

## CHAPTER-6

# SOCIAL ISSUES AND THE ENVIRONMENT

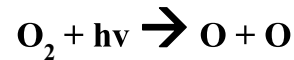
## SUB-TOPICS

- Ozone hole depletion
- Acid rain
- Global warming
- Water conservation
- Rain water harvesting
- Consumerism and waste products
- Environment laws
- Wasteland reclamation

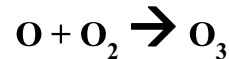
# OZONE HOLE DEPLETION

# How ozone layer formed?

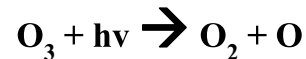
- **Photolysis of oxygen molecules.**



- **Reactive oxygen atom recombines with oxygen molecule.**



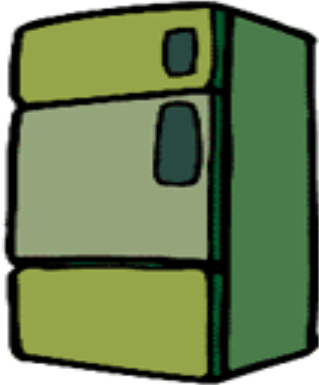
- **Ozone is also destroyed by the following reaction:**



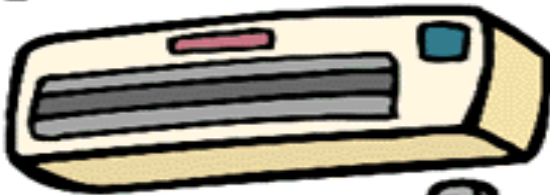
**Ozone is continuously created and destroyed by sun's radiations. This results in an equilibrium concentration of ozone ,but this equilibrium is disturbed by anthropogenic activities.**

- Unit of measurement- DOBSON
- IDU- 0.01mm thickness
- 200DU – Normal
- Less than 200DU – ozone hole
- Dramatic loss of ozone in the lower stratosphere over Antarctica was first noticed in the 1985 by a research group(Farman et.al.)

