UNIT – I:

ECOSYSTEM Contents: Introduction Scope & concept of Ecosystem Kinds of Ecosystem Structure & Function of Ecosystem Food Chain Food Web Ecological Pyramid Energy flow/ Transfer of energy in the Ecosystem Bio-geo-chemical cycles.. Water cycle Carbon cycle Oxygen cycle Nitrogen cycle Potash cycle Phosphorous cycle Aquatic Ecosystem Forest Ecosystem Desert Ecosystem Meanings References

INTRODUCTION OF ECOLOGY:

The term "Ecology" was derived from Greek words viz., Oikes means house or place and logs means a discussion or study. So, ecology is the scientific study of the distribution and the interactions between organisms and their natural environment. The environment (surroundings) consists of: living organisms (biotic) and non-living things (abiotic) such as physical components of wind, temperature, rainfall, water, humidity , light, soil etc and chemical components of C,H,N,K,P,S etc..(in-organic components) and carbohydrates, proteins (organic components). Hence, Ecology involves studying the ecosystems. According to GEORGE JACKSON, an Ecosystem is a natural unit consisting of all plants, animals and micro-organisms in an area functioning together with all of the non-living things. An ecosystem is the smallest unit of biosphere that has all the characteristics to support life. Pond ecosystem, forest ecosystem, desert ecosystem, marine ecosystem, urban ecosystem are some of the examples for ecosystems. An ecosystem vary in sizes from a few square kms to hundreds of square kms. Similarly an ecosystem may be temporary like a fresh pool / agriculture field or permanent like a forest / ocean.

Scope of ecosystem :

Ecology plays an important role in agriculture crop rotation, weed control (unwanted plant); management of grasslands, forestry etc., biological surveys, fishery surveys, conservation of soil, wild life, surveys of water bodies like rivers, lakes; ponds etc...

Concept of ecosystem:

In an ecosystem, the interaction of life with its environment take place at many levels. A single bacteria in the soil interacts with water, air around it within a small space while a fish in a river interacts with water and other animals, rivals in a large space. . Considering the operational point of view; the biotic and abiotic components of an ecosystem are so interlinked such that their separation from each other is practically difficult. So, in an ecosystem both organisms (biotic communities) and abiotic environment (rainfall, temperature, humidity) each influencing the properties with other for maintenance of life.

KINDS OF ECOSYSTEMS: Ecosystem may be natural or artificial. Artificial Ecosystem: These are maintained or created artificially by man. The man tries to control biotic community as well as physico chemical environment. Eg: Artificial pond, urban area development.

Natural Ecosystem: It consists of Terrestrial and Aquatic Ecosystems which are maintained naturally.
Terrestrial Ecosystem: This ecosystem relates to biotic components living on the land.

Vegetation dominates the community and the types of vegetation affect the climate, soil structure & a rapid exchange of O2, water & CO2

Aquatic Ecosystem: This ecosystem relates to biotic community living in water. The types of water (fresh water, saline water, polluted water) dominate and affect the pH of water, depth of water, temperature of water etc.. Aquatic ecosystem has been sub-divided into fresh water and saline water based on the quality of water.

STURCTURE & FUNCTION of ecosystem ECOSYSTEM NATURAL ARTIFICIAL TERRESTRIAL (LAND) ES eg: Forest ecosystem Grassland ecosystem Desert ecosystem

AQUATIC ECOSYSTEM Eg: River ecosystem Marine ecosystem Estuarine ecosystem

FRESH AQUATIC ES Eg: rivers, streams

MARINE AQUATIC ES eg: seas ; oceans, salt lakes

LENTIC (stagnant waters) eg: ponds, wells, lakes

LOTIC (Running waters) eg: river streams

Eg: Agricultural land, artificial pond ;

URBAN AREA

The two major aspects of an ecosystem are: (1) Structure and (2) Function together they illustrate the organization of an ecosystem.

The Structure of an ecosystem consists of:

Abiotic structure includes the **non-living things of the ecosystem** such as physical factors (soil, temperature, light & water) and chemical factors consisting the inorganic compounds (N,C, H, K, P,S) & organic compounds (carbohydrates, proteins).

Biotic structure includes plants, animals & microorganisms present in an ecosystem form the biotic component. These organisms have different nutritional behavior and status in the ecosystem and are known as **Autotrophs** (Producers), **Heterotrophs** (Consumers) & **Micro-consumers** (Decomposers) based on how do they get their food.

Hence, the structure of an ecosystem comprises:

The composition of biological community species (plants, animals, microorganisms), their population, life cycles, distribution in space etc.

The quantity and distribution of non-living things such as soil ; water etc .
The range or intensity of conditions like temperature, light, rainfall, humidity, wind & topography plays a major role in the structure of ecosystem.

Function of ecosystem means how an ecosystem works/ operates under natural conditions. The rate of biological energy flow ; the rate of nutrient cycles ie Bio-Geo-Chemical cycles and Ecological regulation (means regulation of organisms by Environment and regulation of Environment by organisms) plays a major role in the function of an ecosystem

1. Autotrophic components (Producers) :

Autotrophic means self nourishing. Since these organisms are self nourishing, they are also called producers. Eg: Algae, Green plants, Bacteria of photo synthetic. Green plants prepare their food themselves by making use of CO_2 present in the air & water in the presence of sunlight through the process of **photosynthesis.**

$$CO_2 + 2H_2O \; CH_2O + O_2 + H_2O$$

(Carbon dioxide) (Water) (Carbohydrates) (Oxygen) (Water)

A few micro-organisms which can produce organic matter (nutrients) to some extent through oxidation of certain chemicals in the absence of sunlight known as **chemo autotrophs.**

Eg: In the Ocean depths, where there is no sunlight, chemo-autotrophic bacteria make use of the heat generated by the decay of radioactive elements for preparation of their food .

2. Hetero-trophic components (Consumers) :

Hetero-trophic means dependent on others for nourishment directly or indirectly upon the autotrophs (producers) for their food. These are of the following types: a. **Herbivores (Primary consumers) :** These animals feed directly on living plants or remains of plants. Eg: Rabbits, Deer's, Insects.

b. **Carnivores (secondary consumers):** These carnivores (flesh eating) feed on the herbivores. Eg: Snakes, birds, Lizards, fox.

c. **Tertiary consumers (or) Tertiary carnivores:** These feed on the primary & secondary consumers. Eg: Lions, Tigers.

d. **Omnivores:** These consumers feed on both plants & animals. Eg Human beings, Birds (hawk) etc…

Decomposers or Micro consumers: They feed on organic compounds of dead or living plants and animals for their food and energy.

They absorb some of the products from decomposed material and release organic compounds (nutrients) making them available to producers.

Eg: Bacteria, Fungi, Flagellates. The decomposers are also called as "**Saprotrophs**".

FOOD CHAIN:

The transfer of food energy from the producers (plants) through a series of organisms (Herbivores, Carnivores) successively with the repeated activities of eating and being eaten is known as food chain. In an ecosystem(s), one organism is eaten by the second which in turn is eaten by the third and so on... This kind of feeding relationship is called food chain.

Examples of food chain:

Grass Grasshopper Frog Snake Hawk.
Grass Mouse Snake Hawk.
Grass Rabbit Man .
Grass Mouse Hawk.
Plant leaf Caterpillar Sparrow Hawk.

Explanation: A caterpillar eats a plant leaf, a sparrow eats the caterpillar, and a hawk eats the sparrow. When they all die, they are all consumed by micro organisms like bacteria (or) fungi which break down the organic matter and convert it into simple inorganic substances that can again be used by the plants. In nature, there are two basic types of food chains viz:

1. Grazing food chain and (2) Detritus food chain

Grazing food chain: This food chain starts with green plants (primary producers) and goes to herbivores and on to carnivores.

Phytoplanktons Zooplanktons Small fish Tuna.
Phytoplanktons Zooplanktons Fish Man.
Grass Rabbit Fox Tiger.

Detritus food chain: This food chain starts from dead organic matter (dead leaves plants / animals) and goes to Herbivores and on to Carnivores and so on. . Leaves or dead plants Soil mites Insects Birds .

Dead organic matter Bacteria Insects . dead leaves Algae Fish Man

The dead remains of plant and animals, dead leaves and flowers & fruits are degraded by decomposers (Fungi, Bacteria) and convert the organic matter into simple substances which are then taken up by the primary producers as nutrients.

FOOD WEB:

Food web is a net work of food chains where different types of organisms are connected at different trophic levels so that there are a number of options of

eating and being eaten at each trophic level. (A trophic level refers to an organisms position in the food chain) .

In the above figure, it may be observed that there are 5 linear food chains in the food web of a grass land ecosystem.

1. Grass Grasshopper Hawk

2. Grass Grasshopper Lizard Hawk

3. Grass Rabbit Hawk

4. Grass Mouse Hawk

5. Grass Mouse Snake Hawk

ECOLOGICAL PYRAMID:

Ecological pyramids were first studied by a British ecologist **CHARLES ELTAN**

(1927). An Ecological Pyramid is a graphical representation consisting various trophic levels with producers forming the base and top occupy the carnivores. In an ecological pyramid the huge number of tiny individuals form at the base and a few large individuals occupy the top / apex . This formation is known as ecological pyramid.Hence, **all producers** (micro & macro plants) belong to the *I trophic level*; all primary consumers belong to *II trophic level* and **organisms feeding** on these consumers belong to the *III trophic level* and so on.

The ecological pyramids are of three types. They are :
1. The pyramid of Numbers (showing population).

The pyramid of Biomass (showing total mass of organisms).

The pyramid of energy (showing energy flow).

1. The pyramid of Number:

It shows the relationships among the producers, herbivores and carnivores at successive trophic levels in terms of their number. Mostly the pyramid of number is straight (or) upright with number of individuals in successive higher trophic levels goes on decreasing from base to apex.

The maximum number of individuals occur at the producers level. They support a small number of herbivores. The herbivores, in turn, support a fewer number of primary carnivores and so on….. Top carnivores are very few in number.

For eg: (1) In a grass land ecosystem. Grass Grasshoppers Frogs Snakes Peacock / Hawk.

For eg: (2) in a pond ecosystem: Phytoplankton Zooplankton Fish Crane

The pyramids may be inverted in a few cases :A single plant may support the growth of many herbivores and each herbivore in turn provide nutrition to several parasites which support many hyper-parasites. Thus, from the producer towards consumers, there is a reverse position i.e., the number of organisms gradually shows an increase making the pyramid inverted in shape.

For eg: (3) in a Forest ecosystem

Tree Birds / deer Parasites Hyper parasites

Tree Birds eagle

The Pyramid of Biomass: The amount of organic matter present in environment is called biomass. In pyramids of biomass, the relationship between different trophic levels is mentioned in terms of weight of organisms**. The pyramid may be upright for grassland ecosystem and inverted for pond ecosystem.**

Eg: A vegetation produces a biomass of 1000 kg. Out of this 100 kgs of biomass for herbivores, which in turn only 10 kg of biomass for primary

carnivores that gives rise 1 kg of biomass for second order carnivores and so on…1000 kgs 100 kgs 10 kgs 1 kg

Vegetation Herbivores primary carnivores Secondary carnivores

HENCE, A VEGETARIAN DIET CAN SUPPORT A LARGER POPULATION THAN A NON – VEGETATION DIET.

The pyramid of energy: The amount of energy trapped per unit time and area at different trophic levels of a food chain with producers forming the base and the top carnivores at the apex is called pyramid of energy.

The energy content is generally expressed as K cal /m2 / year or K/m2 / year

Large Fish ---126 KJ / m2 / year

Small Fish ----840 – 126 KJ / m2 / year

Zooplankton ---- 7980 KJ / m2 / year

Phytoplankton (producers) --- 31080 KJ / m2 / year

Energy flow /Transformation of energy in Ecosystem

The movement of energy (or) transfer of energy through a series of organisms in an ecosystem from the external environment and back to the external environment again is known as **energy flow.**

In the universe, the main source of energy is SUN that produces energy in the form of light or solar radiation. Different ecosystems in the world receive variable quantities of solar energy depending upon their location on the globe.

The other chief factors that control the amount of solar energy received by an ecosystem are Latitude and Longitude ; Slope; Cloud formation; Pollutants in the atmosphere

The transformation of energy in an ecosystem begin first with the input of energy from the sun by the process of photosynthesis. Carbon dioxide is combined with hydrogen (derived from the splitting of water molecules) to produce carbohydrates (CH_2O) and the energy is stored in the high energy bonds of Adenosine Tri Phosphate (ATP).

Herbivores obtain their energy by consuming plants or plant products, ***carnivores*** eat herbivores and **micro-organisms** consume the droppings and carcasses (dead bodies). In an ecosystem, the utility of energy is taken place in the following manner:

The SUN provides heat to maintain the required temperature in which proper Physical and chemical processes can take place. Certain bacteria obtain useful energy by oxidation of a few elements such as sulphur and iron. **BIO – GEO-CHEMICAL CYCLES:** In every ecosystem sunlight

or solar radiant energy is accepted by producers (green plants) and the energy doesn't recycle through an ecosystem. But nutrients like Carbon; Nitrogen; Oxygen, , Hydrogen; Water, Sulphur; Phosphorous etc move in circular paths through biotic and abiotic components and they are known a

Bio-geochemical cycles.

About forty chemical elements are considered to be essential for living organisms. They are macronutrients of C, H, O, P, K, I, N, S , Mg, Ca etc.. and micro nutrients of Cu, Fe, Co……While all inorganic nutrients have cycles, we focus onthe following:

WATER CYCLE

CARBON CYCLE

OXYGEN CYCLE

NITROGEN CYCLE

POTASSIUM CYCLE

PHOSPHOROUS CYCLE

THE WATER CYCLE OR HYDROLOGIC CYCLE

Due to the solar heat, water evaporates or water is lost to the atmosphere as vapour from the seas / oceans which is then precipitated back in the form of rain, snow, frost etc.. The evaporation and precipitation continues for ever, and thereby a balance is maintained between the two. This process is known as Hydrologic cycle.

THE CARBON CYCLE: All life is based on the element carbon andhence carbon is the main constituent of living organisms.. Carbon may be present in most organic matter from fossil fuels to the complex molecules (DNARNA). In fact, the lithosphere is only 0.032% carbon by weight. In comparision, oxygen and silicon make up 45.2% and 29.4% respectively of the earth's surface rocks.

Plants absorb CO_2 during photosynthesis whereas animals emit CO_2 during respiration. Animals obtain all their carbon through their food and thus, all carbon in biological systems ultimately comes from plants (autotrophs). The dead bodies of plants and animals as well as the body wastes are decomposed by micro-organisms which release carbon in the form of CO_2.Even plant debris if buried a longer time cause for the formation of coal, oil, natural gas and these releases carbon when they burned. Otherwise, the carbon in limestone or other sediments released to the atmosphere when they are subducted (using forces) or undergo chemical reactions. The weathering of rocks also contribute CO_2 into the environment .

OXYGEN CYCLE: Oxygen is present in CO_2, CH_2O (carbohydrates) and H_2O. Oxygen is released into the atmosphere by plants during photosynthesis and taken up both autotrophs and Heterotrophs during respiration.

All the oxygen in the atmosphere is biogenic ie., it was released from water through the process of photosynthesis.Because of the vast amounts of oxygen in the atmosphere, even if all photosynthesis cease it would take 5000 million years to strip out more or less all oxygen.

NITROGEN CYCLE: Nitrogen is used by living organisms to produce a number of complex organic molecules like Amino acids; Proteins ; Nucleic

acids ; Enzymes; Chlorophyll etc..The largest reservoir of nitrogen is the atmosphere where it exists as a gas mainly N2. But atmospheric nitrogen is not utilized directly. However, nitrogen gas undergoes many changes in the nitrogen cycle like: NITROGEN FIXATION; AMMONIFICATION; NITRIFICATION

Nitrogen fixation or conversion of free nitrogen into biologically acceptable form is referred to as Nitrogen Fixation.N2 + 2(O) electric discharge 2 NONitrogen gas oxygen radical nitrogen oxideIn physico chemical process; nitrogen combines with oxygen during lightning or electrical discharges in the clouds and produces different nitrogen oxides (N2O5).

These nitrogen oxides get dissolved in rain water and react with mineral compounds to form Nitrates and Nitrogenous compounds on the earth. N2O5 + H2O 2HNO3

2HNO3 + CaCO3 Ca (NO3)2 + CO2 + H2O

Nitrogen fixation is also carried out by biological process by means of blue – green algae in the oceans. (1) Eg: rhizobium bacteria fix nitrogen in the roots of Leguminous plants (2) Eg: Blue – green algae (Nostoc, Anabena) fix Nitrogen.

Ammonification: when plants or animals die or release waste, the nitrogen is returned to the soil as ammonia. The bacteria (nitrite bacteria) in the soil and in the water which take up ammonia and convert it to Nitrite (NO2). Another bacteria (Nitrate bacteria) take nitrite and convert it to Nitrate (NO3) which can be taken up by plants to continue the cycle.

Nitrification means conversion of ammonia into nitrite by some of the bacterias such as Nitrosmonas, Nitrococcus in oceans and soils.

POTASSIUM CYCLE: The major role of potassium in living organismsis osmotic control and potassium is taken up, retained and excreted in ionic form (K+). The amount of potassium in soil solution is relatively small.

Soils contain potassium in more slowly exchangeable forms which act as sources for crops. In some soils, for example clays, this source of potassium is adequate to meet the requirements of cereals for decades without supplementation with fertilizers. The main pathways for potassium through the plant and soil are mentioned below :

Plant K: Potassium is an essential nutrient in maintaining the osmotic regulation of plant cells. It will constitute between I .6 and 2.5% of the leaf dry matter in healthy leaves.

Fertilizer and manure: The principle sources of potash are manures and sulphate salts. In animal manures, the potash is not biologically fixed to other compounds, unlike nitrogen and phosphate, and thus is readily available to plants. Common fertilizers utilize the muriate (chloride) and sulphate salts of potassium. Chloride, which is not toxic at agronomic applications, should not be confused with chlorine which is a poisonous gas. Manure and fertilizer potassium contribute to potassium in soil solution.

Soil Solution (K+): Potassium in solution is immediately available to plants. The amount of potassium in solution varies with fertilizer application, and cropping history but the amount is generally not enough to meet the requirements of the crop. **Leaching**: Where the amount of potassium added to the soil in fertilizers or manures exceeds the exchange capacity of the soil, potassium can be lost by leaching. **THE PHOSPHOROUS CYCLE:** Phosphorous is present in rocks

in the form of phosphate. When rocks containing phosphate are exposed to water, the phosphate goes into solution. Plants and Fungi have a symbiotic relationship . Plants get phosphates from fungi and give them sugar in return. Phosphorous is an important constituent of cell membrane, DNA, RNA and ATP. Animals obtain phosphorous from plants through food. Phosphorous is a component of bones, teeth and shells. When animals or plants die, the phosphates are returned to the soil or water by the decomposers. Most of the phosphates escape into the sea through the waters, where part of phosphate is deposited in the sediments. This phosphorous will be released when the rock is brought to the surface and weathered.

Marine birds consume phosphorous containing fish from the oceans, their

guano (Guano is a natural manure composed chiefly of the excrement of sea birds) .which falls on land as a high content of phosphorous. Thus marine birds and fish play an important role in returning phosphorous to the cycle.

Aquatic eco system

Eco system that exists in water is known as aquatic ecosystem . Water is the primary requirement for life in biological community. The aquatic ecosystems range from a small pond to a large ocean.Varying quantities of nutrients are carried from terristrial (land) ecosystem by the movement of water and deposited in aquatic ecosystems. The life in aquatic communities is influenced mostly by physical factors like**: Water depth;**

amount light;

temperature;

salinity of water and

amount of oxygen and Carbondioxide.

Aquatic ecosystems are broadly classified into ***fresh water*** and ***marine***

water ecosystems. In some regions, the marine and fresh water environments

overlaps creating "***Estuaries***".

AQUATIC ECOSYSTEM

FRESH WATER MARINE ESTUARIES

Eg: lakes, ponds, eg: salt lakes, seas eg: water bodies
streams, rivers oceans mix of fresh & sea water

I. PONDS & LAKE ECOSYSTEMS: A pond is a small area of still water,

especially is artificial whereas a lake is a large area of water body and the water is natural. The life span of ponds range from a few weeks or months and whereas the life span for lakes depend upon their location, size and depth.

Depending upon temperature, the upper part of the lake becomes warm and is called ***eplimnion*** and the lower part of the lake becomes cold which is called as ***hypolimnion.*** These two zones are separated by **thermocline zone** which acts as a barrier to exchange of material / nutrients within the pond.

During rainy season, entire water body gets same temperature due to mixing of water while in non-rainy season very small amount of mixing occurs by surface waves due to wind blow.

The ***non-living (abiotic) components*** of a pond include Heat; light, pH value of water; organic compounds (water, CO2, O2, Ca, N, P ..) and ***living (biotic) component***s of Autotrophs or producers (green plants, bacteria, rooted plants of Trapa, Typha, Sagi Haria) ; Consumers (Herbivores, insects and large fish) and micro cosumers (bacteria, fungi,…).

STREAM & RIVER ECOSYSTEMS: Rivers and streams are flowing fresh water bodies. Out of all natural ecosystems, rivers are the most intensively used

ecosystems by man. The organization of river and stream ecosystem include:
ABIOTIC COMPONENTS include volume of water, speed of water flow, dissolved oxygen content, temperature etc.. The energy flow usually the organic matter which is being imported from adjacent terrestrial ecosystems.
BIOTIC COMPONENTS include Producers (algae, grass, amphibians); consumers (leaches, water insects, snails, fishes, crocodiles, reptiles) and Decomposers (bacteria, fungi, protozoa).

OCEAN OR MARINE ECOSYSTEMS: The marine environment ischaracterized by its high concentration of salts and minerals. The major oceans of the world are Atlantic; Pacific; Indian, Arctic and Antarctic. These are deep and life extends to all its depths. The sea water contains salt content in the form of NaCl and rest are Mg, Ca, K . Temperature ranges from 0o to 30o C and pressure of 1 ATM at surface and 1000 ATM at bottom of oceans.

The ocean ecosystem consists of the following;

Biotic components of Producers (phytoplanktons, marine plants , Ruppia, Zostera, Halophile are true marine angiospers); Consumers of Molluscas,

fishes etc and Decomposers of bacteria and Fungi.

Abiotic components include Na, Cl, Mg, Ca, Sulphur, Dissolved oxygen content, light , temperature , pressure variations etc.

