6th Semester Civil Engineering

Environmental Studies Notes

5. ENVIRONMENTAL POLLUTION

UNIT V ENVIRONMENTAL POLLUTION

Definition – Causes, Effects and Control Measures of:- (A) Air Pollution (B) Water Pollution (B) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid Waste Management:- Causes, Effects and Control Measures of Urban and Industrial Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management:- Floods, Earthquake, Cyclone and Landslides.

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.

5.2 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, ether, 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.

5.2.1 Classification of Pollutants

5.2.1.1 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.

5.2.1.2 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.

5.3 TYPES OF POLLUTION

5.3.1 AIR POLLUTION

5.3.1.1 Introduction: Air pollution is one such form that refers to the contamination of the air, irrespective of indoors or outside. A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals and humans to survive as the air becomes dirty.

The WHO defines **air pollution** as the presence of materials in the air in such concentration which are harmful to man and his environment. A number of ingredients find their way in the air and these are mostly gases, which rapidly spread over wide areas.

5.3.1.2 Causes of Air pollution:

1. **Burning of Fossil Fuels:** Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles is one of the major causes of air pollution. Pollutants emitting from vehicles cause immense amount of pollution. Carbon Monoxide produced by improper or incomplete combustion emitted from vehicles is another major pollutant along with Nitrogen Oxides that is produced from both natural and manmade processes.
2. **Agricultural activities:** Ammonia is a very common by product from agriculture related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers in agricultural activities emit harmful chemicals into the air and cause water pollution.
3. **Exhaust from factories and industries:** Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.
4. **Mining operations:** Mining is a process wherein minerals below the earth are extracted using large equipments. During the process dust and chemicals are released in the air causing massive air pollution.
5. **Indoor air pollution:** Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution.

6. **Suspended Particulate matter:** Suspended particulate matter popular by its acronym SPM, is another cause of pollution.

5.3.1.3 Types of Air Pollutants

- **Primarily air pollutants** can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called primary pollutants. A classic example of a primary pollutant would be the sulfur-dioxide emitted from factories
- **Secondary pollutants** are the ones that are caused by the inter mingling and reactions of primary pollutants. Smog created by the interactions of several primary pollutants is known to be as secondary pollutant.

5.3.1.4 Common air pollutants

1. **Carbon Dioxide:** CO_2 content of air has increased by 20% during the last century. CO_2 causes nausea and headache. Its increase in the air may cause green house effect, rise in the atmospheric temperature. This may melt the polar ice resulting in rise in level of oceans and flooding of coastal regions.
2. **Carbon Monoxide:** It is a very poisonous gas and is produced by incomplete combustion of fuel. If inhaled. It combines with hemoglobin and reduces its oxygen-carrying capacity. This leads to laziness, reduced vision and death.
3. **Oxides of Nitrogen:** These include NO and NO_2 , which are released by automobiles and chemical industries as waste gases and also by burning of materials. These are harmful and lower the oxygen carrying capacity of blood.
4. **Oxides of Sulphur:** SO_2 and SO_3 are produced by burning of coal and petroleum and are harmful to buildings, clothing, plants and animals. High concentration of SO_2 causes chlorosis (yellowing of leaves), plasmolysis, damage to mucous membrane and metabolic inhibition. SO_2 and SO_3 react with water to form Sulphuric and sulphurous acids. These may precipitate as rain or snow producing acid rain or acid precipitation.

5. **Photochemical Oxidants:** Formed by the photochemical reactions between primary pollutants, viz. oxides of nitrogen and hydrocarbons. Nitrogen oxides in the presence of sunlight react with un-burnt hydrocarbons to form peroxyacyl nitrate (PAN), Ozone, aldehydes and some other complex organic compounds in the air.
6. **Hydrocarbons:** These are un-burnt discharges from incomplete combustion of fuel in automobiles. These forms PAN with nitrogen oxides, which is highly toxic.
7. **Particulate Matter:** Industries and automobiles release fine solid and liquid particles into the air. Fly ash and soot from burning of coal, metal dust containing lead, chromium, nickel, cadmium, zinc and mercury from metallurgical processes; cotton dust from textile mills; and pesticides sprayed on crops are examples of particulate pollutants in the air. These are injurious to respiratory tract.
8. **Aerosols:** Aerosols are chemicals released in the air in vapor form. These include fluorocarbon (carbon compound having fluorine) present in emissions from the Jet aero planes. Aerosols deplete the ozone layer. Thinning of ozone layer results in more harmful ultraviolet rays reaching the earth, which are harmful to skin, and can lead to skin cancer also.
9. **Radioactive Substances:** These are released by nuclear explosions and explosives. These are extremely harmful for health.
10. **Fluorides:** Rocks, soils and. minerals containing fluorides release an extremely toxic gas called hydrogen fluoride on heating. This gas is highly injurious to livestock and cattle.

