

ENVIRONMENTAL ISSUES

- **Pollution:** is any undesirable change in physical chemical or biological characteristics of air, land, water or soil.
- Based on the component of environment affected, Pollution can be of following types: air pollution, water pollution, soil pollution, noise pollution.
- **Pollutant:** Any agent like solids, liquids or gas released into the environment that brings undesirable changes in the properties of our environment is called pollutant.
- **Environment (protection) Act, 1986** to protect and improve the quality of our environment (air, water and soil).

Types of Pollutants:

A. On the basis of form they persist after release

Primary pollutants

- These are pollutants which enter the environment directly from source and persist in the form they are released.
- Effect of primary pollutants is less severe
- Found in different states like reduced, oxidized etc.
- e.g. CO₂, NO₂, SO₂, flyash

Secondary pollutants

- The pollutants develop as a result of interaction of primary pollutants and environmental constituents.
- These pollutants are more toxic to organisms as they show enhance effect (synergism)
- Commonly oxidants
- e.g. Ozone, Peroxyacetyl Nitrate (PAN), NO₂, Smog

B. Based on degradability

Biodegradable pollutants

- They can be decomposed and degraded by microbes.
- Such pollutants do not accumulate.
- After decomposition, they enter the biogeochemical cycles
- Used to generate energy, manure, biogas etc.
- e.g. sewage, livestock, kitchen wastes

Non-biodegradable pollutants

- Such pollutants cannot be decomposed by microbes.
- They often accumulate.
- Most of them do not enter biogeochemical cycles.
- Some pollutants if properly separated can be recycled.
- e.g. DDT, polyethylene bags, plastics

AIR POLLUTION AND ITS CONTROL:

- Presence of any material or gas in the air in such a concentration that can be harmful to men and their environment is called air pollution.
- These substances change the physical or chemical properties of air.

Air pollutants

1. Primary air pollutants: pollutants which persist in the state they are released from the source.

i. Particulate matter: solid or liquid particles present in the air.

- Settleable particulate matter** :----- size $\geq 10 \mu\text{m}$, settles in less than a day
- Suspended particulate matter (SPM)** :----- size $\leq 10 \mu\text{m}$, remain suspended in air for weeks.
 - **Aerosol** – solid, less than $1 \mu\text{m}$,
 - **Dust** – solid, greater than $1 \mu\text{m}$
 - **Mist** – liquid, greater than $1 \mu\text{m}$

- **Aerosol** – found in the form of CFC, FC, oxides of Nitrogen and sulphur, released through jets and supersonic planes, refrigerator, air conditioners etc.
- **Smoke** – visible suspension of carbon released from burning or smouldering organic matter.

- **Shoot** – incomplete burn product of carbohydrates
- **Flyash** – fine particulate matter passed out along with gases during burning of coal

according to Central Pollution Control Board (CPCB) , particulate size 2.5 mm or less in diameter (PM 2.5) are responsible for causing serious health hazards.

- CO:** released from incomplete combustion of fossil fuels (50% by automobiles)
- Hydrocarbons or volatile organic compounds:** incomplete combustion or CH₄
- SO₂:** combustion of sulphur containing fossil fuels and smelting of ores. Lichen is indicator of SO₂ pollution.
- Nitrogen oxides (N₂O, NO, NO₂):** combustion of fossil fuels in industries, automobiles, nitrogen fertilizer etc. Naturally through electric storms, solar flares etc. produce **Brown Air** or **Brown haze**.