IV. ESTUARINE ECOSYSTEM: Estuary is the area at the mouth of the river joins the sea and continents. It has a free connection with the open sea and is thus strongly affected by tidal action. Estuaries are mixed with fresh water from land drainages. River mouth, coastal bay etc are the examples for estuarine ecosystem.

Estuaries are one among the naturally fertile in the world. The components of

Estuarine ecosystem are given below:

Abiotic components: Estuaries have their own ecological characteristics. Physical factors such as salinity, temperature, tidal activity etc are variable in estuaries when compared to the sea or ocean.

Biotic components include Producers, consumers and Decomposers. Producers: Three major life forms of Autotrophs play a significant role in grass production. They are (a) macrophytes (sea weeds, sea grass, spartina, Thalassia, marsh grass, nagrove trees) (b) Phytoplankton and (c) Benthic flora (algae).Consumers include a number of zooplankton, oysters, crabs and some species of fishes capable of surviving in estuarine conditions form

primary, secondary, tertiary consumers of the estuarine ecosystem.Decomposers include bacteria and fungi which actively take part in the breaking down the complex and dead organic matter (Fungi of actinomycites).

Forest ecosystem

Introduction: Forest is a type of terrestrial (land) ecosystem. It consists of f trees, shrubs or woody vegetation occupying an extensive area of land. Forests are important renewable resources.

A different types of forests are seen on this earth. The type of forest depend

upon its geographical location and environment factors (Temperature and moisture) that influence the kind of vegetation that occur in an area. Types of forests:

Savannas: These forests develop where a seasonal rainfall occurs. The grass lands of North Africa are known as savannas. Eg: North Africa, America, Burma & India.

Tropical forests: These exits in areas of good rainfall (>200cm per year) with uniform warm temperature. The Soils found in there forests are old, acidic in nature & poor in nutrients. Eg: Amazon rain forest (South America, India).

Deciduous forests (or) Temperate forests: Deciduous forests consists ofbroad leaved trees & occur where rainfall is plenty (750 - 1000 cms per year)

Eg:Europe & North-East America.

Coniferous forest: These occur in areas with long winters with heavy snowfall. In other words, where moisture is limited & rainfall is low. Herbivores (animals eating plants) & insects exist in these forests. Eg: Moscow.

Tundras: These are the large flat Arctic regions of Northern Europe, Asia and North America where no trees grow and where the soil below the surface of the ground is always frozen. The growing season is short and plants grow very slowly.

Following are the types of forests present in INDIA:

1. Tropical, forests present in Western Ghats of Maharashtra, Karnataka, Kerala.

2. Deciduous forests present at Dehradun, Eastern Ghats of Andhra Pradesh, Tamil Nadu, M.P., U.P.

3. Littoral and swamp forests present at Sunderbans in West Bengal and Andaman islands.

4. Tropical Thorn forests present in New Delhi, Punjab and Gujarat.

5. Mountain wet temperature forests present at Nilgiri and Palani hills.

6. Alpine scrub forests present at Ladakh and Sikkim.

The characteristic features of a forest ecosystem are as follows:

Abiotic components include inorganic and organic compounds and dead organic debris. Further, the natural light conditions are different in forests due to complex stratification in the vegetation.

Biotic components include Producers, consumers and Decomposers. Producers: These are plants and trees and produce the food through photosynthesis. The dominant species of trees are Quercus, Acer, Betula,Thuja, Picea, Abies, Pinus, Cedrus etc…

Consumers: The primary consumers are Ants, beetles, leaf hoppers, bugs, spiders, deers, squirrels etc. The secondary consumers are Snakes, birds, lizards, foxes etc are the examples. The tertiary consumers are lion, tiger, hawk etc.

Decomposers include micro organisms like bacteria, fungi etc.. consume the dead or decayed bodies.

Tropical rain forests are found in the hot and humid regions near the equator: These regions have abundant rainfall (2000 – 4500 mm per year) that occurs almost daily. These forests are found in South and Central America, Western and Central Africa , SE Asia and some islands of the Indian & Pacific Oceans.

These rain forests are marked by a variety of tall trees and a dense canopy. The soils are thin and acidic with poor nutrients. A team of Brazilian scientists

conducted a research and found that a forest could return as much as 75% of the moisture it received back into atmosphere. Hence, more trees are meant for more rain.

Temperate forests are very cold in winter and warm or humid in summer. These forests grow where the annual rainfall is about 750 – 2000 mm per year and are found in Western and Central Europe, Eastern Asia, Eastern America.

Soil is rich in temperate forest areas. oaks, maples, beech, pine trees, ferns, lichens, mosses etc are found in these forests.

Temperate forests contain abundant micro – organisms and mammals (squirrels, porcupines, chipmunks, raccoons, hares, deer, foxes, coyotes, bears. Birds like warblers, wood peckers, owls, hawks are seen. Snakes, frogs are also common these forests.

Coniferous forests derive the name from the abundance of coniferous trees like spruce, fir, pine, hemlock etc. Coniferous tree produces dry fruits called cones. In coniferous forests, winters are usually long and cold. The soil in these forests is acidic and humus rich.

The main animals found in these forests are deer, moose, elk, caribon, mice, hares, squirrels, foxes, bears and birds.

Status of Forests in India:

Forest Survey of India (FSI) , Dehradun estimated, the country's forest cover as 6,76,000 sq km . Of this 6,76,000 sq km; 259000 sq km is open forest,417000 sq km is covered by dense forest and mangroves occupied 4490 sq kms. Madhya Pradesh accounts for the largest forest cover of the country with 77265 sq km followed by Arunachal Pradesh 68045 sq km and Chhattisgarh with 56448 sq km.

Desert ecosystem

Deserts occur in regions when the annual rainfall is in the range of 250 to 500 and **evaporation rate is high.** Deserts occupy about 30% of land area on the globe. Deserts are found 30 above north and below south of the equator. Deserts are characterized by extremely hot days and cold nights. The largest deserts are found in the interiors of continents where m moisture bearing winds do not reach. The desert soils has very little organic matter but rich in minerals. The desert plants have adapted to the dry conditions and conserve water by having few or no leaves.
eg: (1) A plant namely Saguaro cactus has a stem that can expand to store water

(2) Many desert plants have thorns or toxins to protect themselves from being grazed by animals.

(3) Some desert plants have wax – coated leaves that minimize the loss of moisture.

Some desert plants have deep roots that reach the ground water.

A few desert plants have shallow roots that collect water after any rain and store it in spongy tissues.
Desert ecosystem is characterized by scanty flora and fauna. The organisms which with stand the extreme temperatures can survive here. Desert animals are usually small in size and come out during the nights for food.

Human impact on deserts.:

Slow rate of growth of vegetation if topsoil is eroded due to a heavy vehicle transportation across the desert. Desert cities, depletion of ground water, land disturbance, pollution from mining, storage of toxic wastes are some of the human activities that cause damage.

Abiotic components include temperature, rainfall, soil, water etc plays a major role to control the desert ecosystem.

Biotic components include **producers** (shrubs, bushes, grasses, a few trees and plants namely Cacti, Acacias, Euphorbias); **Consumers** of insects, reptiles, rodents of rats & rabbits; birds, camels which are capable of living under desert conditions and **Decomposers** include Bacteria, Fungi due to poor vegetation and the less quantity of dead organic matter. .

A Case study of Desert ecosystem:

The Thar desert (the Great Indian Desert) is spread over four states in India __ Punjab; Haryana; Rajasthan and Gujarat and two states in Pakistan. Thar desert covers an area of about 4,46,000 sq kms.

Though the Thar desert is smaller than the Sahara desert in Africa and the Gobi desert in Russia, the Thar desert is most populated in the world with about 13 million people.

The average rainfall is between 100 mm and 500 mm. The only river in the region is the **Ghaggar** which enters Rajasthan from Punjab and dries up in the forest. The Thar desert has no Oasis. Flowering plants like shrubs, grasses, trees (Khejra, Babul, Rohida); fruit trees (Ber; Pilu) are found in Thar desert.

Sheep, goats, camels are the common animals found in the Thar desert. In addition, wild ass, black buck deer, hare, red lynx, Jackal, Wild dog etc.. About 23 species of Lizard and 25 species of snakes are found in Thar desert region.

ECOSYSTEM (UNIT - I) meanings

Abiotic Non – living organisms (soil, temp, light, water, inorganic components of N,C,H,K,P,S)Algae Simple plant with no leaves. Stems or roots that grow in water Bacteria Simple and smallest form of life exist in water, air, soil and causes of diseases Biomass An organic material from living beings or its residues (wood, animal manure)Biome A characteristic plants & animals that exist in a particular type of environment Biotic Living organisms

Carnivores (sec consumers) Dependent on herbivores (snakes, birds, lizards) Chemo autotrophs Micro organisms produce organic matter through oxidation of chemicals in the absence of sunlight.

Consumers (Heterotrophs) Depends on others for nourishing food

Decomposers Feed on organic compounds of dead or living plants & animals

Ecological Succession Development of ecosystem

Fauna Animals

Feeding levels (Trophic levels) A trophic level refers to an organisms position in the food chain Flora Plants

Fungi (mushrooms,Mildew) Any plant without leaves, flowers or green colouring growing on other plants or decaying matter

Herbivores Depends on plants (rabbit, deers)

Humus A substance made from dead leaves & plants added to soil to help plants grow

Inorganic Not consisting of or coming from any living substances

Lentic Standing water

Lotic Running water

Nourishing To keep a person / animal or plant alive with food Oasis An area in the desert where there is water

Omnivores Depends on plants & animals (human beings, birds)

Organic Produced by or from living things (proteins, carbohydrates, fats)

Plankton Very small plants / insects

Producers (Autotrophs) Self nourishing (algae, green plants)

Puddle A small place where rain water accumulates

Sea weed A plant that grows in the sea or ocean or on rocks at the edge of the sea.

Tertiary consumers Depend on primary & secondary consumers (lions ,, tigers) Weed control To remove unwanted plants

osmosis The tendency of fluids to diffuse in such a manner

DIFFERENCE BETWEEN HABITAT AND NICHE

In ecology, a **niche** is a term describing the relational position of a species in its ecosystem to each other. A definition of niche is how an organism makes living. A niche is the totality of all biological and environmental factors that affect a population. It encompasses everything one can think of that allows populations to live, grow, and reproduce.

The niche of an animal is all the conditions it can tolerate and where it lives. There are two types of niches. A broad and narrow niche. An animal that has a broad niche can tolerate more conditions rather than an animal that has a narrow niche. An example of an animal that has a broad niche is an opposum. An example of an animal that has a narrow niche is a panda bear.

The ecological niche describes how an organism or population responds to the distribution of resources and competitors.

A niche is the functional role of a species in a community—that is, its occupation, or its living. For example, the tanager lives in a deciduous forest habitat. Its niche, its part, is gleaning insects. The community provides the habitat—the place where particular plants or animals live. Within the habitat, organisms occupy different niches. Habitat - is the specific place where something lives.

Niche - is the role of a specie plays in a community such as feeding relationships, space, and what the organism needs to survive in the environment. It includes how a species uses and affects its environment. Encompasses - (to enclose within a circle; surround) Gleaning - To gather (grain) left behind by reapers and to collect bit by bit

Opossums - live in the tree canopies, feeding solely on fruits .

Tanager is a type of bird

Different species of organisms may appear to have the same habitat but each has a different niche so that they can survive in that habitat.

A frog generally tends to have a broad niche. It can live in areas that have little water sources to areas that have a vast region as water sources.

Unit 2-Natural resources

Non-renewable resource

A coal mine in Wyoming. Coal, produced over millions of years, is a finite and non-renewable resource on a human time scale.

A **non-renewable resource** (also known as a finite resource) is a resource that does not renew itself at a sufficient rate for sustainable economic extraction in meaningful human timeframes. An example is carbon-based, organically-derived fuel. The original organic material, with the aid of heat and pressure, becomes a fuel such as oil or gas. Fossil fuels (such as coal, petroleum, and natural gas), and certain aquifers are all non-renewable resources.

Metal ores are other examples of non-renewable resources. The metals themselves are present in vast amounts in the earth's crust, and are continually concentrated and replenished over millions of years. However their extraction by humans only occurs where they are concentrated by natural processes (such as heat, pressure, organic activity, weathering and other processes) enough to become economically viable to extract. These processes generally take from tens of thousands to millions of years. As such, localized deposits of metal ores near the surface which can be extracted economically by humans are non-renewable in human timeframes, but on a world scale, metal ores as a whole are inexhaustible, because the amount vastly exceeds human demand, on all timeframes. Though they are technically non-renewable, just like with rocks and sand, humans could never deplete the world's supply. In this respect, metal ores are considered vastly greater in supply to fossil fuels because metal ores are formed by crustal scale processes which make up a much larger portion of the earth's near-surface environment than those that form fossil fuels, which are limited to areas where carbon-based life forms flourish, die, and are quickly buried. These fossil fuel-forming environments occurred extensively in the Carboniferous Period.

In contrast, resources such as timber (when harvested sustainably) and wind (used to power energy conversion systems) are considered renewable resources, largely because their localized replenishment can occur within timeframes meaningful to humans.

Fossil fuel

Natural resources such as coal, petroleum (crude oil) and natural gas take thousands of years to form naturally and cannot be replaced as fast as they are being consumed. Eventually it is considered that fossil-based resources will become too costly to harvest and humanity will need to shift its reliance to other sources of energy. These resources are yet to be named.

An alternative hypothesis is that carbon based fuel is virtually inexhaustible in human terms, if one includes all sources of carbon-based energy such as methane hydrates on the sea floor, which are vastly greater than all other carbon based fossil fuel resources combined. These sources of carbon are also considered non-renewable, although their rate of formation/replenishment on the sea floor is not known. However their extraction at economically viable costs and rates has yet to be determined.

At present, the main energy source used by humans is non-renewable fossil fuels. Since the dawn of internal combustion engine technologies in the 17th century, petroleum and other fossil fuels have remained in continual demand. As a result, conventional infrastructure and transport systems, which are fitted to combustion engines, remain prominent throughout the globe. The continual use of fossil fuels at the current rate is believed to increase global warming and cause more severe climate change.[1]

Radioactive fuel An open pit uranium mine in Namibia

Annual release of uranium and thorium radioisotopes from coal combustion, predicted by ORNL to cumulatively amount to 2.9 million tons over the 1937-2040 period, from the combustion of an estimated 637 billion tons of coal worldwide.[2]

Further information: Uranium depletion

The use of nuclear technology requires a radioactive fuel. Uranium ore is present in the ground at relatively low concentrations and mined in 19 countries.[3] This mined uranium is used to fuel energy-generating nuclear reactors with fissionable uranium-235 which generates heat that is ultimately used to power turbines to generate electricity.[4]

Nuclear power provides about 6% of the world's energy and 13–14% of the world's electricity.[5] The expense of the nuclear industry remains predominantly reliant on subsidies and indirect insurance subsidies to continue.[6][7] Nuclear energy production is associated with potentially dangerous radioactive contamination as it relies upon unstable elements. In particular, nuclear power facilities produce about 200,000 metric tons of low and intermediate level waste (LILW) and 10,000 metric tons of high level waste (HLW) (including spent fuel designated as waste) each year worldwide.[8]

The use of nuclear fuel and the high-level radioactive waste the nuclear industry generates is highly hazardous to people and wildlife. Radiocontaminants in the environment can enter the food chain and become bioaccumulated.[9] Internal or external exposure can cause mutagenic DNA breakage producing teratogenic generational birth defects, cancers and other damage. The United Nations (UNSCEAR) estimated in 2008 that average annual human radiation exposure includes 0.01 mSv (milli-Sievert) from the legacy of past atmospheric nuclear testing plus the Chernobyl disaster and the nuclear fuel cycle, along with 2.0 mSv from natural radioisotopes and 0.4 mSv from cosmic rays; all exposures vary by location.[10] Some radioisotopes in nuclear waste emit harmful radiation for the prolonged period of 4.5 billion years or more,[11] and storage has risks of containment. The storage of waste, health implications and dangers of radioactive fuel continue to be a topic of debate, resulting in a controversial and unresolved industry.

Renewable resources

Natural resources, called renewable resources, are replaced by natural processes and forces Natural resources, called renewable resources, are replaced by natural processes and forces persistent in the natural environment. There are intermittent and reoccurring renewables, and recyclable materials, which are utilized during a cycle across a certain amount of time, and can be harnessed for any number of cycles.

The production of goods and services by manufacturing products in economic systems creates many types of waste during production and after the consumer has made use of it. The material is then either incinerated, buried in a landfill or recycled for reuse. Recycling turns materials of value that would otherwise become waste into valuable resources again.

The natural environment, with soil, water, forests, plants and animals are all renewable resources, as long as they are adequately monitored, protected and conserved. Sustainable agriculture is the cultivation of plant materials in a manner that preserves plant and animal ecosystems over the long term. The overfishing of the oceans is one example of where an industry practice or method can threaten an ecosystem, endanger species and possibly even determine whether or not a fishery is sustainable for use by humans. An unregulated industry practice or method can lead to a complete resource depletion.[12]

The renewable energy from the sun, wind, wave, biomass and geothermal energies are based on renewable resources. Renewable resources such as the movement of water (hydropower, tidal power and wave power), wind and radiant energy from geothermal heat (used for geothermal power) and solar energy (used for solar power) are practically infinite and cannot be depleted, unlike their non-renewable counterparts, which are likely to run out if not used sparingly.

The potential wave energy on coastlines can provide 1/5 of world demand. Hydroelectric power can supply 1/3 of our total energy global needs. Geothermal energy can provide 1.5 more times the energy we need. There is enough wind to power the planet 30 times over, wind power could power all of humanity's needs alone. Solar currently supplies only 0.1% of our world energy needs, but there is enough out there to power humanity's needs 4,000 times over, the entire global projected energy demand by 2050.[13][14]

Renewable energy and energy efficiency are no longer niche sectors that are promoted only by governments and environmentalists. The increasing levels of investment and that more of the capital is from conventional financial actors, both suggest that sustainable energy has become mainstream and the future of energy production, as non-renewable resources decline. This is reinforced by climate change concerns, nuclear dangers and accumulating radioactive waste, high oil prices, peak oil and increasing government support for renewable energy. These factors are commercializing renewable energy, enlarging the market and growing demand, the adoption of new products to replace obsolete technology and the conversion of existing infrastructure to a renewable standard.[15]

Economic models

In economics, a non-renewable resource is defined as goods, where greater consumption today implies less consumption tomorrow.[16] David Ricardo in his early works analysed the pricing of exhaustible resources, where he argued that the price of a mineral resource should increase over time. He argued that the spot price is always determined by the mine with the highest cost of extraction, and mine owners with lower extraction costs benefit from a differential rent. The first model is defined by Hotelling's rule, which is a 1931 economic model of non-renewable resource management by Harold Hotelling. It shows that efficient exploitation of a nonrenewable and nonaugmentable resource would, under otherwise stable conditions, lead to a depletion of the resource. The rule states that this would lead to a net price or "Hotelling rent" for it that rose annually at a rate equal to the rate of interest, reflecting the increasing scarcity of the resources. The Hartwick's rule provides an important result about the sustainability of welfare in an economy that uses non-renewable source.

However, nearly all metal prices have been declining over time in inflation adjusted terms, because of a number of false assumptions in the above. Firstly, metal resources are non-renewable, but on a world scale, largely inexhaustible. This is because they are present throughout the earth's crust on a vast scale, far exceeding human demand on all time scales. Metal ores however, are only extracted in those areas where nature has concentrated the metal in the crust to a level whereby it is locally economic to extract.

This also depends on the available technology for both finding the metal ores as well as extracting them, which is constantly changing. If the technology or demand changes, vast amounts of metal previously ignored can become economically extractable. This is why Ricardo's simplistic notion that the price of a mineral resource should increase over time has in fact turned out to be the opposite, nearly all metal ores have decreased in inflation adjusted prices since well before the early 20th century. The main reason he was wrong is that he assumed that metals are exhaustible on a world scale, and he also misunderstood the effect of globally competing markets; in human terms the amount of metal in the earth's crust is essentially limitless. It is only in localized areas that metal ores can become depleted, as these local areas compete with extraction costs of resources elsewhere, which does have ramifications for the sustainability of local economies.

UNIT III: BIODIVERSITY

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The word biodiversity is a combination of two words: "*biological and diversity"* and refers to the variety of life on the Earth which include a large number of living things that exist in a certain area (in the air, on land or in water). The area may be considered as small as heap or as big as whole planet. Hence, Biodiversity means " **the existence of a large number of different kinds of animals and plants which make a balanced environment"** (or)" ***the totality of all species and ecosystems in a region"*** is called as biodiversity. Biodiversity deals with a large variety of flora and fauna on this earth. For eg: a wide variety of plants and animals are find in a part of forest. The plant life range from a small herb to a large tree and the animal life vary from a tiny insect to a large mammal in addition to micro-organisms (algae, bacteria, fungi etc) .

Biodiversity is usually considered at three different levels:

Genetic diversity means the variation of genes within the species. For eg: in human species, genetic variation between an Indian and African and genetic variations within a population (eg: within the Indian population) can be seen . In simple terms, genetic matter dictates whether the persons have blue or brown eyes, brown or black hair and tall or short..

Genetic diversity can be identified by using a variety of DNA based and other techniques. One estimate is that there are 1000 crores of different genes distributed across the worlds biota though they do not all make an identical contribution to overall genetic diversity.

1. Species diversity means the richness of species in all ecosystems. It is measured on the basis of number of species in a region. So far 1.75 million

species have been described world wide.

Warmer areas tend to support more species than colder ones and wetter areas contain more species than drier ones. Topography and climate of the areas support and control the species of a region. .

Ecosystem diversity means the study of difference between ecosystem types. Ecosystem diversity is difficult to measure since the boundaries of various sub ecosystems are overlap each other. An example for ecosystem diversity is Godavari – Delta ecosystem which consists of grassland ecosystem, , river ecosystem, estuarine ecosystem, fresh water aquatic ecosystem, marine water aquatic ecosystem .

Importance of biodiversity: Biodiversity performs a number of ecological series for human kind that have economic, and aesthetic values. As an example, the contribution of biodiversity to human health is given below:

One out of 125 plant species produce a major drug as per Herb Research Foundation. Of the 118 drugs in the US, 74% are based on plants; 18% on fungi; 05% on bacteria and 03% on vertebrates. 80% of the world population relies on traditional plant medicine.

