Bhubanananda Orissa School of Engineering,

Branch: Electronics and Telecommunication Engineering

SUBJECT: Environment Studies

Diploma 3rd Semester Students

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CHAPTER-1

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

1. UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

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INTRODUCTION

- The word environment is derived from the French word 'environner' **which** means to **'encircle or surround'.**
- Thus our environment can be defined as "t**he Social, Cultural and Physical conditions that surround, affect and influence the survival, growth and development of people, animals and plants"**
- This broad definition includes the natural world and the technological environment as well as the cultural and social contexts that shape human lives.
- It includes all factors (living and non-living) that affect an individual organism or population at any point in the life cycle; set of circumstances surrounding a particular occurrence and all the things that surrounds us.
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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 inter disciplinary 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.

SCOPE OF ENVIRONMENTAL STUDIES

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

These are the basic aspects of environmental studies which have a direct relevance to every section of society. Several career options have emerged in these fields that are broadly categorized as:

(i) **Research and development in environment:**

Skilled environmental scientists have an important role to play in examining various environmental problems in a scientific manner and carry out R&D activities for developing cleaner technologies and promoting sustainable development.

(ii) **Green advocacy:**

With increasing emphasis on implementing various Acts and Laws related to environment, need for environmental lawyers has emerged, who should be able to plead the cases related to water, air, forest, wildlife, pollution and control etc.

(iii) **Green marketing:**

While ensuring the quality of products with ISO mark, now there is an increasing emphasis on marketing goods that are environment friendly. Such products have Eco mark or ISO 14000 certification. Environmental auditors and environmental managers would be in great demand in the coming years.

(iv) **Green media:**

Environmental awareness can be spread amongst masses through mass media like television, radio, newspaper, magazine, hoardings, advertisements etc., for which

environmentally educated persons are required.

(v) Environmental consultancy:

Many non-government organizations, industries and government bodies are engaging environmental consultants for systematically studying and tackling environment related problems.

IMPORTANCE OF ENVIRONMENTAL STUDIES

- The importance of environmental studies is that, the current trend of environmental degradation can be reversed if people of educated communities are organized, empowered and experts are involved in sustainable development.
- Environmental factors greatly influence every organism and their activities.

- At present a great number of environmental issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. These issues are studied besides giving effective suggestions in the environment studies.
- 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 being of International Importance:

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 must be tackled with international efforts and cooperation.

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. The North, to cleanse their own environment has, fact fully, managed to move 'dirty' factories to South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.

3. Explosively Increase in Pollution:

World census reflects that one in every seven persons in this plant 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. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

4. Need for an Alternative Solution:

It is essential, especially for developing countries to find alternative paths to an alternative goal. We need a goal as under:

(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.

(3) A goal distant from the developing world in the manner it is from the over- consuming wasteful societies of the "developed" world.

5. Need To Save Humanity From Extinction:

It is incumbent upon us to save the humanity from extinction. Consequences to our activities cause destructing the environment and depleting the biosphere, in the name of development.

6. 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

1. **Growing Population:** A population of over thousands of millions is growing at 2.11 per cent every year. Over 17 million people are added each year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates.
2. **Poverty:** India has often been described a rich land with poor people. The poverty and environmental degradation are mixed with one another. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40% of our people are still below the poverty line.
3. **Environment degradation** has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge of

environment degradation are two facets of the same challenge.

4. **Agricultural Growth:** The people must be made familiar with the methods to sustain and increase agricultural growth without damaging the environment. High yielding varieties have caused soil salinity and damage to physical structure of soil.
5. **Need to Increase Ground water:** It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents, chemical fertilizers and pesticides have polluted our surface water and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies. Suitable strategies for conservation of water, provision of safe drinking water and keeping water bodies clean should be developed.
6. **Development and Forests:** Forests serve catchments for the rivers. With increasing demand of water, plan to harness the mighty river through large irrigation projects were made. Certainly, these would submerge forests; displace local people, damage flora and fauna. As such, the dams on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific debate. Forests in India have been shrinking for several centuries owing to pressures of agriculture and other uses. Vast areas that were once green, stand today as waste lands. These areas are to be brought back under vegetative cover. The tribal communities inhabiting forests, respects the trees, birds and animals give them sustenance. We must recognize the role of these people in restoring and conserving forests. The modern knowledge and skills of the forest department should be integrated with the traditional knowledge and experience of the local communities.
7. **Degradation of Land:** At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffers from varying degrees of soil degradation. Of the remaining 123 mha, 40 are completely unproductive. The remaining 83 mha is classified as forest land, of which over half is denuded to various degrees. Nearly 406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the land classified as pasture land, most of which is overgrazed. Thus, out of 226 mha, about 175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha This degradation is to be avoided.
8. **Evil Consequences of Urbanization:** Nearly 27% of Indians live in urban areas. Urbanization and industrialization has given birth to a great number of environmental problems. Over 30 percent of urban Indians live in slums. Out of India's 3,245 towns and cities, only 21 have partial or full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

9. **Air and water Pollution:** Majority of our industrial plants are using outdated and pollution causing technologies and makeshift facilities devoid of any provision of treating q2wr45their wastes. A great number of cities and industrial areas have been identified as the worst in terms of air and water pollution. Acts are enforced in the country, but their implement is not so easy. The reason is their implementation needs great resources, technical expertise, political and social will. Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

INSTITUTIONS INENVIRONMENT

Managing natural resources require efficient institutions at all levels i.e. local, national, regional and global. Among the large number of institutions that deal with environmental protection and conservation, a few well-known organization include government organizations like the BSI and ZSI, and NGOs like the BNHS, WWF-1, *etc*.

1. **The Bombay Natural History Society (BNHS), Mumbai**
2. **World Wide fund for nature- India (WWF-1), New Delhi**
3. **Centre or science and environment (CSE), New Delhi**
4. **C.P.R Environmental Education Centre, Madras**
5. **Centre for Environment Education (CEE)**
6. **Bharati Vidyapeeth University, Institute of Environment Education & Research, Pune**
7. **The Salim Ali Center for Ornithology and Natural History (SACON)**
8. **Wild life Institute of India (WII), Dehradhun**
9. **Zoological survey of India (ZSI)**
10. **The madras Crocodile Bank Trust (MCBT)**
11. **Botanical Survey of India (BSI)**

CHAPTER-2

2. NATURAL RESOURCES: Renewable and non-renewable resources

INTRODUCTION

- 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).
- They are essential for the fulfillment of physiological, social, economic and cultural needs at the individual and community levels.

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.
- Advanced countries produce over 75% of global industrial waste and greenhouse gases.
- Energy from fossil fuels consumed in relatively much greater quantities in developed countries. Their per capita consumption of food too is much greater as well as their waste.

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. It is derived from latin word *'foris'* means *'outside'*. India's Forest Cover is 6,76,000 sq.km (20.55% of geographic area). Scientists estimate that India should ideally have 33% of its land under forests.

FUNCTIONS OF FOREST

1. It performs very important function both to human and to nature.
2. They are habitats to millions of plants, animals and wild life.
3. They recycle rain water.
4. They remove pollutant from air.
5. They control water quality.

6. They moderate temperature and weather.
7. They influence soil condition and prevent soilerosion.

USES OF FOREST

1. **Commercial uses**
2. **Ecological uses**

Commercial uses:

i. 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: Forest provides number of environmental services.

i. **Production of oxygen:** Photosynthesis produces large amount of oxygen which is essential for life.
ii. **Reducing global warming:** Carbon dioxide is one of the main greenhouse gas. It is absorbed by plants for photosynthesis. Therefore the problem of global warming caused by CO_2 is reduced.
iii. **Soil conservation:** Roots of trees bind the soil tightly and prevent soil erosion. They also act as wind breaks.
iv. **Regulation of hydrological cycle:** Watershed in forest act like giant sponges and slowly release the water for recharge of spring
v. **Pollution moderators:** Forest can absorb many toxic gases and noises and help in preventing air and noise pollution.
vi. **Wild life habitat:** Forest is the home of millions of wild animals and plants.

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 woodresources.

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.
        1. Ex: big dams, hydroelectric projects, road construction etc.
2. **Mining operations:** It reduces forest areas. Ex: Mica, coal, Manganese and lime stone.
3. **Fuel requirement:** Wood is the important fuel for rural and tribal population
4. **Shifting cultivation:** Replacement of natural forest ecosystem for mono specific tree plantation. Ex: Teak
5. **Forest fires:** Forest fire destructs thousands of acres of forest.
6. **Over grazing:** Over grazing by cattle reduces the cultivation land

Consequences of deforestation (or) impacts of deforestation:

- Economic loss
- Loss of biodiversity
- Destructs the habitats of various species
- Reduction in stream flow
- Increases the rate of globalwarming
- Disruption of weather patterns and globalclimate
- Degradation of soil and acceleration of the rate of Induces and accelerates mass movement / landslides.
- Increases flood frequency, magnitude / severity.
- Breaks the water cycle
- Breaks the nutrient cycle

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.

In spite of this, it is sometimes necessary to extract timber, so as to meet the needs of a developing country. During the extraction of timber, cutting, felling and handling should be done selectively, carefully and in a planned manner, in order to save the remaining forests and biodiversity.

Effects of Timber Extraction

- The major effects of timber extraction on forest and tribal people include:
- Poor logging results in a degraded forest.
- Floods may be intensified by cutting of trees or upstream watersheds.
- Loss of biodiversity.
- Climatic changes such as less rains.
- New logging roads permit shifting cultivators to gain access to logged areas and cut the remaining trees.
- It results in forest fragmentation which promotes loss of biodiversity because some species of plants and animals require large continuous areas of similar habitat to survive.
- Exploitation of tribal people by the contractors.
- Soil erosion especially on slopes occursextensively.
- Sedimentation of irrigation systems, floods may be intensified by cutting of trees on upstream.

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. Current estimates suggest some 30-40% of irrigated land worldwide relies on dams. Hydropower, another important the use of stored water, currently supplies 19% of the world's total electric power supply and is used in over 150 countries. The world's two most populous countries – China and India –have built around 57% of the world's large dams.

Dams problems

Dams are the massive artificial structures built across the rivers to store water for much beneficial purpose.

Dams are considered a "Temples of modern India". Dams destruct vast area of forest area. India has more than 1600 large dams.

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 tribalpeople.
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 recognized and resettled or compensated.
6. Body condition of tribal people will not suit with new areas and hence they will be affected by many diseases.

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 of Water

- It 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.
- No plant or animal species can survive without water. If water in our body drops by 1% we feel thirst, if it drops by 10% we face death.

HYDROLOGICAL CYCLE:

Water from various water bodies

↓

Evaporated by solar energy

↓

Enters in to the atmosphere as

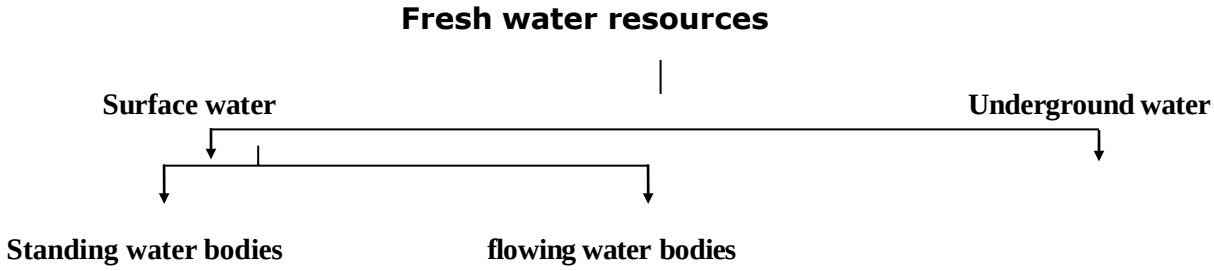
↓

clouds falls again on earth as rain

↓

Ultimately returns to the ocean

DISTRIBUTION OF WATER RESOURCES



Over utilization of water

1. Decrease of ground water:

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

2. Ground subsidence: If ground water withdrawal is greater than its 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.

Problem: a. Lowering of water table

b. Decrease the number of aquifers

c. Change the speed and direction of water.

4. Intrusion of salt water: In coastal area over exploitation of ground water leads to the intrusion of salt water from sea. Therefore that water cannot be used for drinking and agriculture.

5. Over utilization of water causes earth quakes, landslides andfamines.

6. 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.

7. 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.

Overutilization of Surface and Groundwater:

Occurs at various levels. Use of more water than really needed by human beings. Many agriculturists use more water than necessary to grow crops. Industries in order to maximize short-term economic gains, does not bother its liquid waste and releases it into streams, rivers and the sea.

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

1. 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 rainfall
3. Excessive withdrawal of groundwater.

Lack of water for the needs of agriculture, livestock, industry or human population may be termed as a drought. Drought causes serious damages to plants, animals and human life.

CAUSES OF DROUGHT

1. 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 livestock 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.
6. Drought causes large migration of people and urbanization.

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 of Dam:

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

.2 Problems of Dams:

They alter river flows, change nature's flood control mechanisms such as wetlands and flood plains, and destroy the lives of local people and the habitats of wild plant and animal species, particularly is the case

with mega dams.

Some of the problems are mentioned below.

- 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
- Dislodging animal populations
- Disruption of fish movement and navigationalactivities
- Emission of greenhouse gases due to rotting of vegetation
- Natural disasters – reservoirs induced seismicity, flash floods etc and biological hazards due to large-scale impounding of water – increase exposure to vectorbrone diseases, such as malaria, schistosomiasis, and filariasis.

WATER CONFLICTS

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

National conflicts:

a. Sharing of water between Karnataka and TamilNadu.

b. Sharing of Krishna water between Karnataka and Andrapradesh

c. Siruvani – TamilNadu and Kerala

International conflicts:

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

MINERAL RESOURCE

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 equipment's 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. De-vegetation:

- 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.

ENVIRONMENTAL EFFECTS OF OVER EXPLOITATION OF MINERALS

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

FOOD RESOURCES

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

TYPES OF FOODSUPPLY

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) industrialized 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 equipment's, lot of fertilizers, 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

1. Death of non-targetorganism.
2. Producing new pest – super pest
3. Bio magnification – Most of the pesticides are non-bio degradable, keep on concentrating in the food chain and it is harmful to human beings.
4. Risk of cancer:
    a. It directly acts as carcinogen
    b. It indirectly supports immunesystem.

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

Causes of water logging:

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

Remedy:thank

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

ENERGY RESOURCES

An energy resource is something that can produce heat, power life, move objects, or produce electricity.

GROWING ENERGY NEEDS 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.
- Developed country GNP increases and energy consumption increases. In the poor country GNP and energy consumption are less.

1TYPES 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.

Merits of renewable energy resources

1. Unlimited supply
2. Provides energy security.
3. Fits into sustainable development concept.
4. Reliable and the devices are modular in size.
5. Decentralized energy production.

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.

   Solar cell (or) Photovoltaic cell (or) PV cell:

   - Solar cell consists of p- type semiconductor (Si doped with B) and n-

type semi conductor (Si doped with P). P-type forms top layer and n-type forms bottom layer.

- Solar rays fall on the top layer, the electrons from valence band promoted to the conduction band which crosses the p-n junction into n-type semiconductor. Potential difference between the two layers is created which causes flow of electrons.

Uses: It is used in calculators, electronic watches, street light, water pumps etc.

2. **Wind energy:** Moving air is called wind. The energy recovered from the force of the wind is called wind energy its 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.

Condition: Minimum speed for wind generator is 15 Km/hr

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.

Ocean thermal energy:

Temperature difference between surface water and deeper level water in ocean generates electricity. The energy available due to the difference in temperature of

water is called ocean thermal energy.

Condition: Temperature difference should be 200C.

Process: Ammonia is converted into vapours on the surface of warm water, it increases the vapour pressure which rotate the turbine and generates electricity. Deeper level cold water is pumped to cool and condense the vapour in to liquid.

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 geothermal energy.

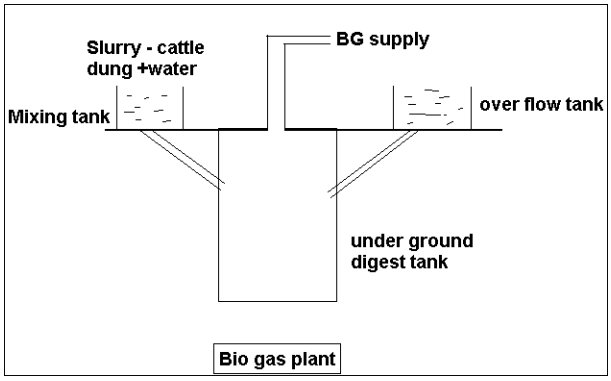
Natural geysers: Hot water or steam comes out of the ground through cracks naturally is called natural geysers.

Artificial geysers: Artificially a drill hole up to the hot region and by sending a pipe into it. The hot water or steam is used to rotate the turbine and generate electricity.

5. **Bio mass energy**:

Bio mass: Organic matter produced by plants or animals used as source of energy

Bio gas: Mixture of methane, carbon dioxide and hydrogen sulphide. Methane is the major constituent. It is obtained by anaerobic fermentation of animal dung (or) plant wastes in the presence of water.



Bio fuels: Fuels obtained by the fermentation of biomass. Ex: Ethanol, methanol

Ethanol: Produced from sugar cane. Calorific value is less.

Methanol: Obtained from ethanol Calorific value too less.

Gasohol: Mixture of ethanol and gasoline India trial is going on to use gasohol in cars and buses.

Hydrogen fuel: Hydrogen produced by pyrolysis, photolysis and electrolysis of water. It has high calorific value. Nonpolluting one because the combustion product is water.

Disadvantages:

1. Hydrogen is highly inflammable and explosive.
2. Safe handling is required.
3. Difficult to store and transport.

NON RENEWABLE ENERGY SOURCES:

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

Coal: It is a solid fossilfuel.

Disadvantages:

1. When coal is burnt large amount of CO_2 is released which causes global warming.
2. S, N produces toxic gases during burning.

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 mmerate of usage, the world crude oil reserves are expected to get exhausted in just 40 years

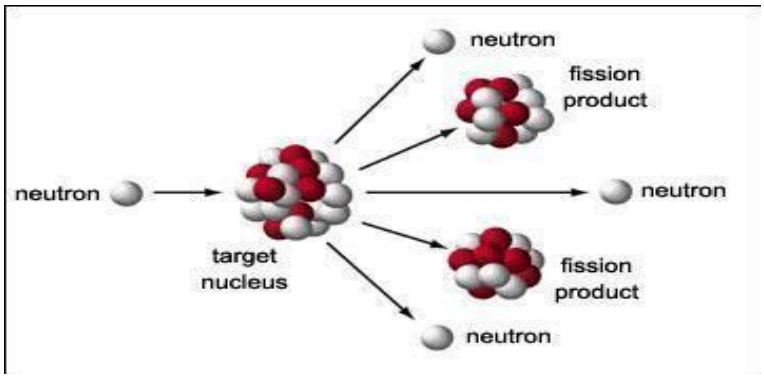
1. **Liquefied petroleum gas (LPG):** Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colorless and odorless gas, but during cylindering mercaptans are added to detect leakage.
2. **Natural gas:** These are found above oil in oil wells. It is a mixture of methane and other hydrocarbons. Calorific value is high. There are two types. Dry gas and wet gas.
3. **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. **Nuclear fission;** It is a nuclear change in which heavier nucleus split into lighter nuclei on bombardment of fast moving neutrons. Large amount of energy is released through chain reaction.

Ex: Uranium with fast moving neutron gives barium and krypton in addition to three neutrons; in the second stage it gives nine neutrons and so on. This process of propagation of the reaction by multiplication is called chain reaction.

Nuclear fission: It is a nuclear change in which lighter nucleus is combined together at extremely high temperature (1 billion 0C) to form heavier nucleus and a large amount of energy is released.

Ex: Isotopes of hydrogen combine to form helium molecule.



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 AS A RESOURCES

- Land area constitutes about 1/5 of the earth surface.
- To meet out the challenging demand of food, fibre and fuel for human population, fodder for animals and industrial raw material for agro based industries, efficient management of land resources will play critical role.
- Soil, water, vegetation and climate are basic natural resources for agricultural growth and development.

LAND DEGRADATION

Due to increasing population, the demands for arable land for producing food, fibre and fuel wood is also increasing. Hence there is more and more pressure on the limited land resources which are getting degraded due to over-exploitation. Nearly 56% of total geographical area of the country is suffering due to land resource degradation. Out of 17 million hectare canal irrigated area, 3.4 million hectare is suffering from water logging and salinity. Soil erosion, water logging, salinization and contamination of the soil with industrial wastes like fly-ash, press mud or heavy metals all cause degradation of land.

Man induces landslides

Human race has exploited land resources for his own comfort by constructing roads, railway tracks, canals for irrigation, hydroelectric projects, large dams and reservoirs and mining in hilly areas. Moreover productive lands under crop production are decreasing because of development activities. These factors are affecting the stability of hill slopes and damage the protective vegetation cover. These activities are also responsible to upset the balance of nature and making such areas prone to landslides.

Soil erosion

Soil erosion refers to loss or removal of superficial layer of soil due to the action of wind, water and human factors. In other words, it can be defined as the movement of soil components, especially surface-litter and top soil from one place to another. It has been estimated that more than 5000 million tonnes topsoil is being eroded annually and 30% of total eroded mass is getting loosed to the sea .It results in the loss of fertility. It basically is of two types, viz. geologic erosion and accelerated erosion. Various factors which affect soil erosions include soil type, vegetation cover, slope of ground, soil mismanagement and intensity and amount of-rainfall.

Desertification

Desertification is a process whereby the productive potential of arid or semiarid lands falls by ten percent or more. Desertification is characterized by de-vegetation and depletion of groundwater, salinization and severe soil erosion.

Causes of Desertification

- Deforestation
- Overgrazing
- Mining and quarrying

Role of an individual in conservation of natural resources

Conservation of energy:

1. Switch off light, fan and other appliances when not in use.
2. Use solar heater for cooking.
3. Dry the cloth in the sun light instead of driers.
4. Use always pressure cookers
5. Grow trees near the house to get cool breeze instead of using AC and air cooler.
6. Ride bicycle or just walk instead of using scooter for short distance.

