ENVIRONMENTAL ISSUES

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- **Pollution:** is any undesirable changed in physical chemical or biological characteristics of air, land, water or soil.
- **Pollutant:** Any solid, liquid or gas released into the environment in such a huge quantities that make our environment unhealthy is called pollutant.
- **Environment (protection) Act, 1986** to protect and improve the quality of our environment (air, water and soil)

AIR POLLUTION AND ITS CONTROL:

Effect of air pollution:

- Cause injury to all living organisms.
- Reduce growth and yield of crops.
- Cause premature death of plants.
- Affects the respiratory system of human being.
- Particulate size 2.5 micrometers or less are responsible for breathing and respiratory symptoms like irritation, inflammations and damage to the lungs and premature death.

Pollution caused by thermal power plant:

- Sources of **particulate matter**: thermal power plant, smelters
- These plants release particulate matter and gaseous air pollutant.
- A harmless gas released by these plants is **Nitrogen** and **Oxygen**.

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.
  - 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.**
  - The exhaust is passed through a spray of water or lime.
- **Methods to reduce vehicular pollution:**
  - Use of lead free petrol or diesel can reduce vehicular pollution.
  - **Catalytic converter:**
    - Having expensive metals namely platinum, palladium and rhodium as the catalyst.

- These metals reduce emission of poisonous gases.
- The **unburnt hydrocarbons** are converted into **CO_2 and H_2O.**
- **Carbon monoxide** and **nitric oxide** are changed to **carbon dioxide** and **nitrogen gas** respectively.
- Motor vehicle equipped with catalytic converter should use **unleaded petrol** because lead in the petrol **inactivates** the **catalyst.**

Controlling Vehicular pollution: A case study of Delhi:

- **Use of CNG (compressed natural gas):**

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.

Other parallel steps taken in Delhi:

- Phasing out old vehicles
- Use of unleaded petrol.
- Use of low-sulphur petrol and diesel.
- Use of catalytic converter in vehicle.
- Application of strict pollution level norms for vehicle.

New auto fuel policy to cut down vehicular pollution.

- Steadily reducing the sulphur and aromatic content in petrol and diesel fuels.
- **Euro-II norms**
  - Sulphur reduced to 350 ppm in diesel.
  - Sulphur reduced to 150 ppm in petrol
  - Aromatic hydrocarbon to be reduced to 42 %.
  - Up gradation of vehicle engines.
- **Due to above steps taken by Delhi Govt. there is substantial fall in CO_2 and SO_2 level between 1997 and 2005.**

NOISE POLLUTION:

- Undesirable high level of sound is called **noise pollution**.

Harm full effect of noise pollution:

- Psychological and physiological disorder in humans.
- High sound level, 150dB or more may damage ear drums.
- Noise causes sleeplessness
- Increased heart rate.
- Altered breathing pattern.

Prevention of Noise Pollution:

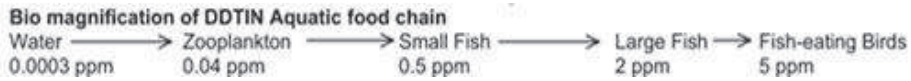
- Use of sound absorbent materials or by muffling noise in industries
- Demarcation of horn free zones around hospitals and schools.
- Permissible sound levels of crackers,
- Timings after which Loudspeakers cannot be played

WATER POLLUTION AND ITS CONTROL:

Domestic sewage and industrial effluents:

- A mere 0.1 percent impurities make domestic sewage unfit for human use
- Sewage contains dissolve salts like nitrates, phosphates, and other nutrients, and toxic metal ions and organic compounds.
- The amount of organic matter in water is estimated by **BOD.**
- **Biochemical oxygen demand:** the amount of Oxygen required oxidizing all organic matter present in one liter of water.
- **Changes take place on discharge of sewage into the river.**
    - Micro-organism involved in biodegradation of organic matter in the receiving water body consume a lot of oxygen, hence there is sharp decline in dissolved oxygen downstream from the point of discharge.
    - Due to low DO there is mortality of fish and other aquatic animals.
- Presence of large amount of nutrients in water also causes excessive growth of **Planktonic** (free floating) algae, called **algal bloom**.
    - Algal bloom imparts distinct color to water bodies.
    - 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 grow abundantly in eutrophic water bodies.
    - Causes imbalance in ecosystem and dynamics of water body.
- **Sewage associated with diseases:**
    - Sewage from home and hospital contain pathogenic microbes.
    - Discharge of such sewage without proper treatment causes diseases like dysentery, typhoid, jaundice, cholera etc.

- **Toxic heavy metals (defined as elements with density > 5g/cm3), released from:-**
  - Petroleum industry.
  - Paper manufacturing.
  - Metal extraction and processing.
  - Chemical manufacturing industries.
- **Biomagnifications:** increase in concentration of the toxicant at successive trophic level is called biological magnification or biomagnifications.
  - 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.**



- **Eutrophication:** The process of nutrient enrichment of water and consequent loss of species diversity is referred to as **Eutrophication**.
- **Natural Eutrophication:**
  - Streams draining into the lake increase nutrients like nitrogen and phosphorus.
  - Increase in nutrient encourages growth of aquatic organisms.
  - Over centuries, as silt and organic debris pileup the lake grows shallower and warmer.
  - Warm-water organisms dominate over that thrive in a cold environment.
  - Marsh plants take root in the shallows and begin to fill in the original lake basin.
  - Eventually the lake gives way to large masses of floating plants (bog), finally converting into land.

- **Cultural or Accelerated Eutrophication:**
  - Pollutants from man's activities like effluents from the industries and homes can radically accelerate the aging process. This phenomenon is called **Cultural** or **Accelerated Eutrophication**.