Value of biodiversity: The value of biodiversity (in terms of its commercial utility, ecological services, social and aesthetic values) is enormous. There are several ways that biodiversity and its various forms are valuable to humans. We get benefits from organisms in an innumerable ways. . Sometimes, one realize the value of the organism only after it is lost from this Earth.

Every year numerous species are lost before we have a chance to know anything about them. The biodiversity value may be classified as follows:

CONSUMPTIVE VALUE: Biodiversity is an essential requirement for the maintenance of global food supply. The main sources of human food includes animals, fish and plant produces.

A large number of plants are consumed by human beings as food. A few animal species are consumed by people which comes from cattle, pigs, sheep, goats, buffaloes, chickens, ducks, geese and turkey species.

Fish: Many fresh water fish can be grown in ponds. Israel and China already get about half of their fish from aqua culture.

Drugs & medicines: About 75% of the worlds population depends upon plants or plant extracts for medicines. The drug Penicillin used as an antibiotic is derived from a fungus called ***Penicillium.*** Likewise, Tetracycline from a bacteria which is used to cure malaria is obtained from the bark of cinchona tree. .

Fuel: The fossil fuels like coal, petroleum products and natural gas are the products of biodiversity.

PRODUCTIVE VALUE: *Some of the organisms* are commercially usable where the product is marketed and sold. The animal products like tusks of elephants; musk from deer; silk from silkworm; wool from sheep or goats; fur of many animals etc all of which are traded in the market.

Calabar bean was tradionally used as a poison in West Africa.

Daisy plants were first used as a lice remedy in the middle east and this led to the discovery of *Pyrethrum*. Mosquito coils made from Pyrethrum are sold in the market.

The bacterium Bacillus thuringiensis produces toxic proteins that kill certain insects.

neem tree has been using in birth control such as parts of neem tree that cause abortion.

SOCIAL VALUE: These are the values associated with the social life, religion and spiritual aspects of the people. Many of the plants are considered to be sacred in our country like Tulasi, Mango leaves, Banana leaves, . The leaves, fruits, flowers of some of the plants are used in worship.

Many animals like cow, snake, bull, peacock also have significant place in spiritual and thus hold special importance. Thus, biodiversity has distinct social value, attached with different societies.

ETHICAL VALUE: The ethical value means that human beings may or may not use a certain species but knowing the very fact that this species exists in nature gives pleasure. For eg: a peculiar species of Pigeon, grey / white bird with short legs is no more on this earth. Similarly, Dodo species is also no more. Human beings are not deriving anything direct from Kangaroo, giraffe but strongly feel that these species should exist in nature.

AESTHETIC VALUE: Every one of us would like to visit vast stretches of

lands to enjoy the visible life. People from farther areas, spend a lot of time and money to visit wild life areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is known as eco tourism.

Eco-tourism is estimated to generate 12 billion dollars of revenue annually that roughly gives the aesthetic value of biodiversity.

A study of the impact of environment on the psyche was undertaken by Kaplan and Kaplan (1989) in which they found that being near nature relieved working stresses while people who worked in closed environment or human made structures experienced much more job stresses and illnesses.

India as a mega diversity Nation:

India contains a great wealth of biodiversity in the forests, wet lands and marine areas. Hence biodiversity can be observed at all levels ie locally, nationally and globally . India, as a subcontinent representing a major part of South Asia is rich in flora and fauna and hence it is one of the world's "MEGADIVERSITY NATIONS" . It is estimated that over 75000 species of animals and over 45000 species of plants are found in India. The identified biodiversity in India and world is :

GROUP NO OF SPECIES

IN INDIA

NO OF SPECIES

IN WORLD

Mammals 350 4629

Birds 1224 9702

Reptiles 408 6550

Amphibians 197 4522

Fishes 2546 21730

Flowering plants 15000 250000

Biogeographic regions of India: According to **wild life Institute of India**, the country has 10 distinct biogeographic zones or regions. They are:

Trans – Himalayan Zone
Himalayan Zone
Desert Zone

Semi – arid Zone
Western Ghats
Deccan Zone
Gangetic plain Zone
NE Indian Zone
Coastal Zone
Islands around the country.

Endangered and Endemic species:

Endangered species A species whose numbers are reduced to the point. That means endangered species are in immediate danger of extinction. The International Union Conservation of Nature (IUCN) classified the species of plants and animals as:

(a) Endangered species

(b) Vulnerable species means depleted species.

(c) Threatened species: Species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future)

(d) Rare species

Among the important endangered animal species, Indian wild ass; the Kashmir stag, the Golden Langur etc .. are considered highly endangered. There are also endangered bird species like Siberian crane; the great Indian Bustard; the florican etc..

The IUCN published the data on endangered species of both plants and animals of India. The data symbolizes the working signal for those species which are endangered and if not protected are likely to become extinct in near future.

India contains 172 species of animal are considered to be endangered; vulnerable; rare and threatened. These include :

TAXANOMIC GROUP

Endangered spVulnerable species Rare species Threatened species Unknown

TOTAL

MAMMALS

(Tiger; Leopard; Indian Lion;Golden cat; Desert cat;Sloth bear; Red fox; Indian wolf; golden monkey; Lion tailed Macaque)

13 20 2 5 13 53

BIRDS (Siberian white crane; Vultures; Great Indian Bustard; peacock; pelican)

6 20 25 13 5 69

REPTILES (Gharial; green sea turtle; star tortoise; python)

6 6 4 5 2 23

AMPHIBIANS 0 0 0 3 0 3

FISHES 0 0 2 0 0 2

INVERTIBRATES (crab; beetle; spider; snail)

1 3 12 2 4 22

26 49 45 28 24 172

During the recent past, Vultures which were common have suddenly disappeared. Several species of Reptiles (lizard; snakes; star tortoise; crocodiles); ; Amphibians (frog); Invertebrates (crab, beetle; spider; snail) are also threatened due to human anthropogenic activities.

India contains some of Asia's rarest animals such as: The Bengal Fox; Asiatic

Cheetah; Marbled Cat; Asiatic Lion; Indian Elephant; Asiatic wild Ass; Indian

Rhinoceros; Markhor; Gaur; Wild Asiatic Water Buffalo etc…

Description of the Asiatic Lion (Panthera Leo Persica): The Asiatic Lion is very similar to the African Lion. The lion is yellowish brown in color. The male lion is distinguished by the presence of the **mane**. The lion on an average grow to about 9 feet in length. The young cubs (young lions) are often spotted or striped. Though the Asiatic lions are once widespread throughout SW Asia (Northern Greece to Central India) their numbers declined with the disappearance of grasslands. Today the Asiatic Lion is restricted to GIR National Park, Gujarat, India and the total population of the Asiatic Lion is around 250 only The effort to conserve this species was initiated as long ago as 1910 by the Nawab of Junagadh who banned the hunting of lions within his province. Emperor Ashoka used the Lion as a symbol of Power & Strength.

Endemic Species is a species that confined to a certain region and are restricted to particular areas. Eg: Penguins usually found on a single ice-

land or glaciers. About 33% of the country's flora (plants) are endemic and are concentrated mainly in :

NE part of India (Rhinoceros is restricted to Assam but was once found throughout the Gangetic plain)

Western Ghats (Lion – tailed macaque & Nilgiri leaf monkey and bull frog; tree frog)

NW and Eastern Himalayas (Oak tree; Pine tree; Hangul deer of Kashmir ; snow leopard; jackal; wild dog; Himalayan wolf)

Andaman and Nicobar islands and South India (Nilgiri Tahr is found in Nilgiri & Annamalai hills in south India)

The Gangetic plains are generally poor in endemics while the Andaman & Nicobar islands are rich.

Hot spots of biodiversity: Biologically hot spots are areas that are extremely rich in endemic species of both plant and animals.

The world is identified with 25 biodiversity hot spots containing 44% of all plant species and 35% of vertebrates & 21% of invertebrates and others of all animal species in land area. The following is the list of identified bio-diversity hot spots of the world:

S No Location S No Location

1 **Tropical Andes** (venezula;

Columbia; peru; argentina)

14 Mediterranean Basin

(surroundings of Europe, Asia;

Africa; Algeria; Libya; Egypt)

2 Meso America (central Mexico) 15 Caucasus

3 Caribbean (West Indies) 16 Sunda land

4 Brazil forest 17 Wallacea

5 Western Ecudor (NW of S.America)

18 Philliphines

Brazil's Cerrado 19 Indo-Burma region

Central Chile 20 South Central China
California Province 21 Western ghats – Sri Lanka
Madagascar 22 SW Australia
Coastal Forest of Kenya (S Africa) 23 New Caledonia
Western African Forests 24 New Zealand
Cape Province (S. Africa) 25 Polynesia / Micronesia
Karoo (Australia)

Hot spots in India: Among 25 hot spots of world two found in India extending into neighbouring countries viz., 1) The Western Ghats – Sri Lanka region and 2) The Indo – Burma region

covering Eastern Himalayas (The Eastern Himalayas form a distinct region which comprises Nepal, Bhutan ; Sikkim and states of Northern India).

PLANTS OF ENDEMIC SPECIES*:* Of India's 45000 plant species, 1600 endemics are found in a 17000 sq kms in the Western Ghats. In Sikkim, in an area of 7298 sq kms, 4250 plant species are endemic while in Nepal, 500 species are believed to be endemic . Bhutan possesses an estimated species of 750 are considered to be endemic. Eg; oak tree; pine tree etc..

ANIMALS OF ENDEMIC SPECIES: Eg: Penguins . Rhinoceros (NE of India); Lion– tailed macaque & Nilgiri leaf monkey and bull frog; tree frog (Western Ghats) Hangul deer of Kashmir ; snow leopard; jackal; wild dog; Himalayan wolf (NW and Eastern Himalayas); Nilgiri Tahr (Nilgiri & Annamalai hills in south India).

Major threats to the Biodiversity:

Biodiversity is threatened by anthropogenic activities in many ways (by destruction of forests, over – hunting conversion of wet lands & grass lands into industrialization; mining of minerals / rocks; pollution; constructions of roads; tourism business; exploitation of timber resources etc..) to eliminate millions of species. Habitat loss is the major cause of species extinction. Habitat loss may be qualitative and quantitative losses:

Qualitative losses involve a change in the structure, function or composition of the habitat. Eg: If a paper industry discharging chemicals into a waterway system and polluting / poisoning the water, thus there has been a qualitative loss. Quantitative losses is measured by looking at a previously mapped area and determining how much of the habitat area is no longer present. Eg: If a wet land is paved over, then there has been a quantitative loss of wet land.

Diseases; The spread of non – native species threatens many local species with extinction (eg: Dodo); climate changes (threatens to force species and ecosystems to migrate towards favourable areas) etc disturb and cause the elimination of species. .

Biogeographical classification of India: India is the 7th largest country in the world and Asia's second largest nation with an area of 32,87,263 sq km. It has a land frontier of 15,200 kms and a coast line of 7516 km. India's northern frontier's are Tibet; China; Nepal and Bhutan. In the North West, India borders on Pakistan ; in the Northeast China and in the East, Burma. The southern peninsula extends into Indian Ocean; Bay of Bengal lying to the Southeast and the Arabian Sea to the Southwest.

For administrative purposes India is divided into 28 states and 7 union territories.

Physically the country is divided into four relatively well defined regions:

Himalayan region

The Gangetic river plains or Indo-Gangetic plains.

The southern (Deccan) Plateau and
The islands of Lakshadweep, Andaman and Nicobar.
The Himalayas in the North include the highest peaks in the world. The highest mountains are:

Khanchen Junga (8586 mts) which is located in Sikkim;

Pir Panjal (3,600 – 4,600 mts) in Kashmir;
Dhaula dhar in Himachal Pradesh and
Siwaliks (900 – 1500 mts) in the Indo – Gangetic plains.

The northern plains of India stretch from Assam in the East to the Punjab in the West covering a distance of 2400 kms. Some of the largest rivers in India including the Ganges, Ghaghara, Brahmaputra and Yamuna flows across this region. Thar desert which is located at the western extremity of Indian part of the plains in the states of Rajasthan. Observations show that the biodiversity is far richer in NE Himalayan range compared to Northwest range. The following factors play a major role in the classification of biogeographical / biodiversity:

CLIMATE: The climate of India is dominated by the Asiatic monsoon, mostly by

southwest rains between June and October and drier winds from the North between December and February. From March to May the climate is dry and hot. .

WET LANDS: India has a rich variety of wetland habitats. The total area of wetlands excluding rivers in India is 5,82,86,000 hectares . Chilka lake (orissa) and Keoladeo National Park (Bhartpur in Rajasthan) have been designated under the convention of wetlands of International importance. The country's wet lands are generally differentiated by region into 8 categories:

The reservoirs of the Deccan Plateau in south
the vast saline expanses of Rajasthan and Gujarat
Fresh water lakes and reservoirs from Gujarat eastwards.
The delta wet lands and lagoons of India's east coast.
The fresh water marshes of Gangetic plain

The Flood plain of Brahmaputra

The marshes and swamps in the hills of NE India and Himalayan foot hills and the lakes and rivers of the mountain region of Kashmir and Ladakh and
Wet lands of the island areas of Andaman & Nicobars.

FORESTS: The panorama of Indian forests ranges from evergreen tropical rain forests in the Andaman and Nicobar Islands ; the Western Ghats to alpine forests in the Himalayas to the North. The country has also several types of forests viz.,

semi – ever green rain forests
Deciduous forests
Thorn forests
Pine forests
Tropical forests (Andaman & Nicobar islands; the Western Ghats)
Rain forests (Orissa)
Western Ghats monsoon forests contain rosewood, Malabar, teak .

Tropical evergreen rain forests and tropical monsoon forests (Andaman & Nicobar)

MARINE ENVIRONMENT: The coastal waters of India are extremely rich in

fishing grounds. In 1981, it was estimated that there were approximately 1,80,000 non – mechanized boats carrying out fishing activities in these waters. At the same time, there were about 20,000 mechanized boats operating mainly out of ports in the states of Maharashtra, Kerala, Gujarat, Tamil Nadu and Karnataka. Indian coral reefs have a wide range of resources which are of commercial value. Exploitation of corals, coral debris is widespread on the Gulf of Mannar and Gulf of Kutch.

Ornamental shells and pearls are the important reef industry. Other marine areas are include sea grass and prawns. Five species of marine turtle occur in Indian waters.

1. Green turtle
   Logger head
   Olive Ridley
   Hawksbill
   Leather back.

Conservation of Biodiversity: In order to maintain and conserve biodiversity, the Ministry of Environment and Forests, Govt of India has already taken several steps to manage wildlife, the objectives of which are:

Maintenance of a number of species in protected areas such as National Parks, Sanctuaries..

To improve the biosphere reserves

Implement strict restrictions of export of rare plants and animals

Educate the public on these through the Govt agencies and NGO's.

Conservation of biodiversity can be carried out in two ways, as shown: **In-situ conservation**: The preservation of species in its natural ecosystem is called in-situ conservation. As a consequence, protected areas are being identified and maintained for natural conservation of species by individual countries. For the conservation and management of endangered species several projects have been established. These are:

Tiger Projects: Corbett National Park which is 300 km from New Delhi is the oldest National Park of India having 1318.54 sq km. It was one of the nine Tiger Reserves created at the launch of the Project Tiger in 1973. The original area of the Park was 323.75 sq. km. to which 197.07 sq. km. was added later. An area of 797.72 sq. km. was added as buffer of the Corbett Tiger Reserve in 1991.

Conservation of Biodiversity

In-situ conservation Ex-situ conservation

National Parks

Wild life sanctuaries

Home gardens,

sacred gardens

Seed bank

Genes Bank

Botanical gardens ; Zoological
garden ; Aquariums

Gir Lion Projects: The Gir Forest of Gujarat where lions are found. This has an area of 1412 sq kms and declared as a National Park.

Elephant Projects: The objective was to ensure long-term survival of population of elephants (not come into operations).

Project Elephant (PE), a centrally sponsored scheme, was launched in February

1992 to provide financial and technical support to major elephant bearing States in the country for protection of elephants and their habitats. The Project is being implemented in 13 States/UTs, viz..Andhra Pradesh, Arunachal

Pradesh, Assam, Jharkhand, Karnataka, Kerala, Meghalaya, Nagaland, Orissa, Tamil Nadu, Uttranchal, Uttar Pradesh and West Bengal.

There are about 7000 protected areas in the world which include a variety of National parks, Sanctuaries etc which vary in size (between 100 to 500 sq km), purpose (protection of one or more species and their habitats).. In India, there are 39 National Parks and 492 wildlife sanctuaries.

National Parks : These are protected areas exclusively for wild life. Human activities like hunting , Firewood collection, timber harvesting etc… are restricted in these areas to that wild plants and animals could grow in a protected environment.

S.No National Park State Wildlife varieties

1 Kaziranga National Park Assam **One horned Rhinoceras**;
Wild buffalo; sambhar; gibbon; pelican bird.

2 Sundarban National Park West Bengal Tiger; Gangetic dolphin; crocodile

3 Hazaribagh National Park Bihar Wild bear; Gaur; Sambhar, Nilgai, Chital;
Sloth bear

4 Corbett National Park U P **Tigers**

Python, king cobra; chital; nilgai;

elephants

5 Gir National Park Gujarat Asiatic Lion

Panther, Hyna; Sambhar;

Chinkara; Langur (leaf monkey) ;

green pigeon

6 Kankha National Park M P Tiger, Panther; chital; Blue bull;

four horned deer; Black buck;

wild dog; grey horn bill

7 Tandoba National Park Maharashtra Langur; Bison; Chital; Blue bull; Tiger; Sambhar

8 Bandipur National Park Karnataka Elephant; gaur; Malabar squirrel; wild dog; slothbear; green pigeon

9 Desert National Park Rajasthan Great Indian Bustard; Black buck; Chinkara

Wildlife sanctuaries: It is an area for the conservation of animals only. Timber collection, Collection of forest produces and private ownerships areallowed subjected to condition that such activities shall not affect the animals.

S.No Wildlife sanctuary State Wildlife varieties 1 Indira Gandhi Wild life Sanctuary

Tamil Nadu Elephant; tiger; guar; sambhar; spotted deer; sloth bear; wild dog; barking deer

2 Jaldapara Sanctuary West Bengal Rhinoceros; leopard, guar, deer, sambhar, **various birds**;

3 Keoladeo Ghana Bird

Sanctuary

Rajasthan Siberian crane; herons; spoon bill; **various famous birds**

4 Sultanpur Lake Bird

Sanctuary

Haryana Crane, sarus, spots bill, duck drake,

python

5 Nagarjuna Sagar

Sanctuary

A P Tiger; panther; wild bear; chital; nilgai;

black buck; fox; jackal; wolf; crocodile

6 Chilka Lake Bird

Sanctuary

Orissa Water fowls, ducks, cranes, ospreys,

golden plovers, sandpipers

Ex-situ conservation is the maintenance and breeding of endangered plants and animal species under certain conditions and locations. It refers to conservation of species in suitable locations outside their natural habitat. In this method, the animal species are put in zoological parks and plants in Botanical gardens to multiply under artificial conditions. Eg: Crocodile Breeding at Madras; Pygmy Hog breeding in Gauhati; Manipur Brown Anti-red deer at

Delhi Suitable locations in field for Ex-situ conservation are:

Botanical / Zoological gardens; **aquarium** and **research centres**

Field gene banks: Growing plants have been assembled

Seed bank: plants seeds are suitable for long term storage.

In vitro (in glass): buds; stem tips are kept under low temperature ie -3o C to 12o C
Census

Wild Species 1993 1994 1995 1996 1997

Tiger 123 128 134 – 138

Panther 100 102 110 – 109

Elephant 417 -- 502 -- 746

Cheetal 36525 -- 31919 -- --

Sambar 5576 -- 5695 -- 5757

Barking Deer 2262 -- 2271 -- 2229

Hog Deer 292 -- 294 -- 477

Bear 54 -- 58 -- 40

Wild Boar 7670 -- 7711 -- 7906

Ghariyal 224 -- 123 -- 283

Mugar 118 -- 119 -- 301

Ghoral 424 -- 433 -- 451

Monkey 12663 -- 12574 -- 12764

Langur 14091 -- 14187 – 14300

UNIT – IV: POLLUTION

Contents:

Introduction

Air Pollution primary air pollutants

secondary air pollutants

Air pollution effects; Prevention & control measures

Water Pollution chemical examination of water
Water pollutants

Prevention & control measures of water pollution

Noise Pollution effects of noise pollution Marine Pollution effects of marine pollution Thermal Pollution Management of Thermal Pollution Solid

Waste Management sources of solid wastes Effects of solid waste pollution

3 R's: Reduce; Reuse; Recycling

Disaster Management

e-waste

INTRODUCTION: According to ODUM (1971), Pollution is ***"an undesirable change in the characteristics of air, water and land that harmfully affect the life and also create health hazards for all living organisms on the globe"***.

According to SOUTHWICK (1976), Pollution can be defined as ***" the unfavorable (or) alteration of environment caused by human activities and causing harm to human beings ".***

Basically the Pollution is of two types viz.,

Natural Pollution: This type of pollution is limited in its occurrence generally from natural hazards like volcanic eruptions, emissions of natural gas, soil erosion, ultraviolet rays, cosmic rays etc and

Man made Pollution: Most of the pollution is man made only. . However, Pollution is usually categorized as Air Pollution; Water Pollution; Thermal Pollution; Noise Pollution; Land & soil Pollution; Radio Active Pollution and Marine Pollution .

AIR POLLUTION

Air pollution may be described as " ***the imbalance in quality of air so as to cause adverse effects on the living organisms existing on earth***" . Pollution is due to the presence of undesirable substance of sufficient quantity which exists in environment. ***The substance or energy which causes pollution is called pollutant***. Pollutants may be classified according to origin and state of matter. **a) According to Origin:** Air pollutants are divided into two categories as primary & secondary. Primary air pollutants are those which are emitted directly into the atmosphere. Eg: C; CO; CO2; SOx ; N; S; H; NOx; CFC's etc .