Conservation of water:

1. Use minimum water for all domestic purposes.

2. Check the water leaks in pipes and repair them properly.

3. Reuse the soapy water, after washing clothes for washing courtyard, carpets etc.

4. Use drip irrigation.

5. Rain water harvesting system should be installed in all the houses.

6. Sewage treatment plant may be installed in all industries and institution.

7. Continuous running of water taps should be avoided.

8. Watering of plants should be done in the evening.

Conservation of soil:

1. Grow different type plants i.e trees, herbs and shrubs.

2. In the irrigation process, using strong flow of water should be avoided.

3. Soil erosion can be prevented by sprinkling irrigation.

Conservation of food resources:

1. Cook required amount of food.

2. Don't waste the food, give it to someone before spoiling.

3. Don't store large amount of food grains and protect them from damaging insects.

Conservation of forest:

1. Use non timber product.

2. Plant more trees.

3. Grassing must be controlled

4. Minimise the use of paper and fuel.

5. Avoid the construction of dam, road in the forest areas.

Equitable use of resources for sustainable life style:

Sustainable development:

Development of healthy environment without damaging natural resources.

Unsustainable development;

Degradation of the environment due to over utilisation of natural resources.

Life style in more developed countries:

22% of world population, 88% of its natural resources and 85% of total global income.

Consumption is more and pollution is more.

Life style in less developed countries:

78% of world population, 12% of its natural resources and 15% of total global income.

Consumption is less and pollution is less.

Causes of unsustainability:

Main cause – difference between MDCs and LDCs.

Sustainable life style:

MDCs should have to reduce the utilisation of natural resources that should have to be diverted to LDCs. This will reduce the gap between MDCs and LDCs, leads to sustainable development of the entire world.

Ecosystem

3.1 What is mean by Ecosystem?

An animal cannot live in isolation and interact with biota and abiotic factors, this relationship constitute the ecological system or ecosystem.

In other words, ecosystem is defined as structural and functional unit of the biosphere, comprising living and non-living factors and their interaction.

3.1.1 Different Types of Ecosystem:

Ecosystem is an open system and material can exchange from one ecosystem to another ecosystem. For ex. Frog moves from the pond to the land and vice-versa. The ecosystem can be classified based on size, nature and duration;

(1) Nature: On the basis of nature, it can be natural or artificial.

Natural Ecosystem: This ecosystem forms naturally without interference of human. Example include are pond, river, forest, village, hill etc.

Artificial Ecosystem: This ecosystem is developed and maintained by human.

Example include are flowerbed, backyard, aquarium etc.

(2) Duration: On the basis of duration, ecosystem can be classified as temporary or permanent.

Temporary ecosystem: it is short lived and man-made or natural.

Example includes rain fed pond.

Permanent ecosystem: it is long lived and self-supported natural ecosystem for very long period. Example includes forest, river etc.

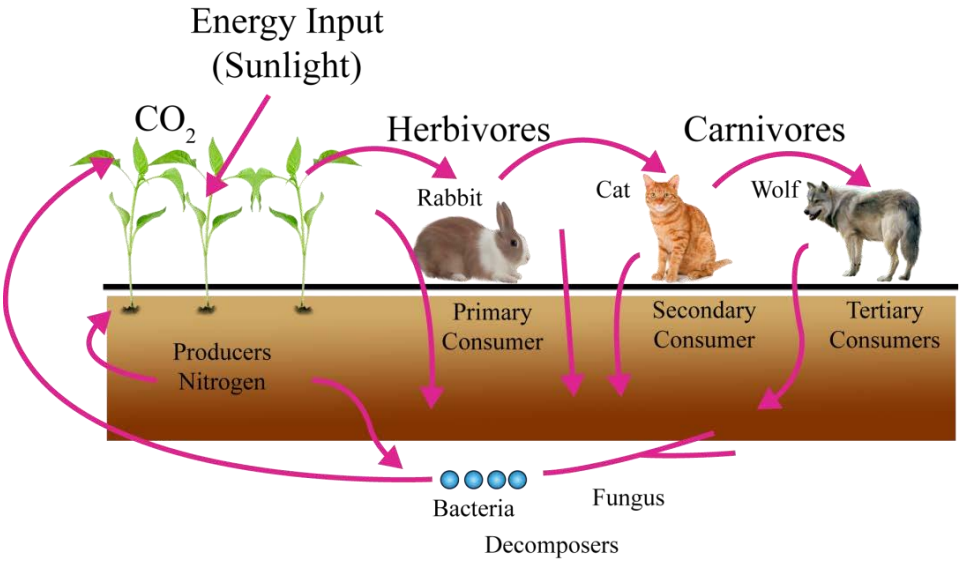
(3) Size: Ecosystem is classified as small or large ecosystem.

Small: it is small and also known as micro-ecosystem. It can be temporary or permanent. For ex. Pond, flowerpot etc

Large: it is large in size and also known as macro-ecosystem. It is always permanent and mostly natural. For ex. Ocean, river, forest and desert.

3.2 Structure of Ecosystem:

Each and every ecosystem has several components to sustain it for long duration. It needs matter (water, oxygen, mineral, and carbon dioxide), different types of organisms and continuous recycling of energy**.** These requirements are met by two important components present in ecosystem; biotic components and abiotic components.



Structure of the Ecosystem.

Biotic Components: The living organisms present in an ecosystem form the biotic component. They are connected through food. In this series, few organisms are producing food whereas others are consoling the food.

3.3 Producers, consumers, decomposers

(i) Producers: The role of producers is to prepare food to provide nutrition to the other organisms present in the ecosystem. There are two types of producers; photoautotrophs and chemotrophs.

Photoautotrophs: These are green plants which can trap sun light to form carbohydrate, simple sugar from carbon di-oxide and water. This process is known as photosynthesis and these organisms are called as photoautotrophs.

Chemoautotrophs: Few bacteria such as sulfur bacteria, nitrifying bacteria, can be able to utilize free energy released from the chemical reactions to prepare organic food with it. They are called chemoautotrophs and the process is known as chemosynthesis.

(ii) Consumers: These are mainly the animals. They are unable synthesize their own food and depends on producers. They utilizes the oxygen being released from the producers as well. Several consumers doesn't get the food from the producers but they are depended on consumers itself. As a result, consumers are related to each other through multiple food chains. There are many types of consumers and we will discuss in details about these consumer in the subsequent lecture. The consumers are known as heterotrophs.

(iii) Decomposers: These are mainly bacteria and fungi. Their primary purpose in the ecosystem is to decompose the complex organic material into the simple inorganic material so that it can be used for producers to prepare food.

ABIOTIC COMPONENTS: These factors include the non-living physiochemical factors of the environment. Abiotic factors are as follows:

(i) Inorganic substances: Inorganic substances like carbon, nitrogen, oxygen, water, carbon di-oxide, calcium, phosphorus and their inorganic compounds. These are available as free form or dissolved in water and may be adsorbed on the soil particles.

(ii) Organic compounds: These are carbohydrates, proteins, lipids, nucleic acids etc. This material is present in dead organic matter. These are broken into the simple compounds by decomposers in ecosystem for recycling of matter.

(iii) Climatic factors: These are factors present in the environment such as temperature, humidity, light, wind, rainfall an atomospheric gaseous etc.

Study of specific Ecosystem: Let's take an example of fresh water pond to understand the function of individual components.

1. Abiotic Components: Non-living part of the pond includes:

(1) Water with dissolved gases, mineral and suspended organic matter.

(2) Air, CO_2 and O_2 on the water surface

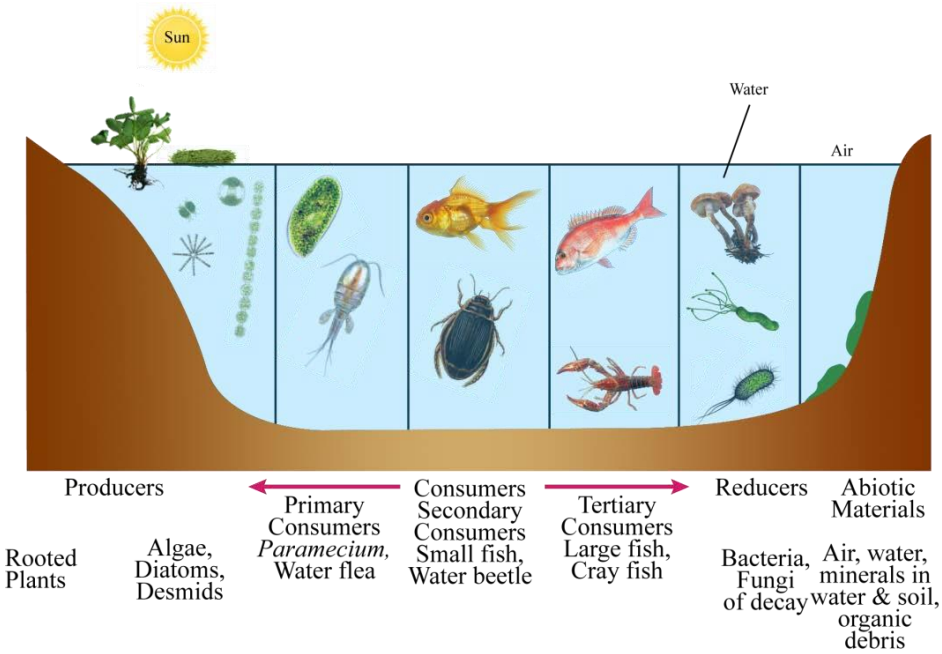
(3) Sunlight.

2. Biotic Components: The biotic constituents include the plants, animals and microorganisms. They play different role in ecosystem.

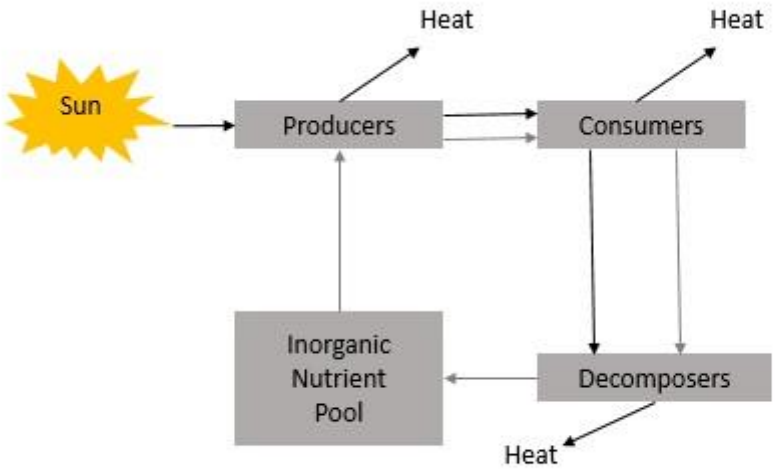
Producers: Green plants act as producers. As discussed previously, they utilized the sun light, CO_2 and water to prepare the food for other organisms.

Consumers: These includes crustaceans, worms, insect larvae and fishes.

Decomposers: Dead plants and animals form the organic debris in the pond. The decomposer such as bacteria and fungi decay dead body into the simple organic and inorganic substances.



Energy moves life. The cycle of energy is based on the flow of energy through different trophic levels in an ecosystem. Our ecosystem is maintained by the cycling energy and nutrients obtained from different external sources. At the first trophic level, primary producers use solar energy to produce organic material through photosynthesis.



The herbivores at the second trophic level, use the plants as food which gives them energy. A large part of this energy is used up for the metabolic functions of these animals such as breathing, digesting food, supporting growth of tissues, maintaining blood circulation and body temperature.

The carnivores at the next trophic level, feed on the herbivores and derive energy for their sustenance and growth. If large predators are present, they represent still higher trophic level and they feed on carnivores to get energy. Thus, the different plants and animal species are linked to one another through food chains.

Decomposers which include bacteria, fungi, molds, worms, and insects break down wastes and dead organisms, and return the nutrients to the soil, which is then taken up by the producers. Energy is not recycled during decomposition, but it is released.

Biogeochemical Cycles

All elements in the earth are recycled. The major elements such as oxygen, carbon, nitrogen, phosphorous, and sulphur are essential ingredients that make up organisms.

Biogeochemical cycles refer to the flow of such chemical elements and compounds between organisms and the physical environment. Chemicals taken in by organisms are passed through the food chain and come back to the soil, air, and water through mechanisms such as respiration, excretion, and decomposition.

As an element moves through this cycle, it often forms compounds with other elements as a result of metabolic processes in living tissues and of natural reactions in the atmosphere, hydrosphere, or lithosphere.

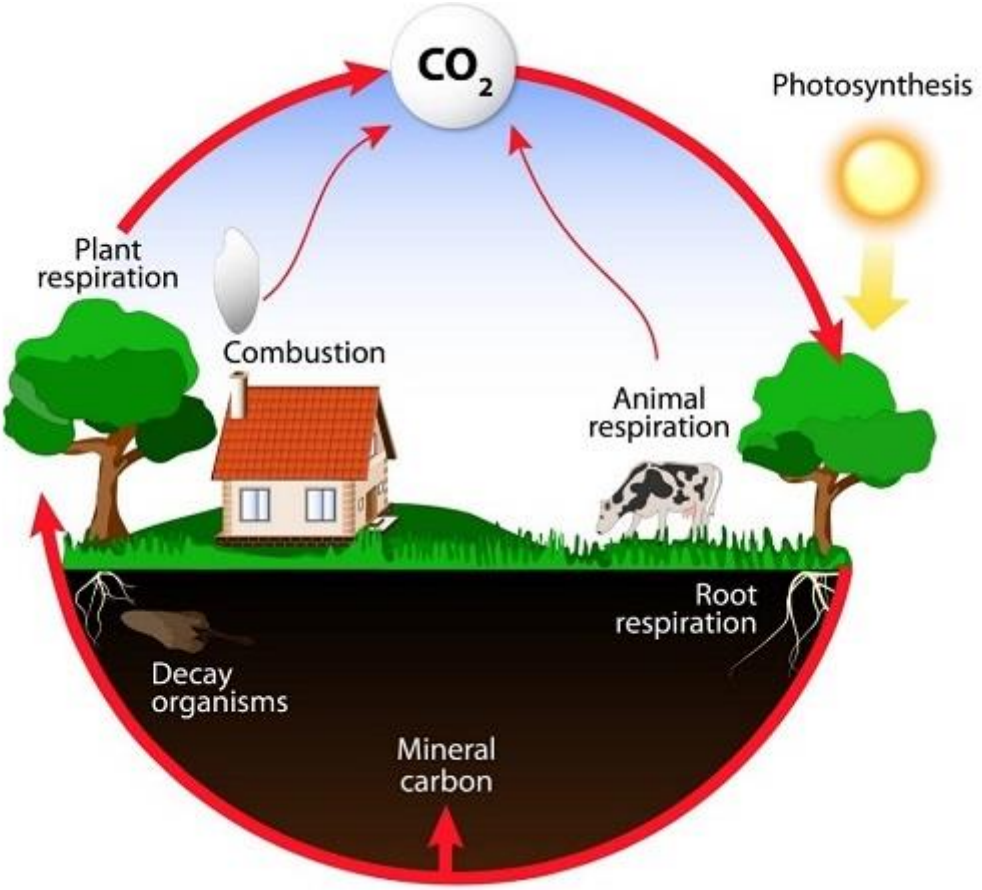
Such cyclic exchange of material between the living organisms and their non-living environment is called Biogeochemical Cycle.

Following are some important biogeochemical cycles −

- Carbon Cycle
- Nitrogen Cycle
- Water Cycle
- Oxygen Cycle
- Phosphorus Cycle
- Sulphur Cycle

Carbon Cycle

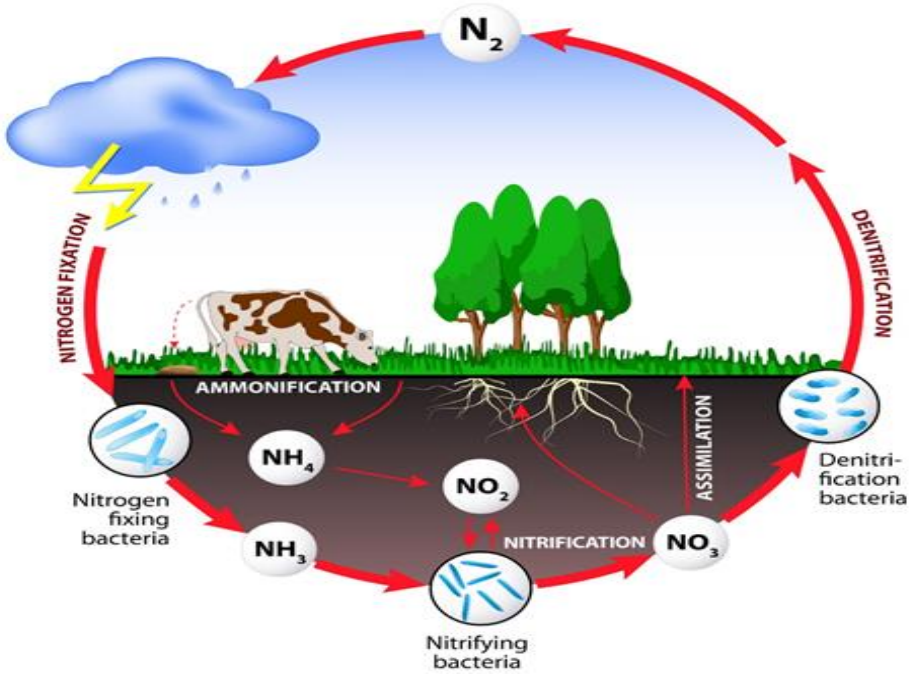
Carbon enters into the living world in the form of carbon dioxide through the process of photosynthesis as carbohydrates. These organic compounds (food) are then passed from the producers to the consumers (herbivores & carnivores). This carbon is finally returned to the surrounding medium by the process of respiration or decomposition of plants and animals by the decomposers. Carbon is also recycled during the burning of fossil fuels.



Nitrogen Cycle

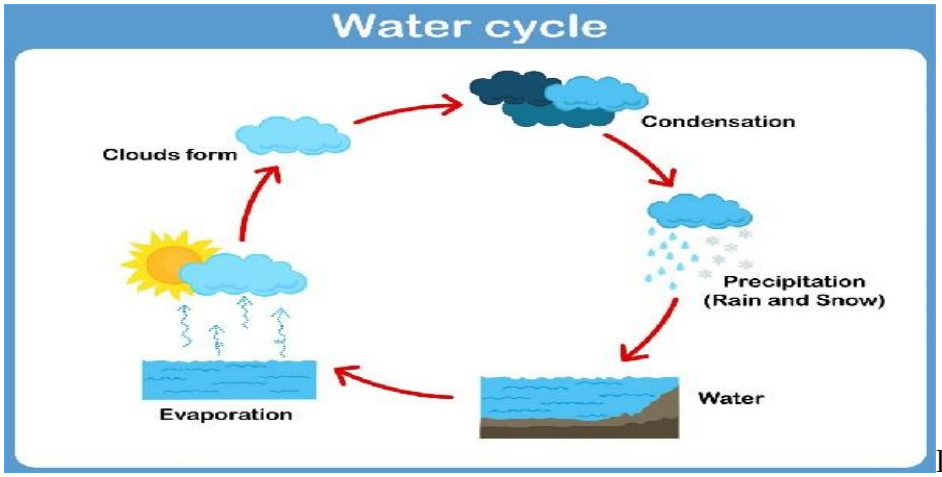
Nitrogen is present in the atmosphere in an elemental form and as such it cannot be utilized by living organisms. This elemental form of nitrogen is converted into combined state with elements such as H, C, O by certain bacteria, so that it can be readily used by the plants.

Nitrogen is being continuously expelled into the air by the action of microorganisms such as denitrifying bacteria and finally returned to the cycle through the action of lightening and electrification.



Water Cycle

The evaporation of water from ocean, rivers,



lakes, and transpiring plants takes water in the form of vapors to the atmosphere. This vaporized water subsequently cools and condenses to form cloud and water. This cooled water vapor ultimately returns to the earth as rain and snow, completing the cycle.

3.5 Ecological Succession

Ecological *succession* is a series of progressive changes in the species that make up a community over time. Ecologists usually identify two types of succession, which differ in their starting points:

- In *primary succession*, newly exposed or newly formed rock is colonized by living things for the first time.
- In *secondary succession*, an area that was previously occupied by living things is disturbed, then re-colonized following the disturbance.

Succession often involves a progression from communities with lower species diversity—which may be less stable—to communities with higher species diversity—which may be more stable^11start superscript, 1, end superscript—though this is not a universal rule.

3.5.1Primary succession and pioneer species

Primary succession occurs when new land is formed or bare rock is exposed, providing a habitat that can be colonized for the first time.

For example, primary succession may take place following the eruption of volcanoes, such as those on the Big Island of Hawaii. As lava flows into the ocean, new rock is formed. On the Big Island, approximately 32 acres of land are added each year. What happens to this land during primary succession?

First, weathering and other natural forces break down the substrate, rock, enough for the establishment of certain hearty plants and lichens with few soil requirements, known as **pioneer species**, see image below. These species help to further break down the mineral-rich lava into soil where other, less hardy species can grow and eventually replace the pioneer species. In addition, as these early species grow and die, they add to an ever-growing layer of decomposing organic material and contribute to soil formation.

This process repeats multiple times during succession. At each stage, new species move into an area, often due to changes to the environment made by the preceding species, and may replace their predecessors. At

some point, the community may reach a relatively stable state and stop changing in composition. However, it's unclear if there is always—or even usually—a stable endpoint to succession, as we'll discuss later in the article.

3.5.2 Secondary succession

In *secondary succession*, a previously occupied area is re-colonized following a disturbance that kills much or all of its community.

A classic example of secondary succession occurs in oak and hickory forests cleared by wildfire. Wildfires will burn most vegetation and kill animals unable to flee the area. Their nutrients, however, are returned to the ground in the form of ash. Since a disturbed area already has nutrient-rich soil, it can be recolonized much more quickly than the bare rock of primary succession.

Before a fire, the vegetation of an oak and hickory forest would have been dominated by tall trees. Their height would have helped them acquire solar energy, while also shading the ground and other low-lying species. After the fire, however, these trees do not spring right back up. Instead, the first plants to grow back are usually annual plants—plants that live a single year—followed within a few years by quickly growing and spreading grasses. The early colonizers can be classified as pioneer species, as they are in primary succession.

Over many years, due at least in part to changes in the environment caused by the growth of grasses and other species, shrubs will emerge, followed by small pine, oak, and hickory trees. Eventually, barring further disturbances, the oak and hickory trees will become dominant and form a dense canopy, returning the community to its original state—its pre-fire composition. This process of succession takes about 150 years.