5.3.1.5 Control measures

The atmosphere has several built-in self cleaning processes such as dispersion, gravitational settling, flocculation, absorption, rain-washout, etc to cleanse the atmosphere. However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies.

1. **Source control:** Some measures that can be adopted in this direction are
    1. Using unleaded petrol

2. Using fuels with low sulphur and ash content
3. Encouraging people to use public transport, walk or use a cycle as opposed to private vehicles
4. Ensure that houses, schools, restaurants and playgrounds are not located on busy streets
5. Plant trees along busy streets as they remove particulates, carbon dioxide and absorb noise
6. Industries and waste disposal sites should be situated outsdide the city preferably on the downwind of the city.
7. Catalytic converters should be used to help control emissions of carbon monoxide and hydrocarbons

2. Control measures in industrial centers:

1. Emission rates should be restricted to permissible levels by each and every industry
2. Incorporation of air pollution control equipment in design of plant layout must be made mandatory
3. Continuous monitoring of the atmosphere for pollutants should be carried out to know the emission levels.

5.3.1.6 Equipment used to control air pollution

Air pollution can be reduced by adopting the following approaches.

1. Ensuring sufficient supply of oxygen to the combustion chamber and adequate temperature so that the combustion is complete thereby eliminating much of the smoke consisting of partly burnt ashes and dust.
2. To use mechanical devices such as scrubbers, cyclones, bag houses and electro-static precipitators in manufacturing processes. The equipment used to remove particulates from the exhaust gases of electric power and industrial plants are shown below. All methods retain hazardous materials that must be disposed safely. Wet scrubber can additionally reduce sulphur dioxide emissions.
3. The air pollutants collected must be carefully disposed. The factory fumes are dealt with chemical treatment.

5.3.2 WATER POLLUTION

5.3.2.1 Introduction: Water pollution may be defined as "the alteration in physical, chemical and biological characteristics of water which may cause harmful effects on humans and aquatic life."

5.3.2.2 Sources of water pollution

1. **Point sources:** These are pollutants that are discharged at specific locations through pipes, ditches or sewers into bodies of surface waters.

   Ex: Factories, sewage treatment plants, abandoned underground mines and oil tankers.

2. **Non point sources:** These pollutants cannot be traced to a single point of discharge. They are large land areas or air-sheds that pollute water by runoff, subsurface flow or deposition from the atmosphere.

   Ex: Acid deposition, runoff of chemicals into surface water from croplands, livestock feedlots, logged forests, urban streets, lawns, golf courses and parking lots.

5.3.2.3 Types, effects and sources of water pollution

Water pollution is any chemical, biological or physical change in water quality that has a harmful effect on living organisms or makes water unsuitable for desired uses.

S.No	Pollutants	Human sources	Health Effects
1	Infectious agents Ex: Bacteria, Viruses, Protozoa, and parasitic worms.	Human and animal wastes	Variety of diseases
2	Oxygen demanding wastes (Dissolved oxygen) Ex: Organic wastes such as animal manure and plant debris	Sewage, Animal feedlots, paper mills and food processing facilities	Degrade water quality by depleting water of dissolved oxygen. This causes fish and other forms of oxygen-consuming aquatic life to die.
3	Inorganic chemicals Ex: Water soluble inorganic	Surface runoff, industrial effluents	• Make freshwater unusable for drinking and irrigation

	chemicals: Acids, Compounds of toxic metals such as lead (Pb), arsenic (As) and selenium (Se) and Salts such as NaCl in oceans and fluoride (F^-) found in some soils.	and household cleansers	• Cause skin cancer and neck damage, Damage to nervous system, liver and kidneys • Harm fish and other aquatic life • Lower crop yields • Accelerate corrosion of metals exposed to such water
4	Organic chemicals Ex: Oil, Gasoline, Plastics, Pesticides, Cleaning solvents and Detergents.	Industrial effluents, household cleansers and surface runoff from farms.	• Can threaten human health by causing nervous system damage and some cancers. • Harm fish and wildlife.
5	Plant nutrients Ex: Water soluble compounds containing nitrate, Phosphate and Ammonium ions.	Sewage, manure and runoff of agricultural and urban fertilizers	• Can cause excessive growth of algae and other aquatic plants, which die, decay, deplete dissolved oxygen in water thereby killing fish • Drinking water with excessive levels of nitrates lower the oxygen carrying capacity of the blood and can kill urban children and infants.
6	Sediment Ex: Soil, silt, etc.	Land erosion	• Causes cloudy water thereby reducing photosynthetic activity • Disruption of aquatic food Chain

			• Carries pesticides, bacteria and other harmful substances • Settles and destroys feeding and spawning grounds of fish • Clogs and fills lakes, artificial reservoirs, stream channels and harbors
7	Radioactive materials: Ex: Radioactive isotopes of: Iodine, Radon, Uranium, Cesium and Thorium.	Nuclear power plants, mining and processing of uranium and other ores, nuclear weapon production and natural sources.	Genetic mutations, birth defects and certain cancers.
8	Heat (Thermal pollution) Ex: Excessive heat	Water cooling of electric power plants and some types of industrial plants.	• Low dissolved oxygen levels thereby making aquatic organisms more vulnerable to disease, parasites and toxic chemicals. • When a power plant starts or shuts down for repair, fish and other organisms adapted to a particular temperature range, can be killed by an abrupt temperature change known as thermal shock.