Secondary air pollutants are those which are produced in the air by the interaction among the primary air pollutants or by reaction with atmospheric constituents. Eg: **Ozone (O3)**; **Smog; Para Acetyl Nitrate (PAN)**; **Acid Rain** ; **Aerosols.**

b) According to State of Matter: Air pollutants include fine solids; liquids and gases. Dust, Smoke, Fumes etc are examples for solid particles whereas

fog is an example for liquid particles. Benzene (C6H6), Methane (CH4), Butane, Aldehydes, Ketones, inorganic gases etc are gaseous air pollutants. Listed below are the major air pollutants:

S No Compound Pollutants

1 Carbon oxides Carbon Monoxide (CO); Carbon dioxide

2 Sulphur oxides Sulphur dioxide (SO2); Sulphur Trioxide (SO3)

3 Nitrogen oxides NO2; Nitrous oxide (N2O); Nitrogen Peroxide (N2O5)

4 Organic compounds Methane; Propane (C3 H8) ; Benzene; Chloro Fluro Carbons (CFC)

5 Photochemical Oxidants Ozone (O3); PAN; Aldehydes

6 Radio active substances Iodine 131; Strontium 90; Plutonium 239

PRIMARY POLLUTANTS:

Carbon Monoxide: It is a colorless, odorless, poisonous gas that is produced

by the incomplete burning of carbon based fuels (coal, petrol, diesel and wood) which comes from the automobile industries, exhaust devices, About 70% of CO emissions are from the transport sector.

When the air is polluted with CO, human blood is likely to be deprived of oxygen and leads to coma and death. In mild dosages, it leads to headache .
Oxides of Sulphur: SO2 is a gas produced from burning of coal, mainly in

thermal power plants. Some industries such as paper mills produce SO2. It is injurious not only to men and plants, but it also attacks rapidly a few rocks such as limestones, marbles, electric contacts etc. It can even dissolve nylon. Paper absorbs SO2 causing the paper to become brittle and fragile. SO2 polluted air leads to corrosion of metals such as Fe, Zn, Cu, steel etc… SO2 is a major contributor to Smog and acid rain.

Sulphur trioxide is more irritant than SO2 because it combines immediately with water to form sulphuric acid.

Oxides of Nitrogen : Combustion of coal, oil, natural gas and gasoline which produces upto 50 ppm of Nitrogen. NOx are also produced when fossil fuels are burned especially in power plants and motor vehicles. NO2 poisoning results SILOFILTER disease. High levels of NO2 exposure causes cough and make the

human beings feel short of breath. People who are exposed to NO2 for a long time have a higher chance of getting respiratory infections.

NOx compounds contribute for the formation of Ozone. Similarly, when nitrogen oxide when combine with SOx to form acid rain.

Chloro Fluoro Carbons: CFC's (also known as Freon) are non- toxic. They

contain Carbon, Fluorine and Chlorine atoms.The Five main CFCs are the following:

CFC – 11 (Trichloro Fluoro Methane CFCl3)

– 12 (Dichloro Fluoro Methane CF2Cl2)

– 113 (Trichloro Trifluoro Ethane C2F3Cl3)

CFC

CFC – 114 (Dichloro Tetrafluoro Ethane C2F4Cl2)

CFC – 115 (Chloropenta Fluoro Ethane C2F5Cl)

CFC

The major uses of CFCs are as coolants in refrigerators and in air conditioners; as solvents in cleaners particularly for electronic circuit boards etc.. CFCs are the main cause of ozone depletion. CFCs have a lifetime in the atmosphere of about 20 to 100 years, and as a result one free chlorine atom from a CFC molecule can do a lot of damage.

SECONDARY POLLUTANTS:

Ozone (O3) / **Ozone layer Depletion** : Ozone consists of oxygen molecules which contain three oxygen atoms. It is not emitted directly into the air but produced in the atmosphere when oxygen combine with oxygen radical (O) in the presence of sunlight. Ozone protects us from ultra violet radiation and other harmful rays.

It is observed that over the last few years, many man made processes release gases into atmosphere causing drastic depletion of ozone layer. The chlorine atoms cause depletion of ozone slowly and holes are formed in the ozone layer.

Ozone reacts with tissues and cause for breathing and decrease the working

ability of the lungs, chest pains and coughing. It lowers the human body resistance power and leads to cold; pneumonia also.

Antarctic Ozone depletion: According to NIMBUS-7 satellite picture which

was taken on 5th Oct 1987 , the protective ozone layer showed a hole over 50% of the area of the Antarctica continent covering 7 million sq km.

On Jan 1st 1989, the country Montreal (Canada) proposed redesigning refrigeration, air conditioning technology replacing the use of CFCs by ozone friendly substitutes.

Smog: Smog is a combination of smoke and fog or various gases when react in the presence of sunlight. The effects of smog on human health cause for respiratory, irritation to the eyes, diseases related to nose, throat, bronchitis, pneumonia, headache, nerves, liver, kidneys.

The first smog related deaths were recorded in London in 1873, when it killed 500 people. In 1892, December, London had worst experiences causing 1000 deaths. In 1940's severe smog began covering the cities of Los Angeles in USA. **Para *Acetyl Nitrate (PAN):*** PAN which is a harmful chemical form in nature and causes irritation of eyes and other human sense organs. It may also cause blisters on the skin.

Acid rain: Acid rain has become one of the most important global environmental problems and poses significant adverse impact on soils, rivers, lakes, forests and monuments. The phenomenon occurs when SOx and NOx from the burning of fossil fuels such as Petrol, Diesel, Coat etc combine with water vapour in atmosphere and fall as rain or snow or fog.

Natural sources like volcanoes, forest fires, etc also contribute SOx and NOx. Increased urban and industrial activities cause air pollution resulting in the rise of concentration of SO2 and NOx. Sulphur dioxide and NO2 combines with water vapour in the atmosphere produce sulphuric acid and Nitric acid respectively and results acid rain. Some of the examples are:

Europe and parts of W Asia have experienced rain with water pH range of 4.5 to 5.0 (acidic) in 1958.

In 1962, acid rain occurred in Sweden with pH of water ranging from 4.5 to 5.0.

Netherlands and Holland also experienced acid rains in the same year.

In April 1984, acid rain occurred in Scottland.

Aerosols: These are Suspended Particulate matter. It consists of dust, soot, asbestos particles, Pb, Ni, Nitrate and sulphate salts, fumes, mists, smoke and sulphuric acid particles etc.. These particles measure less than 1 micron in size because of that, they directly enter into respiratory track. Exhaust gases from aero planes, automobile industries are the main sources for releasing aerosols.

Air pollution effects; Prevention & control measures:

Human beings breath 22000 times a day on the average, inhaling 16 kg of air. Atmosphere constitutes a protective cover of gases surrounding the earth which sustains life and saves it from unfriendly environment. The atmosphere consists of several layers viz. Troposphere, Stratosphere; Mesosphere; Thermosphere & Exosphere. The lower atmosphere ie., the troposphere contains 70% of gaseous components of major, minor and traces. Table depicts the available components in the atmosphere as:

Component Symbol Concentration in Volume%Status

Nitrogen N_2 78.09 Major

Oxygen O_2 20.94 Major

Argon Ar 00.93 Minor

Carbon dioxide CO_2 0.0318 Minor

Ne,He,Kr,H_2, CO, O_3 Traces

NH_3; NO_2, SO_2; H_2S, Xenon etc are still in traces.

Ultra violet radiation from the sun is absorbed by ozone in the stratosphere which is so called ozone layer located between 17 - 26 kms above sea level.

Effects of Air pollution: The effects of pollution may be direct and affect certain organisms. The effects of pollution may posses a hazard or nuisance. Long continued pollution even effects the evolution of a species and eliminate organisms who cannot tolerate certain pollutants and favour others who can eat.

Air pollution causes deaths, Impair health, reduce visibility, brings vast economic losses. It can also cause intangible losses to historic monuments such as Taj Mahal. Finally, Air pollution can affect the environment on a global scale.

Prevention and control of Air Pollution:

Eg: The substitution of high sulphur coal with low sulphur coal in power plants.

Eg: Changing a fossil fuel with nuclear energy can eliminate sulphur emission.

Eg: Chemical and petroleum industries have changed by implementing automated operations, computerized process control by reducing the oxidation of SO_2 to SO_3 by reducing excess air.

□□By involving the control technologies:

Control equipment viz., Wet Collector (scrubber) ; Gravity Settling chamber; Cyclone Collectors; Dry Scrubbers; filters etc.. are to be used to minimize the air pollution.

Water pollution

Hydrosphere in the universe contains water in the form of oceans, rivers, lakes, tanks and many other water sources. Water sources in the world are of two types. They are (1) Marine water bodies and (2) Fresh Water bodies. Water is a good solvent for many substances. Because of this property water cannot exist in its pure form at many parts of the world. Water pollution is mainly because of sewage, industrial disposals ie., effluents ..

Chemical examination of water (tests): pH; Biological Oxygen Demand,; Dissolved Oxygen; Chemical Oxygen Demand etc are some of the chemical tests to find the stage of pollution of water.

pH: The value of pH gives the degree of acidity or alkalinity of polluted water. Determination of pH is important in calculating the coagulant (thick or thin) dose. **Biological Oxygen Demand (BOD)**: It is defined as the quantity of oxygen utilized by micro organisms at a temperature of 20oC, generally measured for

5 days. when water is polluted by unwanted materials, naturally the O2 content gets reduced and that water become not fit for consumption either by human beings or animals or plants.

Living organisms require water with some quantity of sustainable oxygen in it. That oxygen is necessary for living organisms is generally called ***BOD***. If there is reduction in oxygen content of water, it becomes unfit for biological consumption because there is change in BOD.

Dissolved O2: The amount of oxygen in dissolved form in water at a particular temperature and atmospheric pressure is known as dissolved Oxygen. In polluted waters, dissolved oxygen is the factor which determines whether the biological changes are carried by aerobic (needing oxygen) or by anaerobic (oxygen not required) micro-organisms. Eg: 5 to 8 mg/L of dissolved oxygen is required for most of the species and fishes.

Chemical Oxygen Demand (COD): This test is conducted to determine the pollution strength of the sewage. Potassium dichromate and potassium permanganate are used as oxidizing agents.

Common types of water pollutants:

Disease causing agents: Bacteria, viruses, protozoans that enter water from domestic sewage and animal wastes.

Water soluble inorganic chemicals: Acids, salts and compounds of toxic metals such as Pb, Hg can make water unfit to drink, harm fishes and other aquatic life. Also Nitrate, Phosphate compounds dissolve in water that can cause excessive growth of algae, which then die and decay, depleting dissolved O2 in water and killing fish.

Water Soluble Organic chemicals: Oil, gasoline (a type of oil is obtainedfrom petroleum), pesticides, detergents and many other water soluble chemicals that threaten human health and harm fish.

Heat: Large quantity of water is heated when it is used in the cooling towers of thermal power plants. When this hot water is discharged into the nearby water bodies, it causes an increase in its temperature.

Sewage: sewage is waste water from municipal area where there is human habitation. Sewage which comes from homes is called ***domestic sewage***. **Fig depicts the water is being polluted by various factors**: Domestic sewage Radioactive elements

Oils Industrial effluents

Silt Pesticides

Virus

Herbicides Fertilizers

Planktons

Toxic Metals Temp Bacteria

WATER

In nature water pollution is classified into three types by Kimball (1975). They are:

Domestic water pollution: Sewage is a part of domestic water pollution. Domestic sewage not only contains unwanted waste materials, but it is also infested with harmful bacteria, virus etc. These are responsible for causing diseases in animals and human beings, if they drink this polluted water and even plants may die if polluted water is provided.. Domestic water pollution leads to Diarrhea, Cholera, Typhoid etc in human beings.

Agricultural Water Pollution: Water require for plants for its growth. Major irrigation, minor irrigation, sprinkler irrigation, drip irrigation, lift irrigation carry

waste substances and causing water pollution in addition to the utilization of fertilizer and pesticides. Agricultural water pollution leads to Eutrophication & Water Bloom. **Eutrophication** is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. Eutrophication also occurs when fresh water bodies like ponds, lakes, pools which contain organic waste material. Because of that, the fresh water ponds and lakes get polluted. Eutrophication is a type of water pollution. Eutrophication was recognized as a pollution problem in European and North American lakes and reservoirs in the mid-20th century. Since then, it has become more widespread. Surveys showed that 54% of lakes in Asia are eutrophic;

in Europe, 53%; in North America, 48%; in South America, 41%; and in Africa, 28%. Ecological effects: The important troubling ecological impacts are :

Excessive nutrients in water bodies promote plant growth which leads to a

drop in water quality;

marine life (causing a drop in their population).

Decrease in the recreational
Health problems when it occurs in drinking water reserves A

And aesthetic value of water bodies in water transparency (increased turbidity)

Water Bloom is defined as “A growth of algae at or near the surface of a body of water, such as a pond”. This is another kind of water pollution because of the presence of Blue Green Algae (BGA).

Blue-green algae are microscopic organisms that can be considered as simple aquatic plants that occur naturally in habitats such as marine waters, rivers, lakes, damp soil, tree trunks, hot springs and snow. They can vary considerably in shape, colour and size.

They usually are present in low numbers. Blue-green algae can become very abundant in warm, shallow, undisturbed surface water that receives a lot of sunlight. When this occurs, they can form blooms that discolor the water or produce floating rafts or scums on the surface of the

Because of the presence of B G A, the water turns blue in color or blue green which is unsuitable for drinking. This type of pollution of fresh water bodies by Blue Green Algae is generally called “***Water Bloom***”.

Industrial water pollution: Many industries discharge waste materials containing harmful chemicals. Such Industrial wastes are called ***effluents***. Rivers get polluted when the river water is polluted by mixing of chemical substances released by the petrochemical industries, paper industries, chemical industries etc. The river Godavari is polluted because of effluents released by the paper industry. It effects the entire water ecosystem causing enormous damage to fishes, prawns and fresh water animals. Eg: Minimita disease & Fluorosis.

Minamata disease is a neurological syndrome caused by severe mercury poisoning. Symptoms include ataxia, numbness in the hands and feet, general muscle weakness, narrowing of the field of vision and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms.

Minamata disease was first discovered in Minamata city in Japan in 1956. It was caused by the release of methyl mercury from, the Chisso Corporation's chemical factory, which continued from 1932 to 1968.

This highly toxic chemical bio- accumulated in shellfish and fish in Minamata

Bay which when eaten by the local populace resulted in mercury poisoning. While cat, dog, pig, and human deaths continued over more than 30 years, the government and company did little to prevent the pollution.

Fluorosis: People suffer from a disease called fluorosis after consuming water containing fluorine for sufficiently a long time. Quantity of fluoride in water is only 1 ppm. Diseases caused by fluorosis are: of teeth giving bad appearance.

Preventions or control measures of water pollution:

Drinking water should be boiled, cooled and then used.
Disinfection of drinking water should be done by using chemicals like bleaching powder.
Pesticides and insecticides should be prevented from nearby use of water lakes, ponds and pools.

Drainage water should not be allowed to mix with drinking water.
Drainage system should be maintained properly.
Chlorination process is to be adopted for drinking water. For 1 litre of water 30 -mg of chlorine is to be added to get perfect disinfection. It kills bacteria, fungi, fungal spores and other microbes also.

Noise Pollution

Everyone knows that sound is a form of energy that is capable of causing disturbances in human beings. Ears are the hearing organs in human beings. A thin membrane is called Tympanum (or) ear drum receives the vibrations produced by sound to a limited extent. Human ear is capable of perceiving about 85 decibels of sound. Beyond the limit, the ear drum cannot bear sound.

In nature, we hear different types of sounds. Sound is a kind of vibration which travel through air, water, and are sensed by the ear. This is from music, speech, etc from radio / television / computers etc., one thing in this matter is that we can increase the volume of sound or decrease as per our taste whereas,

a noise is a sound which cannot be heard clearly and only mixed sounds will be heard. For eg: in an office one is talking on mobile, phone ringing another side, ring tones in some person's hands, loud conversations with one and another etc., this is called noise. One cannot increase or decrease the volume of noise.

In general, a sound is a vibration from a particular machine, place or material which can be heard clearly whereas a noise a mixed vibrations that will come to us from all directions. A sound can be clear and can be able to hear, whereas a noise will not be clear and cannot be heard.

Sources of Noise

Noise is an unwanted sound and noise pollution occurs through different sources:

working for factories making more noise.

The sources of noise are more in urban and industrial areas, than in rural areas. The sources of noise may be stationary or mobile. The stationary sources include industries, loud speakers, mining operations, use of machineries, TV, Radio, Grinders etc. The mobile sources include Road Traffic, Highway Noise, Railway Traffic, Air Traffic.

(1) Stationary sources:

Industrial noise: The main categories of industrial activity that are particularly relevant to the study of noise are the following: Product fabrication

Product assembly

Power generation by means of generators. Combusting process in furnaces. (burning of gases)

Noise from construction works: Construction noise, a major source of noise pollution is emitted by construction equipment. The sources of noise are dozers, excavators, front end loaders, soil compactors, cranes, air compressors, concrete vibrators, Riveting steel structure during the casting, dismantling of construction materials etc...

Noise from other sources: These include sources such as sirens, barking dogs, ambulances, Police vehicles, Fire engines etc..,

(2) Mobile sources:

Road traffic: Of all sources of noise pollution, road traffic is the most prevalent and perhaps the most source of noise pollution. More people are exposed to noise from motor vehicles and the noise depends on various factors such as *Road location, Road design, Vehicle standards, Driver behaviors, Horns, Traffic density. ,*

Noise of common road vehicles

Vehicle type Noise(db)

Medium road traffic (Main roads) 70- 80

Heavy road traffic (High ways) 80- 90

uses & Trucks upto 3.5 tons 85- 95

Trucks upto 3.5-12 tons 90-100

Motor cycles 90-105

It can be observed that motor cycles with their exposed engines and inadequate silencing arrangements are notorious noise producers, which produce more than 30 times sound than a small passenger car.

Railway traffic: Noise from railway traffic is not serious nuisance as compared to the road traffic noise. The level of noise associated with rail traffic is related to the type of engine, the speed of the train, track type and condition. The majority of noise emitted by trains is produced by the engine (or) by the interaction of wheels with the tracks, horns, warning signals at crossings etc..,

Air traffic: The noise of air craft is different from that of road traffic in the sense it is intermittent. Noise is maximum during take off and landing. Noise

made by jet planes is more disturbance than that of propeller driven air craft. Supersonic air craft produce noise at high levels due to its intensity.

Effects of Noise: At 120 decibels the ear registers pain but hearing damage begins about 85 decibels. Apart from hearing loss, noise can cause lack of sleep, irritation, indigestion, ulcers, High B.P., Heart diseases , Stress etc.,.

Annoyance (Feeling slightly angry): One of the most important effects of noise on human is annoyance. Due to this breathing rate affects.

Noise- induced hearing loss: Exposure to noise for a long enough duration results in damage to the inner ear and thus decreases one's ability to hear. The louder the noise the less time it takes to cause hearing loss.

Effects on sleep: Noise disturbs sleep. It has been found that the cases related to various levels of noise are associated with sleep disturbances. Sleep disturbance by noise depends on the characteristics of the noise such as frequency, loudness and whether the noise is continuous or intermittent.

Other effects: There are many other effects of noises such involve aggression (ready to attack). People may turn mad and nerves may not function normally,

People may be deformed in many ways including increased stress and strain, nonfunctioning of hands, legs etc due to noise pollution if exposed continuously.

Noise pollution control: Noise pollution could be controlled by either reducing the noise at the source or by preventing its transmission .

The first step in the prevention of noise pollution is to control the noise at source itself. for eg: Lubrication of machines reduce the noise produced, Tightening the loose nuts, Reducing the vibrations produced by machines etc…

Failing to control the noise at its source, the second step is to prevent its transmission for eg: keeping the noise machine covered in an enclosure so that the sound does not escape and reach the receivers, construction of noise barriers on

road sides, sound proof the buildings by using heavy curtains on the windows, acoustical tiles on the ceiling and walls, by sealing the cracks in the walls to reduce the noise coming from outside.

If the noise levels are not able to bring down to the desired levels in some cases, the only alternative is to follow :

-generators and Turning down the volume of stereos.

Marine Pollution

Pollution of oceans is damaging the marine environment and is becoming a major problem. Marine environment is interesting for various reasons such as Sea food; Navigation; Adventure; Tourism etc,, Marine Pollution is harmful and its danger can be identified in a variety of ways.

Sources & causes of marine pollution: Marine pollution originates from one of two sources --- the land or the sea which are explained below:

Marine Oil Pollution: Oil is basically an important pollutant which destroys marine environment. The various sources of oil pollution are:

Run-off oil from streets; disposal of lubricants from machines; Off shore oil and gas exploitation from off-shore drilling; blowouts at off-shore drilling rigs; oil escaping under high pressure from a bore hole in the ocean floor. ;

Waste chemicals, mud and accumulation of toxic substances in the ocean in the form of mercury, dioxin, PCBs, PAHs (Poly Aromatic Hydrocarbons) , Radioactivity. benzene; xylene (colorless, flammable liquids) and heavy metals such as lead; copper; nickel, mercury also cause for marine pollution during

the off shore drilling activities. Both dumping and exploitation of ocean resources cause ocean pollution also.

PAHs: It is a chemical compound and organic pollutant. These occur in oil , coal and tar deposits and are produced as by products of fuel burning. PAHs are lipophilic meaning they mix more easily in oil than water. Eg for PAHs are: Acenaphthene; Anthracene; Benzopyrene; Chrysene; Coronene; Fluorene; Pyrene.

Other sources from land : The major sources of marine pollution

originating from the land vary from country to country. Effluents are discharged either directly into the sea or enters the coastal waters through rivers. Thousands of barrels of oil burn when oil wells were set on fire. Tanker accidents on land carries oil to the nearby streams / canals and cause for marine pollution. Due to burning of oil, smoke, SO_2, NO_2, CO are added towards atmospheric contamination.

The effects of oil pollution depend mainly on the following factors:

Type of oil and its viscosity;

amount / quantity released;

distance covered;

time;

average water temp etc..

Effects of Marine Pollution:

S No Source Effect

1 Sewage & run- off fromforestry;Depletes oxygen in water causeskilling of fishes.

2 Sediments from mining Sediments clog in the gills of fishes

3 Sewage from municipalities,

towns; cities etc…Contaminate sea food

4 Industrial discharge; pesticidesfrom farmCause disease in coastal marine life

5 Oil from off shore drilling;industries / automobiles

Low level contamination kill larvaewhereas high level contaminationcauses death for sea fishes 6 Litter (rubbish), waste, plasticsetcMarine life disturbs 7 Hot water from power plants Kills corals.

Marine Pollution Abatement / Prevention & control measures of Marine pollution:

The following are the some of the control measures for marine pollution: tanks).

ered as processes such as land – sea interaction; inter disciplinary co-operation; participation of public

private sector organisations; balance between protection and development public participation to reduce the chance of oil leakage

Thermal Pollution

Thermal pollution is also known as heat pollution and occurs when heat is released into water or air that produces undesirable effects. Sudden heat release usually due to forest fire or volcanoes or human induced activities. Thermal pollution is also the addition of excess undesirable heat to water that makes it harmful to human, animal or aquatic life.