# CFC's and ozone depletion



Household  
refrigerators  
Industrial  
refrigerators



Household air conditioners  
Industrial air conditioners

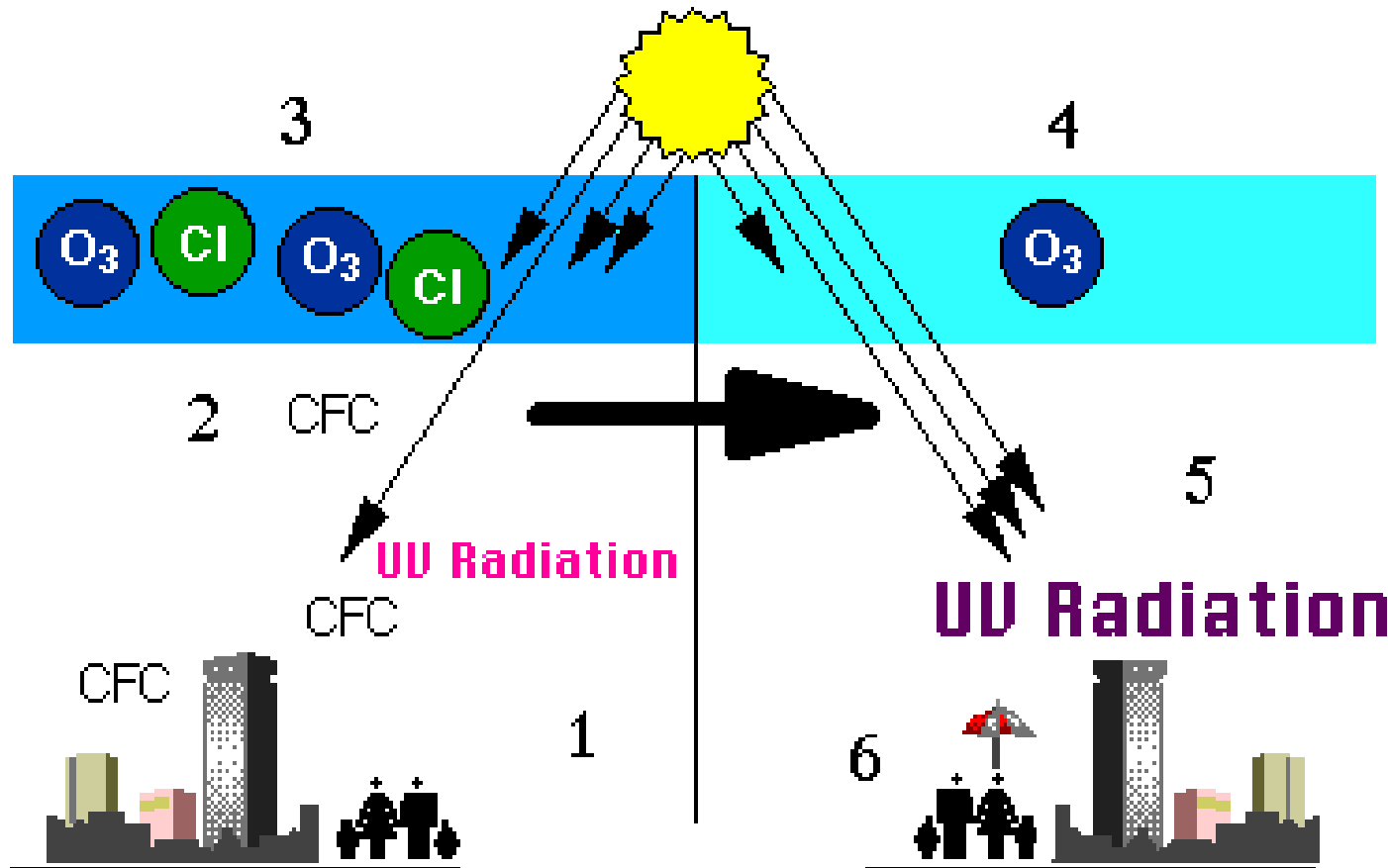


Automobile air conditioners

Chlorofluorocarbons are created and used in refrigerators and air conditioners.

These chlorofluorocarbons are not harmful to humans and have been a benefit to us. Once released into the atmosphere, chlorofluorocarbons are bombarded and destroyed by ultraviolet rays. In the process chlorine is released to destroy the ozone molecules

# Ozone Depletion Process



- 1 - CFCs released
- 2 - CFCs rise into ozone layer
- 3 - UV releases Cl from CFCs

- 4 - Cl destroys ozone
- 5 - Depleted ozone → more UV
- 6 - More UV → more skin cancer

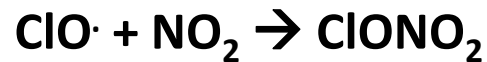
# Few questions

- Why it occurs mainly over Antarctica?
- Why ozone depletion occurs during spring time?
- Why ozone hole is replenished after spring?
- Why scanty ozone depletion occurs over Arctic region?



# Why it occurs mainly over Antarctica?

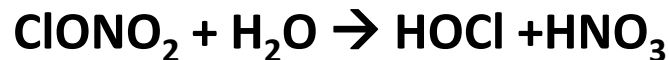
- In other parts of the stratosphere, two key rx. bind ClO· And Cl·



Chlorine nitrate and hydrogen chloride act as natural reservoirs for reactive chlorine atom. Once these are tied up, ozone depletion is not initiated.

In Antarctica, conditions are quite different. During winters polar stratospheric clouds (PSCs) are formed. (PSC Type-I (-75°C) and PSC Type-II (-90°C)).

PSCs provide surface area for the above rx.s to proceed further. Two important transformations of ClONO<sub>2</sub> occur on their surface.

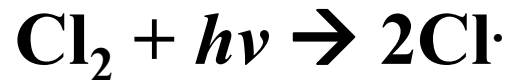
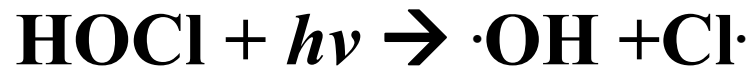


Under milder conditions, hypochlorous acid and molecular chlorine can be reconverted into reactive chlorine atoms, paving the way for ozone depletion.



## Why ozone depletion occurs during spring time?

- Early September to late October.
- During this period, sun begins to shine over Antarctic skies. HOCl and Cl<sub>2</sub> formed in above reactions are photolysed by sunlight.



the reactive chlorine atoms are rendered free to deplete ozone.

# Why ozone hole is replenished after spring?

- During winters, when PSCs are formed over Antarctica, stable wind patterns in the stratosphere, called POLAR VORTEX encircle the continent. Polar vortex is a tight whirlpool of winds. It is so rigid that air within it is isolated from the sun and ozone rich air of the temperate regions. The polar vortex remains intact throughout the spring. Thence, the intensity of sunlight increases and vortex breaks down. The ozone rich air from the temperate region rushes in and replenish the ozone hole.

# Why scanty ozone depletion occurs over Arctic region?

## Antarctica

- Surrounded by oceans.
- Winter temp. drops to about -90. C
- Both the types of clouds are formed. (PSC-I and PSC-II)
- Ozone depletion rex.s proceed to higher extent.

## Arctic

- In contact with habitated land masses.
- Winter temp. drops to about -80. C
- PSC type-I clouds are formed.
- ozone depletion rex.s proceed to lesser extent.

# What causes the depletion?

Release of manmade chemicals:

- CFC - refrigerants, aerosol sprays, solvents and foam-blowing agents
- Halons - bromine-containing derivatives of CFC used in fire extinguishers.

# Effects of UV rays on Aquatic Ecosystems

Ozone depletion causes increases in UV rays' effects on aquatic ecosystems by:

- Decreasing the abundance of phytoplankton – affects the food chain.
- Decreasing the diversity of aquatic organisms – reduces food stock and also destroys several fish and amphibians.