3.6 Characteristics of Food Chain:

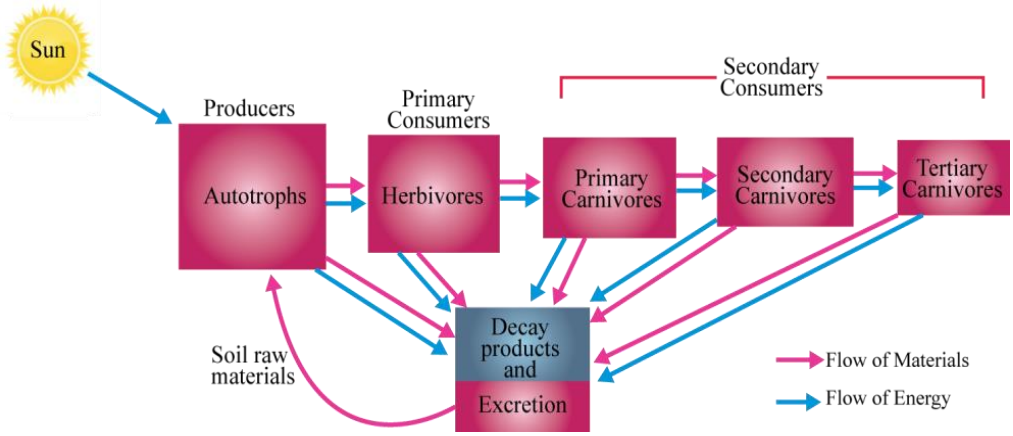
The sequential inter-linking of organisms involving transfer of food energy from the producers, through a series of organisms with repeated eating and being eaten is referred as **“food chain”**.

The biotic components of the ecosystem are linked to each other through food chain. In a typical food chain, producers are at the bottom and their role is to provide food for rest of the community utilizying solar energy

Other organisms belongs to the consumers and finally decomper are present at the bottom to recycle the organic content. In this manner, a nutritive interaction relationship exist between the living organisms of an ecosystem. It is always straight and always follow progressive straight line. The flow of energy is also unidirectional, from sun to producer and then different series of consumers.

In a typical food chain, there are always 4 or 5 trophic level in the food chain. The distinct sequential

steps in the straight food chains are referred as different trophic levels. For ex. Green plants stand at the first trophic level; the herbivorous are the second trophic level; and flesh eaters represent the third trophic levels. The position of plant is at the bottom but the position of other organism varies to different trophic level in different food chains. The typical representative food chains are given in the Table 39.1.

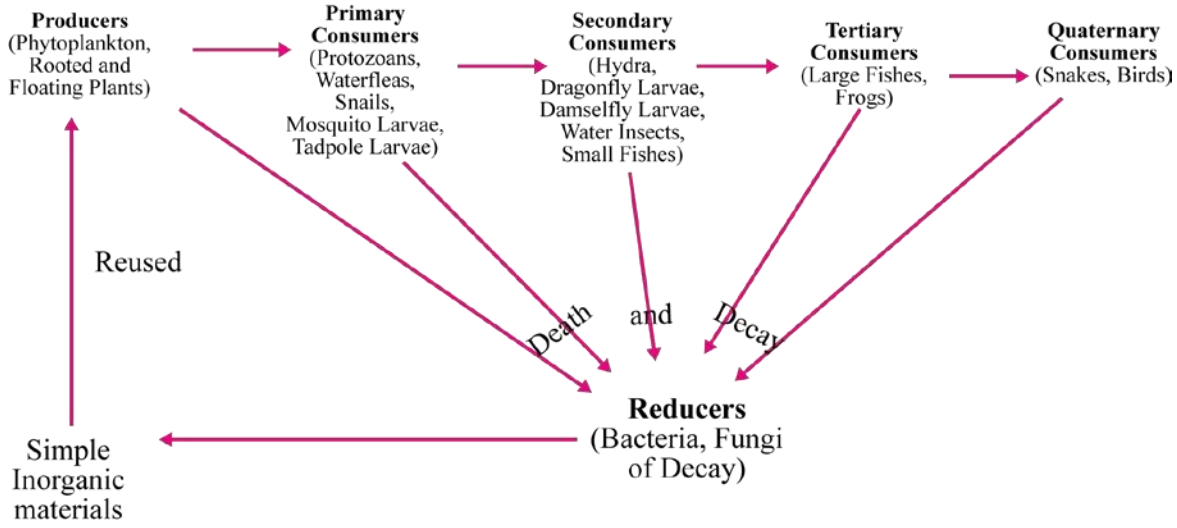


TYPES OF FOOD CHAIN: There are two different types of food chains; grazing food chain and detritus food chain.

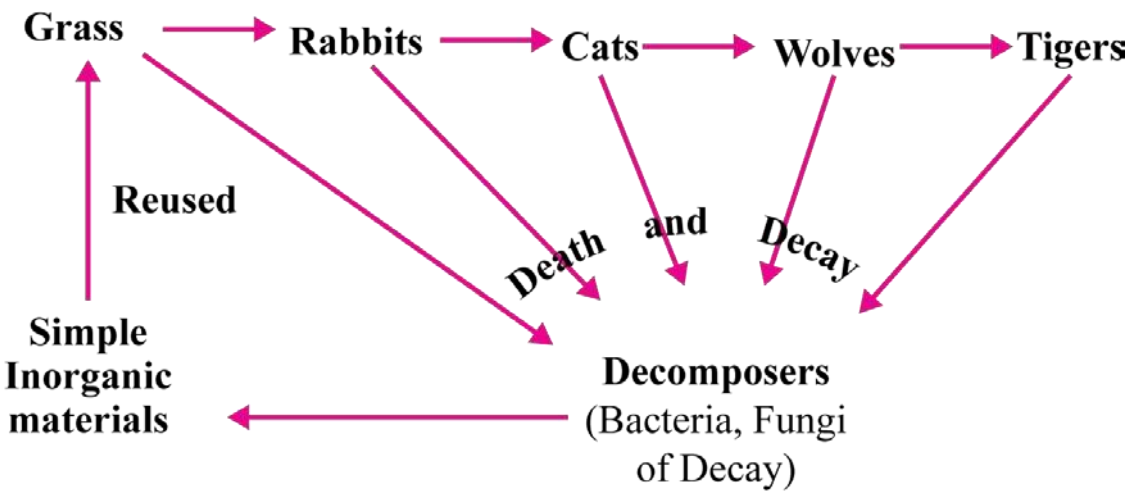
Grazing food chain: In the grazing food chain, solar energy is entrapped by the plants and then biomass, in tuen eaten by the herbivorous, and these are subsequently been consumed by a variety of carnivorous. These are longer food and these food chains end at the decomposer level. Here are two typical example of this type of food chain to understand this type of food chain.

(1) Food chain in a pond: In a pond, floated or rooted plants and algae are responsible for performing photosynthesis to prepare food for other member of ecosystem. They represent producers in the food chain

Unicellular algae are consumed by protozoan, water flies, snail, mosquito larvae and tadpoles. These small organisms represent primary consumers. These organisms are eaten by hydra, dragonfly larvae, giant insects and small fishes. These are secondary consumers. Large fishes and frog fed on these organism and represent tertiary consumers. Frog and fishes are eaten by snakes, birds and these are quaternary consumers. Death of all these organism become the food for bacteria and fungus to produce simple inorganic materials for reuse by the producers.



Food Chain in Pond.



(2) Food chain on land: A typical land food chain is given in Figure 39.3. In land food chain, grass and tree are the producers. Grass is eaten by rabbit and other herbivorous. They represents the primary consumers. Rabbit is eaten by cats (secondary consumers), which in-turn eaten by wolves (tertiary consumers). Both cat and wolves will be consumed by tigers and other big carnivorous (quaternary consumers). Death of all these organism become the food for bacteria and fungus to produce simple inorganic materials for reuse by the producers.

Detritus food chain: Unlike grazing food chain, detritus food chain starts with the dead organic matter either from fallen leaves or dead animal bodies. This food chain doen't depends on solar energy. Common example of detritus food chain is marsh land where mangrove leaves fall into the warm, shallow water (Figure 39.4). The detritus eating animals ex. Bacteria, fungi and protozoan act upon the dead matter of dead leaves to covert them into simple inorganic substances. The detritivorous are subsequently eaten by insect larvae, grass shrimp, copepods, crabs, nematodes, bivalve mollusks, amphipods, mysids etc. In the last step, the detritus consumers are finally eaten by fishes.

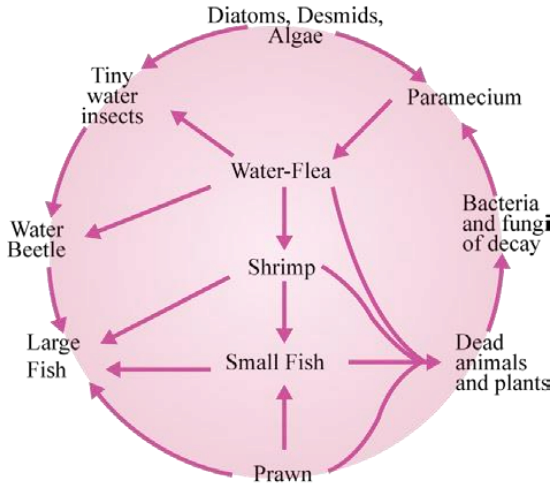
Food Web: The different food chains are inter connected at various trophic level to develop a food web. For example, in grassland ecosystem, grass is consumed by the rabbit but in their absence, it may be eaten by the grazing cattle. Similarly, rat or mouse is eaten by snake but snake can be eaten by predatory birds. In contrast to food chain, food web has several distinct characteristic.

(1) Food web is never straight.

(2) Food web is formed due to interlinking of food chains.

(3) A food web in the ecosystem brings alternate source of food.

The complex food web gives better stability to the ecosystem. Most of the animals are polyphagous and they feed on more than one kind of organism. If the availability of one particular animal is decreasing in the ecosystem, they start eating alternate animal. As a result, it gives chance to other animal to reproduce and grow in number and in addition, it gives chance to predator to survive.



Food web

Ecological Pyramids: In a food chain, producers and consumers at different trophic level are connected in terms of number, biomass and energy. These properties reduces from producers to consumers and representing these parameters for food chain gives a pyramid with a broad base and a tapering apex .

Ecological pyramids can be of three types:

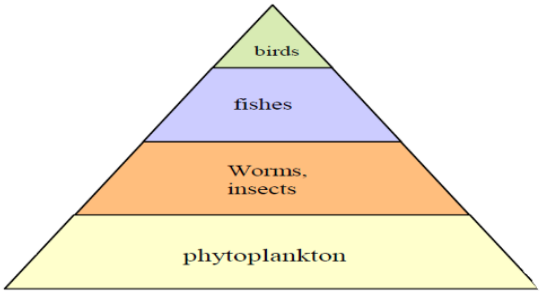
(a) Pyramid of Numbers

(b) pyramid of biomass

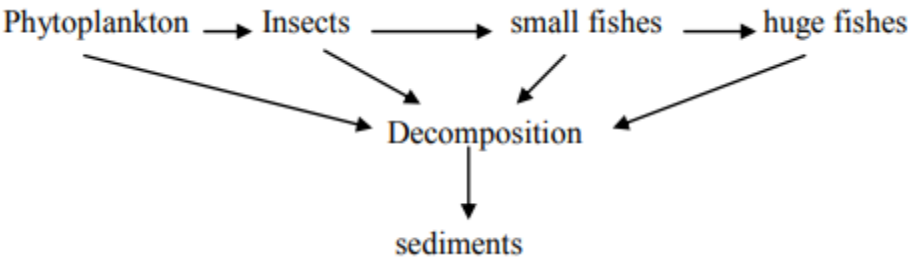
(c) pyramid of energy

Functional components:

Ecological pyramid



Energy flow:



3.7 Forest Ecosystem

A forest ecosystem is a functional unit or a system which comprises of soil, trees, insects, animals, birds, and man as its interacting units. A forest is a large and complex ecosystem and hence has greater species diversity.

Also, it is much more stable and resistant to the detrimental changes as compared to the small ecosystems such as wetlands and grasslands.

A forest ecosystem, similar to any other ecosystem, also comprises of abiotic and biotic components.

Abiotic components refer to inorganic materials like air, water, and soil. Biotic components include producers, consumers, and decomposers.

These components interact with each other in an ecosystem and thus, this interaction among them makes it self-sustainable.

3.7.1 Structural Features of the Forest Ecosystem

The two main structural features of a forest ecosystem are:

1. **Species composition:** It refers to the identification and enumeration of the plant and animal species of a forest ecosystem.
2. **Stratification:** It refers to the vertical distribution of different species which occupy different levels in the forest ecosystem. Every organism occupies a place in an ecosystem on the basis of source of nutrition. For example, in a forest ecosystem, trees occupy the top level, shrubs occupy the second and the herbs and grasses occupy the bottom level.

3.7.2 Components of a Forest Ecosystem

The components of a forest ecosystem are as follows:

1. Productivity

The basic requirement for any ecosystem to function and sustain is the constant input of solar energy. Plants are also the producers in a forest ecosystem.

There are two types of productivity in a forest ecosystem, primary and secondary. Primary productivity means the rate of capture of solar energy or biomass production per unit area over a period of time by the plants during photosynthesis.

It is further divided into Gross Primary Productivity (GPP) and Net Primary Productivity (NPP). GPP of an ecosystem is the rate of capture of solar energy or the total production of biomass. However, plants also use a significant amount of GPP in respiration.

Thus, NPP is the amount of biomass left after the utilization by plants or the producers. We can hence say that NPP is the amount which is available for the consumption to herbivores and decomposers. Secondary productivity means the rate of absorption of food energy by the consumers.

2. Decomposition

Decomposition is an extremely oxygen-requiring process. In the process of decomposition, decomposers convert the complex organic compounds of detritus into inorganic substances such as carbon dioxide, water and nutrients.

Detritus is the remains of the dead plant such as leaves, bark, flowers and also the dead remains of the animals including their faecal matter. The steps involved in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization.

In the process of fragmentation, detritivores break down the detritus into smaller particles. In the process of leaching, water-soluble inorganic nutrients descend down into the soil and settle as unavailable salts.

Under the process of catabolism, bacterial and fungal enzymes reduce detritus into simpler inorganic substances. Humification and mineralization processes take place during the decomposition of soil and not detritus.

The process of humification leads to the accumulation of humus which undergoes decomposition at a very slow rate. In the process of mineralization, the humus gets further degraded by microbes and inorganic nutrients are released.

3. Energy flow

Energy flows in a single direction. Firstly, plants capture solar energy and then, transfer the food to decomposers. Organisms of different trophic levels are connected to each other for food or energy relationship and thus form a food chain.

Energy Pyramid is always upright because energy flows from one trophic level to the next trophic level and in this process, some energy is always lost as heat at each step.

4. Nutrient Cycling

Nutrient cycling refers to the storage and movement of nutrient elements through the various components of the ecosystem. There are two types of Nutrient cycling, gaseous and sedimentary.

For Gaseous cycle (i.e. nitrogen, carbon), atmosphere or hydrosphere is the reservoir whereas for the sedimentary cycle (i.e. phosphorus) Earth's crust is the reservoir.

Three major forest ecosystems are:

1. The Tropical forest ecosystem
2. The Temperate forest ecosystem
3. The Boreal or Taiga forest ecosystem

However, there exist more specific types of forest ecosystems within these larger regions.

3.9 Aquatic Ecosystem

Definition:

Deals with water bodies and biotic communities present in them-Classified as fresh water and marine ecosystems. Fresh water systems are classified as lentic and lotic ecosystems.

Types:

3.9.1 Pond Ecosystem:

Small fresh water ecosystem – seasonal in nature

Organisms: algae, aquatic plants, insects, fishes etc.

Ponds are very often exposed to anthropogenic pressure like cloth washing, bathing, cattle bathing, swimming etc.

3.9.2 Lake Ecosystem:

Big fresh water ecosystem – Zonation or stratification, especially during summer is a common one.

Top layer – shallow, warm, prone to anthropogenic activities – Littoral zone

Second layer – enough sunlight, high primary productivity – Limnetic zone

Third layer – very poor or no sunlight – Profundal zone

Eg. Dal lake in Srinagar, Naini lake in Nainital

Organisms:

Planktons – phytoplankton eg. Algae

Zooplankton eg. Rotifers

Nektons – that swims in water eg. Fishes

Neustons – that float on the surface of water

Benthos – that attached to sediments eg. Snails

Types of lakes:

_oligotrophic lakes – with less nutrient content

– Eutrophic lakes – with very high nutrient content due to fertilizer contamination

– Desert salt lakes – that contains high saline water due to over evaporation

– Volcanic lakes – formed by water emitted from magma due to volcanic eruptions

– Dystrophic lakes – that contains highly acidic water (low pH)

– Endemic lakes – lakes that contain many endemic species – etc.

3.9.3 Streams:

Fresh water ecosystem where water current plays a major role. Oxygen and nutrient content are uniform. Stream organisms have to face extreme difference in climatic conditions but they do not suffer from oxygen deficiency as pond and lake organisms. This is because large surface area of running water provides more oxygen supply. The animals have very narrow range of tolerance towards oxygen deficiency. Thus stream are worst victims of industrial pollution.

3.9.4 Oceans:

Gigantic reservoirs of water covering >70% of earth surface – 2, 50,000 species

– Huge variety of sea products, drugs etc.

– Provide Fe, Mg, oils, natural gas, sand etc.

– Major sinks of carbon dioxide – regulate biochemical cycles.

Two zones: coastal zone

– Warm, nutrient rich, shallow

– High sunlight

– High primary productivity.

Open sea

– away from continental shelf

– vertically divided in to 3 zones.

1. euphotic zone – abundant sunlight

2. bathyal zone – dim sunlight

3. Abyssal zone – dark zone – world's largest ecological unit.

3.9.4 Estuary:

Coastal area where river meet ocean

– Strongly affected by tidal actions

– Very rich in nutrients

– Very rich in biodiversity

– Organisms are highly tolerant

– Many species are endemic

– High food productivity

–Protected from pollution.

Characteristics:

Structural Components:

Abiotic: pH, nutrients, D.O, temp, climatic conditions, etc.

Biotic: Phytoplankton, fishes, snail's insects, birds, etc.

CHAPTER -4

Biodiversity

4.1 Introduction

Biodiversity, a shortened form of **Biological diversity**, refers to the existence of number of different species of plants and animals in an environment.

The Convention on Biological Diversity (1992) of the United Nations gives a formal definition of biodiversity in its Article 2: "Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

Biodiversity is also defined as the existence of variability among living organisms on the earth, including the variability within and between species, and within and between ecosystems.

Species Diversity

Species diversity refers to the variety of different species of plants, animals, fungi, and organisms that are present in a region. It is estimated that there are above 30 million species on the earth. Species diversity is a part of diversity. Even within a small pond, we can notice a great variety of species. Species diversity differs from ecosystem to ecosystem. For example, in a tropical ecosystem more diversity is found than in temperate ecosystem. The most diverse group of species is invertebrates - animals without backbones.

At present, conservation scientists have been able to identify and categorize about 1.8 million species on earth. Many new species are being identified. Areas that are rich in species diversity are called ‘hotspots’ of diversity.

Genetic Diversity

It is the variation in genes that exists within a species. Genetic diversity corresponds to the variety of genes contained in plants, animals, fungi, and micro-organisms. It occurs within a species as well as between species. For example, poodles, German shepherds and golden retrievers are all dogs, but they all are different in look, color, and abilities. Each human being is different from all others. This genetic variability is essential for a health breeding of a population of species.

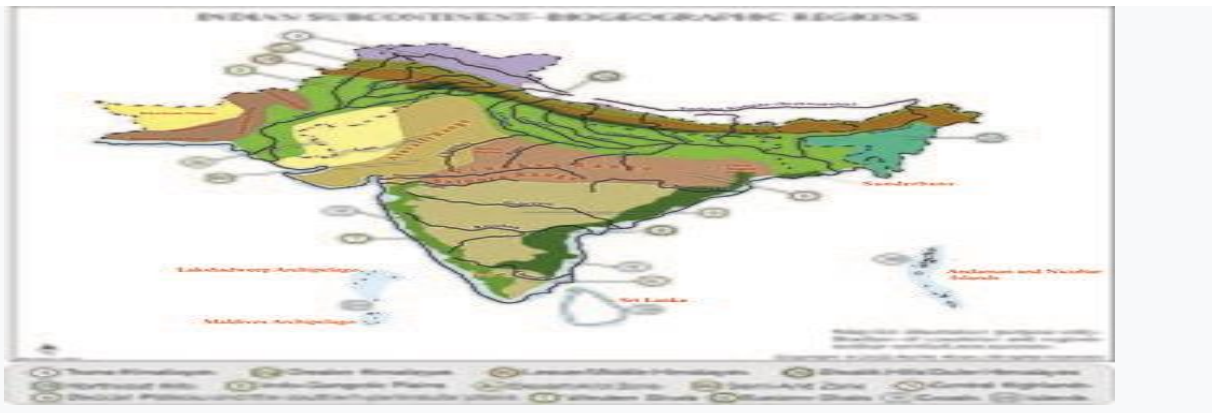
The diversity in wild species make the ‘gene pool’ from which crops and domestic animals have been developed over thousands of years.

Ecosystem Diversity

It is the diversity of ecosystems, natural communities, and habitats. In other words, ecosystem diversity refers to the variety of ways that species interact with each other and their environment. Tropical or temperate forests, grasslands, hot and cold deserts, wetlands, rivers, mountains, and coral reefs are instances of ecosystem diversity.

Each ecosystem corresponds to a series of complex relationships between biotic (living) and abiotic (non-living) components.

4.2 Biogeographic classification of India



Biogeographical map of Indian Subcontinent

Frontispiece to Alfred Russel Wallace's book The Geographical Distribution of Animals

Biogeographic classification of India is the division of India according to biogeographic characteristics. Biogeography is the study of the distribution of species (biology), organisms, and ecosystems in geographic space and through geological time. India has a rich heritage of natural diversity. India ranks fourth in Asia and tenth in the world amongst the top 17 mega-diverse countries in the world.[2] India harbours nearly 11% of the world's floral diversity comprising over 17500 documented flowering plants, 6200 endemic species, 7500 medicinal plants and 246 globally threatened species in only 2.4% of world's land area. India is also home to four biodiversity hotspots—Andaman & Nicobar Islands, Eastern Himalaya, Indo-Burma region, and the Western Ghats.[4] Hence the importance of biogeographical study of India's natural heritage.