Sources of Thermal Pollution: Various sources of thermal pollution include Thermal Power Plants ; Nuclear Power Plants ; Petroleum Refineries; Steel Plants; Metallurgical industries; Paper Mills; Chemical Plants.

Coal fired power plants constitute major sources of thermal pollution. Nuclear plants discharge much heat and also traces of toxic radio active substances . Many industries use water for cooling purpose and thus the heat effluents are finally discharged into water.

Temperature and its effects: Temperature plays an important role in determining the conditions in which living things can survive. Birds and mammals require a narrow range of body temp for survival whereas aquatic species can exist at a certain range of temperatures.

Thermal pollution increases water temperature causing a change (lowering) of dissolved oxygen levels. This disrupts and causes decay of plant and animal species. For eg: the warmer water increases the metabolic rate of fish and other animals in the sea; this decreases the life expectancy of aquatic animals.
Management of Thermal Pollution: Thermal Pollution is controlled by the following methods:

Cooling Towers are designed to control the temperature of water which transfer some of the heat from the water to the surrounding atmosphere by evaporation. There are two types of cooling towers namely wet cooling towers and dry cooling towers.
Cooling ponds are employed for thermal discharges. Heated effluents on the surface of water in cooling ponds maximize dissipation of heat to the atmosphere.
Artificial lakes are man made bodies of water which offer possible alternative. The heating effluents are discharged into lake at one end and the water for cooling purpose may be withdrawn from the other end.

SOLID WASTE MANAGEMENT

Solid Waste is defined as " ***any garbage, refused materials, sludge from a waste treatment plant and other discarded material including solids, semisolids etc resulting from industrial, commercial, mining, agricultural operations etc."***

Solid Waste Management has become very important role in order to minimize the adverse effects of solid wastes. Solid waste (other than liquid or gaseous) can be classified as Municipal Solid Waste (MSW); Industrial Solid Waste; Hazardous Solid Waste; Agriculture Solid Waste; Mining Waste, Sewage Sludge Waste etc..

Solid wastes are being produced since the beginning of civilization. The disposal of Solid Waste has been increased due to the rapid developments in industrialization and urbanization. High population density, intensive land use

for residential, commercial and industrial activities led to generation of more solid waste.

In Andhra Pradesh, the solid waste generated in medium and small municipalities

in the range of 30 – 150 MT / day. The per capita generation of Municipal solid waste in class I cities is in between 100 – 500 gms / day per person.

Sources of Solid Wastes:

Municipal Solid Waste is commonly known as garbage consists of packing materials, furniture, clothing, bottles, food scraps, newspapers, home appliances; paints, batteries etc. Municipal solid wastes are arise from residential quarters, commercial (markets, hotels, garages); institutions; public places, open areas/streets, parks, play grounds etc. MSW also include the following wastes: *Food Wastes* usually generate from domestic houses, hotels, markets and consist of fruits, vegetable residues resulting from the handling, preparation, cooking and eating of foods.

Rubbish waste consists of combustible wastes (papers; cardboards, torn clothes, plastics, wood etc) and non – combustible waste (glass, crockery, aluminum tins, ferrous metals; construction wastes).

Demolition & Construction wastes result from the construction, remodeling and repairing of residential, commercial buildings and industrial factories. These wastes include dust, stones, concrete, bricks, steel pieces etc..

Special Wastes include street sweepings, road side litter, drainage debris; dead animals and abandoned vehicle parts.

Industrial Waste arise from industrial activities such as chemical industries ;

metal and mineral processing industries. Radio Active wastes are generated by Nuclear Power Plants. Thermal Power Plants produce fly ash in large quantities. Fly ash is a fine solid particles result from the burning of wood, coal and other combustible wastes.

Hazardous Solid Waste is any solid waste or combination of wastes that posses a substantial danger, now or in future to human beings and plant / animal life and cannot be handled or disposed. The following is a list of types of hazardous wastes: -specific sources. For eg: disposable
synergies from hospitals is a specific source identified as hazardous solid waste.

action with water or other

substances and releases toxic gases eg: limestone / marble).

Toxic materials which consists of Pb, Cl (Toxic to human beings)

Effects of Solid Waste: The improper handling and transfer of the solid wastes results in various health and environmental problems. The main impacts of waste accumulation are:

SOLID WASTE MANAGEMENT : For Solid Waste Management, we stress in *Three R's –Reduce; Reuse & Recycle* to reduce the adverse affects.

Reduce in use of Raw Material:

Reducing the use of raw materials decrease the production of waste.

For eg: Melting of broken plastic items and toys can be used for moulding them into new ones whereas plastic scrap which are not remoundable can be incinerated to get heat.

For eg: Agriculture waste of rice husk and ground nut shells can be converted into non-polluting fuel. Fermentation of agricultural wastes produce ethanol which can be used as liquid fuel. These helps in reduction of raw material for manufacturing a few things and reduction in the usage of coal, wood etc..

Reuse of solid waste Material:

Making rubber rings from the discarded cycle tubes which are used by newspaper vendors reduces the waste generation during manufacturing of rubber bands. Waste food and vegetable peelings can be reused as food for cattle.

Producing biogas is possible from organic matter; human and animal excreta. Waste paper can be utilized for making paper covers. Wastes of silk industry containing large quantities of waste pupae can be used as poultry feed.

Recycling of materials:

Recycling is the reprocessing of discarded materials into new useful products. Old aluminum cans and glass bottles are melted and recast into new cans and bottles. Worn-out tyres can be rebuttoned. Recycling of paper will reduce cutting of trees.

The process of reducing ; reusing and recycling saves money; energy; raw materials and reduces pollution. .

DISASTER MANAGEMENT

Disaster means a terrible event that causes a great damage / loss to the human beings . It is a situation arising from natural forces where large scale disruption of infrastructure, services etc.. occurs. It causes a serious impact on human life,

economy and environment. Natural disasters are always severe and sudden. Some disasters are:

geological in nature like the earthquakes;

Landslides (rocks slides down from the side of a hill); Volcanic eruptions etc..

Climatic disasters / Natural calamities: These are of different types affect nations all over the world. Because of the large geographical size of the country, India often faces natural calamities like floods, cyclones and drought occurring frequently in different parts of the country. Natural calamities are of two types:
1. Major calamities: eg: earthquakes; droughts; floods, tsunamis; cyclones etc

2. Minor calamities: eg: hailstorms; avalanches; fire accidents man induced disasters include wars, battles, riots, rail/road accidents, nuclear explosions etc..

The disaster Management: The natural disaster management involves the following steps:

Relief measures: it include rescue tools; communication equipments; heavy machines to remove debris; water pumps; technicians; drugs, doctors, ambulances.. Disaster predictions: The predictions of natural hazards may be made on the basis of past history of the area with regular monitoring of the environmental changes caused by human activities to assess the genesis of natural disasters. Education: Disaster education plays a significant role in disaster eduction. It create awareness and improve the standards to prevent from the disasters. Geographic Information Systems: (GIS): GIS is a system that captures, stores, analyzes , manages and presents data with reference to geographic location of the area. In simple terms, GIS is the merging of cartography, statistical analysis and database technology. GIS may be used in Archaeology, Geography, Remote Sensing, Land surveying; Natural Resource Management; Urban Planning etc..

GIS programmes help by means of maps available data of the problem areas, to predict the severity of the disaster.

Words Meanings

Aerosol Atmosphere or gas containing finely divided solids or liquid particles of microscopic size (0.1 – 100 microns)

Avalanche Large amount of snow falls down.

battles Between the persons / enemies

Contamination A substance causing pollution is too low to cause harm
Dioxin Poisonous chemical

disaster Something that causes a lot of harm (bad situation)
Fly ash Fine solid particles exist during the burning of coal
Fog high concentration of liquid particles formed by the condensation of vapour (reduction of visibility to < 1 km)
Formaldehyde A chemical substance

Fumes Very fine liquid or solid particles. (0.03 - 0.3 microns)

Garbage Unwanted things

Gases Matter having no independent shape and expands continuously

Gasoline A mixture of volatile hydrocarbons used as a fuel known as petrol.

hailstorm Small pieces of frozen rain falls from the sky.

Hazard Something that is dangerous.

Haze When the air is not clear because of the presence of heat/ smoke

Herbicides: a chemical used to kill the unwanted plants

Impair To harm something and make it less good

Intangible Can't prove the feelings or quality exits

Landscape The appearance of an area of land

Litter Pieces of paper left in Public places.

Matter Physical substance that exist in the universe.

Mists Liquid particles formed by the condensation of vapor or a chemical reaction.

Noxious gases Harmful gases

Obnoxious Very unpleasant

Pollutant The substance or energy or things which cause pollution.

Eg: aerosol, dust, smoke, fly ash, gases, fumes, smog, fog..

Radon A type of gas due to poor ventilation. It is confined to inside the house.

Riots Violent behavior by a crowd of people.

riots Between the communities ie., violent behavior by a crowd of people

Sludge Soft, wet soil

Smog Mixture of smoke & fog or contain large quantities of different chemicals

Smoke Results from incomplete combustion of fuels(0.001- 1 microns)

Soot Results from incomplete combustion of carbonaceous

material viz bituminous coal, kerosene lamp. eg chimney consists soot.

SPM A mixture of liquid or solid particles and gas under pressure which is released from a container.eg deodorants War Between the nations

UNIT - V: GLOBAL ENVIRONMENTAL PROBLEMS & GOBAL EFFORTS

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Introduction

Green House Gases & Green House Effect

Global Warming, effects & solutions

Climate change & their impacts on human beings

……. EL NINO – LA NINA

Ozone layer formation and depletion

Ozone Depleting Substances (ODS) & role of CFC's International conventions / Protocols:

Earth summit; Montreal Protocol; Kyoto protocol Deforestation and Desertification , effects, case studies

The problems caused by pollutants such as NOx, Sox etc are now worldwide issues. Heating of earth surface; poor air quality in urban areas;

the formation of acid rains, depletion of ozone layer; emission of gases are of our environmental issues which are to be studied.

GREEN HOUSE GASES (GHG) & GREEN HOUSE EFFECT: Greenhouse

gases are those that can absorb and emit infrared radiation. In order, the most abundant greenhouse gases in Earth's atmosphere are: water vapor; carbon dioxide; methane ; nitrous oxide; ozone. In addition to the main greenhouse gases listed above, other greenhouse gases include sulfur

hexafluoride, hydrofluorocarbons, CFC's etc..

Chloro Fluoro Carbons are non – toxic; non-flammable contain fluorine, carbon and chlorine atoms. The five main CFCs are the : CFC- 11 (Trichloro Fluoro Methane … $CFCl_3$)

CFC- 12 (Dichloro Fluoro Methane … CF_2Cl_2) CFC- 113 (Trichloro Tri Fluoro Ethane … $C_2F_3Cl_3$) CFC- 114 (Dichloro Tetra Fluoro ethane $C_2F_4Cl_2$) CFC-11 5 (Chloro Penta Fluoro ethane C_2F_5Cl) **The major uses of CFCs** are:

CFC12 & ethylene oxide) and propellant in aerosols like deodorants; shaving foam, perfumes etc .

Man made CFC's however, are the main cause of stratospheric ozone depletion. CFCs have a lifetime in the atmosphere of about 20 to 100 years and as a result one free chlorine atom from CFC molecule can do a lot of damage.

Methane (CH_4): The major source of methane is extraction from geological deposits known as Natural gas and used as fuel. Since it is a gas at

normal conditions, methane is distributed through pipe lines. It is also called as LNG (Liquified Natural Gas). Methane reacts with halogens and produce Methyl Chloride (CH_3Cl), Chloroform ($CHCl_3$) and Carbon tetrachloride (CCl_4). Since the beginning of the Industrial Revolution, the burning of fossil fuels has contributed to the increase in carbon dioxide in the atmosphere from 280 ppm to 390 ppm. When these gases are ranked by their direct contribution to the greenhouse effect, the most important are: Gas Formula Contribution (%)

Water vapor H_2O 36 – 72 %

Carbon dioxide CO_2 9 – 26 %

Methane CH_4 4 – 9 %

Nitrous oxides NO_x 3 – 7 %

Ozone O3 3 – 7 %

Of these gases, CO2 accounts for about 55% of the earth's Green House effect. Other gases are capable of changing the energy balance and causes for increase of temperature of the earth. A number of changes usually take place in the energy which comes from the sun through the atmosphere. In detail:

26% of the energy is reflected back to the space by clouds and particles whereas about 19% of the energy is absorbed by some of the gases especially ozone in the atmosphere. 4% is reflected from the surface back to space.

Of the remaining 51% of the solar energy is then used in a number of process including the heating of the ground surface, evaporation of water etc….

The main sources of greenhouse gases due to human activity are:

Burning of fossil fuels and deforestation leading to higher carbon dioxide concentrations in the air.

and halogens in fire suppression systems and manufacturing processes. Some halogens are used in fire extinguishers; they in turn produce CFC's. Hence, CFC emissions increases in the atmosphere and then causing Green House Effect .

Agricultural activities, including the use of fertilizers, that lead to higher nitrous oxide (N2O) concentrations.

Hence, **Green House effect** is a naturally occurring process that aids the heating of the earth's surface and atmosphere. Green House effect results from the gases such as CO2; CH4 (methane); N2O (Nitrous Oxide); CFC's; Halogens (F, Br, Cl, I) & O3. Ultimately, the Green House effect may lead to the death of both plants and animals including human beings.

GLOBAL WARMING: Earth has become warmer over the last centaury. As a result of higher concentrations of gases (especially CO2) ; the earth's climate become warmer and this is referred to as Global Warming. Reports that the average climate / temperature of the earth has increased during the twentieth century by about 0.6oC (+/- 0.2oC).

The IPCC (Inter-government Panel on Climate Change), a group established by the World Meteorological Organization (W M O) and The United Nations Environment Programme (UNEP) revealed the following effects of global warming:

causes a decrease of rainfall by 40% all over the world. area of land with water)

depletes in the atmosphere.

earth's surface to the moon) .

-11; 12 and 113 in the atmosphere for a longer period harmful to the human beings.

SOLUTIONS FOR GLOBAL WARMING:

By reducing the emissions of Green House gases.
Clean electricity technologie
such as wind mills/turbines; solar panels;

tidal energy etc are to be used

Bio
-fuels (eg: ethanol - a type of alcohol) and Bio-diesel could

CLIMATE CHANGE & their impacts on Human Environment

The weather conditions and seasonal variations in a region over a long period is called CLIMATE. The average temperature in many regions has been increasing in recent decades. Globally, 1990 was the warmest decade on record.

Climatologists of the Inter-governmental Panel on Climate changes (IPCC) have carried out several experiments in order to estimate the changes in climate.

Accordingly, First Assessment Report (FAR) was completed in 1990 and Second Assessment Report (SAR) in 1997. Following are the main points from the climate reports:

CO2; Methane; Nitrous Oxide have all increased markedly since 1750 and now exceeded the levels.

1990's onwards.

The Third Assessment Report (TAR) on climate change 2001 is the most comprehensive and up-to-date scientific assessment of past, present and future climate change. The report: system. the climate system.

related to scenarios of future climate change using a wide range of models of future emissions of greenhouse gases and aerosols.

Fourth Assessment Report was released in 2007 and concluded that 90% of human beings are caused for Global Warming.

entration of the Carbon Dioxide in the atmosphere (379 ppm in 2005) is higher than the past years (180 to 300 ppm) mainly due to fossil fuel usage.

The studies have also shown that in the near future the Global

surface temperature will rise by 1.4oC to 5.8oC and leads to floods and/or droughts.

The Global mean seal level is projected to rise by 9.88 cm by the year 2100.

ELTA in Egypt and Ganges – Brahmaputra delta in Bangladesh may become vulnerable (liable to be damaged).

Finally, it was concluded that continued Green House Gas emissions cause further Global warming and induce many changes in the Global climate system during the 21st centaury.

IMPACTS ON HUMAN BEINGS

Eronment will be seriously affected by extremes of climate by means of Floods and Droughts. drinking water.

mosquitoes) which in turn spread infectious diseases such as Malaria; Filariasis, Dengue, diarrhea; Yellow fever etc..

El Nino – LA NINA

Oceans not only control the climate of the areas by absorbing and storing solar energy, but also distribute heat between lower and higher latitudes. The **Pacific Ocean** is the largest of the Earth's oceanic division extends from the Arctic in the north to the South of Antarctica, bounded by Asia and Australia in the west, and the US (Americas) in the east. The equator subdivides it into the **North Pacific Ocean** and **South Pacific Ocean.** Interesting examples of the interaction between

the oceans and the atmosphere are the **El Niño and La Niña phenomena** patterns.

El Nino is defined by prolonged differences in pacific ocean surface temperatures. It is also defined as a periodic warming ie variations in the temperature in the Pacific ocean. The accepted definition is a warming of at least 0.5 °C (0.9 °F) over the east-central Pacific Ocean. Typically, this anomaly happens at irregular intervals of 3–7 years..

Because of variations in the temperature, the winds create cyclones, which is an another sign of a El Niño. The Pacific Ocean is a heat reservoir (that drives global wind patterns) and the resulting change in its temperature alters weather on a global scale.

Global wind patterns means “the region of Earth receiving the Sun's direct rays is the equator. Here, air is heated and rises, leaving low pressure areas behind. Moving to about thirty degrees north and south of the equator, the warm air from the equator begins to cool and sink. The air movements toward the equator are called **trade winds”.**

The European Remote Sensing Satellites ERS-1 and ERS-2 measured sea surface topography continuously since July 1991. One of the areas of interest is the Pacific Ocean where the famous El Niño roars every year. This event is characterized by relatively high sea level (along the coast of Central America) accompanied by with heavy rainfall. At the same time, sea level drops in the Western Pacific ocean , where extreme droughts devastate crop yields.

Envisat was launched in 2002 is the largest Earth Observation spacecraft . It carries ten sophisticated optical and radar instruments to provide continuous observation and monitoring of the Earth's land, atmosphere, oceans and ice caps. More advanced imaging radar, radar altimeter and temperature-measuring radiometer instruments extended ERS data . This is supplemented by new instruments including a medium-resolution spectrometer sensitive to both land features and ocean colour. Envisat also carries two atmospheric sensors monitoring trace gases. The first signs of an El Nino are:

Rise in surface pressure over the Indian Ocean, Indonesia and Australia Fall in air pressure in eastern Pacific Ocean Warm air near Peru, causing rain in the northern Peruvian deserts.

The white areas off the tropical coasts of South and

North America indicate the pool of warm water

ENVISAT

LA NINA: The results of La Niña are mostly the opposite of those of El Niño. La Niña often causes drought conditions in the western Pacific but flooding in northern South America; mild wet summers in northern North America, and drought in the southeastern United States.

During a period of La Niña, the sea surface temperature across the equatorial Eastern Central Pacific Ocean will be lower than normal by 3–5 °C.

Eg: Singapore experienced the driest February in 2010 with 6.3 mm of rain fell in the month and temperatures hitting as high as 35 degrees Celsius.

The name La Niña originates from Spanish, meaning "the girl," analogous to El Niño meaning "the boy."

OZONE LAYER and Ozone layer depletion

The earth's atmosphere is composed of several layers viz.,
EXOSPHERE ……. The outer most layer extended upto 960 ms….

THERMOSPHERE… Layer extended upto 400 km from Mesosphere
MESOSPHERE .... another layer extended upto 80km from the surface of the earth

STROTOSPHERE .. next layer extended upto 50 km from the surface of the earth

TROPOSPHERE … lower layer extended upto 18 km from the surface of the earth

OZONE FORMATION: Ozone is a form of oxygen that has three atoms in each molecule (O3). Ozone is bluish colored and highly poisons gas that has a boiling point of 112oC. At atmospheric pressure, ozone can partially dissolve in water. At standard temperature and pressure, the solubility of ozone is thirteen times that of oxygen.

Standard Temperature and Pressure**:** STP is commonly used to define standard conditions for temperature and pressure which is important for the measurements and documentation of chemical and physical processes. *STP is defined by IUPAC (International Union of Pure and Applied Chemistry) as air at 0oC (273.15 K, 32 oF) and 105 pascals or 100 kPa .*

The atmospheric ozone density is measured in Dobson Unit (DU). 1 Dobson unit under standard temperature and pressure is 2.69 x 1016 ozone molecules per sq cm. The instrument to measure total ozone from the ground is called the Dobson ozone Spectrophotometer.

Ozone is formed by the action of sunlight on oxygen. When normal oxygen absorbs solar ultra violet radiation; splitting oxygen molecules into radical oxygen (O). This atomic oxygen quickly combines with further oxygen molecules to form ozone . This action takes place naturally in the atmosphere.

$O_2 + UV \rightarrow O + O$

O + O2 O3

DESTROY OF OZONE LAYER : *Two different processes destroy ozone naturally:* The first is when a free oxygen radical combines with an ozone molecule to produce two diatomic oxygen molecules. O + O3 2O2

The other process when ozone molecules absorb ultraviolet radiation and form one diatomic oxygen molecule and one free oxygen radical .

O3 + UV O + O2

OZONE DEPLETING SUBSTANCES (ODS)

Ozone Depleting Substances (ODS) are those which deplete the ozone layer.

The ODS's are Chloro Fluoro Carbons …… CFS's

Hydro Chloro Fluoro Carbons …….. HCFS's

Methyl Chloroform

Carbon Tetrachloride and Halogens

EFFECTS on human beings:

Ozone makes human beings eyes itch, burning sensation.
It

lowers the human body resistance power and leads to cold and pneumonia.

EFFECTS on Global environment :

Certain crops may be damaged if ozone layer is depleted thus affecting natural food chains and food webs so that the ecology system disturbs. The effect of ozone depletion in Antarctica is severe; however, the ozone in the arctic region should not be neglected. Depletion of ozone causes Global warming.

INTERNATIONAL CONVENTIONS / PROTOCOLS

Convention: large formal meeting of people with the same interest or work.

Protocol: The rules about what you must do and how you behave in an official situation.

The objectives of the International Conventions are to stabilize the Green House Gas concentrations in the atmosphere to certain levels to prevent dangerous human interference with the climate system of the world..