5.3.2.4 Control measures of water pollution

1. Administration of water pollution control should be in the hands of state or central government
2. Scientific techniques should be adopted for environmental control of catchment areas of rivers, ponds or streams
3. Industrial plants should be based on recycling operations as it helps prevent disposal of wastes into natural waters but also extraction of products from waste.
4. Plants, trees and forests control pollution as they act as natural air conditioners.
5. Trees are capable of reducing sulphur dioxide and nitric oxide pollutants and hence more trees should be planted.
6. No type of waste (treated, partially treated or untreated) should be discharged into any natural water body. Industries should develop closed loop water supply schemes and domestic sewage must be used for irrigation.
7. Qualified and experienced people must be consulted from time to time for effective control of water pollution.
8. Public awareness must be initiated regarding adverse effects of water pollution using the media.
9. Laws, standards and practices should be established to prevent water pollution and these laws should be modified from time to time based on current requirements and technological advancements.
10. Basic and applied research in public health engineering should be encouraged.

5.3.3 THERMAL POLLUTION

5.3.3.1 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.

5.3.3.2 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.

5.3.3.3 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

5.3.3.4 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.
5. **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.
6. **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.

5.3.3.5 Control measures for thermal pollution

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

1. **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:

   (i) 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.

   (ii) 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 be recycled.
2. **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.
3. **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.
4. **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

5.3.4 SOIL POLLUTION

5.3.4.1 Introduction

Soil pollution is defined as, "contamination of soil by human and natural activities which may cause harmful effect on living organisms".

5.3.4.2 Types, effects and sources of soil pollution

S.No	Pollutants	Sources	Health Effects
1	Industrial wastes	Industrial pollutants are mainly discharged from various origins such as pulp and paper mills, chemical fertilizers, oil refineries, sugar factories, tanneries, textiles, steel, distilleries, fertilizers, pesticides, coal and mineral mining industries, drugs, glass, cement, petroleum and engineering industries etc.	These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter into human food chain from the soil or water, disturb the biochemical process and finally lead to serious effects on living organisms.
2	Urban wastes	Plastics, glasses, metallic cans, fibers, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles and other discarded manufactured products.	Alter the constitution of soil Cause Water logging Cause biomagnifications of toxic materials through food chain
3	Agricultural practices	fertilizers, pesticides, weedicides, farm wastes, manure debris, soil erosion	Water logging, Salinisation, micronutrient imbalance, loss of fertile soil
4	Radioactive pollutants	Atomic reactor, nuclear radioactive devices, Explosion of hydrogen weapons and cosmic radiations	Mutations, changes functions of living beings, Biomagnifications, cancers, Infant mortality

5	Biological agents	The human and animal wastes, garbage, waste water	Variety of diseases Cause nutrient imbalance
6	Pesticides	chlorinated hydrocarbon insecticide Organic phosphorous pesticides	Reduces the activity of sex hormones of male and female. Causes diseases to human beings.
7	Fertilizers	Different fertilizers discharge N, Na, K, S, Nitrates etc	The nitrate causes cancer, blue baby syndrome in infants.
8	Polymer, Plastics & other water	Waste from different sources	Biomagnifications, water logging, create cancers in animals and human beings.

5.3.4.3 Control measures of soil pollution

1. **Soil erosion can be controlled** by a variety of forestry and farm practices.
   Ex: Planting trees on barren slopes
2. Contour cultivation and strip cropping may be practiced instead of shifting cultivation
3. Terracing and building diversion channels may be undertaken.
4. Reducing deforestation and substituting chemical manures by animal wastes also helps arrest soil erosion in the long term.
5. **Proper dumping of unwanted materials:** Excess wastes by man and animals pose a disposal problem. Open dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field.
6. **Production of natural fertilizers**: Bio-pesticides should be used in place of toxic chemical pesticides. Organic fertilizers should be used in place of synthesized chemical fertilizers. Ex: Organic wastes in animal dung may be

used to prepare compost manure instead of throwing them wastefully and polluting the soil.

7. **Proper hygienic condition**: People should be trained regarding sanitary habits.

   Ex: Lavatories should be equipped with quick and effective disposal methods.

8. **Public awareness**: Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.

   Ex: Mass media, Educational institutions and voluntary agencies can achieve this.

9. **Recycling and Reuse of wastes:** To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.

   Ex: Industrial wastes should be properly treated at source. Integrated waste treatment methods should be adopted.

10. **Ban on Toxic chemicals:** Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.