The first initiative to classify the forests of India was done by Champion in 1936 and revised by Seth in 1968. This was followed by pioneering work on India's biogeography by MS Mani in 1974. Numerous schemes divide India into biogeographic regions as part of global schemes based on varying parameters, e.g. the Global 200 scheme of the Worldwide Fund for Nature. In addition,

ongoing research focusing on particular taxa have included biogeographic aspects particular to the taxa under study and the area under consideration.

Rogers and Panwar of the Wildlife Institute of India outlined a scheme to divide India zoogeographically in 1988 while planning a protected area network for India. Similarly the Forest Survey of India has issued an atlas of forest vegetation types in 2011 based on Champion & Seth (1968). However, there is no official scheme mandated by the Government of India, as has been issued by the European Environment Agency in the case of the European Union.

4.3 Value & Productive Use of Biodiversity

The importance of biodiversity is second to none. It boosts the ecosystem of productivity where each species, irrespective of their size, have an important role to play. Greater diversity in species ensure natural sustainability for all life forms. Hence, there is a need to preserve the diversity in life on the earth.

According to the UN sources at least 40 percent of the world's economy and 80 percent of the needs of the poor are derived from biological resources. In addition, the richer the diversity of life, the greater the opportunity for medical discoveries, economic development, and adaptive response to such new challenges as climate change.

4.3.1 Significance of Biodiversity

Environmental services from species and smooth running cycles of ecosystems are necessary at global, regional, and local levels.

Biodiversity is essential for maintaining the water cycles, production of oxygen, reduction in carbon dioxide, protecting the soil, etc. It is also essential for preserving ecological processes, such as soil formation, circulation of and cleansing of air and water, global life support, fixing and recycling of nutrients,

maintaining hydrological balance within ecosystems, maintaining rivers and streams throughout the year, etc.

Biodiversity has many values such as consumptive use value, productive use value, social values, ethical and moral values.

A healthy biodiversity offers many valuable services as follows.

- The more a region is rich in terms of biodiversity, better is the regulation of the different cycles. For example, 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.
- Protects water resources from being depleted, contaminated, or polluted.
- Helps in soil formation and protection.
- Helps in nutrient storage and recycling.
- Helps check pollution.
- Contributes to climate stability.
- Helps an ecosystem in recovery from unpredictable events.
- Provides biological resources such as food, medicinal resources, and pharmaceutical drugs, wood products, ornamental plants, breeding stocks, etc.
- Provides recreation and tourism facilities.
- Helps in research, education, and monitoring.
- Preservation of biological resources is essential for the well-being and long-term survival of mankind.

4.3.2 Productive Use Value of Biodiversity

Productive Use Value refers to the commercial value of products that are commercially harvested for exchange in formal markets.

Modern civilization is invariably a gift of biodiversity. The food we eat, the medicine we take in, the furniture we use, the industries, for example, are derivatives of biological diversity.

The agricultural crops of the present day have originated from wild varieties. Biotechnologists use the wild plants for developing new, high-yielding, and pest or diseaseresistant varieties. Biodiversity is home to original stock from which new varieties are being developed.

Similarly, all our domesticated animals came from their wild-living ancestral species. With the help of scientific breeding techniques, animals giving better yield of milk, meat, etc. are being developed. The animal products used by modern society come from the advances made in the fields of poultry farming, pisciculture, silviculture, dairy farming, etc.

Fossil fuels, considered to be pivotal in modern society, such as coal, petroleum, and natural gas are gifts of biodiversity from the geological past.

Most of the pharmaceutical drugs and medicines used in the present time are extracted from different plants.

Biodiversity provides rich storehouse for industrialists and entrepreneurs to develop new products. It provides agricultural scientists and biotechnologists with ample scope for developing new and better crops. New crop varieties are being developed using the genetic material found in wild relatives of crop plants though biotechnology.

The need of the hour is the preservation of biodiversity for industrial, economic, and above all, environmental safety. This is called **'biological prospecting'**.

4.3.3 Biodiversity Hotspots

The Earth's biodiversity is evenly distributed across its surface. There are over a thousand major eco-regions in the world. It is estimated that there are about 200 richest, rarest and most distinctive natural areas in the world. These are referred to as the Global 200.

Hotspots of biodiversity refer to bio-geographic regions where significant levels of biodiversity with richness and unusual concentration of endemic species are found, however, they are threatened with mindless exploitation and destruction.

A biodiversity is termed as a hotspot if −

- It has at least 1,500 vascular plants as endemic.
- It must be threatened or under threat of destruction to a considerable extent.

Across the world, about 35 areas are marked as hotspots of biodiversity and they represent 2.3 percent of the Earth's land surface but they support more than half of the world's endemic plant species and almost half of birds, mammals, reptiles, and amphibians as endemic.

4.3.4 List of Biodiversity Hotspots in the World

North and Central America − California Floristic Province, Madrean pine-oak woodlands, Mesoamerica

The Caribbean − Caribbean Islands

South America − Atlantic Forest, Cerrado, Chilean Winter Rainfall-Valdivian Forests, Tumbes-Chocó-Magdalena, Tropical Andes

Europe − Mediterranean Basin

Africa − Cape Floristic Region, Coastal Forests of Eastern Africa, Eastern Afromontane, Guinean Forests of West Africa; Horn of Africa; Madagascar and the Indian Ocean Islands; Maputaland-Pondoland-Albany; Succulent Karoo

Central Asia − Mountains of Central Asia

South Asia − Eastern Himalaya, Nepal; Indo-Burma, India and Myanmar; Western Ghats, India; Sri Lanka

South East Asia and Asia-Pacific − East Melanesian Islands; New Caledonia; New Zealand; Philippines; Polynesia-Micronesia; Southwest Australia; Sundaland; Wallacea

East Asia − Japan; Mountains of Southwest China

West Asia − Caucasus; Irano-Anatolian

About 1.8 million species are known to mankind at present. Scientists, however, have estimated that the number of species of plants and animals on the earth can go up to 20 billion. It means a majority of species still remain undiscovered.

World's most prolific bio-rich nations are in the south. On the other hand, the majority of the countries capable of exploiting biodiversity are the developed Northern countries. These countries have very low level of biodiversity.

Developed nations want to consider biodiversity as 'global resources'. However, nations rich in biodiversity like India don't want to compromise their sovereignty over their biological diversity unless there is a revolutionary change in global thinking about sharing of all types of natural resources such as rare minerals as uranium, oil, or even intellectual and technological resources.

India is home to rich biodiversity. Countries with diversities higher than India are located in South America such as Brazil, and South East India countries such as Malaysia and Indonesia.

Biological diversities are now being increasingly appreciated as being of unimaginable value. International initiatives such as World Heritage Convention, Biodiversity Action Plan (BAP) aims for the protection and support of biologically rich natural areas and address threatened species and habitats to protect and restore biological systems.

Convention in the Trade of Endangered Species (CITES) is intended to reduce the utilization of endangered plants and animals by controlling trade in their products and in pet trade.

4.4 BIODIVERSITY AT GLOBAL, NATIONAL AND LOCAL LEVELS: INIDA AS A MEGA-DIVERSITY NATION

4.4.1 The Global Patterns in Biodiversity

The present geological era is perhaps the richest in biological diversity. About 2.1 million species have been identified till date, while many more species are believed to exist. According to UNEP (1993-94) (UN convention on environment protection) estimate, the total number of species that might exist on Earth range between 9.0 – 52 million .

Invertebrate animals and plants make-up most of the species. About 70% of all known species are invertebrates (animals without backbones such as insects, sponges, worms, etc.); while, about 15% are plants. Mammals, the animal group to which man belong, comprise a comparatively small number of species.

Of all the world's species, only 10 to 15% live in North America and Europe. By contrast, the centers of greatest biodiversity tend to be in the tropics.

4.4.2 Patterns in Biodiversity

Species are not uniformly distributed over the Earth; diversity varies greatly from place to place. In terms of the number of basic kinds of organism and number of species of each kind, biodiversity has varied markedly through geological time; and, in terms of present day species richness, biodiversity varies greatly between one part of the earth and another. The present global patterns in biodiversity indicate that the species richness tends to vary geographically according to a series of fairly well defined rules.

4.4.3 India as a Mega Diversity Region

A **mega diversity region** or country is one that harbors majority of the Earth's species and is therefore considered extremely bio-diverse. India is rich in biodiversity from north to south and from east to west. Geological events in the landmass of India, different climatic regions across the country and its special geographical position between a couple of distinct biological evolution and radiation of species are responsible for India's rich and varied biodiversity.

India is one among the top 10 countries with rich biodiversity and one among the 12 Mega biodiversity regions in the world. Around 18 biosphere reserves have been set up in India.

India is home to 350 different mammals (rated highest in the world), 1, 200 species of birds, 453 species of reptiles and 45, 000 plant species. India is home to 50, 000 known species of insects, that include 13, 000 butterflies and moths. It is estimated that the number of unnamed species could be much higher than the existing number.

More than 18 percent of Indian plants are endemic (native to a particular region) to the country and found nowhere else in the world.

India has 27 indigenous breeds of cattle, 40 breeds of sheep, 22 breeds of goats and 8 breeds of buffaloes.

Among the amphibians found in India, 62 percent are unique to this country. High endemism has also been recorded in various flowering plants, insects, marine worms, centipedes, mayflies, and fresh water sponges.

Apart of noticeable diversity in Indian wild plants and animals, there is also a great diversity of cultivated crops and breeds of domestic livestock. The traditional cultivars (a plant variety that has been produced in cultivation by selective breeding) include about 50,000 varieties of rice and a number of cereals, vegetables, and fruits. The highest diversity of cultivars is found concentrated in the high rainfall areas of Western Ghats, Eastern Ghats, Northern Himalayas and North-Eastern hills.

4.5 Threats to Biodiversity

Biodiversity is a paramount factor for the survival of the living world in general and mankind in particular. The fewer species (animals and plants) we have, the fewer people we will have on the earth. During the last few decades, loss of biodiversity is on the rise. Following are the major causes of threat to biodiversity.

4.5.1 Habitat Loss

Today, major loss to biodiversity in the world has been done by man. Man has begun to overuse or misuse most of these natural ecosystems.

Due to mindless and unsustainable resource use, once productive forest and grasslands have been turned into deserts, and wastelands have increased all over the world. Rapid industrialization, urbanization, and growth in population have resulted in massive deforestation and consequential habitat loss around the world.

For instance, mangroves have been cleared for fuel-wood and prawn farming, which has led to a decrease in the habitat essential for breeding of marine fish.

Forests all over the world, in particular tropical rainforests such as the Amazon, are under unforeseen threat largely from conversion to other land-uses.

Scientists have estimated that human activities are likely to eliminate approximately10 million species by the year 2050. It is also estimated that at the present rate of extinction about 25 percent of the world's species will undergo extinction fairly rapidly. Rich biodiversities such as tropical forests, wetlands, and coral reefs world over will constitute the major part of this extinction.

4.5.2 Poaching of Wildlife

Poaching of wildlife for trade and commercial activities has been on the rise for the last many decades. It has been a significant cause of the extinction of hundreds of species and the endangerment of many more, such as whales and many African large mammal, Asian tigers, etc. Most extinction over the past several hundred years is mainly due to overharvesting for food, fashion, and profit.

Illicit trade in wildlife in current times is driving many species of wild animals and plants to extinction. Elephants are poached for ivory; tigers and leopards for their skin; pangolins for meat and scales; and rare timber is targeted for hardwood furniture.

The global illegal wildlife trade is estimated to be between $7 billion and $23 billion in illicit revenue annually. It is now considered the most lucrative global crime after drugs, humans, and arms.

In 2015, the United Nations General Assembly unanimously adopted a resolution for tackling illicit trafficking in wildlife. The Sustainable Development Goals has laid down specific targets to combat poaching and trafficking of protected species.

4.5.3 Man-Wildlife Conflict

Man-wildlife conflict refers to the interaction between wild animals and people and the consequential negative impact on both of them. Human population growth and the resultant destruction of wildlife habitat for human habitation and economic prosperity create reduction of resources or life to some people and wild animals.

World Wide Fund for Nature (WWF) defines this conflict as "any interaction between humans and wildlife that results in a negative impact on human social, economic, or cultural life, on the conservation of wildlife population, or on the environment."

Although man-wildlife conflict is as old as human civilization, in modern times the degree of conflict has been on the rise due to high rise in human population in the past several centuries.

Since human populations expand into wild animal habitats, natural wildlife territory is displaced. Reduction in the availability of natural prey/food sources leads to wild animals seeking alternate sources. Alternately, new resources created by humans draw wildlife resulting in conflict. Competition for food resources also occurs when humans attempt to harvest natural resources such as fish and grassland pasture.

There are many consequences of man versus wildlife conflicts. The major consequences are −

- Destruction of wildlife habitat
- Injury and loss of life of both humans and wildlife
- Crop damage and livestock depredation
- Damage to human property
- Decrease in wildlife population and reduction in geographic ranges
- Trophic cascades

Apart from the above, there are other causes of threat to biodiversity. Factors such as climate change, invasion of non-native species also add to biodiversity losses in some or the other.

4.5.4 Conversation of Biodiversity

Considering the degree of threat to biodiversity around the world and the vital importance of biodiversity for living beings of which mankind is a major part, there is an urgent need to conserve biodiversity in the world. Further, we should be concerned about saving biodiversity because of the benefits it provides us – biological resources and ecosystem services, and the social and aesthetic benefits.

There are two main methods for the conservation of biodiversity.

In-situ Conservation

In-situ or on-site conservation refers to the conservation of species within their natural habitats. This is the most viable way of biodiversity conservation. It is the conservation of genetic resources through their maintenance within the environment in which they occur.

Examples − National Parks, Wild Life sanctuaries, Biosphere Reserves, Gene Sanctuaries

Ex-situ Conservation

Ex-situ conservation means the conservation of components of biological diversity outside their natural habitats. In this method, threatened or endangered species of animals and plants are taken out of their natural habitat and placed in special settings where they can be protected and provided with natural growth.

In ex-situ conservation methods, the plants and animals taken away from their habitats are taken care of in an artificially created environment.

Examples − Captive Breeding, Gene Banks, Seed Banks, Zoos, Botanical gardens, Aquaria, In vitro fertilization, Cryopreservation, Tissue Culture.

National Biodiversity Act

National Biodiversity Act in India draws from the objectives of Convention of Biodiversity (CBD). It aims at conservation of biodiversity, sustainable use and equitable sharing of the benefits of such use.

To achieve its objectives, it has put in place a three-tier institutional structure such as −

- National Biodiversity Authority based in Chennai
- State Biodiversity Board (SBBs) in every state
- Biodiversity Management Committee (BMCs) at Panchayat/Municipality levels

The Ministry of Environment and Forestry (MoEF) is the nodal agency.

Main Provisions of the Act

- Prohibition on transfer of Indian genetic material outside the country without specific approval of the Indian Government.
- Prohibition of anyone claiming an IPR such as a patent over biodiversity or related knowledge without the permission of Indian Government.
- Regulation of collection and use of biodiversity by Indian national, while exempting local communities from such restrictions.
- Measures from sharing of benefits from the use of biodiversity including transfer of technology, monitory returns, joint research and development, joint IPR ownership, etc.
- Measures to conserve sustainable use of biological resources including habitat and species protection projects, integration of biodiversity into the plans and policies of the various departments and sectors.
- Provisions for local communities to have a say in the use of their resources and knowledge and to charge fees for this.
- Protection of indigenous or traditional laws such as registration of such knowledge.
- Regulation of the use of the genetically modified organisms.
- Setting up of national, state and local biodiversity funds to be used to support conservation and benefit sharing.
- Setting up of Biodiversity Management Committees (BMC) at local village levels. State Biodiversity Boards at state level and National Biodiversity Authority.

CHAPTER -5

ENVIRONMENTAL POLLUTION

5.1 INTRODUCTION

- **Pollution** may be defined as an undesirable change in the physical, chemical or biological characteristics of air, water and land that may be harmful to human life and other animals, living conditions, industrial processes and cultural assets. Pollution can be natural or manmade.
- The agents that pollute are called pollutants.

POLLUTANTS

Pollutants are by-products of man's action. The important pollutants are summarized below:

- **Deposited matter—**Soot, smoke, tar or dust and domestic wastes.
- **Gases—**CO, nitrogen oxides, sulphur oxides, halogens (chlorine, bromine and iodine).
- **Metals—**Lead, zinc, iron and chromium.
- **Industrial pollutants—**Benzene, acetic acid etc., and cyanide compounds.
- **Agriculture pollutants—**Pesticides, herbicides, fungicides and fertilizers.
- **Photochemical pollutants—**Ozone, oxides of nitrogen, aldehydes, ethylene, photochemical smog and proxy acetyl nitrate.
- **Radiation pollutants—**Radioactive substances and radioactive fall-outs of the nuclear test.

Classification of Pollutants

Nature of disposal: On the basis of natural disposal, pollutants are of two types:

1. **Non-degradable pollutants:** These are the pollutants, which degrade at a very slow pace by the natural biological processes. These are inorganic compounds such as salts (chlorides), metallic oxides waste producing materials and materials like, aluminum cans, mercuric salts and even DDT. These continue to accumulate in the environment.
2. **Biodegradable pollutants:** These include domestic sewage that easily decomposes under natural processes and can be rapidly decomposed by natural/ artificial methods. These cause

serious problems when accumulated in large amounts as the pace of deposition exceeds the pace of decomposition of disposal.

Nature of form: On the basis of the form in which they persist after their release into the environment, pollutants can be categorized under two types:

(i) Primary pollutants: These include those substances, which are emitted directly from some identifiable sources. This include-

a. **Sulphur compounds:** SO2, SO3, H2S produced by the oxidation of fuel.
b. **Carbon compounds:** Oxides of carbon (CO+CO2) and hydrocarbons.
c. **Nitrogen compounds:** NO2 and NH3.
d. **Halogen compounds:** Hydrogen fluoride (HF) and hydrochloric acid (HCl).
e. **Particles of different size and substances:** These are found suspended in air. The fine particles below the diameter of 100u are more abundant and include particles of metals, carbon, tar, pollen, fungi, bacteria, silicates and others.

(ii) Secondary pollutants: The secondary pollutants are produced by the Combination of primary emitted pollutants in the atmosphere.

Ex: In bright sunlight, a photochemical reaction occurs between nitrogen oxides; oxygen and waste hydrocarbons from gasoline that forms peroxy-acetyle nitrate (PAN) and ozone (O3), both of them are toxic components of smog and cause smarting eyes and lung damage.

5.1.1 AIR POLLUTION

Air pollution is define as the composition of air is disturbed due to presence of gas, smoke, dust, chemical particulate etc., which are injurious to human being, plant and animal.

Types of Air pollution

i) Primary pollutant: Pollutants that are emitted directly from the human or natural activities are known as primary pollutant. For example, CO2, SO2, NOx, particulate matter, hydrocarbons etc.

ii) Secondary pollutant: when primary pollutants are react with atmospheric

moisture content then a new category of pollutants is form, known as secondary pollutant. For example, carbonic acid, nitric acid, sulphuric acid etc.

Cause of Air pollution

a) Urbanization b) Population c) Deforestation d) Industrialization e) Vehicle emission

Major Air pollutants and their effects

a) Carbon dioxide: the concentration of CO2 gas increase in atmosphere due to emission from vehicles, burning of fossil fuel, emission from volcano, industries, agricultural activity etc. it increase green house effect which causes global warming and climate change.

b) Carbon monoxide: carbon monoxide gas releases after incomplete combustion of fossil fuel or other product. The source of CO is vehicle emission, burning of coal, biomass combustion etc. CO causes headache, dizziness, heart failure (in blood CO combines with oxygen which reduced the affinity of haemoglobin towards oxygen), etc.

c) Sulphur dioxide: SO2 releases from oil refineries, volcanic eruption, and chemical industries etc. sulphur dioxide react with moisture to form

secondary pollutant which causes eye irritation. It can also cause allergic reaction and asthma.

d) Lead: tetra ethyl lead used as anti-knocking agents in petrol for smooth function vehicle. Lead particle coming out from the exhaust of vehicle and mixed with air. It causes injurious effect on kidney and liver. It also lowers down the intelligence power in children.

e) Nitrogen oxide: it release from vehicle exhausts, volcanic eruption, lighting etc. like SO2, it also react with moisture content present in atmosphere and causes eye irritation.

Techniques used for prevention of Air pollution

i) Filters: filter remove particulate matter from the gas stream. Bag house filter system is the most common and it is made up of cotton fibers. When polluted gas passed through it, then polluted gas are deposited on cotton fibers.

ii) Electrostatic scrubber: the emitting dust is charged with ions and ionized particulate matter is collected on oppositely charged surface. The collected particles are removed by shaking the surface.

iii) Scrubbers: Scrubbers are wet collectors. They remove aerosol from a stream of gas either by collecting wet particle on a surface followed by their removal on the particles are wetted by scrubber liquid.

5.1.2 WATER POLLUTION

The undesirable biological or chemical substance present in water which adversely affect living organism is referred as water pollution.

Source of Water pollution

i) Point source pollution: if pollutants discharge from single identifiable source then it is known as point source. For example, municipal sources, industrial sources etc.

ii) Non-point source pollution: if pollutants discharge from random or scattered source then it is known as non-point source. For example, construction site, agricultural site, Acid rain, animal waste etc.

Cause & effects of Water pollution

a) Disease causing agents: the micro-organism including bacteria, virus, protozoa, if present in drinking water causes disease.

b) Oxygen depleting waste: organic matters present in water are degraded by microorganism present in water which required oxygen. If large amount of organic matter present in waste water then large amount of oxygen is required by the microorganism to degrade the waste.

Therefore oxygen content in water decrease. The amount of oxygen consumed by microorganism is referred as Biological Oxygen Demand (BOD). High level of BOC means large amount of waste present in water.

c) Water soluble inorganic chemicals: the elements like lead, mercury, cadmium, arsenic

adversely affect the human being and animals. For example, cadmium causes Itai-Itai disease, mercury causes Minamata disease. d) Suspended solids: if suspended solid present in water bodies, then water become turbid and therefore proper sunlight does not reach to the aquatic plant and animal which disturb the life of aquatic ecosystem.

Control measure for preventing water pollution

i) Industrial effluent and domestic waste must be treated before disposal.

ii) Recycling of waste water through waste water treatment.

iii) Public awareness program.

5.1.3 SOIL POLLUTION

Soil pollution can be defined as introduction of undesirable substance in soil which adversely affects its physical, chemical and biological properties.