EARTH SUMMIT: The **United Nations Conference on Environment and Development** (UNCED), also known as the **Rio Summit**, **Rio Conference**, **Earth Summit** (Portuguese) was a major conference held in Rio de Janeiro from 3 June to 14 June 1992. Totally 172 Governments were participated with their heads and representatives, NGO's accounting 17000 people. The issues included:

lead in gasoline.

are linked to global climatic changes. emissions in cities.

out with proper utilization methodologies.

out any activities on lands that would cause environment degradation.

MONTREAL PROTOCOL:

Several meetings have taken place to address the ozone layer depletion problem. The well known meeting was held in Montreal on 16-09-1987 and the agreement signed is called the Montreal Protocol, which set a timetable to phase out of CFCs as well as halogens which contain bromine and 96 harmful chemicals in the Protocol subject the schedules.

The **Montreal Protocol** on substances that deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16, 1987, and entered into force on January 1, 1989, followed by a first meeting in Helsinki (Finland), May 1989. Since then, it has undergone seven revisions, in 1990 (London), 1991 (Nairobi capital of Kenya), 1992 (Copenhagen, capital of Denmark), 1993 (Bangkok in Thailand, SE Asia), 1995 (Vienna, capital of Austria), 1997 (Montreal, Canada), and 1999 (Beijing, china).

After implementing the schedules, following are the identified advantages of

Montreal protocol:

in 1988. Substances were used chiefly as refrigerants, cleaning solvent, foam blowing agents and propellants in spray can. In 1996 the consumption level was reduced to zero and maintain at that level since.

FCs since

1996. As a result, consumption of HCFCs was reduced from around 630 ODP (Ozone Depletion Potential) metric tons in 1996 to 383 ODP metric tons in 2004, which indicated a 40% reduction from the baseline level.

a doubling effect of Ultra violet – Beta

radiations reached the earth in the northern latitudes and also the amount of ozone depleting chemicals in the atmosphere would have been 5 times greater.

incorporated in decisions quickly.

the ozone layer is expected to recover by 2050.

KYOTO PROTOCOL :

The Kyoto Protocol is a legally binding International agreement to reduce Green House Gas (GHG) emissions of 5.2% by the year 2012.

The Protocol states that "developed countries are committed, individually or jointly to ensure that the emissions of Green House Gases do not exceed amounts assigned to each country in Annexure A to the Protocol.

The agreement specifies that all countries must follow a number of statements and some of which are as follows:

- Design and implementation of climatic change mitigation (to reduce the harmful effects of something) and adoption programmes.
- Preparation of a national inventory of emission removal procedures.
- Promotion of climate friendly technology transfer.
- Accounting, reporting and review to ensure the integrity (honesty and

the ability to do) of the protocol.

DEFORESTATION AND DESERTIFICATION

Forests are one of the most important natural resources and a part of biosphere since these are natural assets on this earth. Forests predominantly composed of trees, shrubs, woody vegetation etc… Approximately 1/3rd of the earth's total land area is covered by forests.

Forests are important ecologically and economically. Ecologically forests are to be considered as earth's lungs because they consume CO2 and release O2 which is required for sustaining the life on this earth. The poisonous gas CO2 is

absorbed by the trees of forests and reduce the global warming; helps to continue hydrological cycle, reduce soil erosion….

Forest ecosystems are extremely good & hold a good quantity of water. Economically forests provide timber, fodder to grazing animals, firewood (conventional fuel), bamboos, rubbers, medicines, gums, resins, food items etc. Deforestation refers to the loss of forest cover (or) the aimless destruction

of trees . The clearing of forests across the earth has been occurring on a large scale basis for many centuries. This process involves the cutting down, burning and damaging of forests.

Currently 12 million hectares of forests are cleared annually and the current rate of deforestation continues, the world's forests will vanish within the next 100 years About 80% of the original forests on the earth has already been cleared. Deforestation is taking place in many parts of the world for many reasons such as:

million hectares of forest for rubber and oil palm plantations)

EFFECTS OF DEFORESTATION:

The removal of trees leads to soil exposure & results in soil erosion, rapid water run-off, loss of wildlife.

Deforestation ---- cause unknown effects on global climate and eliminating the majority of plant and animal species on this earth. Various living beings

(wildlife is diminish) may come down resulting in imbalance of forest ecosystem. ts, fruits etc will be

A variety of food products such as coffee, tea, spices, nu

reduced.

Rainfall decreases to a great extent.
Climatic conditions MAY are change.

CASE STUDIES:

Chipko movement related to mining or quarrying opposed by Sundarlal Bahuguna in North India (refer text books for further information)
Sardar Sarovar – Narmada project is a multipurpose project in Gujarat (refer text books for further information)

DESERTIFICATION: The processes by which an area becomes even more barren, less capable of retaining vegetation and is known as a desert. This may become a disaster in long term. Hence, desertification refers to land degradation in arid and semi-arid areas due to anthropogenic activities.

Desertification often starts as patchy destruction of productive land. Increased dust particles in atmosphere also lead to desertification . The chief causes of desertification also include:

Climatic factors and (ii) human factors (population growth, increased population density

According to the United Nations Environmental Programme (UNEP), deforestation is an important factor contributing to desertification. At the time of Independence in India, about 22% of area was under forest cover and today this has been reduced to 19%

UNEP estimated that desertification threatened 35% of the world's land surface and 20% of the world's population.

ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN

Contents:

Definitions of Impact; Impact Assessment and Environmental Impact Assessment

Classification of Impacts

Significance of effects

Methods of Baseline Data Acquisition

Prediction of Impacts & Impact Assessment Methodologies Environmental Impact Statement Environmental Management Plan

Green Belt Development

Water Conservation & Rainwater Harvesting methods
Geographic Information System Remote Sensing

Definition of Impact: An impact can be defined as any change in physical, chemical, biological, cultural or socio-economic environmental system as a result of activities: relating to a project OR adverse effects caused by industrial, infrastructural projects OR by the release of a substance into the environment.

Definition of Impact Assessment: Impact assessment is the process of identifying the future consequences (bad results) of a proposed project. Impact Assessment ensure that projects, programmes and policies are economically viable; socially equitable and environmentally sustainable.

Definition of Environmental Impact Assessment: The United Nations of Environmental Programme (UNEP) defined that EIA is a tool used to identify the environmental and economic impacts of a project prior to decision making regarding the project planning, design, adverse impacts, etc..

For all proposed and development projects, whether Government or Private, the Ministry of Environment and Forests (MoEF) requires an Environmental impact assessment report related to the following parameters:

The report must define what impact it would have on water; soil and air including flora and fauna.

Affect on the lives of local people.

To ensure that no way harm the environment on a short term or long term basis.

Why is EIA important ?

By identifying potential alternatives and adverse impacts, Nations can better achieve goals for sustainable development; avoid adverse environmental; social and cultural impacts; reduces cost, provides better plan for infrastructure etc.. D**r G SUBBARAO, PROFESSOR, A V N INSTITUTE OF ENGG & TECHN, HYD Mob: 94944 13053**

CLASSIFICATION OF IMPACTS:

Environment impacts arising from any development projects fall into three categories: (i) Direct impacts

Indirect impacts and
Cumulative impacts.

According to their nature, these three groups reveal :

– term and long – term impacts

For eg to construct a major project: **Direct impacts are** related to:

aesthetics in the area (understanding of beautiful things); (b) traffic at nearby junctions, (c) removal of natural vegetation; (d) interference with natural water ways; (e) additional housing or commercial shops to support employees. **Indirect impacts** may occur due to delay in time for the proposed project whereas **Cumulative impact** occur where individual projects when combined with other projects may cause an overall adverse cumulative effect.

Ex of various types of impacts that occur in a *typical Road Development project:* **Direct impacts** are caused by the removal of gravel from a pit for use of surfacing the road. In this case, the land area in which the pit site is located has been directly affected by activities associated with the road project. **Indirect impacts** are difficult to measure, however, such as the land degradation, quality of surface water, urban growth near a new road.. New roads often lead to the rapid depletion of animals due to poaching (illegal catching and animals). **A cumulative impact** might be the de-vegetation and the roadside vegetation is also damaged by vehicle and foot traffic and the soil is left unprotected.

The vegetation never has enough time to recover (because of high traffic volume on the road) and the problem is exacerbated (to make something worse) over time.

SIGNIFICANCE OF EFFECTS: Significant effects are likely to occur where valuable resources are subject to impacts of severity. EIA is recognized by adopting the five levels of significance as described in the draft to good practice and procedures. These five levels of significances are::

Severe: Sites of national importance and unique resources (to exist in only one place) if lost, cannot be replaced or relocated.

Major : These effects are to be important considerations at a regional or district scale during the decision making process..

Moderate: These effects at a local scale are likely to be key decision making issues.

Minor: These effects may be raised as local issues but are unimportant in the decision making process.

Neutral: No effect, not significant.

METHODS OF BASELINE DATA ACQUISITION:

An Environmental Baseline Study (EBS) is an investigation conducted to establish the level of contaminants in the project areas and to assess the extent of contamination. The information needed to conduct an EBS can be acquired from the available sources:

Land features include topography; climatology (temperature, rainfall)

Geology & Hydrogeology (Lithology of rock formations, drainage pattern, ground water table)

Air environment (study of SPM, SOx; NOx)

Noise environment

Water Environment (pH; TDS; F; dissolved Oxygen; BOD etc..)
Soil quality Soil analysis reflect the presence of nutrients like N, P, K, Ca, Mg, Fe, Mn and Al

Flora and Fauna of the proposed area

Socio economic study include Population density; Literacy rate; Category of workers viz., cultivators, agriculture laborers, etc);

Medical facilities ; Main sources of availability of water viz., rivers, canals, hand pumps, taps etc..

PREDICTION OF IMPACTS AND IMPACT ASSESSMENT SYSTEMS (METHODOLOGIES)

One of the main challenges in today's society is to access to have a relevant and quality environmental data.

An impact assessment system must consist of:

All aspects of consequence reports (especially a bad result report) about existing and future emissions to air.

-situation, accidental situations etc of the site area should be mapped.

require a full or partial impact assessment study

adverse impacts on biodiversity

E I A METHODOLOGIES include:

Adhoc methods: In this method, each environmental area such as air; water and the nature of impacts (short term or long term ; reversible or irreversible) are considered.

This method serves as a preliminary assessment which helps in identifying more important areas like: **Wildlife, Endangered species; Natural vegetation; Grazing; Natural drainage; Groundwater; Air Quality; Economic values; Public facilities** etc…

Checklist methodologies: Checklists in general are strong in impact identification. Impact identification is the most fundamental function of an EIA. These are of 4 broad categories used in E I A system. They are:

(i) Simple Check lists: A list of parameters without guidelines provided on how to interpret.

Examples for simple checklist parameters;

Land Use includes open space, Agricultural land; Residential; commercial; Industrial.

Water resources include Quality, irrigation; Groundwater

Air Quality include oxides (sulphur, C, N); SPM; Odors; Gases

Service Systems include Schools; Police; Fire Protection; Water & Power System.

Biological conditions include Wildlife; Trees, Shrubs.
Aesthetics include Scenary; Structures.

(ii) Descriptive checklists: A list of environmental parameters with guidelines provided on how to interpret.

Scaling Checklists: Similar to descriptive checklists with additional information.
Scaling Weighing Checklists: These are decision making parameters.

Matrix methods: A matrix should be considered as a tool for the purposes of analysis that means the interactions between various activities and environmental parameters. For eg:

ACTIVITY ENVIRONMENTAL PARAMETERS
Resource extraction needs

Drilling & Blasting affects on Flora/ Fauna, insects; Fishes

Network Matrix: Networks generally consider only adverse impacts on the environment and hence decision making in terms of the cost and benefit of a project to a region.

Overlay methods: These methods involve preparation of a set of maps, which represent the spatial distribution of certain parameters. For eg: extent of forest area. Geographic Information Systems are now being used for these methods.

Environmental Index: Following some of the codes are considered:

Cost / benefit analysis: It provides the nature of expenses and benefits of a project.

Essential steps to complete an environmental impact assessment include:

Environmental impact statement:

Most development projects such as industries, roads, railways and dams affect the lives of local people. New projects are called “Green Field Projects” where no development has been done. Projects that already exist but require expansion are called “Brown Field Projects.” Projects can be classified into

Mild Projects
Moderate Projects
Serious Projects

Some projects may have a temporary impact during the construction phase which could be later become less damazing. In other situations the impact may continue and even

the affect of impact may increase (for eg: where toxic solid waste will be constantly generated).

Environmental Impact Statement is a

describes the impacts as a result of proposal action.

format and environmental impact statements , generally forwarded to MoEF.

The EIS has Typically four sections

An introduction including a statement of the purpose and the need of the proposed action.

A range of alternatives to the proposed action.

A description of the affected environment

An analysis of the environmental impacts of each of the possible alternatives.

Hence an Environmental Impact Statement (EIS) which is a summary of the project is kept for the public to read,

project (positive and negative ideas).

EF.

Environmental Management Plan:

Environmental Management Plan (EMP) is aimed to maintain the existing environmental quality.

The main objective of EMP is to investigate specific activities which are related to adverse impacts. The impacts can be first minimized by various planning activities. Some more measures can be practiced to minimize the impacts on environment are as follows:

removed immediately.

include regular maintenance of machinery and provision of productive equipment to workers where needed.

Green Belt Development

A **green belt** is a policy and used in land use planning to retain areas of largely undeveloped land or agricultural land surrounding or neighbouring urban areas. Green belt development also has a special importance in hydro electric projects as the project construction process emanates lot of dust due to excavation works, crushing of material and batching of aggregates. In addition, air pollution also takes

place due to vehicular movement during construction and operation phases.

In order to combat different kind of pollutions and avoid land slips from the portion of catchment area, a green belt is usually developed along project site & around the reservoir.

The objectives of green belt policy are to:

-natural environments;

The green belt has many benefits for people:

and wildlife.

The general consideration involved while developing the greenbelt are:

Trees growing up to 10 m or above in height should be planted .

Planting of trees should be undertaken in appropriate encircling rows around the project site.

Generally fast growing plant species should be planted.

The effectiveness of Green Belts differs depending on location and country. In the 7th Centuary, Muhammed established a Green Belt around Medina by prohibiting any further removal of trees in a 12 – mile long strip around the city.

Although the forest loss due to the reservoir submergence and construction of various projects can be compensated if afforestation is implemented . However, it is

proposed to develop greenbelt around the perimeter of various project boundaries , selected stretches along reservoir periphery, etc.

Recommended tree species for Greenbelt Development

Botanical name	**Common name**
Dendrocalamus sp.	semla
Callistemon citrinus	Battle Brush
Calotropis gigantea	Gigantic Swallow
	Wort
Emblica officinalis	Omla
Ficus benjamina	Chilabor
Aegle marmelos	Bel
	Fruit and medicinal
Albizia lebbeck	Siris
Cinnamomum tamala	Tej pata
	Spices, medicinal, fuel

BUDGET: The cost of plantation is estimated at Rs. 40,000 per ha which includes sapling cost, nursery cost, labour cost, cost of manure, weeding etc. It is proposed to

afforest about 50 ha of land as a part of Greenbelt Development Plan. The total cost works out to Rs 20,00,000 . The plantation for this purpose will be carried out by Forest Department, state government of Arunachal Pradesh.

The plantation will be at a spacing of 2.5 x 2.5 m. About 1600 trees per ha will be planted. The treated wastewater and the components manure generated by solids waste will be used for the greenbelt development.

Notable green belts can be observed in the following countries:

Australia

Brazil: With approximately 17,000 km².

Canada: Ottawa Greenbelt - Surrounds the Capital city of Ottawa; Greenbelt of Golden Horseshoe is 7300 km²

Europe: European Green Belt; Stockholm Eco park; German Green Belt

New Zealand : Dunedin's Town Belt is one of the world's oldest green belts, having been planned at the time of the city's rapid growth during 1860s.

Pakistan: Islamabad, often called the "green city," is known for its green belts found on most roadsides which are often decorated and filled with various flora.

The Philippines : Makati City's green belt is very green yet full of malls and modern structures.

South Korea: Seoul

United Kingdom: There are fourteen green belt areas, in the UK covering 16,716 km² of England, and Scotland;.

United States: The U.S. states of Portland, Oregon; Virginia ; Lexington, Barton Creek Greenbelt, Austin;

WATER CONSERVATION & RAINWATER HARVESTING METHODS

Water conservation means "*saving water for future*". Water is necessary to man for many purposes and also for metabolic activities. Due to growth of population, industrialization and expanding agriculture have pushed up the demand for water. Efforts have been made to collect water by constructing dams, reservoirs, digging wells, and by implementing water shed management methods .

Water shed management means the wet lands should not be flooded with water and water logging should be avoided. Sprinklers (or) drip methods of water supply should be used. Ground water recharging by means of harvesting rain water is also should be used. In ancient India, water conservation methods were adopted for eg:

Indus Valley Civilization in Western & Northern India especially at both Mohenjodaro and Harappa.

Dholavira a village in Rann of Kutch area in Gujarat where a large number of tanks were made in the rural to provide drinking water.

In Tamil Nadu, the ancient people stored rain water in places separately one for drinking purpose and another for bathing and the other for domestic purposes and called them as ***Ooranies.***

In south India, temples are built with a small tank at the centre which is called as Koneru. During the monsoon season, these koneru's get filled with water so that they are used for many purposes .

***Methods for water conservation*:**

A. *Decreasing run-off losses:* Huge water loss occurs due to run-off; which can be reduced by allowing the water to infiltrate into the soil. By adopting

(1) Contour cultivation (Cultivation across the slope without much skill to the benefit of conservation water in any region

(2) Terrace farming (Construction of a series of benches for catching the runoff water where the slope is above 15 degrees)

(3) Water spreading (Water flow is controlled by a series of diversions with vertical intervals and small depressions are dug in the area for temporary storage of water)

(4) Surface residues (Crop residues, animal residues etc help reducing run – off by allowing more time for water to penetrate into the soil).

B. Reducing evaporation losses: This is more effective in sandy soil and less effective in loamy sand soils. A chemical called "super Slurper" (starch + Acrylonitrile) absorbs water if used in sandy soils.

C. Reducing irrigation losses: Irrigation in early morning/ late evening reduces the evaporation losses. Sprinkling and drip irrigation methods conserve water by 30%. Growing hybrid crop varieties with less water requirements help conserve water.

D. Increasing block pricing: The consumer has to pay a proportionately higher electricity bill with higher use of water. This helps in economic use of water by the consumers.

E. Preventing wastage of water: Wastage of water is to be arrested in houses, commercial buildings, public places etc.. Closing taps when not in use; repairing leakages from pipes & using small capacity flush in toilets prevent wastage of water. *F. Rainwater harvesting Methods***:** Rainwater harvesting means collecting rain water on the roofs of buildings and storing it underground for later use.

Rainwater Harvesting Methods : Rain water harvesting means collecting rain water and storing it underground for later use. Not only this method recharging the groundwater, it also raises the water table and help augment water supply. Town and civic authorities in many cities in India are introducing by laws making rainwater harvesting compulsory in all new structures.

Rain water harvesting methods are classified as ., Traditional and Modern methods. Traditional Rainwater Harvesting is still prevalent in rural areas as surface storage bodies like lakes, ponds, tanks etc..

Modern methods of Rainwater harvesting are include Absorption pit method; absorption well method; and recharge trench method and collecting rain water on

the roofs of buildings and stored in underground.

Fig depicts rain water harvesting facility for a building.

Geographic Information System

A **geographic information system** (GIS) is a computer-based tool for mapping and analyzing geographic features (phenomenon) that exist and events occur on earth. A **GIS** that captures, stores, analyzes, manages, and presents data that are linked to locations. In the simplest terms, GIS is the merging of cartography , statistical analysis, and database technology .

GIS applications allow users to analyze spatial information, edit data and maps and present the results of all these operations. A GIS has 4 main functional subsystems. These are:

A data input subsystem: It allows the user to capture, collect and transform spatial and thematic data into digital form. The data inputs

are usually derived from a combination of hard copies of maps, aerial photographs, Remote Sensing images, Reports, Survey documents etc.

A data storage and retrieval subsystem: It organizes the data and attribute (a quality ie a particular point of thing) and permits quickly retrieved by the user for analysis and accurate updates to be made to the data base.

A data manipulation and analysis subsystem: It allows the user to define and execute spatial information. This subsystem is known as the "heart of a GIS" and usually distinguishes it from other database information system and computer-aided drafting systems (CAD).

A data output and display subsystem: It allows the user to generate graphic displays (normally maps) and tabular reports.

USES: GIS may be used in archaeology, geography, remote sensing, land surveying, public utility management, natural resource management, photogrammetry, urban planning, emergency management, landscape architecture, navigation, aerial video. GIS may allow to easily calculate and the movement of response resources (for logistics) in the case of a natural disaster. GIS might be used to find wetlands that need protection strategies regarding pollution. Most city and transportation systems planning offices have GIS sections.

Therefore, in a general sense, the term describes any information system that integrates, stores, edits, analyzes, shares, and displays geographic information for decision making.

GIS techniques and technology:

Modern GIS technologies use digitization (method of data creation), where a hard copy map or survey plan is transferred into a digital medium through the use of a computer-aided design (CAD) program, and geo-referencing capabilities
CARTOGRAPHY: The art or technique of making maps or charts

GEOGRAPHIC FEATURES are the features of things such as the bodies of waters, and landforms where they are on earth. Mount Everest is a geographic feature . A water fall, an island etc are some more examples.

DATABASE: A **database** is an organized collection of data for one or more purposes, usually in digital form.

SPATIAL INFORMATION: describes the absolute and relative location of geographic features.

THEMATIC DATA: data describing the characteristics of geographic features..

REMOTE SENSING

Remote Sensing is the technique of deriving information about objects on the surface of the earth without physically coming into contact with them. This process involves:

radars etc) mounted on platforms (aircraft and satellites) which are at a considerable height from the earth surface.

n

photographic films and video tapes; digital data on CDs, magnetic tapes.

earth, platform attitude, earth curvature, non-uniformity of illumination, variations in sensor characteristics . This can be done either using electro-optical techniques or by using computers.

with appropriate rectification.

Conventionally Remote Sensing uses electromagnetic radiation. It refers to the identification of earth features by detecting the characteristic electromagnetic radiation that is reflected / emitted by the earth surface.

Just as our eyes need objects to be illuminated by light so that we can see them, sensors also need a source of energy to illuminate the earth's surface. Different forms of electromagnetic (E M) energy are used for this purpose. Whenever E M energy falls on an object, part of it is absorbed, part of it is allowed to pass through and the remaining is either reflected / scattered. The proportion of this

distribution is different for different wavelengths of the incident energy and depends on the nature of the object.