5.3.5 NOISE POLLUTION

5.3.5.1 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.

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

1. Industrial Noise
2. Transport Noise
3. 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.

5.3.5.3 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 ofthe 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

5.3.5.4 Control measures:

1. **SOURCE CONTROL:** This includes source modification such as acoustic treatment to machine surface, design changes, limiting operational timings, etc
2. **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.
3. **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.
4. **OILING:** Proper oiling will reduce noise from the machine.

5.3.5.5 Preventive measures

1. Prescribing noise limits for vehicular traffic
2. Ban on honking (usage of horns) in certain areas
3. Creation of silence zones near schools and hospitals
4. Redesigning buildings to make them noise proof
5. Reduction of traffic density in residential areas
6. Giving preference to mass public transport system.

5.3.6 MARINE POLLUTION

5.3.6.1 Introduction

The discharge of waste substances in to the sea resulting in harm to the living resources, hazards to the human health hindrances to the fishery and impairment of quality use of sea water.

5.3.6.2 Sources

1. **Dumping the wastes:** Dumping of untreated wastes and sewages in the oceans by coastal towns, cities and industries. Rivers on the way to sea carry huge amount of sewage garbage agricultural discharge pesticide heavy metals. Huge quantity of plastic dumped in to the sea.
2. **Oil:** This is discharged in to the sea as crude oil and as separate fraction. Oil and it's fractions are used in houses automobiles and industries. This causes devastation of marine environment
3. **Radioactive materials** enter the ocean from nuclear weapon testing.
4. **Toxics:** Toxic waste is the most harmful form of marine pollution. Once toxic wastes affects an organism it quickly passes along the food chain and as sea food which cause various problems.
5. **Marine Debris:** Garbage like plastic bags, ropes helium balloons

5.3.6.3 Effects of marine pollution

1. Heavy metals and organic pollutants damages birds by thinning of egg shells and tissue damage of egg.

2. Oil pollution causes damage to marine animals and plants including algae bird, fish etc.
3. Oil spilling in the sea causes abnormal low body temperature in birds resulting in hypothermia. During Exxon Valdez accident 150 rare species of bald eagles are affected by ingested oil.
4. Oil films are able to retard the rate of oxygen uptake by water.
5. Hydrocarbon and benzpyrene accumulate in food chain and consumption of fish by man may cause cancer.
6. Many marine birds ingest plastic that causes gastrointestinal disorders.
7. Oil spills inhibit photosynthesis and the growth of planktons. All aquatic animals depend either directly of indirectly on planktons the basis of tropic chain.

5.3.6.4 Control of marine pollution

- Nature and world conservation union suggest the principles
    1. The industrial unit on the coastal lines should be equipped with pollution control instrument.
    2. Urban growth near the coast should be regulated.
- Methods of removal of oil
    1. Physical methods.
        - skimming the oil off the surface with suction device
        - Floating oil can be absorbed using absorbing materials like ploy urethane foam. Chopped straw and saw dust also used to absorbed oil from the sea water.
    2. Chemical methods like dispersion , emulsification and using chemical additives are used to coagulated the oil

5.3.6.5 Protective method

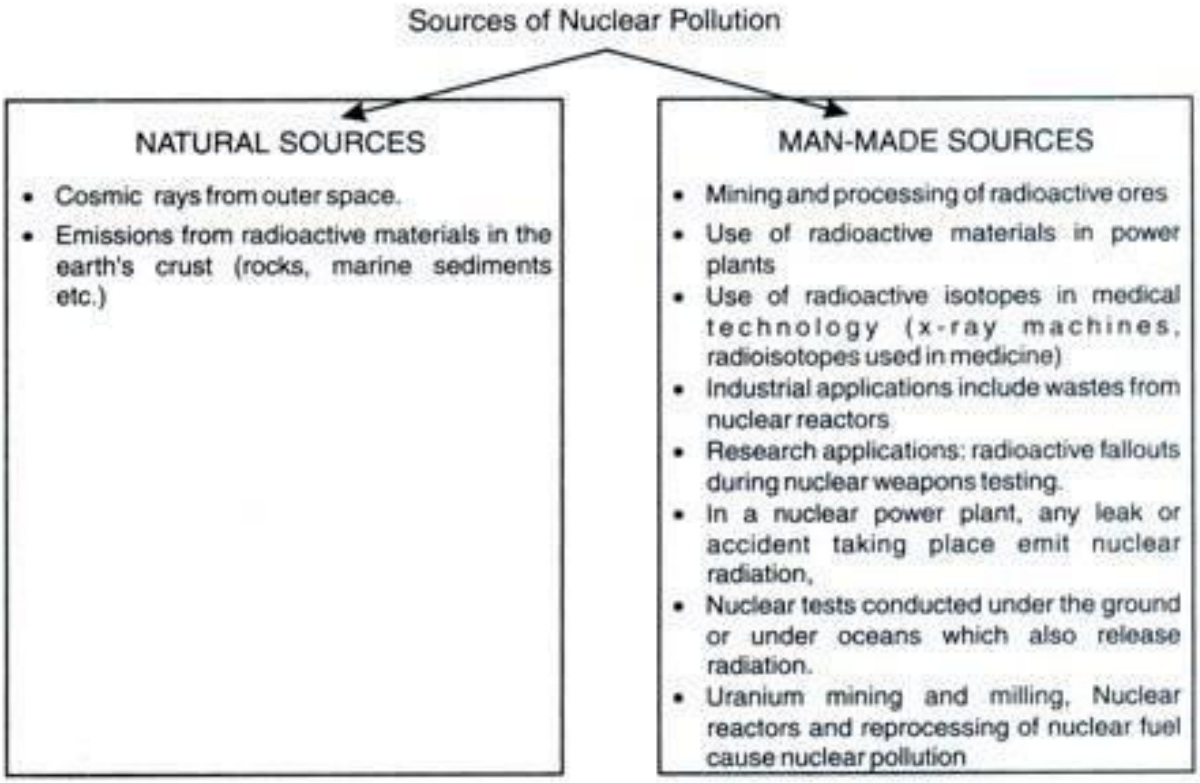
1. Municipal and industrial waste should be treated before disposing in to sea
2. Coastal waste are periodically analyzed for detecting pollution level
3. Soil erosion in the coastal land should be arrested be suitable techniques
4. Recreation beaches should be maintained to meet hygienic and aesthetic standard.