2. Secondary air pollutants: Produced photochemically through reactions between primary pollutants and environmental components. E.g. Smog, Peroxy acetyl Nitrate, O₃

- Smog – opaque or dark fog having condensed water vapours, dust, smoke and gaseous like SO₂, H₂S, NO₂
- Two types :

1. Classical or London smog

- Form by condensation of water vapours with H₂S and SO₂ over dust or smoke particles
- First reported in London 1952
- Occurs at low temperature
- Have reducing effect on environment
- Dark brown in colour
- No secondary pollutants

2. Photochemical or Los Angeles smog

- Formed by reaction of emissions from automobiles like nitrogen oxides and hydrocarbon and solar radiations in still air
- First reported in Los Angeles 1946
- Occurs at high temperature
- Have oxidizing effect on environment
- Grey/brown in colour
- Contains secondary pollutants like PAN

Source of Air pollution:

- Automobile exhaust:** In efficient combustion of fossil fuels cause 80% of air pollution. They released hydrocarbons (14%), CO (77%), NO (8%) and sulphur oxides and lead.
- Burning of fossil fuels like coal, petroleum in industries, refineries leads to emission of CO, NO and S₂O.
- Thermal power plant:** source of particulate matters and gaseous air pollutant.
- Use of insecticides, pesticides and fertilizers released NH₃
- Dust particles and chemicals from mining.
- Natural sources:** Volcanoes released huge amount of flyash, NO, H₂O, CO and others and smoke, pollens and dust etc.

Effect of air pollution:

- Cause injury to all living organisms.
- Particulate size **2.5 micrometers** or less are responsible for breathing and respiratory symptoms like **irritation**, **inflammations** (bronchitis) and damage to the lungs, **lungs cancer** and premature death.
- Affects the respiratory system of human being. Smoke causes **asthma**, **bronchitis**, **emphysema**
- Leakage of **methylisocyanate** (MIC) gas killed over 2500 people in Bhopal gas tragedy in 1980.
- CO** combines with haemoglobin to form **carboxyhaemoglobin** (COHb). It reduces the oxygen carrying capacity of blood, impair vision and psychomotor activities. Affinity of CO is 200 more than O₂.
- Reduce growth and yield of crops and premature death of plants.
- It results in **acid rain**, depletion of ozone layer and global warming.

Effect on environment

- Affect the biodiversity including water ecosystem
- Causes depletion of ozone layer

- Caused acid rain
- Cause global warming

Acid rain

- Rainfall and other form of precipitation with pH of less than 5.
- It is caused mainly by large scale emission of SO₂, NO_x from industries and automobiles.
- Both are changed into sulphuric acid and nitric acid by combining with water and oxygen.

$$2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$$

$$\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$$

$$2\text{NO} + [\text{O}] \rightarrow \text{N}_2\text{O}_5$$

$$\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_3$$
- Acid rain damages plants by direct effect on foliage and growing points --- chlorosis, necrosis, defoliation, dieback.
- Acid rain corrodes metals and marbles – causing stone leprosy
- It causes skin cancer etc.

Prevention of air pollution: ways to remove particulate matter:

- **Electrostatic precipitator**
 - ✚ Widely used to remove particulate matter in the exhaust from a thermal power plant.
 - ✚ Has electrode wires that are maintained at several thousand volts, which produce a corona that release electrons.
 - ✚ Electron binds with particulate matter giving them a net negative charge.
 - ✚ Positively charged collecting plates attract the charged dust particle.
- **Scrubber:**
 - ✚ Removes gases like **sulphur dioxide from industrial exhausts.**
 - ✚ The exhaust is passed through a spray of water or lime.
 - ✚ Water dissolves the gases and lime reacts with SO₂ to form calcium sulphate.
- **Methods to reduce vehicular pollution:**
 - ✚ Use of lead free petrol or diesel can reduce vehicular pollution.
 - ✚ **Catalytic converter:**
 - Made up of expensive metals namely **platinum, palladium** and **rhodium** as the catalyst.
 - When the exhaust pass through catalytic converter following changes occur.
 - The **unburnt hydrocarbons** are converted into **CO₂ and H₂O.**
 - **Carbon monoxide** and **nitric oxide** are changed to **carbon dioxide** and **nitrogen gas** respectively.
 - These metals reduce emission of poisonous gases like CO and NO₂.
 - Motor vehicle equipped with catalytic converter should use **unleaded petrol** because lead in the petrol **inactivates the catalyst by depositing on the surface.**
 - ✚ **Other parallel steps taken in Delhi:**
 - Phasing out old vehicles.
 - Use of low-sulphur petrol and diesel.
 - Use of unleaded petrol.
 - Application of strict pollution level norms for vehicle.