UNIT – VII: ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS

Contents:

National Environmental Policy,

Water (Prevention and Control of Pollution) Act – 1974;

Water pollution Cess Act – 1978;

Air (prevention and Control of Pollution) Act – 1981;
Environmental (Protection) Act, 1986 Forest Conservation Act,

Municipal Solid waste management and handling rules,2000 Treatment of solid wastes

Biomedical waste management and handling rules, 1998 Case study of Minamata disease

Hazardous waste management and handling rules 1989
Environmental Legislation

Salient features of Central Pollution Control Board

National Environmental Policy: The Govt of India constituted a

Central Board for Prevention and Control of various pollution acts such as Water Act in 1974; Air Act in 1981 and Environment Act in 1986.

Several other Acts and Rules were also enacted. Accordingly, all the State Governments also constituted Pollution Control Boards in their respective States and accepted in their legislative Assemblies.

There are several loopholes in the implementation of various pollution Acts. For eg, the water courses in most of the cities carry highly noxious waters with high pollution potential. State Pollution Control Boards cannot take action against the Municipalities, Corporations , simply because they are not empowered to do so due to political system.

The Water (Prevention & Control of Pollution) Act 1974:

The Water Act 1974 was enacted in Parliament to prevent and control of water pollution and maintaining or restoring of wholesomeness of water. This Act also to prevent the pollution of water by industrial, agricultural and , municipalities including domestic waste water that can contaminate natural water resources.

Waste waters with high levels of pollutants that enter wetlands, rivers, wells etc cause serious health hazards. Individuals can do several things to reduce water pollution by avoiding chemicals for household use; reducing the use of pesticides in gardens and identifying the polluting sources .

The salient features and provisions of the Act are:

- Maintenance and restoration of quality of a ll types of surface and ground water.
- Establishment of State boards for pollution control.
- Prevention and control of water pollution.
- Central Government resolve disputes among the States if any arise

agriculture with proper treatment.

The Water (Pollution) Cess Act 1978:

According to Water (Pollution) Cess Act, anyone consuming water has to pay certain amount of cess depending on:

- Whether the industry is using water for industria

l purposes , spraying

in mining areas or for boilers purpose to produce electricity.

are toxic.

However, those industries that had installed a suitable treatment plant for the treatment of industrial effluents can get a rebate of 70% on the cess payable. The major activities and provisions in the Water (pollution) cess Act can be summed up as follows:

The Water cess Act provides for setting up of National Parks, Wild life Sanctuaries etc… (Thus, as of today, there are 67 National Parks and 394 Sanctuaries in India).

Under the Water cess Act, prohibition of hunting of the endangered species was mentioned. Protection to some endangered plants like Beddome cycas, Blue Vanda Orchid , Lady Sliper Orchid, Pitcher Plant etc. is also included.

There is a provision for trade and commerce in some wildlife species with license for sale, possession, transfer etc.. This act provides legal powers to officers and punishment to offenders. BEDDOME CYCAS BLUE VANDA

ORCHID

LADY SLIPPER

ORCHID

PITCHER PLANT

The Air (Prevention & Control of Pollution) Act, 1981:

A team of Indians attended UN conference on “Human Environment” which was held at Stockholm (Europe) in the month of June 1972. Later

the Air (Prevention & Control of Pollution) Act was enacted in the Indian Parliament in 1981..

The objective of the Air Act is to establishment of Central and State Boards to prevent and control and reduce air pollution. The air act has many sections in which 19, 20, 31A, 37 plays a vital role.

Section

-19 deals with the declaration of measures in case of industries to be established / already established. For eg: Dust

collector, noise recorder in addition to other relevant ones are important measures to establish a crushing unit.

Section

Section -20 deals the standards for emission of air pollutants.

-31A deals with the closure of industry and disconnecting the electricity.

Section

– 37 deals with the penalties for violation of rules
Dust sampler / collector Sound level metre

The Air Act has made provisions for appeals. An appellate authority consisting of a single person or three persons usually appointed by the Head of the State/the Governor to hear appeals as filed by any aggrieved party (industry). The sources of air pollution such as industries, vehicles, thermal power plants etc are not permitted to release Pb, CO, SO2; NO2; volatile organic compounds, toxic substances beyond a prescribed level.

The limits of air pollutants (micrograms / cum) in an area are as follows: area SO2 NO2 Pb CO

Industrial 120 120 0.75 1.00
Domestic 80 80 1.50 5.00
Hospitals, schools 30 30 1.00 2.00

The Act is created ' to take appropriate steps for the preservation of the natural resources of the Earth which ensure the high quality of air and ensures controlling the level of air pollution.

The Environment (Protection) Act, 1986:

Bhopal tragedy was occurred on the mid night of 2nd Dec 1984 at the UNION CARBIDE INDIA LTD, a pesticide plant in Bhopal. A leak of methyl isocyanate gas causing a death of 3,787 people and also injured for5,58,125 people.

The Govt of India enacted the Environment (Protection) Act in the year

1986 under article 253 of the constitution. The purpose of the Act to provide a frame work on water, air, land and the inter-relationships with the human beings and other living micro-organisms…

The Act came into force on Nov, 19th 1986, the birth anniversary of late Prime Minister Indira Gandhi, who was a pioneer of environmental protection issues in India. Some important features of this Act are:

or operations shall not be carried out without any safe-guards.

Emissions and effluents standards in respect of 61 categories of

industries have been evolved and notified.

Who ever fails (or) violate the environmental pollution Act, be punishable with imprisonment upto 5 years or with fine which may extend to one lakh

rupees or both.

Those industries who require consent under the Environment Act are required to submit an environmental audit report to the concerned Environment Board on or before 30th Sep every year.

Forest (conservation) Act 1980

Forest is a biotic community composed predominantly of trees, shrubs, bushes etc. whereas forest produce includes timber, charcoal, oils, resins, tree bark, seeds, fruits , flowers, grass, honey, wax etc. Increasing population is causing for decrease in biotic community ie forests and implementation of forest conservation is essential and mandatory. Forest (Conservation) Act was enacted in the parliament in 1980.

The State Governments or other agencies (eg ITDA) cannot violate the Forest (Conservation) Act unless prior approval by the Central Government. The objectives of the Forest (Conservation) Act are:

other purposes.

-forest

purposes.

person or to any corporation / agency.

in that land.

However, according to Section 32 of Forest (Conservation) Act, the State Governments can make avail the use of :

Removal of forest produces, conversion timber etc for proper utilization
Granting of license to the agencies / inhabitants to collect timber and forest produce for their own use.

Granting of license to persons for felled trees / timber and other forest produces for trade purposes.

The Forest (Conservation) Act also include:

areas.

Municipal Solid Waste (Management and Handling) rules 2000:

Central Government notified in the sections of 3, 6 and 25 of the Environment (Protection) Act 1986 with the objective of regulating the management and handling of the Municipal Solid Wastes. Municipal solid waste generate in residential and commercial areas.

Residential wastes include garbage, unused house hold items, pieces of clothes, rotten vegetables etc while commercial establishments generate different wastes depending upon the type of activity. For eg: shops and other establishments generate wastes containing large quantity of paper, and cardboard packing cases .

The wastes from streets are also part of the municipal solid wastes. Street wastes are classified into 3 main categories – natural waste, road traffic waste and behavioral waste.

Natural wastes include the dust blown from unused lands / roads. **Road traffic waste** originate from transport vehicles. The motor vehicles while moving on the road deposit petrol, oil at sometimes and still their contents (grease, lubricants) on roads.

Behavioral wastes originate from wastes thrown by pedestrians using the streets and the wastes from adjoining houses, shops which spill out due to improper storage.

Municipal Solid Waste Management:

It is estimated that 291 class I and 345 Class II towns together generate 52000 tonns of Municipal Solid Waste per day in India. Solid wastes are generated @ 10,000 tons /day in all the 117 municipalities / corporations of Andhra Pradesh. To minimize the municipal solid waste, the Municipal authority made an implementation of Management plan as per Schedule – I.

Any municipal solid waste generated in a city or a town, shall be managed and handled in accordance with the procedure laid down in Schedule - II.

The waste processing units and disposal facilities are to be set up by the municipal authority on their own or through an operator shall meet the specifications and standards as specified in schedule – III.

Treatment of solid wastes: Basically there are 3 types of disposal techniques practiced in Municipal solid wastes.

Sanitary Land Fill
Composting

Incineration.

Dumping the solid waste at the out-skirts of the city, especially in low lying areas, or on either side of the road is very common. In case

of mineral excavations, granite quarries or soil excavation for brick making, low lying areas are created. *Restoration to original level with solid wastes is a good example for sanitary landfill.*

Decomposition of solid waste material is known as **composting and the final product is called *compost.*** Compost contains nutrients (NPK)

for the growth of plants. A few methods of treatment and disposal of composting system are given below:

The composting systems can be broadly grouped as aerobic and anerobic. Composting systems can be operated either manually or mechanically in open pits or in enclosed digesters in addition to natural process.

Aerobic composting is a process in which bacteria, actinomycites, fungi and other biological forms are actively involve. Aeration is a natural process occurs on the surface areas of the composting mass, while the inner layers tend to progressively turn anaerobic.

Trench method is best suited for flat land where excavation can be carried out easily. A trench 2 mts deep with 5 mts length and 2 mts wide is cut.

The excavated soil is placed on the sides of the trench and the trench is filled with solid waste refuse in layers and finally with a soil cover .

Area method is best used in areas where natural depressions exist as in quarries, valleys. The waste is put in the natural depressions and compacted a layer of soil is thrown on top. The process is repeated till the depression is filled up.

Incineration is a common sight to see small fires of burning dry leaves, paper etc on the sides of roads. However, such fires produce considerable smoke and air pollution.

Increasing population and rising standard of living styles create the solid waste and require integrated policies/rules and technologies.

Biomedical Waste (Management and handling) rules, 1998: Biomedical waste is also known as Hospital waste which is generated during the diagnosis, treatment, immunization of human beings or animals; in research activities or testing of biological aspects. It may also include wastes like anatomical waste, culture waste, discarded medicines and chemical wastes. It is also in the form of disposable syringes, broken glasses, bandages, body fluids, human excreta etc .

It has been roughly estimated that of the 4 kg of biomedical waste generated in a hospital at least 1 kg would be infected. Surveys carried out by various agencies show that due attention is not given to Biomedical waste management.

After the notification of the Bio-medical Waste (Handling and management) Rules, 1998 establishments are slowly streamlining the process of waste collection, segregation, treatment, and disposal. The biomedical handling rules will apply to hospitals, Nursing Homes, Veterinary Hospitals, animal Houses, Pathological labs and Blood Banks.

Management of Biomedical waste:

Producers who are generating the bio-medical waste need to install an appropriate facility in their premises to ensure that biomedical waste should be collected in accordance with Schedule – I.

The biomedical waste need to be segregated into containers or bags at the point of generation in accordance with Schedule – II, prior to its storage, transportation, treatment and disposal.

The containers shall be labeled according to Schedule - III.

The biomedical waste which is generated by means of various activities shall be handled without any adverse effects to the human health and the environment.

Hazardous Waste (Management and handling) rules, 1989: It is a waste that makes it dangerous to human health or the environment. Hazardous wastes can be liquids, solids, gases or sludges. Waste products that are either infectious or radioactive also belong to hazardous category. The other hazardous wastes include Arsenic, Barium, Chromium, Lead, Mercury, Selenium, DDT (Dichloro Diphenyl Trichloro ethane) substances.

Hazardous waste is defined based on physical or chemical properties of toxicity, reactivity, ignitability and corrosivity of wastes.

- **toxic wastes** are harmful when a toxic substance combine with ground water.

- **reactive wastes** (Lithium-sulphur batteries; gun powder; nitroglycerine; explosives etc cause explosions, when heated or compressed or mixed with water) ;

- **Ignitable wastes** (gasoline, paint thinners; alcohol; waste oils; solvents etc create fires under certain conditions);

- **corrosive wastes** (Acids or Bases that are capable of corroding metal containers such as storage tanks, drums and barrels);

Hazardous waste is regulated under the Resource Conservation and Recovery Act (RCRA) - Subtitle C. The hazardous waste are listed into three categories:

The F- list (waste generate in non-specific units at source points) : Wastes generate during manufacturing of substances in industries such as solvents that have been used in cleaning operations.

The K – list (waste generate in specific units at source points): Wastes generate from specific industries such as petroleum refinery or pesticide manufacturing units.

The P – list and the U – list (discarded products): Wastes include

specific commercial chemical products in an unused form. Some pesticides and

some pharmaceutical products become hazardous waste when discarded. Wastes included on the P- and U-lists can be found in the regulations at 40 CFR - 261.33 .

Handling Rules:

The lead acid batteries should cover with a cap.

Records are to be maintained for disposal of hazardous waste (collection, treatment, transport, storage and disposal operations) in Form 3.

The producer shall send annual returns to the State Pollution Control Board in Form 4.

Where an accident occurs at the hazardous waste site or during transportation of hazardous wastes, the occupier or operator of a facility shall report immediately to the State Pollution Control Board about accident in Form 5.

Case study: Environmental problems caused by hazardous wastes:

A large plastic plant located near the Minamata bay used a mercury containing compound in a reaction to produce Vinyl Chloride , a common plastic material. The left – over mercury was dumped into the Bay along with other wastes from the plant.

Though the mercury was in its less toxic inorganic state when dumped, the micro organisms at the bottom of the bay converted the mercury into its organic form. This organic mercury then entered into the tissues of fish which were, in turn consumed by the people living in the area.

The contaminated fish thus caused an outbreak of poisoning, killing and affecting several people. Mercury poisoning is thus called MINAMATA DISEASE.

Environmental Legislation & Pollution Control Acts in India

The term “Environmental Legislation” refers to the management of the environment under a strong legal frame work to help and protect the environment. Environment was first discussed in the “United Nations Conference on “Human Environment” in Stockholm (Europe) on 5th June 1972 and thereafter 5th June is celebrated all over the world as “WORLD ENVIRONMENT DAY”. India is the first country in the world to have made provisions for the Protection and Conservation of Environment in its Indian Constitution.

Under Article 47 of the Constitution, the States shall ensure the raising of the level of nutrition and the standard of living of its people and the improvement of public health and, in particular, the State shall endeavour to bring about prohibition of the consumption (except for medicinal purposes) drinks and of

drugs which are injurious to health."

Under the article 48 – A of Indian Constitution, the states shall Endeavour to protect and improve the environment and to safe guard the forests and wildlife of the country.

Article 51 – A (g) reads as follows “ It shall be the duty of every citizen of India

to protect and improve the natural environment including forests, rivers, wild life. The Govt of India has formulated about 30 acts and rules related to the environment. The environmental legislations passed by Govt of India are enlisted below:

The Water (Prevention & Control Pollution) Act, 1974
The Water (Prevention & Control Pollution) Cess Rules 1978
Forest (Conservation) Act 1980

The Air (Prevention & Control Pollution) Act, 1981
The Air (Prevention & Control Pollution) Rules 1982
The Air (Prevention & Control Pollution) for Union Territories Rules Act 1983.
The Environment (Protection) Act, 1986
The Environment (Protection) Rules 1986
Hazardous Wastes Rules 1989
Manufacture and storage of hazardous chemical Rules, 1989
The Public Liability Insurance Act 1991
The Public Liability Insurance Rules 1991
The National Environment Tribunal Act, 1995
Bio medical waste, Rules 1998
Re-cycled plastics manufacture and usage Rules, 1999
Dumping and disposal of Fly ash --- notification
Noise Pollution Rules 2000
Municipal solid wastes Rules 2000
Ozone depleting substances rules 2000

Salient features of CPCB (Central Pollution Control Board):

The Central Pollution Control Board is a statutory organization, was constituted in Sep 1974 under the Water (Prevention and Control of Pollution) Act, 1974. CPCB provides technical services to the Ministry of Environment and Forests. The principal functions of the CPCB are:

tters related to prevention and

control of water pollution.

To improve the quality of air and to prevent control air pollution in the

country.

Organizes training programmes for prevention and control of pollution.
Collects, compiles and publish the t

echnical data and statistical data

related to pollution.

- Lays down standards of water quality parameters.
- Establishes and recognizes laboratories for analysis of water, sewage

samples.

- CPCB has an automatic monitoring station in New Delhi. At this st

ation

RSPM (Respirable Suspended Particulate Matter); CO; O3; SO2; NO2 etc are being monitored regularly.

One of the mandates of CPCB is to collect, consolidate the statistical data relating to water pollution. Hence, Water Quality Monitoring (WQM) is utmost importance. The State Pollution Control Boards (SPCB) also have similar functions to be executed at State level and are governed by the directions of CPCB.

Acids Acids**:** A substance that liberates hydrogen ions (H) in solution and reacts with base to form salt and water only. Many acids are corrosive and sour taste.

Bases A substance that liberates hydroxyl ions (OH) in solution and reacts with acids to form salt and water only DDT Dichloro Diphenyl Trichloro ethane

enacted As per norms

Legislation Group of laws

Policy A set of ideas / plans

regulations An official rule that controls something

Rules An official instruction(s)

Solvent A substance, usually a liquid, capable of dissolving another substance

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UNIT – VIII : TOWARDS SUSTAINABLE FUTURE CONTENTS:

Sustainable Development ___ Concept

____ Measures

___ Threats

Population and its explosion

Strategies for achieving sustainable development:

Environmental Education

Urban Sprawl

Conservation of Resources

Over-exploitation of resources

Sustainable cities and sustainable communities
Human Health

Role of Information Technology in environment

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Carbon Trading

Cybernetics

Sustainable Development means improvement of quality of life with continuous progress without exhausting natural resources. Society of the population must require to meet the needs by managing the natural resources efficiently and maximizing the benefits from them so as not to overload the world's ecosystem.

Sustainable development implies using the natural resources in such a manner which doesn't eliminate or diminish their usefulness for future generations eg: coal, crude oil; forests_. Hence, the concept of Sustainable Development could be termed development without destruction.

Measures for Sustainable Development: Following are the measures for the sustainable development:

Population Control: Population growth should be limited to the desirable level. Slow human population growth, reduce the stress on global life.

Biodiversity ((variety of life on earth and how the living things interact with each other) must be conserved.

Recycling of wastes: Recycle at least 60% of the materials which are discarded now as trash.

Reduced Consumption: Lifestyle should be shifted to lesser consumption of resources.

Efficient usage of Resources: Resources should be renewed or reused.

Water Resource Management: Some of the consequences of poor water resource management such as

(A) River flooding; (B) Silting of reservoirs, ponds, lakes;

(C) over exploitation of groundwater; (D) Water logging by over irrigation

(E) Improper drainage (F) Pollution of water bodies

are to be taken up for implementation. So, Sustainable development insists optimum management of water resources locally and globally.

Integrated Land use planning: Using lands for agriculture, forestry, fodder cultivation, industrial growth, traffic etc should be planned

Creating Awareness: Creation of environmental awareness and spreading environmental education among the people is must for fruitful results.. **THREATS TO SUSTAINABILITY:** Though the measures are adopted for implementation of Sustainable Development , some of the threats such as Energy depletion; climate system collapse; ecological collapse; Economic slump etc are reduce the sustainability of life.

Energy depletion: The availability of crude oil resources are less and usage is more and more. Since the increased number of human beings mainly dependent on energy source especially fossil fuels, the future generation will have to work hard to restructure the way they live.

Climate system collapse: Huge quantities of Green House Gases have been releasing into the atmosphere over the last 100 years. And more is being released every day, future generation may be unstable with the climate systems of floods, storms, droughts, extreme temperatures etc_ **Ecological collapse:** Numerous industries are coming up by consuming the natural resources and releasing the toxic substances into the atmosphere. These substances cause soil pollution, air pollution; water pollution and in turn causing the imbalance of ecosystem.

Economic slump: Although the world has never had an economic recession all over, there may be a global economic depression may takes place because of the destruction of ecosystem. .

POPULATION GROWTH AND POPULATION EXPLOSION:

Population growth is the change in population over a period of time. Population Growth Rate (PGR) is the rate at which the number of individuals in population increases over a unit time period.

Population Growth Rate =

(population at end of the period – population at beginning of the period)
population at beginning of period)

Population growth rate varies greatly among regions and even among countries within the region. Any country depends upon the PGR for its development and "a developed country is one that allows all its citizens to enjoy a free and healthy life in a safe environment".

Japan in Asia; Canada and the United States in northern America;

Australia and New Zealand; Western Europe; Israel are considered "developed" regions or areas.

Countries such as Italy, Portugal, Russian Federation ; India; Sri Lanka and Spain have rate of population growth is near zero and are included under

"developing regions"..

On the other hand, according to the classification from International Monetary

Fund (IMF) 2004, all the countries of Eastern Europe as well as the former Soviet Union (USSR) countries in Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan) and Mongolia were not included under either developed or developing regions, but rather were referred to as "countries in transition"; however they are now widely regarded (in the international reports) as "developing countries".

INDIA PRESENTS A MIXED PICTURE, WITH HIGH FERTILITY RATES IN THE NORTH OF THE COUNTRY AND LOW ONES IN THE SOUTH. Family

planning services and high levels of education among women have supported declining fertility rates in southern India and Sri Lanka .

While Pakistan's fertility rates remain high, family size in Bangladesh is now steadily declining.

As far as the size of population is concerned, India ranks second in the world,

next to China. India's landscape is 2.4% of the total world area whereas its population was 16.2% of the world population (1991 census).

POPULATION GROWTH (2010)

COUNTRY / REGION Population Growth Rate (%)

COUNTRY / REGION Population Growth Rate (%)

JAPAN -0.1 BHUTAN 1.7

HUNGARY -0.26 NEPAL 1.8

RUSSIA -0.47 SOMALIA 2.3

SRILANKA 0.9 KENYA 2.6

BANGLADESH 1.1 ETHIOPIA 2.7

CAMBODIA 1.1 MADAGASKAR 2.9

VIETMA, 1.1 TANZANIA 3

NEW ZEA;AMD 1.2 UGANDA 3.24

INDIA 1.3 AFGHANISTAN 3.85

MALDIVES 1.3 BURUNDI 3.9

TAJAKISTAN 1.4 LIBERIA 4.5

MANGOLIA 1.6

ZAMBIA 1.6

AUSTRALIA 1.7

Population Explosion:

Sudden increase in population is called as Population Explosion. India is now passing through the phase of population explosion. Rapid growth of population

causes poverty and proves to be a barrier to development.. The reasons of Population Explosion are:

illiteracy

Poor Family Planning awareness but better health care facilities increase in agricultural and industrial productivity

IMPACT of Population Explosion: Population Explosion causes Poverty; Malnutrition; Environment degradation; Over exploitation of natural resources; Spread of diseases; Economic inequity; more disposal of garbage; sanitation problems etc..