5.3.7 Nuclear Pollution

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

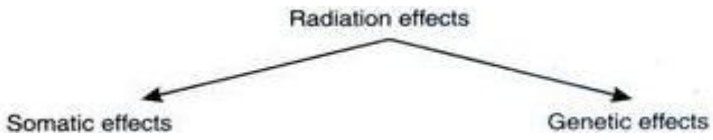
5.3.7.1 Sources of Nuclear Pollution

The sources of radioactivity include both natural and manmade.



5.3.7.2 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.



1. **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, cell division, growth and death.
2. **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.

5.3.7.3 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)

5.3.7.4 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.

5.3.8 SOLID WASTE MANAGEMENT

5.3.8.1 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.

5.3.8.2 Types of solid wastes

Depending on the nature of origin, solid wastes are classified into

1. Urban or municipal wastes
2. Industrial wastes
3. 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.

5.3.8.3 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.

5.3.8.4 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.

5.3.8.5 EFFECT OF IMPROPER SOLID WASTE MANAGEMENT

1. Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors.

2. Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil
3. Toxic substances may percolate into the ground and contaminate the groundwater.
4. 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.
5. Solid waste management involves waste generation, mode of collection, transportation, segregation of wastes and disposal techniques.

5.3.8.6 STEPS INVOLVED IN SOLID WASTE MANAGEMENT

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

1. **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.

2. 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.

5.3.8.7 Discarding wastes

The following methods are adopted for discarding wastes:

1. Landfill
2. Incineration and
3. Composting

1. 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.

5.3.9 DISASTER MANAGEMENT

5.3.9.1 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.

3.3.9.1 CAUSES OF FLOOD

- Construction of buildings in a flood plain
- Removing vegetation
- Paving roads and parking areas
- Deforestation
- Heavy rainfall
- Urbanization

- Earthquakes

3.3.9.2 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.

3.3.9.2 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.

3.3.9.2.1 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.

3.3.9.3 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.

3.3.9.3.1 Effects of earthquake

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

- Tsunami

3.3.9.3.2 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.

UNIT VI 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.

Chapter 6- 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.

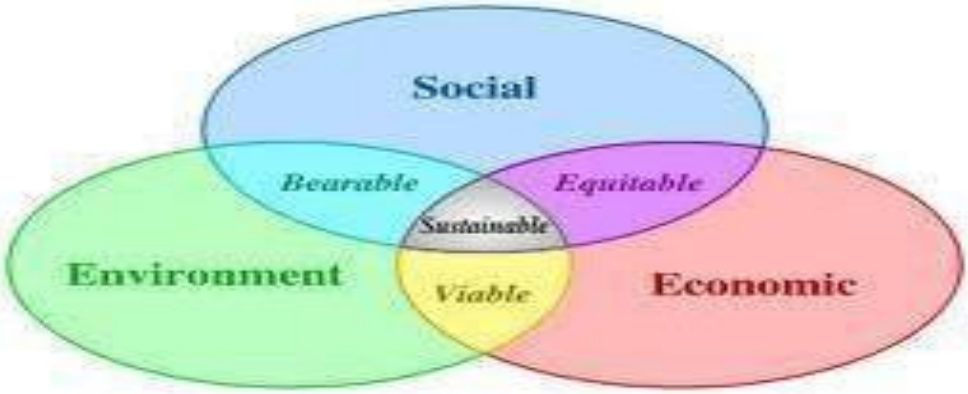
Sustainable development: Meeting the needs of the present without compromising the ability of future generation to meet their own needs.