Controlling Vehicular pollution: A case study of Delhi:

- Use of CNG** (compressed natural gas) in all vehicles for public transport (bus and auto rickshaw) by 2002:
Advantages of CNG
 - CNG burns most efficiently.

- Very little remain unburnt.
- Cannot be siphoned
- Cannot be adulterated like petrol or diesel.
- CNG is cheaper than petrol and diesel.

Problem of use of CNG:

- Difficulty in laying down pipelines to deliver CNG
- Non-assurance of uninterrupted supply.

II. New auto fuel policy to cut down vehicular pollution.

- Steadily reducing the sulphur and aromatic hydrocarbon content in petrol and diesel fuels to 50ppm and 35% respectively.
- **Euro-II / BS II norms**
 - 350 ppm and 150 ppm S content in petrol and diesel. Aromatic HC to 42%
 - CO 2.2 g/Km and HC and NO_x 0.5 g/Km in petrol cars.
 - CO 4.0 g/Km and HC and NO_x 8 g/Km in diesel cars
- It results in substantial fall in CO₂ and SO₂ level between 1997 and 2005 in Delhi.
- Mass Emission Standards, Bharat stage II which is equivalent to Euro II norms are no more applicable in India.
- SC ban sale of Bharat Stage III vehicles w.e.f. April 1, 2017.
- New vehicles manufactured after it should comply BS IV norms.
- BS IV / Euro 6 norms
 - CO 1.0 g/Km and HC and NO_x 0.18 g/Km in petrol
- In India 'The Air (Prevention and Control of pollution) Act' came into force in 1981, amended in 1987.

NOISE POLLUTION

- Undesirable high level of sound is called **noise pollution**.
- Noise level – decibel (db).
- Bearable – below 80db. Above pollution.

Causes of Noise Pollution

- Jet Plane or rocket take-off (150db)
- Use of loudspeakers and music systems for longer periods of time.
- Traffic noises, industries like textile mills and factory noises.

Harm full effect of noise pollution:

- Psychological and physiological disorders in humans.
- High sound level, 150dB or more may damage ear drums rendering permanent hear impairment.
- Noise causes anxiety, sleeplessness and increased heart rate.
- Altered breathing pattern and stress

Control or Prevention of Noise Pollution:

- Use of sound absorbent materials or by muffling noise in industries by **planting more trees**.
- Demarcation of horn free zones around hospitals and schools.
- Permissible sound levels of crackers,
- Timings after which Loudspeakers cannot be played.
- Sticking to permissible sound level of crackers and loudspeakers.

WATER POLLUTION AND ITS CONTROL:

- Changes in the physical, chemical or biological properties of water due to disposal of waste and their abuse that can affect the living beings adversely is called water pollution.
- Govt. of India passed water (Prevention and control of water pollution) Act in 1974 to safeguard the water resources from pollution.

Categories of water pollution

- 1) **Point source:** It refers to pollutants which enter the water body from a discrete or single source. E.g. Sewage
- 2) **Non-point source:** It refers to pollutants that enter the water body from a wide source. E.g. Surface run-off.

Sources of water pollution

- 1) **Natural sources:** Clay and silt from soil erosion, leaching of minerals, falling of organic matter from banks
- 2) **Anthropogenic or man-made source:** human activities and pollutant generated by them.

These consist of four categories

i. Domestic sewage:

- Released from every household on daily basis, primarily contains biodegradable organic matter. The impurities include

- Suspended solids – sand, silt and clay
- Colloidal material – faecal matter, food residues, bacteria, cloth and paper fibres
- Dissolved material – detergents, soaps, nutrients like nitrates and phosphates.