Causes:

- Sewage and agricultural and industrial wastes.
- Prime contaminants are nitrates and phosphates.

Effects:

- Unsightly scum and unpleasant odors.
- Robbing the dissolved oxygen form water.
- Pollutant inflow kills the fish.
- Decomposition of dead fish causes further depletion of DO.
- Finally a lake can literally choke to death.

Thermal pollution:

Cause:

- Heated (thermal) waste waters flowing out of electricity-generating units. E.g. thermal power plants.

Effects:

- Thermal wastewater eliminates or reduces the number of organism sensitive to high temperature.
- Enhance the growth of plants and fish in extremely cold areas but only after causing damage to the indigenous flora and fauna.

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:-**
  - The conventional sedimentation, filtering and chorine treatment are given.
  - The biologist developed a series of six connected marshes over 60 hectares of marshland.
  - Appropriate plants, algae, fungi and bacteria were seeded into this area, which neutralize, absorb and assimilate the pollutant
  - The water flows through the marshes, it 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:

- Ecological sanitation is a sustainable system for handling human excreta, using dry composting toilets.
- This is a practical, hygienic, efficient and cost-effective solution to human waste disposal.
- With this composting method human excreta can be recycled into are source (as natural fertilizer).
- 'EcoSan' toilets are being used in Kerala and Srilanka.

SOLID WASTES:

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

- **Municipal solid wastes** are wastes from homes, offices, stores, schools, hospitals etc. It comprises paper, food wastes, plastics, glass, metals rubber, leathers, textiles etc.
- Open damp of these wastes serve as the breeding ground for rats and flies.
- **Sanitary landfills** were adopted as substitute for open-burning dumps.

Sanitary landfills:

- Wastes are dumped in a depression or trench after compaction and covered with dirt everyday.

Disadvantages:

- Shortage of space for huge garbage's.
- Danger of seepage of chemicals, polluting the ground water resources.

Solution to solid wastes:

- All solid wastes are categorized into thee types:
  - **Bio-degradable.**
  - **Recyclable.**
  - **Non-biodegradable.**
- All the garbage generated is sorted first.
- Recyclable material to be separated and send for recycles.
- Biodegradable wastes can be put into deep pits in the ground and be left for natural breakdown.
- Only Non-biodegradable wastes are left and required to be disposed.

Prevention:

- The need to reduce our garbage generation should be a prime goal.
- Reduction in use of plastics and use of eco-friendly packaging.
- Carrying cloth or other natural fiber carry bags when we go shopping.
- Refusing polythene bags.

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 helped to increase road life by a factor of three.
- The raw material used for polyblend is plastic film waste.

Hospital wastes:

- Hospitals generate hazardous wastes that contain disinfectants and other harmful chemicals, and also pathogenic organisms.
- The use of **incinerators** is crucial to disposal of hospital wastes.

Electronic wastes (e-wastes):

- Irreparable computers and other electronic goods are known as **electronic wastes (e-wastes).**
- E- Wastes are buried in landfills or incinerated.
- Metals like copper, iron, silicon, nickel and gold are recovered during recycling process of e-wastes.
- Manual recycling process exposes workers to toxic substances present in e-wastes.
- Recycling is the only solution for the treatment of e-wastes.

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.

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

- Integrated organic farming 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, diary management, water harvesting, composting and agriculture in a chain of processes, which support each other and allow an extremely economical and sustainable venture.

Advantages:

- 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.

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 and Chernobyl.
    - 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, should be done in suitably shielded containers buried within the rocks about 500 m deep below the earth's surface.

GREEN HOUSE EFFECT AND GLOBAL WARMING:

- The term "Greenhouse effect" has been derived from a phenomenon that occurs in greenhouse.
- In a greenhouse the glass panel lets the light in, but does not allow heat to escape. Therefore the greenhouse warms up, very much like inside a car that has been parked in the sun for a few hours.
- The greenhouse effect is a naturally occurring phenomenon that is responsible for heating of Earth's surface and atmosphere.
- Without greenhouse effect the average temperature at surface of earth would have been a chilly -18° C rather than the present average of 15° C.
- Clouds and gases reflect about one-fourth of the incoming solar radiation and absorb some of it but half of incoming solar radiation falls on Earth's surface heating it, while a small portion is reflected back.
- Earth's surface re-emits heat in the form of infrared radiation but some part of this does not escape into space because of atmospheric gases (e.g. carbon dioxide, methane etc).
- The molecule of these gases radiate heat energy and a major part of which again comes to Earth's surface, thus heating it up once again.
- Carbon dioxide and methane – are commonly called as greenhouse gases because they are responsible for greenhouse effect.
- 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.
- Improving efficiency of energy usage.
- Reducing deforestation.
- Promoting aforestation programme.
- Slowing down growth of human population.
- International initiative to be taken to reduce emission of green house gases.

OZONE DEPLETION IN THE STRATOSPHERE:

- **'Bad' ozone** formed in the lower atmosphere (troposphere) that harms plants and animals.
- There is **'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 (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.

Ozone depletion:

- Balance of ozone in stratosphere is disrupted due to enhancement of ozone degradation by **chlorofluorocarbons (CFCs)**.
- 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.**

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 exposes 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:

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.

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
- Loss of biodiversity
- Damage to hydrological cycle
- Leads to soil erosion
- Desertification of land

Reforestation

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

A case study of people's participation in forest conservation

- 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 Bishnois 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.

CPCB: Central Pollution Control Board
BOD: Biological Oxygen Demand
CNG: Compressed Natural Gas
FOAM: Friends of Arcata Marsh
JFM: Joint Forest Management.