing global warming disease patterns will continue to change. Tropical diseases spread by vectors such as the mosquito will undoubtedly spread malaria further away from the equator. Global warming will also change the distribution of dengue, yellow fever, encephalitis, etc. Warmer wetter climates could cause serious epidemics of diseases such as cholera. El Nino which causes periodic warming is likely to affect rodent populations. This could bring back diseases such as the plague.

CASE STUDY

Tuberculosis in India

There are 14 million TB patients in India, account for one third of the global cases of TB. Everyday 20,000 Indians contract TB and more than 1,000 die due to this chronic illness. TB attacks working adults in the age group of 15 to 50 years.

Malaria is a life-threatening parasitic disease transmitted by mosquitoes. The cause of malaria, a single celled parasite called plasmodium, was discovered in 1880. Later it was found that the parasite is transmitted from person to person through the bite of a female Anopheles mosquito, which requires blood for the growth of her eggs. There are several types of human malaria. Falciparum malaria is the most dangerous type of infection and is most common in Africa south of the Sahara, where it accounts for extremely high mortality rates. There are also indications of the spread of P. falciparum malaria in India and it has reappeared in areas where it had been eliminated.

HUMAN RIGHTS

Several environmental issues are closely linked to human rights. These include the equitable distribution of environmental resources, the utilisation of resources and Intellectual Property Rights (IPRs), conflicts between people and wild- life especially around PAs, resettlement issues around development projects such as dams and mines, and access to health to prevent environment related diseases.

One of the primary concerns in environmental issues is how wealth, resources and energy must be distributed in a community. We can think of the global community, regional community issues, national concerns and those related to a family or at the individual level. While economic disparities remain a fact of life, we as citizens of a community must appreciate that a widening gap between the rich and the poor, between men and women, or between the present and future generations must be minimised if social justice is to be achieved.

The right to the use of natural resources that the environment holds is an essential component of human rights. It is related to disparities in the amount of resources available to different sectors of society. People who live in wilder- ness communities are referred to as ecosystem people. They collect food, fuelwood, and non-wood products, fish in aquatic ecosystems, or hunt for food in forests and grasslands. When land use patterns change from natural ecosystems to more intensively used farmland and

pastureland the rights of these indigenous people are usually sacrificed. Take the case of subsidies given to the pulp and paper industry for bamboo which makes it several times cheaper for the industry than for a rural individual who uses it to build his home. This in-

fringes on the human right to collect resources they have traditionally used free of cost. Another issue is the rights of small traditional fishermen who have to contend against mechanised trawlers that impoverish their catch and over-harvest fish in the marine environment. These people's right to a livelihood conflicts with the powerful economic interests of large-scale organised fisheries.

VALUE EDUCATION

Value education in the context of our environment is expected to bring about a new sustainable way of life. Education both through formal and non-formal processes must thus address understanding environmental values, valuing nature and cultures, social justice, human heritage, equitable use of resources, managing common property resources and appreciating the cause of ecological degradation. Essentially, environmental values cannot be taught. They are inculcated through a complex process of appreciating our environmental assets and experiencing the problems caused due to our destruction of our environment. The problems that are created by technology and economic growth are a result of our improper thinking on what 'development' means. Since we still put a high value only on economic growth, we have no concern for aspects such as sustainability or equitable use of resources. This mindset must change before concepts such as sustainable development can be acted upon.

What are values?

Values deal with one's own principles and standards from which we judge what is right and wrong behaviour.

Every human being has a great variety of feelings for different aspects of his or her surroundings. The Western, modern approach values the resources of Nature for their utilitarian importance alone. However true environmental values go beyond valuing a river for its water, a forest for its timber and non-wood forest products, or the sea for its fish. Environmental values are inherent in feelings that bring about a sensitivity for preserving nature as a whole. This is a more spiritual, Eastern traditional value. There are several writings and sayings in Indian thought that support the concept of the oneness of all creation, of respecting and valuing all the different components of Nature. Our environmental values must translate to pro conservation actions in all our day to day activities. Most of our actions have adverse environmental impacts unless we consciously avoid them. The sentiment that attempts to reverse these trends is enshrined in our environmental values.

ROLE OF INFORMATION TECHNOLOGY IN ENVIRONMENT AND HUMAN HEALTH

The understanding of environmental concerns and issues related to human health has exploded during the last few years due to the sudden growth of Information Technology. The computer age has turned the world around due to the incredible rapidity with which IT spreads knowledge. IT can do several tasks extremely rapidly, accurately and spread the information through the world's networks of millions of computer systems. A few examples of the use of computer technology that aid environmental studies include software such as using Geographical Information Systems (GIS). GIS is a tool to map land use patterns and document change by studying digitized toposheets and/or satellite imagery. Once this is done, an expert can ask a variety of questions which the software can answer by producing maps which helps in land use planning.

The Internet with its thousands of websites has made it extremely simple to get the appropriate environmental information for any study or environmental management planning. This not only assists scientists and students but is a powerful tool to help increase public awareness about environmental issues. Specialised software can analyse data for epidemiological studies, population dynamics and a variety of key environmental concerns. The relationship between the environment and health has been established due to the growing utilisation of computer technology. This looks at infection rates, morbidity or mortality and the etiology (causative factors) of a disease. As knowledge expands, computers will become increasingly efficient. They will be faster, have greater memories and even perhaps begin to think for themselves.

CASE STUDY

Karnataka's GIS scheme, Bhoomi, has revolutionized the way farmers access their land records. Farmers can now get a copy of the records of rights, tenancy and crops from a computerized information kiosk without harassment and bribes. Karnataka has computerized 20 million records of land ownership of 6.7 million farmers in the State