- A mere 0.1 percent impurities make domestic sewage unfit for human use.

ii. Municipal/hospital waste

- Sewage from municipal areas and hospital contain pathogenic microbes.
- Discharge of such sewage without proper treatment causes diseases like dysentery, typhoid, jaundice, cholera etc.

iii. Industrial waste

- Effluent from petroleum, paper manufacturing, metal, chemical industries.
- Contains toxic heavy metals (density $\geq 5\text{g/cm}^3$): - Hg, Cd, Cu, Pb etc.
- Oil spills from offshore oil drilling and refineries.
- Thermal waste water** from thermal power plant eliminate temperature sensitive organisms. It enhance growth of plants and fish in extremely cold areas after causing damage to local flora and fauna.

iv. Agricultural Run-off

- Run-off from agriculture land like pesticides and fertilizers into ponds, rivers, lakes other water bodies. It causes accelerated eutrophication of water bodies.

Effects of Water pollution

i. Increase in BOD

- The amount of organic matter present in water is estimated by **BOD**.
- Biochemical oxygen demand (BOD):** The amount of Oxygen in mg required to oxidize all organic matter present in one liter of water.
- Polluted water have higher BOD.
- Changes take place on discharge of domestic sewage into the river.**
 - Stimulates micro-organisms to perform biodegradation of organic matter in the receiving water body.
 - They consume a lot of oxygen, hence there is sharp decline in dissolved oxygen in water body.
 - Due to low DO there is mortality of fish and other aquatic animals.

ii. Algal bloom

- Presence of large amount of nutrients in water also causes excessive growth of free floating **Planktonic** algae. This excessive growth of algae is called **algal bloom**.
 - Algal bloom imparts distinct color to water bodies.
 - Causes deterioration of water quality and fish mortality.
 - Some bloom-forming algae are extremely toxic to human and animals.
- The world's most problematic aquatic weed is water hyacinth (*Eichhornia crassipes*) called 'Terror of Bengal'.**

- ✚ Introduced to India for their lovely flowers.
- ✚ Excessive growth causes blocks in waterways.
- ✚ They cutoff light from submerged plants causing their death.
- ✚ Causes imbalance in ecosystem and dynamics of water body.

iii. Eutrophication

- The ageing of lake or water body due to nutrient enrichment and consequent establishment of different communities of organisms is referred to as **Eutrophication**.
- **Types of eutrophication:**
 - a. **Natural Eutrophication:**
 - ✚ Enrichment of nutrients like nitrogen and phosphorus through deposition of silts and organic debris brought by streams draining into the lakes.
 - ✚ Increase in nutrient encourages growth of aquatic organisms and subsequently other forms replace it with continued increase in nutrient content.
 - b. **Cultural or Accelerated Eutrophication:**
 - ✚ Pollutants from man's activities like effluents from the homes and use of nitrogen fertilizers in agricultural can radically accelerate the aging process. This phenomenon is called **Cultural or Accelerated Eutrophication**.
 - ✚ The prime contaminants being nitrates and phosphates which act as plant nutrients overstimulate the growth of algae.
 - ✚ This depletes dissolve oxygen needed by other aquatic life forms leading to death.

Biomagnifications

- Increase in concentration of the toxic substances at successive trophic level is called biological magnification or biomagnification.
- ✚ Toxic substance accumulated by an organism cannot be metabolized or excreted.
- ✚ The accumulated toxic passed to the next trophic level.
- ✚ This phenomenon is well known for **mercury** and **DDT**.
- **Bio magnification of DDT in Aquatic food chain.**



- **Effects**
 - ✚ High concentration of DDT interferes with calcium metabolism in birds.
 - ✚ It causes thinning of eggshells and their premature breaking.
 - ✚ This ultimately causes decline in bird population.

Control measures of water pollution

- Biomagnification of toxic chemicals can be controlled by judicious use of small doses of fertilizers and manure.
- Sewage containing organic matter should be first treated before discharge into water bodies.