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

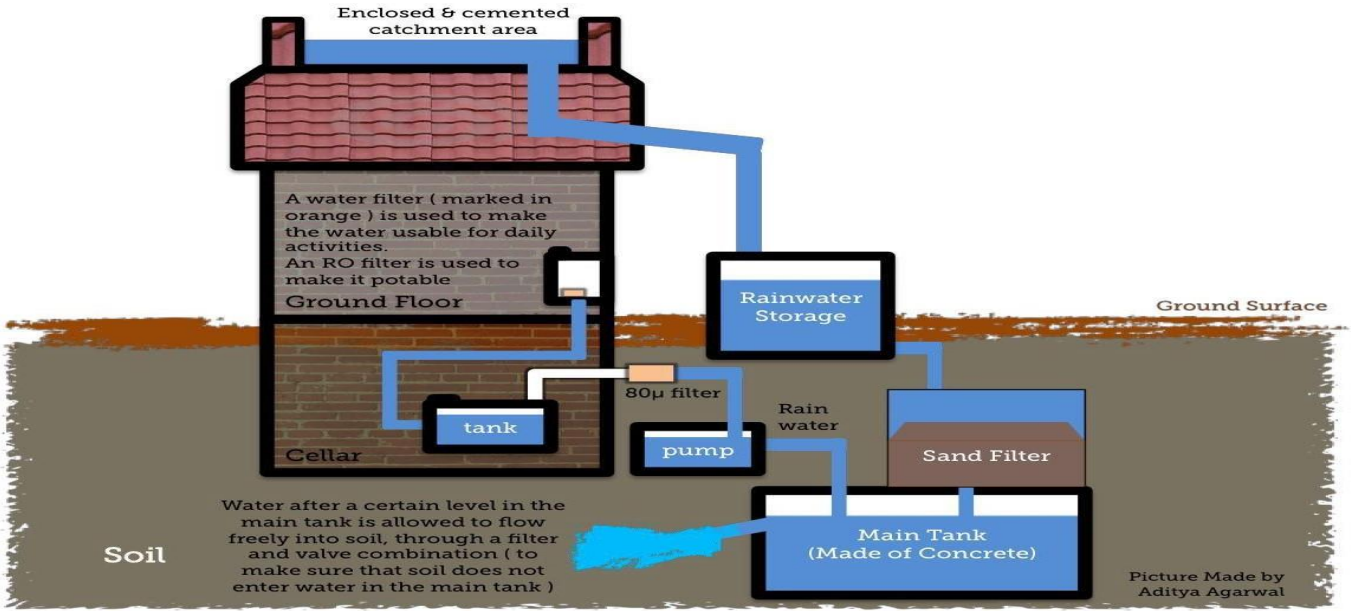
1. Roof top method: collecting rain water from roof of the building and storing in the ground. It is the low cost and effective technique for urban houses and buildings.

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:

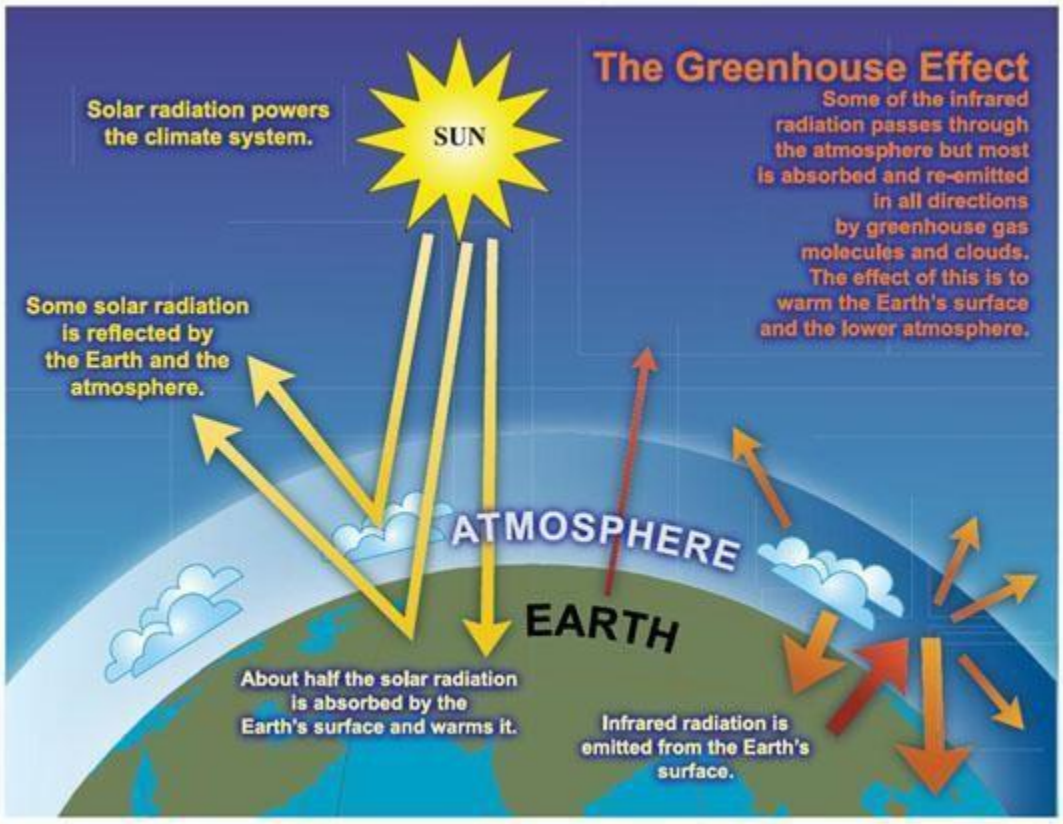
1. Presence of green house gases in the atmosphere Increases the global temperature.
2. Depletion of ozone layer increases the global temperature.