Source of Soil pollution

Cause of Soil pollution or degradation

a) Soil erosion: removal or movement of top soil from one place to another place is known as soil erosion, it is a natural process. But the erosion enhances by human activities like mining, construction, new land for agricultural practices, deforestation, overgrazing etc. Due to erosion, soil become less fertile and erosion also reduce the soil water holding capacity.

b) Excess use of fertilizers: Essential micronutrients like N, P, K are supplied by chemical fertilizer to increase the crop yield or productivity. The microorganism present in the soil converts nitrogen into nitrate ions; enter into food chain from soil disturbing the biochemical process.

c) Acid Rain: acid rain increases the acidity of soil which reduces the crop yield.

d) Salinity of water: Due to excessive irrigation, concentration of soluble salt increase in soil, then productivity and quality of soil decrease. These salts deposit on the surface then diffusion of oxygen and drainage of water in soil does not occur therefore growth of plant

is slow down.

e) Industrial waste: various pollutants present in the environment from industrial waste. Discharge from chemical industries, fertilizer and pharmaceutical companies are highly polluting.

Effect of Soil pollution

i) Salinity and water logging reduce the fertility of soil and crop yield.

ii) Toxic chemical present in the soil also affect the plant growth and human life.

iii) Soil pollution contaminated the underground water.

Control measures for preventing soil pollution

i) Soil erosion must be prevented by proper tree plantation.

ii) Waste from industry and domestic must be treated before dumping.

iii) Replace synthetic fertilizers with organic fertilizers.

iv) Toxic and non-degradable materials must be banned.

v) Recycling and reuse of waste materials.

vi) Public awareness.

5.1.4 MARINE POLLUTION

Marine pollution defined as contamination of oceans or seas, due to presence of unwanted materials or pollutants. The most common pollutants include chemicals, oils, toxic bio-matter, plastics etc.

Cause of Marine pollution

i) Rivers receive huge amount of sewage, garbage, pesticides, toxic chemical from industries ends up in the sea.

ii) Dumping of radioactive elements, discharge of oils and petroleum product into the sea also causes marine pollution.

iii) Large amount of plastic bags dumped into sea also causes marine pollution.

iv) The waste material from container ships like gases, chemicals, and sewage also causes marine pollution.

v) Greenhouse gases releases from burning of fossil fuel, dissolve in the sea water and making sea water more acidic.

vi) Deep sea mining also causes marine pollution.

Effect of marine pollution

a) Dumping of sewage, chemicals, organic matters into ocean can results in depletion of oxygen. Due to depletion of oxygen, it is hard to survive aquatic plants and animals.

b) Discharge of oil and petroleum products into the ocean, can block the sunlight which is used by aquatic plants for photosynthesis.

c) Many aquatic animals and marine birds ingest small piece of plastic, causes gastro-intestinal disorder and damage the tissue of eggs.

d) When greenhouse gas like CO_2 when dissolve, increase the acidity of sea water ad affect the aquatic plant and animal.

Control measure for marine pollution

i) Waste water must be treated before dumping.

ii) Reduce the use of single use plastic.

iii) To minimize the greenhouse gases use alternative energy resources.

iv) Chemical fertilizers may be replacing by organic fertilizers.

v) Proper monitoring of sea water.

vi) Campaigns should be done to prohibit marine pollution.

5.1.5 THERMAL POLLUTION

Introduction

Thermal pollution is defined as the addition of excess of undesirable heat to water thereby making it harmful to man, animal or aquatic life. Thermal pollution may also cause no significant departures from or activities of aquatic communities.

Sources of Thermal Pollution

The following sources contribute to thermal pollution.

1. **Nuclear power plants:** Nuclear power plants including drainage from hospitals, research institutions, nuclear experiments and explosions, discharge a lot of heat that is not utilized along with traces of toxic radio nuclides into nearby water streams. Emissions from nuclear reactors and processing installations are also responsible for increasing the temperatures of water bodies. The operations of power reactors and nuclear fuel processing units constitute the major contributor of heat in the aquatic environment. Heated effluents from power plants are discharged at 10 C higher than the receiving waters that affect the aquatic flora and fauna.
2. **Coal-fired power plants:** Coal fired power plants constitute a major source of thermal pollution. The condenser coils in such plants are cooled with water from nearby lakes or rivers. The resulting heated water is discharged into streams thereby raising the water temperature by 15C. Heated effluent decreases the dissolved content of water resulting in death of fish and other aquatic organisms. The sudden fluctuation of temperature also leads to "thermal shock" killing aquatic life that has become acclimatized to living in a steady temperature.
3. **Industrial effluents:** Industries like textile, paper, pulp and sugar manufacturing release huge amounts of cooling water along with effluents into nearby natural water bodies. The waters polluted by sudden and heavy organic loads result in severe drop in levels of dissolved oxygen leading to death of several aquatic organisms.
4. **Domestic Sewage:** Domestic sewage is discharged into rivers, lakes, canals or streams with minimal treatment or without any treatment. These wastes have a higher organic

temperature and organic load. This leads to decrease in dissolved oxygen content in the receiving waters resulting in the set-up of anaerobic conditions causing release of foul and offensive gases in water. Eventually, this leads to development of anoxic conditions resulting in rapid death of aquatic organisms.

5. **Hydro-electric power:** Generation of hydroelectric power sometimes leads to negative thermal loading in water systems. Apart from electric power industries, various factories with cooling requirement contribute to thermal loading.

Thermal pollution in streams by human activities

- Industries and power plants use water to cool machinery and discharge the warm water into a stream
- Stream temperature rises when trees and tall vegetation providing shade are cut.
- Soil erosion caused due to construction also leads to thermal pollution
- Removal of stream side vegetation
- Poor farming Practices also lead to thermal pollution

Effects of Thermal pollution

1) **Reduction in dissolved oxygen**: Concentration of Dissolved Oxygen (DO) decreases with increase in temperature.

2) **Increase in toxicity**: The rising temperature increases the toxicity of the poison present in water. A 10C increase in temperature of water doubles the toxicity effect of potassium cyanide, while 80C rise in temperature triples the toxic effects of o- xylene causing massive mortality to fish.

3) **Interference in biological activity**: Temperature is considered to be of vital significance to physiology, metabolism and biochemical processes that control respiratory rates, digestion, excretion, and overall development of aquatic organisms. Temperature changes cause total disruption to the entire ecosystem.

4) **Interference in reproduction:** In fishes, several activities like nest building, spawning, hatching, migration and reproduction depend on optimum temperature.

Direct mortality:

Thermal pollution is directly responsible for mortality of aquatic organisms. Increase in temperature of water leads to exhaustion of microorganisms thereby shortening the life span of fish. Above a certain temperature, fish die due to failure of respiratory system and nervous system failure.

Food storage for fish: Abrupt changes in temperature alter the seasonal variation in the type and abundance of lower organisms leading to shortage of right food for fish at the right time.

Control measures for thermal pollution

The following methods can be adapted to control high temperature caused by thermal discharges:

Cooling towers: Use of water from water systems for cooling systems for cooling purposes, with subsequent return to the water way after passage through a condenser, is called cooling process. Cooling towers transfer heat from hot water to the atmosphere by evaporation. Cooling towers are of two types:

Wet cooling tower: Hot water coming out from the condenser (reactor) is allowed to spray over baffles. Cool air, with high velocity, is passed from sides, which takes away the heat and cools the water.

Dry cooling tower: Here, hot water is allowed to flow in long spiral pipes. Cool air with the help of a fan is passed over these hot pipes, which cools down hot water. This cool water can berecycled.

Cooling ponds: Cooling ponds are the best way to cool thermal discharges. Heated effluents on the surface of the water in cooling ponds maximize dissipation of heat to the atmosphere and minimize the water area and volume. The warm water wedge acts like a cooling pond.

Spray ponds: The water coming out from condensers is allowed to pass into the ponds

through sprayers. Here water is sprayed through nozzles as fine droplets. Heat from the fine droplets gets dissipated to the atmosphere.

Artificial lakes: Artificial lakes are manmade water bodies that offer once-through cooling. The heated effluents can be discharged into the lake at one end and water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation

5.1.6 NOISE POLLUTION

Introduction

Noise is defined as, "the unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings". Sound intensity is measured in decibels (dB) , that is the tenth part of the longest unit Bel. One dB is the faintest sound that a human ear can hear.

Types of noise: Environmental noise has been doubling every ten years. Noise is classified as:

Industrial Noise

Transport Noise

Domestic Noise

Industrial Noise:

It is sound with a high intensity sound caused by industry machines. Sources of such noise pollution are caused by machines from machines in various factories, industries and mills. Noise from mechanical saws and pneumatic drills is unbearable and a nuisance to the public. The Indian Institute of Oto-Rino Laryngology, Chennai reported that increasing industrial pollution damages the hearing ability by at least 20%. Workers in steel industry, who work close to heavy industrial blower, are exposed to 112dB for eight hours suffer from occupational pollution.

Transport Noise:

Transport noise mainly consists of traffic noise from road, rail and aircraft. The number of automobiles on roads like motors, scooters, cars, motor cycles, buses, trucks and

diesel engine vehicles has increased enormously in the recent past further aggravating the problem of transport noise. Noise levels in most residential areas in metropolitan cities are hovering around the border line due to increased vehicular noise pollution. This high level of noise pollution leads to deafening in the elderly.

Domestic noise:

This type of noise includes disturbance from household gadgets and community. Common sources of noise are musical instruments, TV, VCR, Radios, Transistors, Telephones, and loudspeakers etc. Statistically ever since the industrial revolution, noise in the environment has been doubled every ten years.

Effects of Noise pollution

- Noise pollution affects both human and animal health. It leads to:
  - contraction of blood vessels
  - making skin pale
  - Excessive adrenalin in the blood stream which is responsible for high blood pressure.
  - Blaring sounds are known to cause mental distress
  - Heart attacks, neurological problems, birth defects and abortion
- Muscle contraction leading to nervous breakdown, tension, etc
- The adverse reactions are coupled with a change in hormone content of blood, which in-turn increases heart beat, constriction of blood vessels, digestive spams and dilation of the pupil of the eye.
- Adverse affects health, work efficiency and behavior. Noise pollution may cause damage to the heart, brain, kidneys, liver and may produce emotional disturbance.
- The most immediate and acute effect of noise is impairment of hearing that diminishes some part of the auditory system.
- Prolonged exposure to noise of certain frequency pattern leads to chronic damage to the inner ear.
- Impulsive noise may cause psychological and pathological disorders

- Ultrasonic sound can affect the digestive, respiratory, cardiovascular system and semicircular canals of the internal ear.
- The brain is adversely affected by loud and sudden noise by jets and airplanes. People are subjected to psychiatric illness.
- Recent reports suggest that blood is thickened by excessive noise.
- The optical system of human beings is also affected by noise pollution. Severe noise pollution causes:
- Popularly dilation
- Impairment of night vision and
- Decrease in rate of color perception

Control measures:

SOURCE CONTROL: This includes source modification such as acoustic treatment to machine surface, design changes, limiting operational timings, etc

TRANSMISSION PATH INTERVENTION: This includes containing the source inside a sound insulating enclosure, constructing a noise barrier or provision of sound absorbing materials along the path.

RECEPTOR CONTROL: This includes protection of the receiver by altering the work schedule or provision of personal protection devices such as ear plugs for operating noisy machinery. The measure may include dissipation and deflection methods.

OILING: Proper oiling will reduce noise from the machine.

Preventive measures

Prescribing noise limits for vehicular traffic

Ban on honking (usage of horns) in certain areas

Creation of silence zones near schools and hospitals

Redesigning buildings to make them noise proof

Reduction of traffic density in residential areas

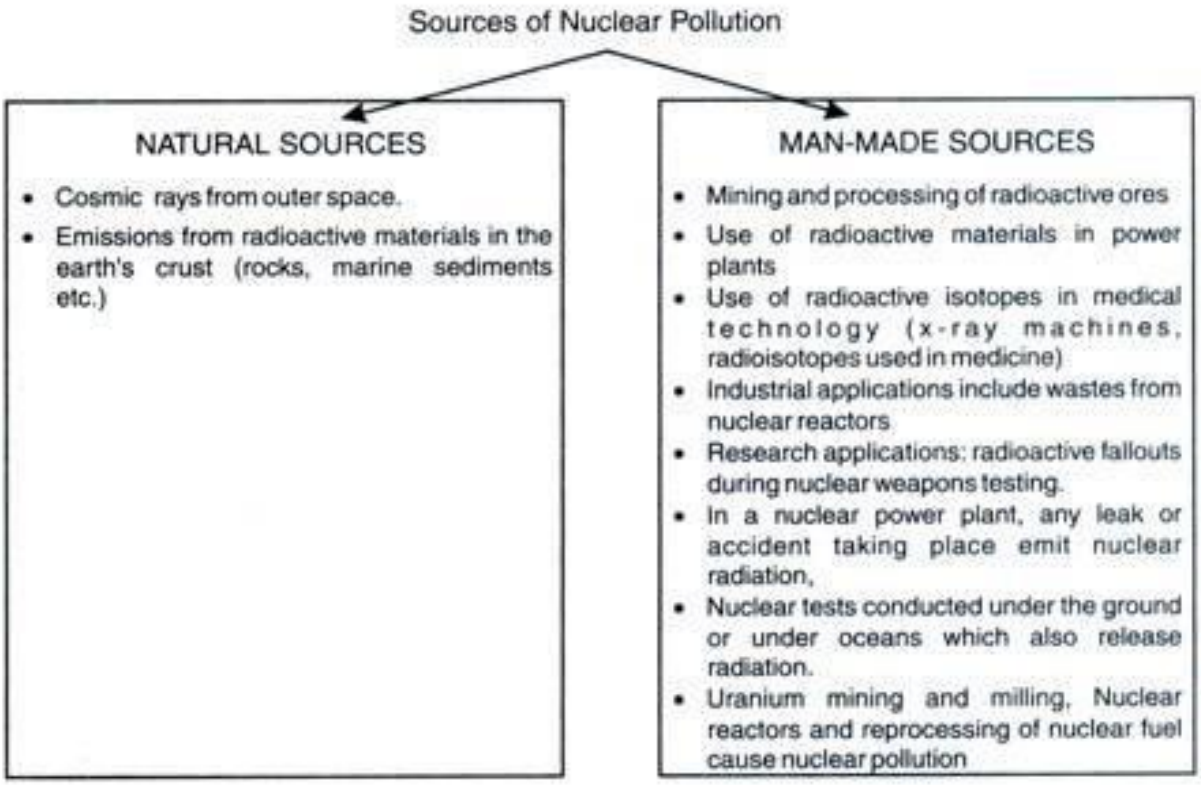
Giving preference to mass public transport system.

5.1.7 Nuclear Pollution

Nuclear pollution is the physical pollution of air, water and soil by radioactive materials.

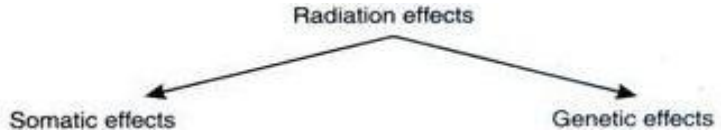
Sources of Nuclear Pollution

The sources of radioactivity include both natural and manmade.



Effects of Nuclear Pollution

Studies have shown that the health effects due to radiation are dependent on the level of dose, kind of radiation, duration of exposure and types of cells irradiated. Radiation effects can be somatic or genetic.



Somatic effects: Somatic affects the function of cells and organs. It causes damages to cell membranes, mitochondria and cell nuclei resulting in abnormal cell functions, celldivision, growth and death.

Genetic effects: Genetic effects the future generations. Radiations can cause mutations, which are changes in genetic makeup of cells. These effects are mainly due to the damages to DNA molecules. People suffer from blood cancer and bone cancer if exposed to doses around 100 to 1000 roentgens.

Management of Radioactive Waste

- The radioactive waste which comes out from industry, nuclear reactors should be stored and allowed to decay either naturally in closed drums or in very large underground air tight cemented tanks (Delay and Decay).
- The intermediate radioactive waste should be disposed off into the environment after diluting it with some inert materials (Dilute and Disperse)
- Now-a-days small quantities of high activity wastes are converted into solids such as concrete and then it is buried underground or sea. (Concentrate and contain)

Control Measures

- Laboratory generated nuclear wastes should be disposed off safely and scientifically.
- Nuclear power plants should be located in areas after careful study of the geology of the area, tectonic activity and meeting other established conditions.
- Appropriate protection against occupational exposure.
- Leakage of radioactive elements from nuclear reactors, careless use of radioactive elements as fuel and careless handling of radioactive isotopes must be prevented.
- Safety measure against accidental release of radioactive elements must be ensured in nuclear plants.
- Unless absolutely necessary, one should not frequently go for diagnosis by x- rays.
- Regular monitoring of the presence of radioactive substance in high risk area should be ensured.

- Among the many options for waste disposal, the scientists prefer to bury the waste in hundreds of meters deep in the earth's crust is considered to be the best safety long term option.

5.2 SOLID WASTE MANAGEMENT

Introduction

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

Urban or municipal wastes

Industrial wastes

Hazardous wastes

- **Sources of urban 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 is 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.

EFFECT OF IMPROPER SOLID WASTE MANAGEMENT

- 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.
- 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.
- 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.

- Solid waste management involves waste generation, mode of collection, transportation, segregation of wastes and disposal techniques.

STEPS INVOLVED IN SOLID WASTE MANAGEMENT

Two important steps involved in solid waste management are- Reduce, Reuse and Recycle of Raw Materials

Discarding wastes

- Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced.
- Reuse - Refillable containers that are discarded after use can be reused. Rubber rings can be made from discarded cycle tubes and this reduces waste generation during manufacture of rubber bands.

Recycle- Recycling is the reprocessing of discarded materials into new useful products

Ex: Old aluminum cans and glass bottles are melted and recast into new cans and bottles, preparation of cellulose insulation from paper, Preparation of automobile body and construction material from steel cans This method (**Reduce, Reuse & Recycle**), i.e, **3R's** help save money, energy, raw materials and reduces pollution.

`Discarding wastes

The following methods are adopted for discarding wastes:

Landfill

Incineration

Composting

LANDFILL: Solid wastes are placed in a sanitary landfill in which alternate layers of 80 cm thick refuse is covered with selected earth-fill of 20 cm thickness. After 2-3 years solid waste volume shrinks by 25-30% and land is used for parks, roads and small buildings. This is the most common and cheapest method of waste disposal and is mostly employed in Indian cities.

Advantages:

1. It is simple and economical
2. Segregation of wastes is not required
3. Land filled areas can be reclaimed and used for other purposes
4. Converts low-lying, marshy waste-land into useful areas.
5. Natural resources are returned to soil and recycled.

Disadvantages:

1. Large area is required
2. Land availability is away from the town, transportation costs are high
3. Leads to bad odor, if landfill is not properly managed.
4. Land filled areas will be sources of mosquitoes and flies requiring application of insecticides and pesticides at regular intervals.
5. Causes fire hazard due to formation of methane in wet weather.

2. INCINERATION:

- It is a hygienic way of disposing solid waste. It is suitable if waste contains more hazardous material and organic content. It is a thermal process and very effective for detoxification of all combustible pathogens. It is expensive when compared to composting or land-filling.
- In this method municipal solid wastes are burnt in a furnace called incinerator. Combustible substances such as rubbish, garbage, dead organisms and non- combustible matter such as glass, porcelain and metals are separated before feeding to incinerators.
- The non-combustible materials can be left out for recycling and reuse. The leftover ashes and clinkers may account for about 10 to 20% which need further disposal by sanitary landfill or some other means.
- The heat produced in the incinerator during burning of refuse is used in the form of steam power for generation of electricity through turbines.
- Municipal solid waste is generally wet and has a high calorific value. Therefore, it has to be dried first before burning. Waste is dried in a preheated from where it is taken to a large

incinerating furnace called "destructor" which can incinerate about 100 to 150 tons per hour.

- Temperature normally maintained in a combustion chamber is about 700 C which may be increased to 1000 C when electricity is to be generated.

ADVANTAGES:

1. Residue is only 20-25% of the original and can be used as clinker after treatment
2. Requires very little space
3. Cost of transportation is not high if the incinerator is located within city limits
4. Safest from hygienic point of view
5. An incinerator plant of 3000 tons per day capacity can generate 3MW of power.

DISADVANTAGES:

1. Its capital and operating cost is high.
2. Operation needs skilled personnel.
3. Formation of smoke, dust and ashes needs further disposal and that may cause air pollution.

3. COMPOSTING: It is another popular method practiced in many cities in our country. In this method, bulk organic waste is converted into fertilizer by biological action. Separated compostable waste is dumped in underground trenches in layers of 1.5m and finally covered with earth of 20cm and left for decomposition. Sometimes, Actionmycetes are introduced for active decomposition. Within 2 to 3 days, biological action starts. Organic matter is destroyed by actinomycetes and lot of heat is liberated increasing the temperature of compost by 75C and the refuse is finally converted into powdery brown colored odorless mass called humus that has a fertilizing value and can be used in agriculture. Humus contains lot of Nitrogen essential for plant growth apart from phosphates and other minerals.

ADVANTAGES:

1. Manure added to soil increases water retention and ion-exchange capacity of soil.
2. This method can be used to treat several industrial solid wastes.
3. Manure can be sold thereby reducing cost of disposing wastes
4. Recycling can be done

DISADVANTAGES:

1. Non-consumables have to be disposed separately
2. The technology has not caught-up with the farmers and hence does not have an assured market.

5.3 Role of an Individual in the Prevention of Pollution

Administrative director of UNEP, M. Kolba (1992) suggested that care and share is the simple and best method to control pollution. This is being followed in advanced countries but in developing countries, people have began to understand what care is but they do not follow to share.

The main causes of pollution in developing countries

i. Increasing population
ii. Illiteracy and poverty
iii. Rapid industrialization
iv. Failure in pollution management

Individually man can participate in solving the problem of pollution mainly in two ways:

1. Direct role
2. Indirect role

Direct Role of an Individual

Direct Role of an Individual involves those functions which are done by individual himself. Since nature cannot solve the problem of pollution on its own basis, it is the duty of man to find means to solve this problem.

Since the cause of pollution is mainly human beings, only they can minimize it by preventing its increase and spread.