A case study of integrated waste water treatment:

- Wastewater including sewage can be treated in an integrated manner, by utilizing a mix of artificial and natural process.
- It has been done in town of Arcata, in the northern coast of California.
- **The treatment is done in two stages:-**
- **Step I**
 - ✚ The conventional sedimentation, filtering and chlorine treatment are given. After this stage heavy metals and toxic pollutants remain in the water.

• Step II

- ✚ The biologist developed a series of six connected marshes and appropriate plants, algae, fungi and bacteria were seeded into this area.
- ✚ The water flows through the marshes, the pollutants are neutralize, absorb and assimilated by the plants thus the polluted water get purified naturally.
- The marshes also constitute a sanctuary, with high level of biodiversity in the form of fishes, animals and birds that now reside there.
- A citizens group called **Friends of the Arcata Marsh (FOAM)** is responsible for the upkeep and safeguarding of this project.

Ecological sanitation: (EcoSan)

- Toilets especially design to facilitate ecological sanitation of human waste or excreta through dry composting is called **EcoSan** toilets.
- 'EcoSan' toilets are being used in Kerala and Srilanka.
- Advantage
 - ✚ This is a practical, hygienic, efficient and cost-effective solution to human waste disposal.
 - ✚ With this composting method human excreta can be recycled into natural fertilizers to replace artificial fertilizer.

SOLID WASTES

- Solid wastes** refer to everything that goes out in trash.

Sources of solid waste and its effects:

- Municipal solid wastes:** wastes from homes, offices, stores, schools, hospitals etc. It comprises paper, food wastes, plastics, glass, metals rubber, leathers, textiles etc.
- Industrial waste:** scrapes, toxic heavy metals, fly ash (oxides of iron, silica, aluminum etc.) generated by industries.
- Electronic waste (e-waste):** Damage electronic goods and irreparable computer and parts, battery etc. contains copper, iron, silicon, nickel, lead and gold. Manual recycling process exposes workers to toxic substances present in e-wastes.
- Defunct Ships:** dismantle in developing countries for cheap labour and demand for scrap metal. However such ships are generally loaded with toxic heavy metals like asbestos, lead, mercury etc. the people involve in breaking ship are exposed to such metals and thus suffer from various diseases. It also pollute the surrounding area.

Methods of Solid Waste Disposal

i. Recovery and Recycling :

- Waste after proper sorting into recyclable, biodegradable and non- biodegradable categories, they can be reused or put into pits to generate manure and non-biodegradable waste can be disposed with other methods.

ii. Source reduction

- Composting of organic waste to prepare manure
- Gobar gas plant: Cowdung and other organic waste is biogas plant to generate bio-gas and manure.

iii. Sanitary landfills:

- Wastes are dumped in a depression or trench after pulverization and compaction and covered with a layer of earth everyday.

iv. Burning: Burning in open. **Better methods are**

- Incineration:** It involves controlled aerobic combustion of waste in closed chamber at high temperature. Incinerators are fitted with scrubbers and electrostatic precipitators. It is a method to dispose waste from hospitals containing pathogen, disinfectants and other harmful chemicals etc. E-waste can also be disposed through incineration.

- **Pyrolysis:** Combustion of waste in close chambers in absence of oxygen at low temperature. It does not yield pollutants but industrial gas and other useful substances are produced.

Three 'Rs' of waste management: Reduce, Reuse, Recycle

- 1st R: Reduction in use of plastics and others to reduce generation of solid waste. Use of eco-friendly packaging. And carrying cloth or other natural fiber carry bags when we go shopping and refusing polythene bags etc.
- 2nd R: Reuse of articles time and again like bottles and containers.
- 3rd R: Recycling of waste and broken articles for the manufacture of new products like glass, metals, plastics, flyash.

Case study of Remedy for Plastic wastes: (Ahmed Khan)

- **Polyblend**, a fine powder of recycled modified plastic, was developed by his company.
- Polyblend is mixed with bitumen that is used to lay roads.
- It increases the water repelling property of bitumen, and increase road life by a factor of three.
 - The raw material used for polyblend is plastic film waste.