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

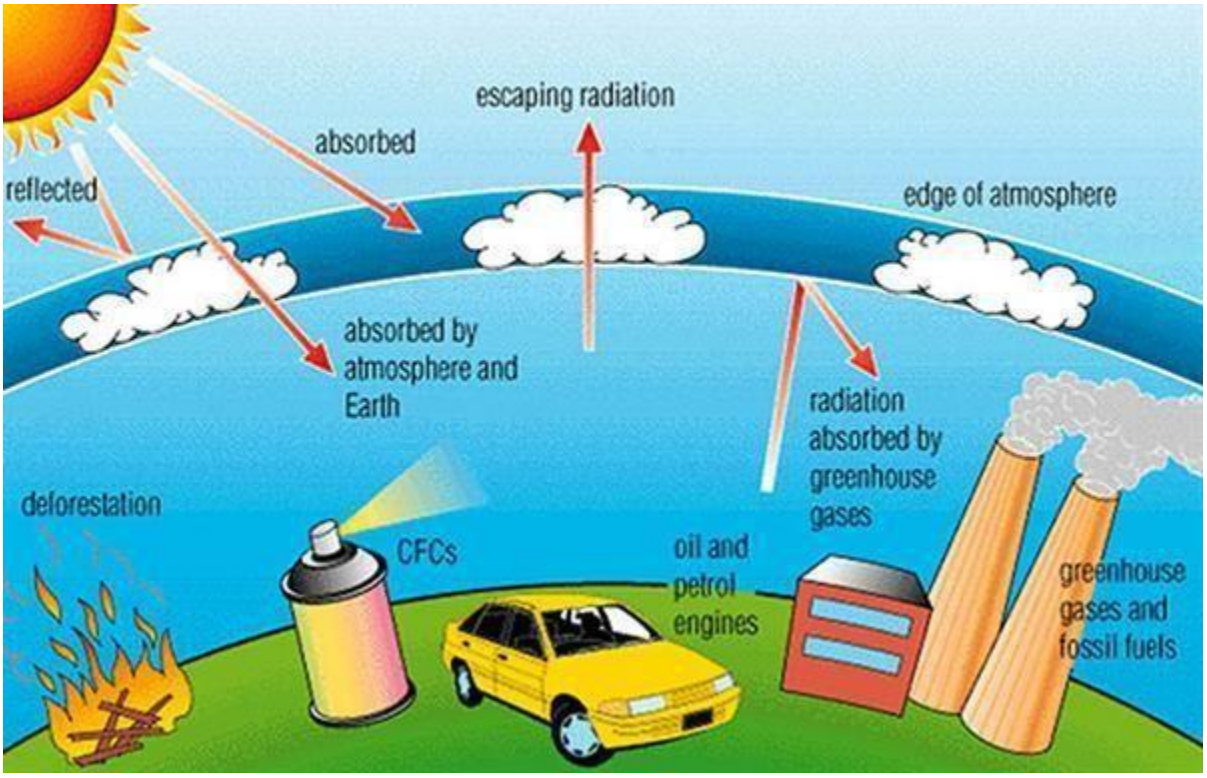
Among these CO_2 is the most important green house gas.O_3 and SO_2 act as serious pollutants causing global warming.Progrssive warming up of a gas surface due to blanketing effect of man made CO2 atmosphere.



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.