One can remember the old saying that prevention is better than cure. A man should regulate and reduce the causes of pollution at every step. Some simple principles to reduce the pollution are as follows-

Preventive measures for Air Pollution

1. Establish or transfer factories or industries away from residential areas.
2. Reduce the use of automobiles and make use of public transport system.
3. Keep vehicle filters clean and use only quality fuels.
4. Make vehicle's engine off while taking or standing at any crossing.
5. Use CNG (Compressed Natural Gas) as fuel for auto engines instead of liquid petroleum.
6. Use self or low noise horns and avoid blowing them unnecessarily.
7. Use efficient silencer in vehicles.
8. Use of crackers should be avoided.
9. Use LPG for cooking instead of wood, coal.
10. Do not burn plastics.
11. Quit smoking.
12. Reduce the use of air conditioners, refrigerators etc.
13. Support companies that are committed to sustainable manufacturing practices and reducing pollution in the air.
14. Plant trees around our home and in our community that can help to reduce air pollutants.

Preventive measures for Water Pollution

1. Sewage disposal is the main cause of water pollution in big cities. One should take care of proper disposal of sewage.
2. Sewage should be released to water only after treatment.
3. Industrial effluents should be released into water bodies only after proper treatment.
4. Use of chemical pesticides, weedicides, insecticides etc. should be minimized. Promote the use of bio-pesticides, fertilizers etc.
5. Proper checking of super tankers in the sea in order to prevent oil spillage.
6. Use the minimum amount of detergent.
7. Use only phosphate free soaps and detergents.

Preventive measures for Solid Waste Pollution

1. Divide the domestic wastes into biodegradable and non-biodegradable components before discharging
2. Biodegradable wastes can be used as fertilizers.
3. One should never allow scattering of domestic wastes
4. Recharge batteries rather than using disposable.
5. Give items to charity or sell in a yard sale rather than throwing them away.
6. Use of cloth bags rather than plastics.
7. Buy environmentally friendly electronics.
8. Recycle & reuse items rather than sending them to the landfill.
9. Ensure the proper disposal of solid wastes.

Indirect Role of an Individual

Man can participate in various activities for solving the problem of pollution.

1. One should support expansion of environmental education by participating or supporting the system.
2. One should make efforts to develop awareness of environmental pollution by:
    - Publishing information on pollution
    - Organizing various exhibitions or competitions
    - Sponsoring environment related advertisement
3. One should make Non-Governmental Organizations or encourage and help in developing NGO for social services against environmental pollution.
4. One should celebrate environmental dates as festivals of society and develop them as non-caste and non-religious occasions for all.
5. One should organize special programmes and rallies on Tree Plantation Day (7 July) & World Environmental Day and raise the slogans in the society.
6. One should encourage to follow Environmental Laws by making them popular and help people to respect.

5.4 DISASTER MANAGEMENT

FLOODS

Increased rainfall or rapid snow melting causes more flow of water in the streams. This excess water flow in a stream covering the adjacent land is called a flood. Floodplain is defined in terms of a flood frequency. Flood frequency is referred as 10 -year flood, 100- year flood, etc. A 10-year flood at any point in a stream is that discharge of water which may be expected to occur on average once in 10 years. Floodplains are genera lly fertile, flat and easily formed.

CAUSES OF FLOOD

- Construction of buildings in a floodplain
- Removing vegetation
- Deforestation
- Heavy rainfall
- Urbanization

Effects of flood

- Erosion of top soil and vegetation
- Damage and loss to land, house and property
- Spread of endemic waterborne diseases
- Interruption of basic facilities of community such as highways, railways, telephone, electricity and day-to-day essentials
- Silting of reservoirs and dams

FLOOD CONTROL

- Construction of flood control dam
- Deepening, widening and straightening of streams
- Lining of streams
- Banning of construction of buildings in floodplains
- Converting flood-plains into wildlife habitat, parks, and recreation areas.

LANDSLIDES

- Landslides occur when mass of earth material move downward. It is also called mass wasting or mass movement.
- Sudden landslide occurs when unconsolidated sediments of a hillside are saturated by rainfall or water logging.
- Many landslides take place in coincidence with earthquakes. The most common form of landslides is earthquake induced landslides or more specifically rock falls and slides of rock fragments that form on steep slopes.
- The size of area affected by earthquake induced landslides depends o n the magnitude of the earthquake, its focal depth, the topography and geologic conditions near the causative fault, the amplitude, frequency, composition and duration of ground shaking.

Control measures for landslides

- Avoid construction activity in landslide occurring areas.
- Reducing slope of hilly side
- Stabilizing the slope portion
- Increasing plantation of deep rooted vegetation on the slope.

EARTHQUAKES

- An earthquake occurs when rocks break and slip along a fault in the earth. Earthquakes occur due to deformation of crust and upper mantle of the earth.
- Due to heating and cooling of the rock below these plates, movement of adjacently overlying plates and great stresses, deformation occurs.
- Tremendous energy cans build-up between neighboring plates.
- If accumulated stress exceeds the strength of the rocks, the rocks break suddenly releasing the stored energy as an earthquake.
- The earthquake releases energy in the form of waves that radiate from the epicenter in all directions.
- The 'p' wave or primary wave alternately compresses and expands material in the same

direction it is travelling.

- This wave can move through solid rocks and fluids.
- These are the fastest waves. The is wave or secondary wave is slower and shake the ground up, down, back and forth perpendicular to the direction in which it is travelling. Surface waves follow both the 'P' and 'S' waves.
- The magnitude of an earthquake is measured in Richter scale. The Richter scale is logarithmic.

Effects of earthquake

- Ground shaking
- Liquefaction of ground
- Ground displacement
- Landslides
- Flood
- Fire
- Tsunami

Control of earthquake

- There is virtually no technique to control the occurrence of earthquake. However, certain preventive measures can be taken to minimize the damage.
- Minimizing development activity (especially construction, mining, construction of dams and reservoirs) in areas known to be active seismic zones.
- Continuously monitoring seismic activity using 'seismographs' and alerting people regarding any recorded disturbance in advance.

Causes of waste land formation:

1. over exploitation of natural resources.
2. Industrial and sewage wastes.
3. Due to soil erosion, deforestation, water logging, salinity etc.
4. Mining activities destroy the forest and cultivable land.

Objects of waste land reclamation:

1. To prevent soil erosion, flooding and landslides.
2. To avoid over exploitation of natural resources.
3. To improve the physical structure and quality of the soil.
4. To conserve the biological resources and natural ecosystem.

Methods waste land reclamation:

Drainage: Excess water is removed by artificial drainage. This is for water logged soil reclamation.

Leaching: Leaching is a process of removal of salt from the salt affected soil by applying excess amount of water. Leaching is done by dividing the field into small plots. In continuous leaching 0.5to 1.0cm.

Water is required to remove 90% of soluble salts.

Irrigation practices: High frequency irrigation with controlled amount of water helps to maintain better availability of water in the land. Application of green manure and bio fertilizers improves saline soil.

Application of gypsum: Soil sodality can be reduced with gypsum. Ca of gypsum replaces sodium from the exchangeable sites. This converts clay back into calcium clay.

Social Forestry programme: These programs involve strip plantation on road, canal sides and degraded forest land etc.

COSUMERISM AND WASTE PRODUCTS

The consumption of resources by the people is called consumerism. It is related to both increase in population size as well as increase in our demand due to change in life style. If needs increases the consumerism of resources also increases.

TRADITIONAL FAVOURABLE RIGHTS OF SELLERS

The right to introduce any product.

The right to change any price.

The right to use incentives to promote their products

IMPORTANT INFORMATION TO BE KNOWN TO BUYERS

1. Ingredients of the products.
2. Manufacturing date and expiry date.
3. Whether the product has been manufactured against an established law of nature or involved in right variation.

Objectives of consumerism.

1. It improves the right and powers of buyers.
2. It involves making manufacturer liable for the entire life cycle of a product
3. It force the manufacturer to reuse and recycle the product after usage.
4. Active consumerism improves human health and happiness and also it saves resources. Sources of wastes are agriculture, mining, industrial and municipal wastes.

Example for waste products.

It includes paper, glass, plastic, garbage, food waste, Scrap, construction and factory wastes.

E- waste: Electronic equipment's like computer, printers, mobile phones, calculator etc after usage thrown as waste.

Effects of waste:

- Waste from industries and explosives are dangerous to human life. Dumped wastes degrade soil and make it unfit for irrigation.
- E-wastes contain more than 1000 chemicals which are toxic and cause environmental Pollution.
- In computers lead is present in monitors, cadmium in chips and cathode ray tube , pvc in cables.
- All these cause cancer and other respiratory problems if inhaled for long long periods.
- Plastics are non-degradable and their combustion produces many toxic gases.

Factors affecting consumerism and generation of wastes:

People over population –

Over population cause degradation of sources, poverty and premature deaths. This situation occurs in less developed countries (LDC's).In LDC's the percaptia consumption f resources and waste generation are less.

Consumption Over population:

It occurs when there are less people than the available Resources. Due to luxurious life style per captia consumption of resources is very high. Consumption is more and waste generation is more. Environment is also degraded.

CHAPTER-6 SOCIAL ISSUES AND THE ENVIRONMENT

From Unsustainable To Sustainable Development – Urban Problems Related To energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, Its Problems and Concerns, Case Studies – Environmental Ethics:- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies – Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues Involved in enforcement of Environmental Legislation – Public Awareness.

SOCIAL ISSUES AND ENVIRONMENT

Introduction:

From Unsustainable to Sustainable Development

Man is part of the nature and he is bound to obey the laws of nature. He depends on his environment for basic things. More developmental activities are adopted in order to increase the quality of life. For that he uses the available resources. The Earth has limited supply of resources and renewable resources. These are to be managed in a scientific manner for availing the generations to come. Hence developmental activities are to be taken with more care about the environment and its protection. It brings benefits to all not only to the present generation but also for future generations.

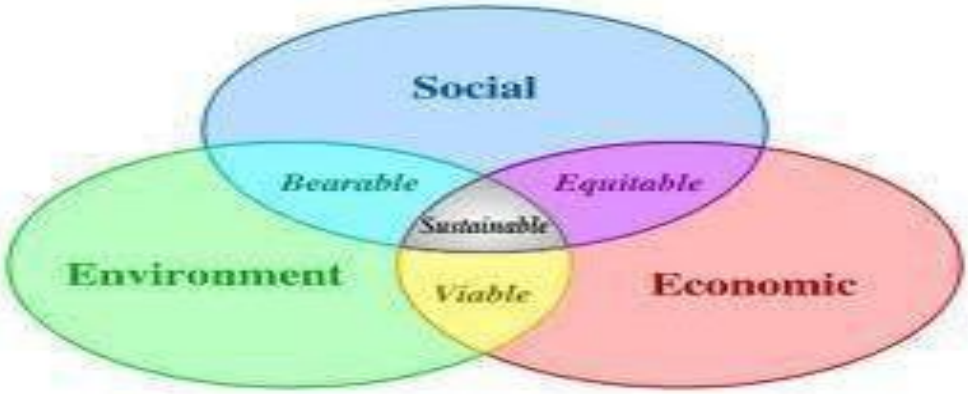
Sustainable development: Meeting the needs of the present without compromising the ability of future generation to meet their own needs.

Important components of Sustainable development:

1. Economic development

2. Community development

3. Environmental protection



True sustainable development aims at optimum use of natural resources with high degree of reusability, minimum wastage, least generation of toxic by-products and maximum productivity. Aspects of sustainable development:

Inter generational equity-It states stat we should hand over a safe, healthy and resourceful environment to future generation.

Intra generational equity:

A technological development of rich countries should support the economic growth of poor countries and help in narrowing the wealth gap and lead to sustainability.

Approaches for sustainable development:

1. Devloping appropriate technology-technology which is locally adoptable, ecofriendly, resource efficient and culturally suitable should be adopted. It uses local labour, less resources and produces minimum waste.
2. Reduce ,Reuse and Recycle (3Rapproach) –Optimum use of natural resources using it again and again instead of throwing it on wasteland or water and recycling the material in to further products. It reduces waste generation and pollution.
3. Providing environmental education and awareness-Thinking and attitude of people towards earth and environment should be changed by providing environmental awareness and education.
4. Consumption of renewable resources- It is very important to consume the natural resources in such a way that the consumption should not exceed the regeneration capacity.
5. Non-renewable resources should be conserved by recycling and reusing.
6. By population control we can make sustainable development.

Urban problems related to energy:

Urbanization –Movement of human population from rural; areas to urban areas for want of better education, communication, health, employment etc.

Causes:

Cities are the main centers of economic growth, trade transportation, medical facilities and employment.

Urban sprawl:

The phenomenon of spreading of the cities in to sub-urban or rural areas is called urban sprawl. Urban growth is so fast and is difficult to accommodate all commercial industrial residential and educational facilities within the limited area.

Energy demanding activities:

Urban people consume lot of energy and materials in comparison with rural people. This is because urban people have high standard of life and their life style demand more energy.

Examples for energy demands:

1. Residential and commercial lightings.
2. Industries using large proportion of energy.
3. Usage of fans fridge, A.C, washing machines.

Control and prevention of pollution technologies need more energy.

Solution for urban energy problems:

1. Energy consumption must be minimized in all aspects.
2. Public transportation should be used instead of motor cycles and cars.
3. Using of solar energy and wind energy.
4. Production capacity must be increased.

WATER CONSERVATION

The original source of water is precipitation from the atmosphere. The water available on the earth may occur in all three stages as gas, liquid or solid. Temperature is the main factor in deciding the state of water. As a liquid, the water forms hydrosphere. About 75% of the Earth's surface is covered by the hydrosphere.

The process of saving water for future utilization is called conservation of water.

Need for water conservation.

1. Better life style requires more fresh water.
2. Agriculture and Industrial activities require more fresh water.
3. As the population increases the requirement of water is also more .

Strategies of water conservation

Reducing evaporation losses

Evaporation of water in humid regions can be reduced by placing horizontal Barriers of asphalt below the soil surface.

Reducing irrigation losses

Sprinkling and irrigation conserves water by 30- 40%. Irrigation in early morning (or) later evening reduces evaporation losses. Growing hybrid crop varieties also conserve water.

Reuse of water

Treated waste water can be reused for irrigation. Water from washings, bath rooms etc. can be used for washing cars, gardening.

Preventing of wastage of water

Closing the taps when not in use and repairing any leakage from pipes.

Decreasing run off losses

Run off , on most of the soils can be reduced by using contour cultivation (or) Terrace farming.

Avoid discharge of sewage

Disposal into natural water resources should be avoided

Methods of water conservation

Rain water Harvesting and Watershed management

It means capturing rain where it falls or capturing the run off in your own village or town. And taking measures to keep that water clean by not allowing polluting activities to take place in the catchment.

Therefore, water harvesting can be undertaken through a variety of ways
Capturing runoff from rooftops

- Capturing runoff from local catchments
- Capturing seasonal floodwaters from local streams
- Conserving water through watershed management

These techniques can serve the following the following purposes:

- Provide drinking water
- Provide irrigation water
- Increase groundwater recharge
- Reduce stormwater discharges, urban floods and overloading of sewage treatment plants

In general, water harvesting is the activity of direct collection of rainwater. The rainwater collected can be stored for direct use or can be recharged into the groundwater. Rain is the first form of water that we know in the hydrological cycle, hence is a primary source of water for us. Rivers, lakes and groundwater are all secondary sources of water. In present times, we depend entirely on such secondary sources of water. In the process, it is forgotten that rain is the ultimate source that feeds all these secondary sources and remain ignorant of its value. Water harvesting means to understand the value of rain, and to make optimum use of the rainwater at the place where it falls.

Rainwater harvesting. It is a technique of collecting and storing rain water for use in non-monsoon periods. In the present age, concrete houses, well-built roads, footpaths and well –concreted courtyards have left few open grounds. With the decrease in natural forest cover, increase in concrete jungles and the decrease in exposed earth; very little open ground is left for water to soak in and thereby increase the ground water table. So, artificial recharging of the ground water is extremely essential. It is done through rain water harvesting. For the purpose, rain water is collected at the roof top or in an open well and then carried down for immediate use or it is directed into the aquifer.

Rain water harvesting techniques

There are two main techniques for rain water harvesting:

1. Storage of rain water on the surface for future use
2. Recharge of ground water

Recharge of ground water is a recent concept and the structures used for the purpose are:

- Pits
- Trenches

- Dug wells
- Hand pumps
- Recharge shaft
- Lateral shafts with bore wells
- Spreading technique

Objectives of rain water harvesting.

1. To raise the water table by recharging the ground water.
2. To minimize water crises and water conflicts
3. To reduce rain water run off and soil erosion.
4. To reduce the ground water contamination from intrusion of saline water

Concept of rain water harvesting

Rain water harvesting involves collecting water that falls on roof of house during Rain and conveying water through PVC or Al pipe to a near by covered storage tank.

Method of rain water harvesting

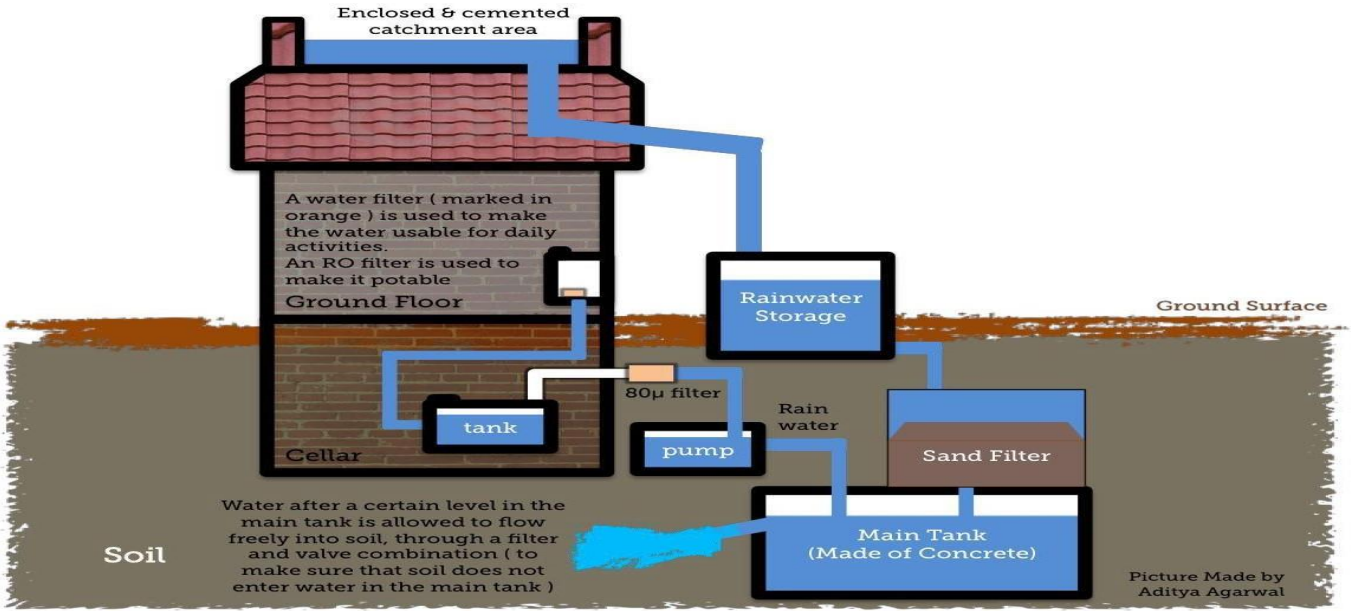
1. Roof top method: collecting rain water from roof of the building and storing in the ground. It is the low cost and effective technique for urban houses and buildings.

2. The rain water from roofs, road surfaces, play grounds is diverted into the surface tank or recharge pits. The pit base is filled with stones and sand which serves as a

Advantages:

Rise in ground water level and minimizing the soil erosion and flood Hazards. Scarcity of water is reduced.

Rainwater harvesting systems channel rainwater that falls on to a roof into storage via a system of gutters and pipes. The first flush of rainwater after a dry season should be allowed to run to waste as it will be contaminated with dust, bird droppings etc. Roof gutters should have sufficient incline to avoid standing water. They must be strong enough, and large enough to carry peak flows. Storage tanks should be covered to prevent mosquito breeding and to reduce evaporation losses, contamination and algal growth. Rainwater harvesting systems require regular maintenance and cleaning to keep the system hygienic.



WATERSHED MANAGEMENT

Water shed (or) drainage basin: It is defined as land area from which water drains under the influence of gravity into stream, lake, reservoir (or) other body of surface water. Watershed management of rain fall and resultant run off is called watershed management.

Factors affecting watershed :

1. Overgrazing . deforestation , mining , construction activities affect and degrade watershed.
2. Droughty climate also affects the water shed.

Need or objectives of watershed management

1. To raise the ground water level.

2. To protect the soil from erosion by run off.

3. To minimize the risks of floods, drought and landslides.

4. To generate huge employment opportunities in backward rain fed areas to ensure security for livelihood.

Watershed management techniques

Trenches (pits) were dug at equal intervals to improve ground water storage. Earthern dam or stone embankment must be constructed to check run off water.

Farm pond can be built to improve water storage capacity of the catchment's area.

Maintenance of watershed

Water harvesting: Proper storage of water in water shed can be used in dry season In low rainfall areas.

Afforestation and agro-forestry help to prevent soil erosion and retention of moisture in watershed areas

Reducing soil erosion: Terracing, contour cropping minimize soil erosion and run off on the slopes of water sheds

Scientific mining and quarrying minimize the destructive effect of mining in water shed areas **Public participation** is essential for water shed management. People should be motivated for maintaining water harvesting structures implemented by the government.

RESETTLEMENT & REHABILITATION

Based on the resettlement schemes proposed by each affected village and present policies, laws and regulations of different levels of governments and the resettlement requirements of ADB, the Resettlement Plan of Lauding Expressway Project was prepared by PPTA consulting team and the staff from NPAEC under GPCD assisted by design institute and Local County and township governments.

Target and Task

The overall objective of resettlement and rehabilitation is to ensure that the affected production base will be restored, the affected labor force will be re-employed, and income and livelihood of affected people will be improved or at least restored to their previous levels before resettlement.

At present, the rural population of project impact area is mainly engaged in agricultural actives, with most of their income coming from planting, economic trees, and animal husbandry. According to the actual production and living standard among affected villages, and the approved economic and social development plans for the relevant counties, the target of

Resettlement and rehabilitation is set as follows:

(1) The resettle's grain production level will be self-sufficient after resettlement.

(2) The income per capita shall be recovered to the standard before resettlement.

(3) The affected public infrastructures, school, hospitals, social welfare level, natural environment and traffic condition etc. shall be improved after resettlement.