RADIOACTIVE WASTES:

- Nuclear energy was hailed as a non-polluting way for generating electricity.
- Later on it was realized that it has two very **serious inherent problem:-**
 - ✚ Accidental leakage, as occurred in Three Mile Island, Chernobyl, Fujiyama
 - ✚ Safe disposal of radioactive wastes.
- Radiation from radioactive waste causes mutation at very high rate.
- High dose of nuclear radiation is lethal, but lower doses create genetic disorders and also cause cancer.

Disposal of nuclear wastes:

- Storage of nuclear waste, after sufficient pre-treatment and compaction, should be done in suitably shielded containers buried within the rocks about 500 m deep below the earth's surface or bottom of the sea.

AGRO-CHEMICAL AND THEIR EFFECTS:

- Use of inorganic fertilizers and pesticides has increased manifold for enhancing crop production.
- Pesticides, herbicides, fungicides etc. are being increasingly used.
- These are toxic to non-target organisms that are important components of the soil ecosystem.
- Increasing amounts of artificial fertilizers causes **eutrophication, biomagnification** and **soil pollution**.

Case study of organic farming: (Ramesh Chandra Dagar of Sonipat)

- **Integrated organic farming** – it is a cyclical, zero waste procedure, where waste products from one process are cycled in as nutrients for other processes.
- Maximum utilization of resource and increase the efficiency of production.
- He includes bee-keeping, dairy management, water harvesting, composting and agriculture in a chain of processes, which support each other and allow an extremely economical and sustainable venture.

Advantages of integrated farming:

- There is no need of use of chemical fertilizers for crops.
- Cattle excreta are used as manure.
- Crop waste used to create compost, which can be used as a natural fertilizer or can be used to generate natural gas for energy need.
- It will reduce dependency on nitrogen fertilizers and reduction in water pollution.

GLOBAL ENVIRONMENTAL CHANGE -- GREEN HOUSE EFFECT AND GLOBAL WARMING:

- The term "Greenhouse effect" has been derived from a phenomenon that occurs in greenhouse.
- The greenhouse effect is responsible for heating of Earth's surface and atmosphere.

- Without the average temperature at surface of earth would have been a chilly -18°C rather than the present average of 15°C .
- **Mechanism**
 - Total incoming solar radiation
 - $\frac{1}{4}$ reflected by clouds and gases
 - $\frac{1}{4}$ absorb by clouds and dust particles
 - $\frac{1}{2}$ falls on Earth's surface, a small portion is reflected back.
 - Earth's surface re-emits heat in the form of infrared radiation.
 - This heat radiations does not escape into space because of atmospheric gases (e.g. carbon dioxide, methane etc).
 - Instead reflected back to Earth's surface, thus heating it up once again.

Green house gases

- **Carbon dioxide (60%), methane (20%), CFCs (14%) and Nitrous oxide (N_2O 6%)**
- Increase in the level of greenhouse gases has led to considerable heating of Earth leading to **global warming** or **enhanced green house effect**.
- During the past century, the temperature of Earth has increased by 0.6°C .

Effect of global warming:

- Deleterious changes in the environment and resulting in odd climatic changes (e.g. El Nino effect).
- Increased melting of polar ice caps as well as of other places like the Himalayan snow caps.
- Rise in sea level that can submerge many coastal areas.

Control of global warming:

- Reduce use of fossil fuel and emission of greenhouse gases.
- Improving efficiency of energy usage.
- Reducing deforestation.
- Promoting afforestation program.
- Slowing down growth of human population.