105



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:

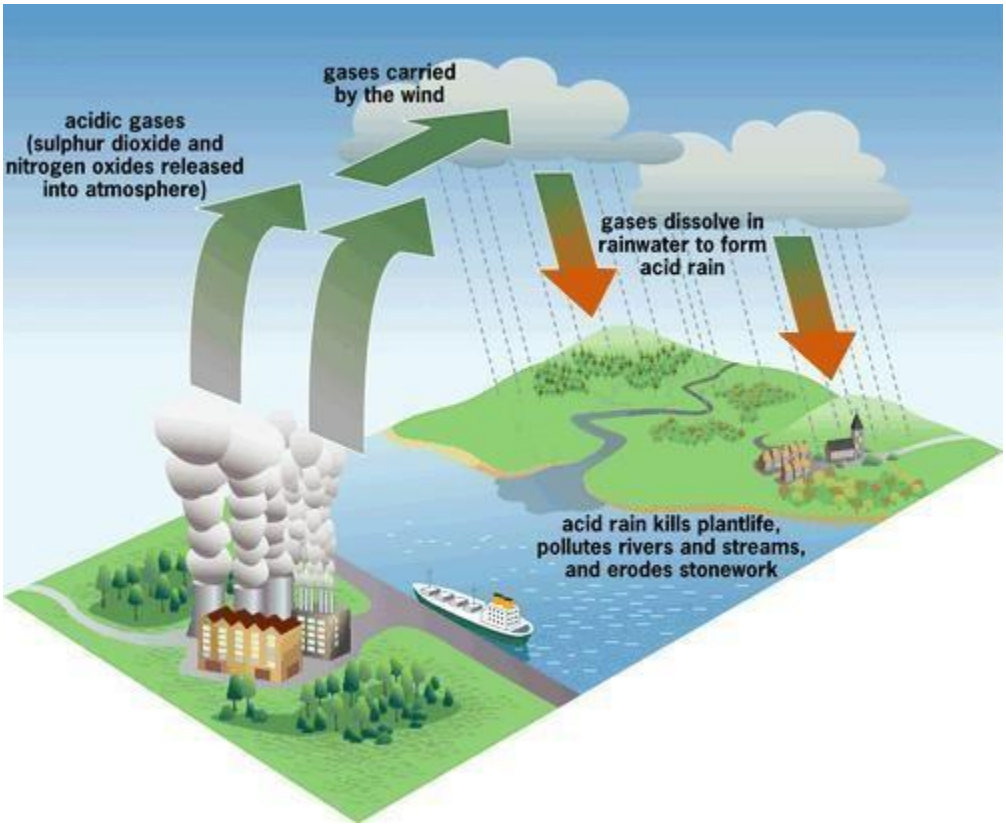
Normal rain water is always slightly acidic (pH 5-5.6) because of Co_2 present in the atmosphere gets dissolved in it. Because presence of SO_2 and NO_2 gases as pollutants in the atmosphere. The pH of the rain is further lowered. This type of precipitation of water is called acid rain.

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.

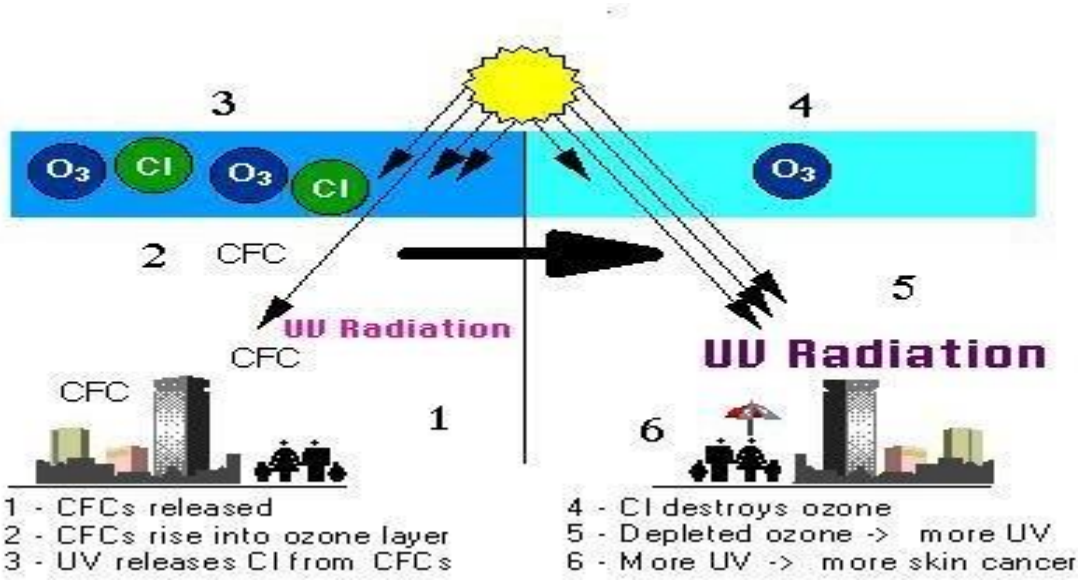
Causes of O_3 layer depletion : Refrigerators , air conditioners , aerosol sprays and cleaning solvents release CFC s into the atmosphere. CFCs releases chlorine which breakes O_3 to O_2

$Cl + O_3$ ----------) $ClO + O_2$ (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.

109



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:

1. To prevent soil erosion, flooding and land slides.
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

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 allaquifers.
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.

UNIT VII 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

Chapter-7 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.