Resettlement Task

In 2005, there were 2,829 households with 13,149 persons to be resettled or rehabilitated, in which 520 households and 2,352 persons will need house relocation.

The basic resettlement policy of Lauding Expressway Project is to respect the wishes of affected People and maintain their current production and living traditions. Based on consultation of local affected peoples, the economic rehabilitation will be based on developing replaced farming Resources within their own townships and villages. Planting will be the focus of economic Rehabilitation strategy by developing new farmland and improving the remaining farmland in the affected villages, and supplemented by developing various other income generation opportunities in the project areas. In other words, the resettlement and rehabilitation strategy will first to reestablish the physical production bases for the affected persons, which will provide a long-term development potential by fully utilizing local land resources.

Resettlement Principle

Under such policy, a number of resettlement and rehabilitation principles have been developed for the Project.

(1) The resettlement plan will be based on detailed inventory for land acquisition and houses Demolition, and adopted compensation standards and subsidies.

(2) The resettlement shall be combined with the local development, resource utilization and Economic growth as well as environment protection. Considering the local conditions, a Practical and feasible resettlement plan should be developed to restore or improve their Economic production and create basic conditions for long-term development.

Overall Scheme of Resettlement

Since the construction of Lauding Expressway Project will only acquire limited land acquisition and demolition along the road alignment line, it will not have significant negative impacts on production and livelihood for most affected villages. A series of consultation meetings were held among affected villages and townships. According to the resettle's opinion and suggestion, and combined with the actual condition of affected area, the basic rehabilitation scheme was determined as follows:

(1) Project affected persons will be resettled within their original villages and village groups, so

that their way of production, living and social relationship can be maintained, which will be beneficial for them to restore or improve their production and income level after resettlement.

(2) In order to reduce the impacts on the production and livelihood among resettle's, the demolished houses will be dismantled after the new houses built. The reconstruction of houses will adopt two approaches. For most relocated households, they will choose to rebuild their houses by themselves, and all salvage materials will belong to them. The second approach is for those who live near towns, their rehabilitation will be carried out by local government in order to promote small town development and save farmland.

(3) The rural relocated households will be resettled in their original villages. For those who lose

Some farmland, the land-based rehabilitation will be adopted with a combination of developing new farmland, redistributing remaining farmland and receiving their share of resettlement subsidy among affected village groups.

Environmental Ethics

It refers to issues, principles and guidelines related to human interactions with their Environment. **(OR)**

Ethics is a branch of philosophy. It deals with morals and values. An ethic is a principle or value that we use to decide whether an action is good or bad.

Ethics differs from country to country.

Functions of Environment:

1. It moderates climate conditions of the soil.

2 A healthy economy depends on healthy environment. 3It is the life supporting medium for all organisms.

3. It provides food , air , water and other important natural resources to the human beings Environmental problems : Deforestation activities , population growth and urbanization water Pollution due to effluents and smoke from industries, Scarcity.

Solution to environmental problems:

Reduce the waste matter and energy resources.

Recycle and reuse as many of our waste product And resources as possible. Avoid over exploitation of natural resources.

Minimse soil degradation and Protect the biodiversity of the earth. Reduce population and increase the economic growth our country.

Ethical guidelines on environmental protection:

1. The earth is the habitat of all living species and not of human beings alone.
2. Natural resources and energies are depleting fast. We must protect them.
3. Involve yourself in the care of the earth and experience nature.
4. Respect nature, you are a part of it.
5. Think of the global cause and act for local protection
6. Keep yourself informed about ecological changes and developments.
7. Observe austerity, reserve scarce resources for the future and the future generations.
8. We must be cooperative, honest, affectionate and polite to society and nature.

CLIMATE:

It is the average weather of an area. It is the general weather condition, seasonal variations of the region. The average of such conditions for a long period is called climate.

Causes of climate changes:

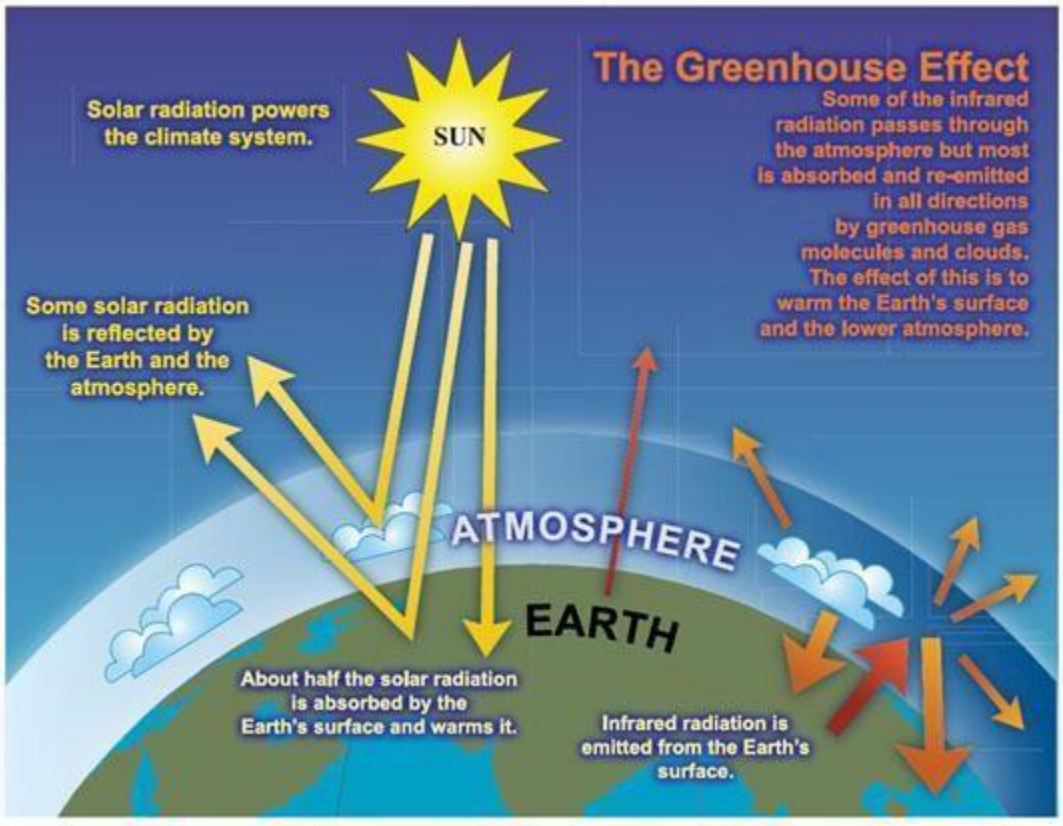
1. Presence of green house gases in the atmosphere Increases the global temperature.
2. Depletion of ozone layer increases the global temperature.

Effects of climate change:

1. Small climate changes disturb agriculture which leads To migration of animals and human.
2. Climate change may upset hydrological cycle which results in floods and droughts in different parts of the world.
3. Global pattern of winds and oceans currents also gets disturbed by climate change.

Green house effect: Green house gases are CO_2 , Methane .Nitrous oxide NO_2, CFC

Among these CO_2 is the most important green house gas.O_3 and SO_2 act as serious pollutants causing global warming.Progrssive warming up of a gas surface due to blanketing effect of man made CO2 atmosphere.



GLOBAL WARMING:

Green house gases in the atmosphere are transparent to light but absorb IR radiation. These gases allow sunlight to penetrate the atmosphere and are absorbed by the earth surface. This sunlight is radiated back as IR which is absorbed by gases. As a result the earth surface and lower atmosphere becomes warm. This is called global warming.

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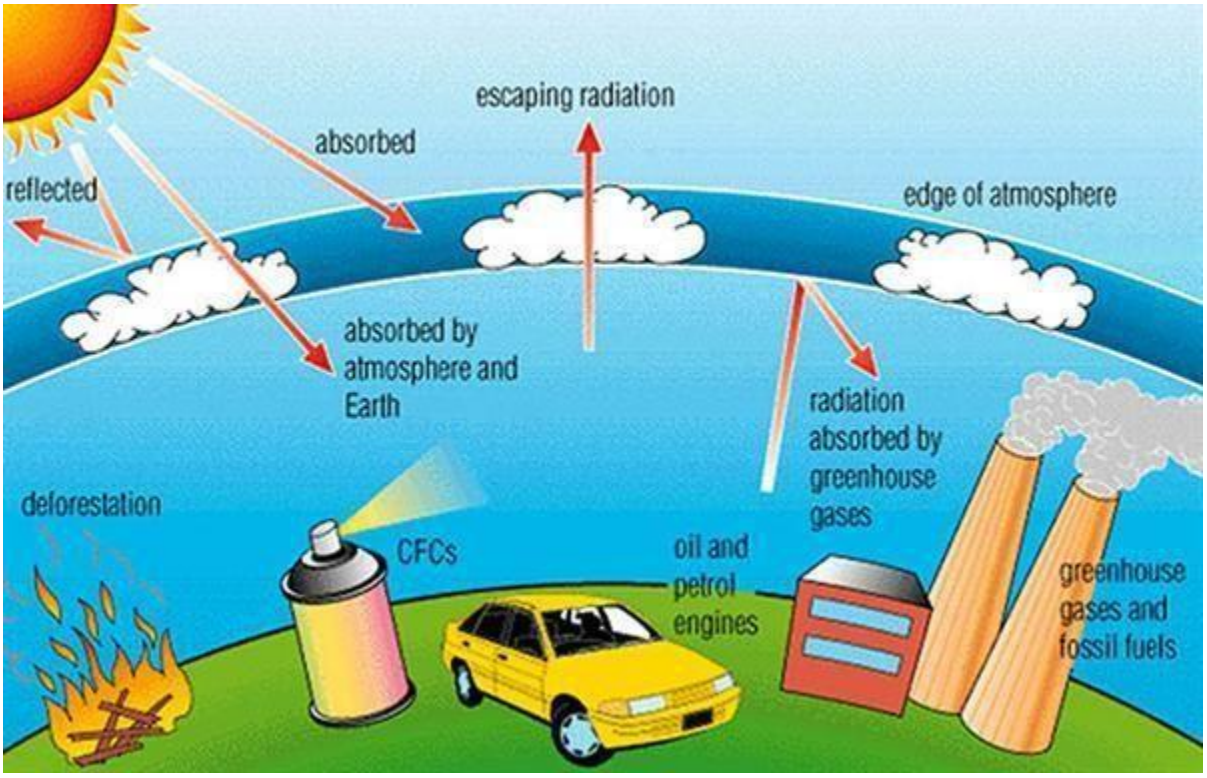


EFFECTS OF GLOBAL WARMING:

1. Sea level increases as result of melting and thermal expansion of ocean.

2. High CO2 level in the atmosphere have a long term negative effect on crop production and forest growth.

3. Global rainfall pattern will change .Drought and floods will become more common. Raising temperature will increase domestic water demand.

4. Many plants and animal species will have a problem of adapting. Many will be at the risk of extinction, more towering verities will thrive.

5. As the earth becomes warmer the floods and drought becomes more frequent. There would be increase in water-borne diseases.

MEASURES TO CHECK GLOBAL WARMING:

1. CO2 emission can be cut by reducing the use of fossil fuel.
2. Plant more trees.
3. Shifting from coal to natural gas.
4. Stabilize population growth.
5. Remove efficiently CO2 from smoke stocks.
6. Removal atmospheric CO2 by utilizing photo synthetic algae.

ACID RAIN:

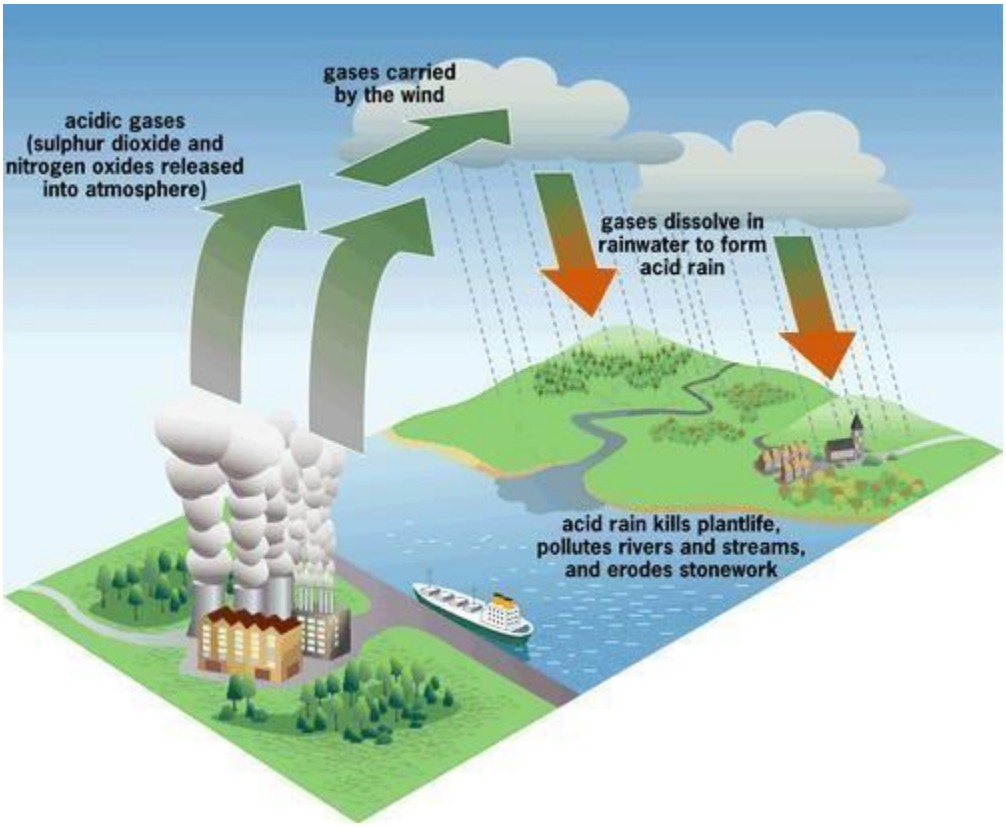
Normal rain water is always slightly acidic (pH 5-5.6) because of Co_2 present in the atmosphere gets dissolved in it. Because presence of SO_2 and NO_2 gases as pollutants in the atmosphere. The pH of the rain is further lowered. This type of precipitation of water is called acid rain.

Formation:

Acid rain means the presence of excessive acids in the rain water. The thermal power plants industries and vehicles release NO_2 and SO_2 in to the atmosphere due to the burning of coal and oil. These gases reacts with water vapor in the atmosphere and from acids like HNO_3,$H2SO_4$.These acids descends on to the earth as acid rain through rain water.

$SO_x + H_2O \square H_2SO_4$

$NO_y + H_2O \square HNO_3$



EFFECTS:

Effect on human being:

Human nervous system respiratory system and digestive system are affected by acid rain.It cause premature death from heart and lung disorder like asthma, bronchitis.

On building:

At present Taj mMahal in Agra is suffering due to SO2 and H2SO4 fumes from Madura refinery.Acid rain corrodes houses, monuments ,statues ,bridges and fences.

Acid rain causes corrosion of metals.

Terestrial and lake Ecosystem.

Reduce the rate of photosynthesis and growth in terrestrial vegetation.

Acid rain retards the growth of crops like beans potatoe ,carrot ,spinach. Acid rain rduces fish population ,black flies,mosquitoes ,deer flies occurs largely which causes number of complications in ponds rivers and lakes.

Activity of bacteria and other microscopic animals is reduced in acidic water. The dead materials are not rapidly decomposed.Hence the nutrients like N,P are locked up in dead matter.

Control of acid rain:

Emmision of No2 and SO2 from industries from power plants should be reduced by using pollution control equipments.

Liming of lakes nad soils should be done to correct the adverse effect of acid rain. In thermal points low sulphur content coal should be used.

OZONE LAYER DEPLETION

Ozone gas is present in the atmosphere. It is highly concentrated at the stratosphere Between10to 50 Km above the sea level and is called as ozone layer.

Importance: O_3 protects us from damaging UV radiation of the sun. It filters UV- B radiation. Now days certain parts of O_3 layer is becoming thinner and O_3 holes are formed. Because of this more UV–B radiation reaches the earth's surface. UV –B radiation affects DNA molecules, causes damages to the outer cell of plants and animals.

It causes skin cancer and eye disease in human beings.

Formation of O_3 : It is formed in the atmosphere by photochemical reaction

$O_2 + hv$ ----------) $O^* + O^*$

The atomic oxygen reacts with molecular O_2 to
form O_3 $O^* + O_2 + M$ ----------) $O_3 + M$

Where M = third body like nitrogen.

Causes of O_3 layer depletion : Refrigerators , air conditioners , aerosol sprays and cleaning solvents release CFC s into the atmosphere. CFCs releases chlorine which breakes O_3 to O_2

$Cl + O_3$ ----------) $ClO + O_2$ (g) ClO
$+ O^*$ ----------) $Cl + O_2$

Each chlorine atom is capable of breaking several O_3 molecules . It is a chain reaction. 1% loss of O_3 results in 2% increase in UV rays reaching the earth surface .

Ozone depletion chemicals CFC , HCFC , BFC. Some times atmospheric sulfur dioxide Is converted in to H_2SO_4 which increases the rate of O_3 layer depletion.

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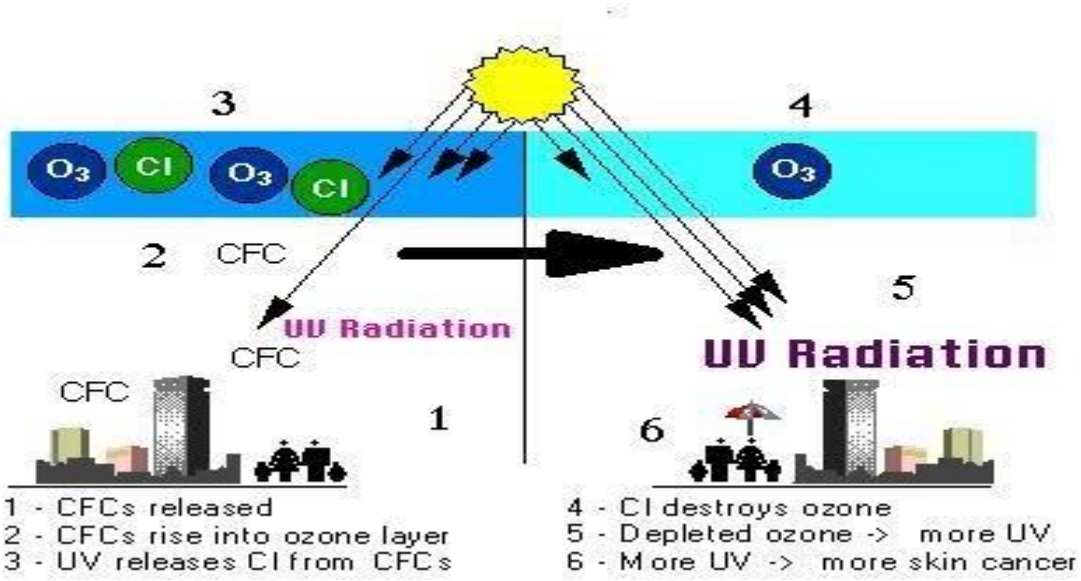

Effects ozone layer depletion:

Effects on human beings

1. UV rays causes skin cancer.
2. Increases the rate of non melanin skin cancer in fair colored people.
3. Prolonged expose to UV rays leads to actinia Katatities (slow blindness) and cataracts.

Effects on aquatic system :

1. UV rays affects phytoplankton , fish , larval crabs.
2. phytoplankton consumes large amounts of CO_2 .
3. Decrease in phytoplankton results in more amount of CO_2 in atmosphere. This contributes to global warming.3. Ozone Depleting chemicals can causes global warming.

Control measures : Manufacturing and using of O_3 depleting chemicals should be stopped. Use of methyl bromide .which is a crop fumigant should be controlled. Replacing CFC s by other maerials which are less damage

NUCLEAR ACCIDENTS AND HOLOCAUST

Energy released—during a nuclear reaction is called nuclear energy. Nuclear fission and Nuclear fusion are used to prepare nuclear energy. During nuclear accidents large amount of energy and radioactive products are released into the atmosphere.

Types of nuclear accidents :-

Nuclear Test- Nuclear explosions –release radioactive particles and radioactive rays into the atmosphere.

Nuclear power plant accidents: Nuclear power plants located in seismic vulnerable area may cause nuclear accidents which releases radiation.

Improper disposal of radioactive wastes: Drums with radioactive wastes, stored underground rust and leak radioactive wastes into water, land and air.

Accidents during transport . Trucks carrying radioactive wastes (or) fuels in accidents. The major accident at a nuclear power plant is a core melts down.

Effects of nuclear radiation

1. Radiation affects DNA in cells.
2. Exposure to low dose of radiation (100to 250 rds) people suffer from fatigue, vomiting ,and loss of hair.
3. Exposer to high radation (400- 500 rds) affect bone marrow ,blood cells , natural resistance fail of blood clot.
4. Exposure to very high dose of radiation (10000rds) kills organisms by damaging the tissues of heart and brain.

Nuclear Holocaust : -Destruction of Biodiversity by nuclear equipments and nuclear bombs is called nuclear holocaust.

Effects of nuclear holocaust.

Nuclear winter, Nuclear bombardment will cause combustion of wood , plastics , forests etc.

Large quantity of soot will be carried out into the atmosphere.

Black soot absorbs all UV radiation and will not allow the radiation to reach the earth. There fore cooling will result. This reduces evaporation of water .In stratosphere there wont be significant moisture to rain out the black soot. Due to nuclear explosion a process opposite to global warming will occur. This is called Nuclear winter.

Nuclear holocaust in Japan

In 1945 two nuclear bombs were dropped in Hiroshima and Nagasaki in Japan. About 100000 people were

Killed and the cities were badly destroyed. This explosion emitted forceful neutrons and gamma radiation.

Radioactive Strontium liberated in the explosion replaced calcium in the bones .Large scale bone deformities occurred in the people of these cities.

WASTE LAND RECLAMATION

Waste land. The land which is not in use is called waste land . Waste land is unproductive, unfit for cultivation and grazing etc. 20% of the geographical area of India is waste land.

Types of waste land:

1. Uncultivable waste land.
2. Cultivable waste land.

Uncultivable waste land: Barren rocky areas, hilly slopes,
sandy deserts.

Cultivable waste land: These are cultivable but not cultivated for more than 5 years.Ex Degraded forest land.