OZONE DEPLETION IN THE STRATOSPHERE:

- Ozone (O_3) gas is continuously formed by the action of UV rays on molecular oxygen, and also degraded into molecular oxygen in the stratosphere. There should be proper balance of formation and degradation of ozone.
- Types:
 - ✚ **'Bad' ozone** formed in the lower atmosphere (troposphere) that harms plants and animals.
 - ✚ **'good' ozone** also; this ozone is found in the upper part of the atmosphere called **stratosphere**, and it acts as a shield absorbing ultraviolet radiation from the sun.
- The thickness of ozone layer is measured in terms of **Dobson units (DU)**

Ozone depletion:

- Balance of ozone in stratosphere is disrupted due to enhancement of ozone degradation by **chlorofluorocarbons (CFCs)**.
- Mechanism of degradation
 - ✚ CFCs find wide use as refrigerants.
 - ✚ CFCs discharged in the lower part of atmosphere move upward and reach stratosphere.
 - ✚ In stratosphere, UV rays acts on CFCs and release **active Cl atoms**.
 - ✚ Cl degrades ozone releasing molecular oxygen.
 - ✚ Cl acts as catalysts and not consumed during reaction.

Whatever CFCs are added to the stratosphere, they have permanent and continuing affects one Ozone levels.

- The depletion is marked particularly over the **Antarctic region**. This has resulted in formation of a large area of thinned ozone layer, commonly called as the **ozone hole**.
- Hole is maximum size during spring time

Effects of UV rays:

- UV radiations shorter than UV-B are almost completely absorbed by Earth's atmosphere, if the ozone layer is intact.
- DNA and proteins of living organisms are damaged by UV rays as they potentially absorb it.
- The high energy of UV rays breaks the chemical bond in these molecules.
- UV – B damages DNA and mutation may occur.
- It causes ageing of skin.
- Damage skin cells and causes skin cancers.
- In human eye cornea absorb UV – B radiation and high dose of UV – B causes inflammation of cornea called **snow-blindness, cataract etc.**
- Such exposures may damage cornea.

Prevention:

- **Montreal Protocol** was signed at Montreal (Canada) in 1987 to control emission of ozone depleting substances.
- Many efforts are being made to reduce emission of ozone depleting substances.

DEGRADATION BY IMPROPER RESOURCE UTILIZATION AND MAINTENANCE:

Deforestation:

- Conversion of forested areas to non-forested one.

How deforestation does occurs:

- Slash and burn agriculture/jhum cultivation
- Farmers cut down the trees of the forest and burn the plant remains.
- Ash is used as fertilizer and land is used for farming or cattle grazing
- Later, Land is left uncultivated for several years for replenishment of minerals

Effects of deforestation

- Leads to global warming due to excess carbon-dioxide released during burning and removal of plants which purify the CO₂.
- Loss of biodiversity,
- Damage to hydrological cycle, flash floods in one region and drought in other.
- Leads to soil erosion due to removal of forest cover and roots which binds the soil particles.
- Desertification of land

Reforestation

- Restoring forest that was existing earlier E.g. Observing Van-Mahotsavas
- Aforestation : Developing a forest in a new area where no such forest existed in that area.

Soil erosion

- The removal of top fertile layer due to human activities

Reasons: -

- Over cultivation
- Unrestricted grazing
- Deforestation
- Poor irrigation practices

Water logging and soil salinity:

- Irrigation with proper drainage, leads to water lodging in the soil.
- Draws salt to the surface of the soil.

- The salt starts collecting at the roots of the plants.
- The salt damages the roots and crop productions.

A case study of people's participation in forest conservation

- **Amrita Devi Bishnoi Wild Life Protection Award**

- ✚ A king of Jodhpur wanted to arrange wood for his new palace in 1731.
- ✚ Few Bishnois hugged the trees and asked to cut them first rather than cutting trees.
- ✚ 365 persons lost their lives in this act
- ✚ A small temple is now present there in remembrance of this act
- ✚ Amrita Devi Bishnoi Wild Life Protection Award is instituted for individuals of rural areas who take keen interest in protecting wild life.

- **Chipko movement**

- ✚ It was started by local women of Garhwali; they hugged the trees to protect them from the axes of contractors.

- **Joint forest management (jfm)**

- ✚ Strategy Government of India in 1980
- ✚ Local communities worked with the government to save the forest.
- ✚ Communities get forest products for encouragement.

SIR LOYAL