Problems of Population growth/ Population explosion:

Rapid population growth will over stress the earth's natural resources and crowded out undomesticated plant and animal species. Hence, population explosion is causing severe resource depletion and environmental degradation.

Sources like water, fossil fuels, minerals etc are limited and due to over exploitation these resources are getting exhausted. In addition forests, grass lands etc.., are under tremendous pressure. Industrial and economic growth are raising the quality of life but adding toxic pollutants into the air, water and soil.

As population increases, more resources are needed to meet basic requirements. At the same time people consume these resources of they produce waste that is again put back into the air, land and water. The greater amount of waste from larger populations puts more stress on ecosystems.

Highest Population growth rates are found especially in developing countries but the G7 nations (the US, Canada, Britain, France, Germany, Japan & Italy) represent only 10% of global population but consume over 40% of the earths fossil fuels as well as most of the worlds commodities and forest products. Though consumption rates are high in these countries, even small increases in population can have a significant impact.

As the worlds population continuous to grow geometrically, great pressure is being placed on land, water, energy and biological resources to provide an adequate supply of food.

Water is critical for all crops and require during the growing season . About 87% of the worlds fresh water is consumed or used up by agriculture and thus is not recoverable. Water resources are under greater stress as populous cities and states require water from rivers, lakes as aquifers ever year.

Fossil energy is another prime resource used for food production. The intensive farming technologies of developed countries use massive amounts of fossil energy for fertilizers, pesticides, irrigation and for machines as a substitute for human labour.

Every second, on an average of 4 to 5 children are born and 2 people die, thus resulting a net gain of 2 persons every second. This means that every hour we are growing by about 7200 persons and everyday by about 1,72, 800 persons and this is

called as the **population clock.**

STRATEGIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT:

The World Summit on "Sustainable Development" 2002 reiterated (to say something again so that people take notice of it) all countries to make progress in the formulation and elaboration of National strategies such as environmental education, urban sprawl, conservation of resources etc for Sustainable Development.

ENVIRONMENTAL EDUCATION:

Education plays a very important role in dealing with the global issue.

Environmental Education is an integral process, which deals with man's interrelationship with his (natural and man made) surroundings viz., relation of

population, pollution, resource allocation, resource depletion, conservation, technology ; urban and rural planning.

Environmental Education is intended to promote the awareness and understanding of the environment among the citizens. Hence, Environmental Education is meant to bring about the required changes in knowledge, understanding attitudes and skills pertaining to the environment, conservation and ecological balance.

So, Environmental Education must be considered as a solution for all environmental problems and the goal of Environmental Education should be to improve and enhance the quality of life.

The objectives of Environmental Education are:

Awareness--- to help individuals acquire an awareness of environment and its allied problems.

Knowledge--- to acquire basic understanding of the environment **Skills**--- to acquire the skills for solving environmental problems. **Participation**-to develop responsibility regarding environmental problems to ensure appropriate action to solve those problems.

Importance of Environmental Education: The importance of environmental protection has long been recognized in our country. Article 51 (g) of the constitution states " It shall be the duty of every citizen to protect and improve the Natural environment including forests, lakes, rivers, wild life" etc.. Education about environment provides learners with the know how on environment. Education for environment will be concerned about conservation, preservation and upgradation.

Conservation of Natural Resources: As the human population increases, greater demands are placed upon the available natural resources. Large areas of the earth are being converted for the exclusive use of man. Thus, many valuable natural resources, which were available yesterday are not seen today.

At present, world environment is suffering critical stress not only by utilization of natural resources but also with the environmental damage inflicted by deforestation, species loss and climate change. So, a new environmental ethic with responsibility is required to recognize the earth's limited capacity of natural resources. This ethic must motivate the people to effect the needed changes. The global population had already crossed 6

billions and may reach 8 billions by 2019 while the per capita availability of forests, pasture lands, crop lands etc will be decreased. Resources consumption in developed countries causes significant pollution problems, environmental degradation and resource depletion. For eg: an average US citizen consumes 50 times as much as the average citizen of India.

Hence, there must be a holistic way of thinking regarding the management of land resources, water resources, forest resources etc..

Over-exploitation of resources: The over-use or over-harvesting of plants,

animals or natural resources threatens the Earth's biodiversity is called as overexploitation. Over-exploitation causes diminishing of resources which include medicinal

plants, forest wood, grazing pastures, fish stocks, forests; water aquifers and species extinctions. If over-exploitation is sustained, it can lead to the destruction of the environment.

Over-hunting has been a significant cause of the extinction of hundreds of species including whales large mammals etc. Commercial hunting, both legal and illegal is the principal threat.

Deforestation, Desertification, Extinction of species; Soil erosion; Fossil fuel depletion; Ozone depletion; increase of Green House Gases etc may arise from over-exploitation of natural resources.

URBAN SPRAWL

The spreading of houses and shopping centers on undeveloped land near a city is called as Urban Sprawl.

Basically the rapid growth and spread of big cities takes place where the consumption of land is faster than the population growth. The rapid growth of population causes environmental problems such as increase in pollution, smog, pollution from vehicles, increased water usage, energy consumption, and the loss of animals and their natural habitats. This has become a very serious problem because these suburban areas take up a lot of land that could be otherwise used for agriculture.

Urbanization refers to migration of population from rural regions to towns and cities. Man has always moved to new places in search of better opportunities. Hence, migration is not a new phenomenon. However, recent studies have shown a steep rise in urbanization in the late 19th and early 20th century. This sudden increase in

urbanization can be attributed to Industrial Revolution, which provided better economic opportunities in the cities, due to setting up of factories and industries. Cheaper land and housing costs in the suburbs as compared to urban centers to settle in urban sprawl areas. There has been an increase the development of infrastructure like roads, water and electricity in the suburbs than in existing urban centers, thus adding benefits to urban sprawls.

There has been an increase in commercial lending practices that favor suburban development. Sprawls are characterized by low density populations and less traffic congestion. Higher property and business taxes in the cities have pushed businesses to the suburbs where taxes are generally low.

Effects: Sprawls have been criticized for increasing public costs where public

money is being spent on redundant infrastructure outside the urban areas at the cost of neglecting the infrastructure in the cities that is either not utilized or underutilized. Populations living in urban sprawls commute to cities in their automobiles. This has resulted in heavier traffic on the roads leading to traffic congestion, increase in air pollution and automobile related accidents.

Increasing dependence on automobiles has led the sprawl population to use their vehicles even for short distances. Such behavior is believed to have led to increase in obesity and hypertension, in the population living in sprawls than those in the cities.

Due to heavy dependence of people residing in sprawls on automobiles, city planners are compelled to spend more money on larger highways and parking spaces. This is considered as an additional burden on the state treasury as this reduces the area of taxable land.

Urban sprawl is the later stage of urbanization and is an inevitable phenomenon. Just like every other process urban sprawl has its own pros and cons. However, the negative aspects of urban sprawls can be neutralized by monitoring their growth in a

planned way, so that they are not a liability either to the society, economy or the environment.

Sustainable cities and sustainable communities:

A sustainable city, is a city designed with consideration of environment impact, to minimize required inputs of energy, water, food and waste and also to reduce the outputs of heat, emissions of CO2, methane . Richard first coined the term "ecocity" in his 1987 book, "Ecocity Berkley: *building cities for a healthy feature".* The crux of this is to create the possible ecological foot print, and to produce the lowest quantity of pollution; to efficiently use land; recycle conversion of waste to energy, and thus the city's overall contribution to climate change will be minimal .

It is estimated that around 50% of the worlds population now lives in cities and urban areas. In order to make achievements, building design and practice, as well as

perception and lifestyle must adopt sustainability thinking.

Practical achievements: These ecological cities are achieved through various means such as:

??Zero

-emission transport

-energy building

– garden and landscape design for water conservation.

The industrial park in Kalundborg is often cited as a model sustainable city in Denmark.

India is working on Gujarat International Finance Tec-City (GIFT) which is an under construction world class city in Gujarat. It will come up on 500 acres (2.0 km2) of land. It will also be first of its kind fully sustainable city.

Sustainable communities are communities planned, built to promote sustainable living. A sustainable community is one that:

interrelated and that these should be addressed “holistically”. (Treating the whole of something and not a part of it).

ctices.

development and community operations.

and acts to protect and enhance them.

vation and pollution prevention.

Human Health: Health is the general condition of a person in all aspects. It is also a functional, metabolic efficiency of an organism.

Public health problems caused by environmental contamination and emerging infectious diseases are a growing concern worldwide. These public health threats are affected by the relationship between people and the physical, chemical and biological nature of our natural environments.

Vector borne and Zoonotic diseases; water contaminants; airborne contaminants Environmental threats to public health require marshalling of all our scientific knowledge and know-how to develop new solutions.

The Nation’s natural science agency, play a significant role in providing scientific knowledge and information that will improve our understanding of the environmental contributions to disease and human health.

ROLE OF INFORMATION TECHNOLOGY IN ENVIRONMENT

Information Technology has tremendous potential in the field of environmental education as in other fields like business, economics, politics. Development of Internet facilities, World Wide Web, Geographical Information System through satellites has generated a wealth of up to date information on various aspects of environment. A number of software's have been developed for environment and health studies in understanding the subject especially in India.

Prediction of any natural calamity through the use of IT: Population in a State or country will be subjected to many environmental disasters. Scientists study and predict the same through information technology and express the possible occurrence of the natural disaster quite before.

The predictions about any disaster that is about to occur in a short time, in future should be studied well and the information about the forthcoming disaster should be informed to all people through the information technology or e – communication.

Public awareness of environmental disasters through the information technology: Whenever any environmental disaster occurs, people concerned should prepare to do some activities to minimize the affects and it is possible only through I.T.

Database on Environment: It is usually in computerized form and can be retrieved whenever required. Database is also available for diseases like HIV / AIDS, malaria etc..

The Govt of India under the Ministry of Environment and Forests established an Environmental Information System (ENVIS) as a plan & to provide environmental information to scientists, engineers, research workers all over the country. National Management Information System (NMIS) under the Dept of science and Technology has compiled a database on Research and Development projects related to environmental information on environmental pollution (eg: ground water pollution, marine pollution, forest destruction etc).

ENVIRONMENTAL ETHICS is a branch of philosophy that considers

the moral relations between human beings and their natural environment. Environmental Ethics is concerned with the morality (right or wrong) of human actions as they affect the environment where we live in. Environmental Ethics deals with issues that are related to how we utilize and distribute resources. There are many ethical decisions that human beings make with respect to the environment. For example:

mental obligations do we need to keep for future generations?

convenience of humanity?

CONCEPT OF GREEN BUILDING:

Green Building, is also known as Green Construction is the practice of creating structures such as design, construction, operation, maintenance, renovation etc throughout a building's life cycle. Green building helps to preserve the external environment and provides great benefits to humans through the use of safe building materials, efficient use of natural resources, human safety etc..

The most fundamental benefit of Green Building is that it is environmentally friendly and safe for people occupying the building. Its aesthetic design and well architectural features such as sufficient safe, proper layouts and pleasant lighting to people. While, elements such as clean air, clean water make it safe and beneficial to human health.

Another important benefit of Green Building is Energy efficiency which results in reduced energy consumption for AC and Heating needs. Effective use of natural lighting, cool roof and wall panels which leads directly cost savings to the building owners.

The use of Solar Energy in green building can provide free electricity for the building owners. Solar panels can be installed on the roof top of the building where the solar energy will be converted to electricity.

Another way to generate electricity is through the use of wind energy by setting in pathway of winds

CLEAN DEVELOPMENT MECHANISM

With the Kyoto Protocol becoming legally on 16 February 2005, the Clean Development Mechanism (CDM) is a key instrument for limiting greenhouse gas emissions (GHG) and promoting sustainable development. For both developing and

developed countries to benefit from the CDM, it is important to establish increased awareness and understanding of its various aspects. A CDM project should result in a net decrease of Green House Gases emissions.

The Clean Development Mechanism defined in article 12 of the Protocol, under the Kyoto Protocol to implement an emission-reduction projects in developing countries.

The **CDM** allows in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of CO2. These CERs can be traded and sold, and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol.

The CDM is the main source of income for the UNFCCC Adaptation Fund, which was established to finance adaptation projects and programmes in developing countries particularly vulnerable to the adverse effects of climate change. The Adaptation Fund is financed by @ 2% levy on CERs issued by the CDM.

A CDM Project activity might involve, for eg , a rural electrification project using

solar panels or the installation of more energy – efficient boilers.
From a business point of view, CDM represents new opportunities for entrepreneurs in the developed countries.

Family Welfare Programmes & the importance of Family Planning: According to Charles Darwin, every living organism is mainly interested in two activities of life. They are (1) .Feeding and (2) Breeding. In case of human beings this rule is applicable and it was found to be true.

In olden days, people have many children because of joint families since all people use to live together and they do not have separate individual families of their own. In recent years, people have realized the importance of family welfare through family planning specially in limiting the number of children irrespective whether they are boys or girls.

India launched the National Family Welfare Programme in 1951 with the objective of "***reducing the birth rate to stabilize the population at a consistent level***". As per

constitution of India, Family planning is being implemented under five year plan programmes as :

I & II Five Year Plans were mainly ***"clinical"*** under which facilities for providing of services were created. On the basis of data brought out by the 1961 census, clinical was replaced by "***Extension and Education Approach***" along with a spread of message of small family during III Five Year Plan. In the IV Five Year Plan (1969-

74), high priority was accorded to the family welfare programme and was proposed to reduce birth rate from 35 per thousand to 32 per thousand by the end of the plan. The objective of the V Five Year Plan (1974-79), was to bring down the birth rate to 30 per thousand. The name of the program was changed to family welfare from family planning with no force or coercion or compulsion etc..,

In the VI Five Year Plan (1980-85), family planning methods of sterilization, IUD insertions, C.C, Oral Pills etc.., were implemented by achieving the following:

morality rate from 127 to below 60.

The family welfare program during VII Five Year Plan (1985-90), was to provide facilities or services nearer to the door steps of population by establishing subcenters, sub-district level hospitals, universal immunization programs etc.., The VII Five Year Plan was continued during 1990-1992.

To impart new dynamism to the family welfare program, so many ongoing schemes were revamped in the VIII Five Year Plan. Enhanced allocation of financial resources, amounting to Rs.50 lakhs per year per district was made for upgradation of health infrastructure from 1992-93 to 1995-96. This amount is being used for providing well equipped operation theatres, labor rooms, a six bedded wards and

residential quarters for paramedical workers.

The targets fixed for the VIII Five Year Plan of a National level birth rate of 26 was achieved by all states except Assam, Bihar, Haryana, M.P, Orissa, Rajasthan & U.P.

Reduction in the population growth rate has been recognized as one of the objectives during the IX Five Year Plan.

The strategies during the IX Five Year Plan were to assess the needs for child health at Primary Health Center (PHC) level and to provide high quality, integrated reproductive and child health care.

Family Planning: Modern science has provided several birth control techniques including surgical methods, chemical pills and other family planning methods. More than a hundred contraceptive methods are on trial.

The United Nations Family Planning Agency provides funds to 135 countries. Many of these countries include abortion as a part of the population control programme which very often encourages female infanticide there by disturbing the optimal male, female ratio in a society. The birth control programs have often faced strong opposition from religious groups.

Salient features of the universal declaration of Human Rights by UNO

On December 10th, 1948 the general assembly of the United Nations Organization (UNO) adopted and proclaimed the universal declaration of Human Rights.

The Universal Declaration of human rights as a common standard of achievement for all peoples and all Nations, keeping this declaration constantly in mind to promote respect for these rights and freedoms to secure their universal and effective recognition among the peoples of Member States themselves and among the peoples of Territories under their jurisdiction. The following is a list of typical human right issues monitored as programs by the National Human Rights Commission in India:

Article-1: All human beings are born free and equal in dignity and rights..

Article-2: Everyone is entitled to all the rights and freedoms set forth in this declaration without distinction of any kind such as color, sex, language, religion,

political, national, property, birth etc..,

Article-3: Everyone has the right to live, liberty and security.

Article-4: No one shall be held in slavery.

Article-5: No one shall be subjected to torture or to cruel or punishment.

Article-6: Everyone has the right to recognition anywhere as a person before the law.

Article-7: All are equal before the law.

Article-8: Everyone has the right to an effective remedy by the competent National Tribunals for acts violating the fundamental rights granted him by the constitution or by law.

Article-9: No one shall be subjected to arbitrary arrest or detention.

Article-10: Everyone is entitled in full equality to a fair and public hearing by an independent in the determination of his rights.

Article-11: Everyone charged with a penal offence has the right to be presumed innocent until proved according to law.

Article-12: No one shall be subjected to interference with his privacy, family and correspondence.

Article-13: Everyone has the right to freedom of movement and residence within the borders of each state. Also has the right to go any country including his own and to return to his country.

Article-14: Everyone has the right to seek and to enjoy in other countries.

Article-15: Everyone has the right to a Nationality.

Article-16: Men & Women of full age without any limitation to marry as to form a family. Marriage shall be entered into only with the free and full consent of the intending spouses.

Article-17: Everyone has the right to own property alone.

Article-18: Everyone has the right to freedom of thought, belief in religion, worship and observance.

Article-19: Everyone has the right to freedom of opinion and expression.

Article-20: Everyone has the right to freedom of peaceful assembly or association

Process of HIV infection / the modes of transmission of HIV and prevention for control of AIDS in India

Human populations suffer from many types of diseases. These diseases are either transmissible or non-transmissible. Populations have been suffering from many centuries due to transmissible diseases like Malaria, Filarial etc through mosquitoes. HIV stands for **Human Immuno Deficiency Virus**, the virus that causes ***Acquired Immuno Deficiency Syndrome*** (**AIDS)**. AIDS is a result of the HIV virus. It is not a disease but a weakness in the body and unable to fight off illness. AIDS is the most serious stage of HIV infection. It results from the destruction of the infected persons immune system.

All human beings being unisexual in nature with men and women should come together and engage themselves in health conditions. The HIV is generally transmitted from one person to the other through sexual act apart from the transfuse of blood which contains HIV also.

HIV is a syndrome with group of diseases that affect the immune system of the body thereby the infected person will be suffering from many diseases and leads to death. There is no medicinal control for AIDS virus only method is prevention. People who are infected with HIV may not have any symptoms for many years. However, following are the signs of infection with HIV:: Rapid weight loss

Dry cough; Fever ; Fatigue

Swollen lymph glands

Diarrhea for more than a week; Pneumonia

White spots or blemishes on the tongue or in the mouth
Memory loss; Depression and other neurological disorders.

Transmission of HIV: It occurs when body fluids of an infected person enters the body of an uninfected person. HIV enter the body through a vein (eg: Injection), the anus, the vagina, the penis etc.., HIV is also transmits from one person to another:

-infected person.

-infected women to babies before or during birth or through breast feeding after birth.

HIV & AIDS in India: India had a sharp increase in the HIV infections from 3.8 million in 1990 to 4.6 million children & adults with HIV/AIDS in 2002. India has a large population and population density, low literacy levels and lack of awareness at low levels, HIV/AIDS is one of the most challenging public health problems ever faced by the country.

Methods suggested for prevention of occurrence of HIV/AIDS:

By controlling the sexual habits

Avoiding sex with unknown partners

By using a condom during the sex

Avoiding the injections from unsterilized syringes

By using a new needle every time for having an injection

Avoiding blood transfusion, if necessary with thorough check before transfusion
By checking the Blood banks

Avoiding unnecessary risks from the opposite sex

By avoiding unhygienic sex practices.

Extra care before blood test etc

CARBON (EMISSIONS) TRADING

Carbon emissions trading is a form of carbon dioxide emissions trading (calculated in tones of carbon dioxide equivalent or tCO_2e). This trading is a common method in developed countries as specified by the Kyoto Protocol for the reduction of carbon emissions for future climate change.

Carbon emissions trading works by setting a quantitative limit on the emissions produced by emitters. In the case of climate change, GHG emissions affect the welfare of people living in the future, as well as affecting the natural environment and external costs (ethical issues, social issues, services) may affect the welfare of people.

Carbon emissions trading has been steadily increasing in recent years. According to the World Bank's Carbon Finance Unit, 374 million metric tones of carbon dioxide equivalent (tCO_2e) were exchanged through projects in 2005, a 240% increase relative to 2004 (110 $mtCO_2e$) which was itself a 41% increase relative to 2003 (78 $mtCO_2e$).

Based on a survey of 12 European countries, it was concluded that an increase in carbon and fuel prices of approximately ten percent would result in a short-run increase in electrical power prices of roughly eight percent.[28] This would suggest that lowering carbon emissions will likely lead to an increase in the costs of alternative power sources.

One criticism of carbon trading is that it is a form of colonialism, where rich countries maintain their levels of consumption while getting credit for carbon savings in inefficient industrial projects. Nations that have fewer financial resources may find that they cannot afford the permits necessary for developing an industrial infrastructure, thus inhibiting these countries economic development.

Another criticism is of non-existent emission reductions produced in the Kyoto Protocol due to the surplus ("hot air") of allowances that some countries have.

CYBERNETICS

Cybernetics is the interdisciplinary study of the structure of regulatory systems. Cybernetics is closely related to information theory, control theory and systems theory.

The term *cybernetics* is a broad field of study, but the essential goal of cybernetics is to understand and define the functions and processes of systems that have goals and that move from action to the desired goal, and again to action in circular or chain systems. Studies in cybernetics provide a means for examining the design and function of any system, including social systems such as business management and organizational learning more efficient and effective.

Cybernetics is most applicable when the system is being analyzed in a closed signal loop ie., where action by the system causes some change in its environment and that change is fed to the system via information. The system changes affect its behavior. This "circular casual" relationship is necessary and sufficient for a cybernetic perspective.

The early 20th century: Contemporary cybernetics began as an interdisciplinary study connecting the fields of control systems, electrical network theory, mechanical engineering, logic modeling, evolutionary biology and neuroscience in the 1940s. Recent endeavors into the true focus of cybernetics, systems of control and emergent behavior, by such related fields as game theory (the analysis of group interaction), systems of feedback in evolution, and meta materials (the study of materials with properties have led to a revived interest in this increasingly relevant