Causes of waste land formation:

1. over exploitation of natural resources.
2. Industrial and sewage wastes.
3. Due to soil erosion, deforestation, water logging, salinity etc.
4. Mining activities destroy the forest and cultivable land.

Objects of waste land reclamation:

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Drainage: Excess water is removed by artificial drainage. This is for water logged soil reclamation.

Leaching: Leaching is a process of removal of salt from the salt affected soil by applying excess amount of water. Leaching is done by dividing the field into small plots. In continuous leaching 0.5to 1.0cm

Water is required to remove 90% of soluble salts.

Irrigation practices: High frequency irrigation with controlled amount of water helps to maintain better availability of water in the land. Application of green manure and bio fertilizers improves saline soil.

Application of gypsum: Soil sodality can be reduced with gypsum. Ca of gypsum replaces sodium from the exchangeable sites. This converts clay back into calcium clay.

Social Forestry programme: These programs involve strip plantation on road, canal sides and degraded forest land etc.

COSUMERISM AND WASTE PRODUCTS

The consumption of resources by the people is called consumerism. It is related to both increase In population size as well as increase in our demand due to change in life style. If needs increases The consumerism of resources also increases.

TRADITIONAL FAVOURABLE RIGHTS OF SELLERS

1. **T**he right to introduce any product.
2. The right to change any price.
3. The right to use incentives to promote their products

IMPORTANT INFORMATION TO BE KNOWN TO BUYERS

1. Ingredients of the products.
2. Manufacturing date and expiry date .Whether the product has been manufactured against an established law of nature or involved in right variation.

Objectives of consumerism.

1. It improves the right and powers of buyers.
2. It involves making manufacturer liable for the entire life cycle of a product
3. It force the manufacturer to reuse and recycle the product after usage.
4. Active consumerism improves human health and happiness and also it saves resources. Sources of wastes are agriculture, mining, industrial and municipal wastes.

Example for waste products. It includes paper, glass, plastic, garbage, food waste, Scrap, construction and factory wastes.

E- waste : Electronic equipments like computer, printers, mobile phones, calculator etc After usage thrown as waste.

Effects of waste: Waste from industries and explosives are dangerous to human life. Dumped wastes degrade soil and make it unfit for irrigation.

E-wastes contain more than 1000 chemicals which are toxic and cause environmental Pollution. In computers lead is present in monitors, cadmium in chips and cathode ray tube , pvc in cables. All these cause cancer and other respiratory problems if inhaled for long long periods.

Plastics are non-degradable and their combustion produces many toxic gases.

Factors affecting consumerism and generation of wastes:

People over population –Over population cause degradation of sources, poverty and premature deaths. This situation occurs in less developed countries (LDC's).In LDC's the percaptia consumption f resources and waste generation are less.

Consumption Over population: It occurs when there are less people than the available Resources . due to luxurious life style per captia consumption of resources is very high. Consumption is more and waste generation is more. Environment is also degraded.

ENVVIRONMENTAL LEGISLATION AND LAWS

Water (prevention and control of pollution) Act.1974.

This act provides for maintaining and restoring the sources of water. It also provide for preventing and controlling water pollution.

Features of water act.

1. This act aims to protect the water from all kind of pollution and to preserve the quality of water in all aquifers.
2. The act further provides for the establishment of central board and state boards For prevention of water pollution.
3. The states are empowered to restrain any person from discharging a pollutant (or) sewage or) effluent into any water body with out the consent of the board.
4. The act is not clear about the definition of pollutant, discharge of pollutant Toxic pollutant.

State pollution control board

The consent of this board is needed

1. To establish any industry or any treatment and disposal system or any extension or addition which likely discharge Or trade effluent into a stream or well or river or on land.
2. To use any new or altered outlet for the discharge of sewage.
3. To begin to make any new discharge of sewage.

Act also empowers the state board to order closure or stoppage of supply of Electricity, water or any other service to the polluting unit.

AIR PREVENTION ACT 1981

This act was enacted in the conference held at Stock Holm. It envisages the establishments Of central and State control boards to monitor air quality and pollution control.

Important features:

1. The central board may lay down the standards for quality of air.
2. The central board co-ordinates and settle the disputes between state boards.
3. The central board provides technical assistance and guidance to state boards.
4. The state boards are empowered to lay down the standards for emission of air pollutants from industries or other resources.
5. The state boards are to examine the manufacturing processes and control equipment for for the prescribed standards.
6. The direction of central board is mandatory on state boards.
7. With out the consent of the central board operation of an industrial unit is prohibited in heavily polluted area.
8. Violation of law is punishable with imprisonment for three months or fine of Rs 10000 or both.

This act applies to all pollution industries. This act empowers the state board to order closure of any industrial unit or stoppage of water supply or stoppage of electricity.

FOREST (COSERVATON) ACT 1980

This act is enacted in 1980. It aims to arrest deforestation. This act covers all types of Forests including reserved forests, protected forests and any forest land.

IMPORTANT Features of the act :

1. The reserved forests shall not be diverted or dereserved wit out the permission Of central govt.
2. The forest land may not be used nonforest purposes.
3. This act stops illegal activities with in forest area.

Features of amendment act of 1988

.1. Forest departments are departments are forbidden to assign any forest land by way of lease or to any private person or NG body for re- afforestation.
2. For re-afforstation clearance of any forest land is forbidden.
3. The division of forest land for non –forest uses is punishable.

WILD LIFE ACT 1972.

This act was amended in 1983, 1986, and 1991.This act is aimed to protect and preserve all animals and plants that are not Domesticated. India has 350 species of mammals, 1200 species of birds and about 20000 Known species of insects. Some of them are listed as endangered species in wild life protection act. Wild life is declining due to human action. Wild life products like skins, firs, feathers, Ivory etc. have decimated the population of many species. Wild life population monitored regularly and management strategies formulated to protect them.

Important Features

1The act covers the rights and non- rights of forest dwellers.
2It allows restricted grazing in sanctuaries but prohibits in national parks.

3. I t also prohibits the collection of non timber forest.

4. The rights of forest dwellers recognized by forest policy of 1988 are taken away by Amended wild life act of 1991.

ENVIRONMENT (PROTECTION) ACT 1986

This act empowers the central govt. to fix the standards for quality of air, water, soil, and noise. The central govt. formulates procedures and safe guards for handling of hazard substances.

Important features: 1. this act empowers the govt. to lay down procedures and safe guards for the prevention of accidents which cause pollution and remedial measures if accidents occur.

2 The govt.has the authority to close or prohibit or regulate any industry or its operation if

The violation of provisions of the act occurs.

3. Violation of the act is punishable with imprisonment for 5 years or fine of one lakh or both.

4. If violation continues an additional fine of Rs5000 per day may be imposed for entire period of Violation of rules.

5. The act empowers the officer of the central govt.to inspect the sight or the plant or machinery for preventing pollution and to collect samples of air , water, soil and other materials from any

Factory or its premises for testing.

PUBLIC AWARENESS

In order to conserve our environment each and every one must be aware about our environment problems and objectives of various environmental policies at natural and local level.

Objectives of public awareness:

1. To create awareness among rural and city people about ecological Imbalance, local environment and technological development.

2 To organize meetings, tree plantation programs, group discussion on development, exhibitions.

3. To focus on current environment problems and situations.

4. To train our planners, decision makers, politicians and administrators.

5. To eliminate poverty by providing employment that over comes the basic environmental issues.

METHODS TO CREATE ENVIRONMNTAL AWARENESS

1. Environmental education must be imparted to the students in schools and colleges.

2. Media like TV Radio and cable net work can educate the people on environmental issues through Cartoons, documentaries, street plays.

3. Cinema about environmental education should be prepared and screened in theatres compulsorily .This films may be released with tax free to attract the public.

4. All the news papers and magazines must publish the environment related problems.

5. Special audio visual and slide shows should be arranged in public places.

6. Voluntary organizations like NCC, NSS, and ROTRACT Club should be effectively utilized for creating environmental awareness.

7. Arranging competitions like story and essay writing painting competition on environmental issues for student as well as public.Attreactive prizes should be awarded for the best effort.

8. Public leaders cine actors and popular social reformers can make an appeal to the public about the urgency of environmental protection.

CHAPTER-7 HUMAN POPULATION AND THE ENVIRONMENT

Population Growth, Variation Among Nations – Population Explosion – Family Welfare Programme – environment and Human Health – Human Rights – Value Education – HIV /AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.
Field Study of Local Area to Document Environmental assets – River/Forest/Grassland/Hill/ Mountain.
Field Study of Simple Ecosystems – Pond, River, Hill Slopes, etc
Field Study of Local Polluted Site – Urban/Rural/Industrial/Agricultural

Human population and the Environment

Population:- Group of individuals belonging to the same species which live in a given area at given time.
Population density:- Number of individuals of the population per unit area ® per unit-volume.
Parameters effecting population:-

Birthrate (OR) Nationality:- Number of live births per 1,000 people in a population in a given year.

Death Rate (OR) Mortality:- Number of deaths per 1000 people in a population in a given year

Immigration:- It denotes the arrival of individuals from neighboring population.

Emigration:- It denotes the disposal of individuals from the original population to new areas.

Rate = Number of births

Number of years

Mortality = orn of babies died

er of babies born x Number of year

h rate = Change of population

Number of year

Population Growth :- Results from the difference between the rate of birth and death. In 1980 the global population was about 1 billion people. In 1930 it reached 2 billion. In 1975 it reached 4 billion with in 45 years. Now the population in 6 billion. It reaches 10 billion by 2050 as per the world Bank calculation.

Causes:- 1. Due to decrease in death rate and increase in birth rate.

2. Availability of antibiotics, immunization increased food production, clean water and air, decreases the famine related deaths and infant mortality.
3. The poverty and illiteracy lead controlled growth of population.
4. Child Marriages
5. People's superstitions. People believe that it is because of God's grace.

Characteristics of P.G.:-

Exponential growth:- Population growth occurs exponentially live 10, 10^2, 10^3, 10^4 etc., Which shows the dramatic increase in global population in the past 160 years.

Doubling Time:- Time required for the population to double its size at a constant annual rate. It is calculated as follows:-

Td = 70 / r When r = annual growth rate

If a ration has 2 % annual growth its population will double in 35 years.

Infant Mentality:-

Percentage of infant died out of those born in one year. This rate is decreased in the last 50 years. This differs widely in developing and developed countries.

Total fertility rates (TFR):

Average number of children delivered by a woman in her life time. The TFR varies from 2 in developed to 4.7 in developing countries.

This ratio should be fairly balance in the society.

Male – female ratio has been upset in many countries including China - India. In china the ratio of girls and boys is 100 – 140.

Demographic transition:

P.G. is redacted to economic development. The birth rate and death rate full due to improved living conditions. This results in low population growth. This pheromones in called demographic transition.

Variation of population among Nation:

At present the worlds population has crossed 6 billions. Less developed countries (Africa, Asia, S.A) have 80% population while developed countries have only 20%.

In most developed countries like USA, Canada, Australia population increases by less than 1%. But is less developed countries the population increases by more than 1% / year.

Kenya is the fastest population growing countries in the world. When 20 million are residing.

China & India's populate on was above 1000 million in 2000 years. Its share is 1/3 of the world population.

Europe and N.H. accoents for 14% of world population.

Variation of pollution based on Age structure

Age structure of population can be classified into 3 classes.

Pre- productive population (0 – 14 years)

Reproductive population (15 - 44 years)

Post reproductive population (Above 45 years)

Variation of population is now explained based on the above three classes.

Pyramid shaped Variation of population (increase)

Eg. In India, Bangladesh, Ethiopia, Algerian Reproductive population is more in companion to pre reproductive population and post productive population. Hence the population increases.

Bell shaped variation of population:

Eg: In France, USA, UK, Canada etc., pre reproductive population and reproductive population is more (OR) less equal. Hence population growth in stable.

Urn shaped variation of populations

Eg: In Germany, Italy, Sweden,

In Japan pre productive age group population in smaller than the reproductive age group population. In the next 10 years. The number of people in reproductive age group less than before resulting in decrease of population.

Population Explosion:

The enormous increase in population due to low death rate and high birth rate is called as population expansion.

Doubling time: The number of years needed for a population to double in size. The doubling time varies from country to country.

of the country	ng time
Turkey	rs
an	

Population growth is higher in less developed countries.

Cause of population explosion:

1. Invention modern medical facilities, reduces the death rate and increases birth rate, which leads to population explosion.
2. Increase of life expectancy is another important reason for population explosion. Eg:- In 1956, the average life expectancy of the human beings was 40 years. But now it is 61 years.
3. Illiteracy is one of the reasons for the population wxplosion.

Effect of population explosion (OR) environmental and social impacts of growing population

Poverty:

1. Population explosion leads to environmental degradation.
2. Population explosion causes over exploitation of natural resources. Hence there will be a shortage of resources for the futune generation.
3. Increase in population will increases diseases, economic in equity and command wars.
4. Forests, grass lands are under threat.
5. The main reason for the growing unemployment in growing population.
6. Educating vast population is a very big task.
7. Population explosion is the main cause for pollution of air, land, water and noise.
8. Disposal of plastics and wastages is another problem of over population.
9. Scancity of fuel is also due to population explosion.

Family welfare programmes

Family welfare programme was implemented by Govt. of India as a voluntary programme. It is a policy of growth covering human health, family welfare children and women's right.

Objectives:

1. Slow down the population explosion by reducing fertility.
2. Pressure on the environment, due to over exploitation of natural resources is reduces.

Population stabilization Ratio

The ratio is derived by dividing crude birth rate by crude death rate.
Developed countries: The stabilization ratio of developed countries is 1. indicating zero population growth.

Developing countries:

The ratio of developing countries is rearing 3 which in expected to lower down by 2025. Stabilization in developing countries is possible only through family welfare programmes.

Family planning Programme

If provides educational and clinical services that help couple to choose how many children to have and when to have them. Family planning programme provides information on birth spacing birth control and health care for pregnant woman and infants. It also reduced the number of legal and illegal abortions per year and decreased the risk of death from pregnancies.

Objectives:

1. Reduce infant mortality rate to below 30 / 1000 infants.
2. Achieve 100% registration of births, deaths marriage and pregnancies.
3. Encourages late marriages and late child bearing.
4. Encourages breast feeding.
5. Enables to improve woman's health education, employment.
6. Constrain the spnead & Aids / HIV.
7. Prevent and control of communical diseases.

Fertility control methods

Traditional methods

It includes taboos and folks medicine.

Modern methods

It includes birth control techniques like mechanical barriers, surgical methods, chemical pills and physical barriers to implantation. More than 100 contraceptive methods are on trial.

Family planning programme in India

1. In 1952 India started family planning programme.
2. In 1970 Indian govt. forced FP campain all the over country.
3. In 1978 govt. legally raized the minimum age of marriage for men from 18 to 21 and for women 15 to 18 years.
4. In 1981 census report showed there is no drop in population. Hence funding for FP programme has been increased.

Environment & human Health

Healthy person:- Physically fit person with out suffering any disease is called a healthy person.

Disease:- Harmful changes in the body's condition by nutritional, biological, chemical (or) psychological factors are called diseases.

Important Hazards and their health effects refer – bort

Chemical Hazards and their health effects refer T.B.

Biological Hazards and their health effects Refers T.B.

Preventive measures:

1. Always wash your hand before eating.

2. Cut short and clean your nails systematic.
3. Drinking chemically treated and filtered water.
4. Eat food always in hot condition.
5. Wash the vegetables and fruits a with clean water before cooking.
6. Avoid plastic containers and Al vessels.

7. Do physical exercise to have proper blood circulation.

Human Rights

Human rights are the fundamental rights possessed by human beings irrespective caste, nationality, sex & language.

The aim of Govt. is to ensure happiness to the entire citizen with equal rights.

Under the Indian constitution the following fundamental rights have been guaranteed to human beings.

1. Human right to freedom
2. Human right to property
3. Human right to freedom of religion.
4. Human right to culture and education.
5. Human right to constitutional remedies
6. Human right to Equality
7. Human right to against exploitation.
8. Human right to food and environmental
9. Human right to health

1. Human rights to freedom

Every citizen has the freedom to express his view freely.

Citizen can assemble at any place to express their views.

Freedom to form unions (or) associations.

Freedom to slant any profession.

Indian Constitution

Indian constitution provides for civil, social, cultural, educational and political rights.

Article 14 – equality before law.

Article -15

Prohibits discrimination on the ground of race, religion caste, sex (or) place of birth.

Article 16

Provides equal opportunity for all citizens in regarding to employment.

Article 19

Provides for freedom of speech and expression, forming association and union.

Article – 20

Protection from connection except in accordance with the law of the land.

Article – 22 – lays down the rights of a person in custody.

Article – 24 – prohibits exploitation of labour children.

Article – 25 – grantees freedom to profess, practice and propagate a religion of one's choice.

Value education

Education is nothing but learning through which knowledge about a particular thing can be acquired with the help of our knowledge and expedience we can identify our value to understand ourselves and our relationship with other and their environment.

Types of Education:

Format Education:- (In this all leaning process are self related). All people will read write, will get good jobs and take with any problem with the help of formal education.

Value Education:- It is an instrument used to analyse our behavior and provide proper direction to our youth. It teacher the youth the distinction between right & wrong, to be helpful loving, generous and tolerant.

Eg:- If a person is highly, Qualified and well settled in life, something he does not know how to behave with his environment.

Value based environmental education

The provides knowledge about the principle of ecology, fundamental of environment and biodiversity. It creates sense of duty to care for natural resources and to mange them in sustainable key.

Objectives:

1. Improve integral growth of human being.
2. To create altitudes and improvement towards sustainable life style.
3. To increase awareness about our national history, cultural heritage, constitutional rights, national integration.
4. To understand (about the our) natural environment in which how land, air and water are interlinked.
5. To know about various living and non living organism and their interaction with the environment.

Types of values:

1. Universal values (or) social values:

These values tells about the importance of the human conditions. These are reflected in life, joy, love, tolerance, truth etc.

2. Cultural values:

These values various with respect to time and place. These are concerned with rights & wrong, good & bad true & false and behavior of human beings. It is reflected in language, education, law, economics, philosophy etc.

3. Individual values:

These are personal principles and the result of individual personality and experience parents & teachers are the main key to shape and individual values. I t is reflected in individual goods, relationship, commitments.

4. Global values:

Human civilization is a part of the planet. Nature and natural pheromone on the earth are interconnected and inter-linked with special bonds of harmony. If this harmony disturbed any where leads to catastrophic results due to ecological imbalance.

Aids / HIV – Discover in 1983. Source of the virus is not beer identified spread through African monkey. Through vaccine program – spread by small pox vaccine programme of Africa. Hepatitis – B Viral vaccine legmy and new York.

World scenario

90% from developing countries. 13% of world's population live is Africa. Almost all states & African countries were affecters HIV. India ranks 2nd in the world with 5 million affects people.

Scenario in India:

Large number of infected people are in Maharastra & Tamil Nadu followed by Delhi, UP, Karnataka & Goa. Till sept. 2003 24,667 cases are found in Tamil Nadu.

Smog:- Mixture of smoke from coal combustion and fog in suspended droplets form photochemical smog cause irritation to eyes and lungs (ii) many damage plants (iii) Irritation to nose & throat (iv) asthma

Role of IT in Environment

IT plays a vital role in the field of environment education. IT means collection, processing, storage and dissemination of information. The internet facilities, information through satellites,www and geographical information provides up to date information on various aspects of environment, weather.

Remote sensing

It refers to any method which can be used to gather information about an object without coming in contact with it. Gravity, magnetic, electro magnetic forces could be used for remote

sensing. Remote sensing covers various disciplines from laboratory testing to astronomies. Now remote sensing is used to denote identification of earth feathers by detecting the characteristic electro magnetic radiation. That is reflected by the earth.

Components of a remote sensing system

The system consists of a **sensor** to collect radiation. Other important parts are a **platform**, an **aircraft**, a **balloon, rocket and satellite.**

The information received by the sensor is suitably manipulated and transported back to earth. The data's are reformed and processed on the ground to produce photographs, computer compatible magnetic taps and digital storage medium.

Applications

1 Agriculture: In India agriculture provides livelihood of 70% of population and contributes to about 35% of net nation product. We require optimal management of land and water resources along with high yielding variety seeds, fertilizer input.

Remote sensing can provide valuable information for land and water management.

2. Forests: Remote sensing provides information clearly on the type, density and extent of forest cover, wood volume and biomass, forest fire, encroachment etc.

3. Land cover: Spatial information on land is required at different scales depends upon use remote sensing data is converted to map. The spatial resolution plays a role on the scale of mapping.

4. Water resources: Remote sensing data has been used in many application related to surface water body mapping, ground water targeting, wet land, flood monitoring, reservoir sedimentation, water quality monitoring etc. One of the most simple applications is inventorying surface water body.

DATABASE

It is the collection of inter related data on various objects. In the computer the information of database is arranged in a systematic manner.

Applications: I The ministry of environment and forest. They are compiling database on various biotic components. Database is also available for diseases likes HIV | AIDS. Malaria, Fluorosis.

National Management Information System (NMIS) : They compile database on R & D Projects along with information about research scientists and personnel involved. Environmental Information System : It functions in 25 centres all over the country.

They generate net work of database in areas like pollution control, remote sensing, biodiversity, and desertification.

GEOGRAPHICAL INFORMATION SYSTEM (GIS)

It is **a** technique of superimposing various thematic maps using digital data on large Number of inter related aspects.

Applications: Different thematic maps having digital information on water resources,

Soil type, forest land, crop land, grass lands are superimposed on a layered form in computer using soft ware.

Interpretation of polluted zones, degraded lands can be made on GIS base.
3. GIS can be used to check unplanned growth and related environmental problems.

SATELLITE DATA:

It helps in providing correct and reliable information forest cover

Provides information of monsoon, ozone layer depletion Smog etc.

Helps in discovering reserves of oil, minerals.

WWW:

More current data is available on www on line learning centre.

Www .mhhe.com \ environmental science.

Multimedia Digital content manager (DCM) in the form of CD ROMS.

Application of computers in the field of Environment & human health:

1. Unknown parameters can be stimulated by computer techniques
2. EIA(Environmental Impact Assessment) problems can be analyzed
3. Inventories of emission sources are compiled and maintained
4. Net-work analysis, statistical analysis and the status of environmental pollutions can be high lighted
5. Comprehensive administrative system can be developed by using computer network techniques.
6. Remote sensing-Graphical Interface System are useful for coral reef mapping and ocean resources. They are also useful to access the loss of biodiversity/hot spots etc.