# Effects of UV rays on Terrestrial Ecosystems

- Damage to plant cell DNA molecules - makes plants more susceptible to pathogens and pests
- Reductions in photosynthetic capacity in the plant - results in slower growth and smaller leaves

# Harmful effects of UV rays on people

- Skin cancer
- Premature aging (photoaging) of the skin (different from normal chronological aging)
- Cataracts and eye disorders (corneal sunburn and blindness)
- Immune system damage

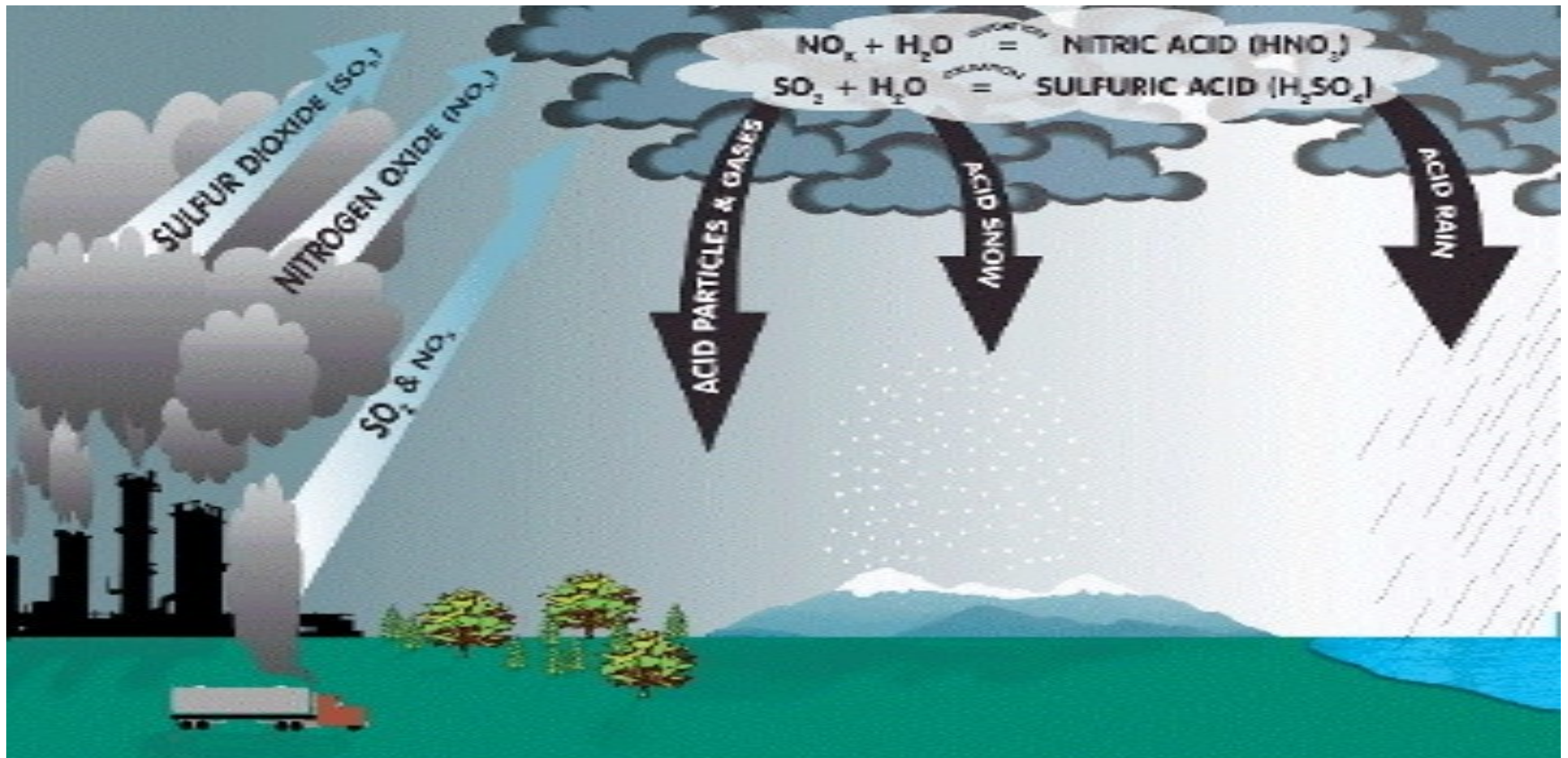
# Abatement of ozone depletion

- AFC's (Alternate fluorocarbons)
  - HCFC's – ozone depletion potential is 0.02%
  - HFC's - 0.0%

**The MONTERAL PROTOCOL**



# ACID RAIN



# What is Acid Rain? How Does it Form?

- Precipitation with a pH lower than 5.6 is considered acidic
- Acid rain originates from sulfur dioxide and nitrogen oxide particles
- By combining with water vapor, these particles form acids which fall to the earth as acid rain.

# Where do Sulfur Dioxide (SO<sub>2</sub>) and Nitrogen Oxide (NO<sub>x</sub>) Particles Come From?

- Industrial factories
- power-generating plants
- vehicles

# Power Plants



Credit: Tennessee Valley Authority (TVA)

- Most sulfur dioxide comes from power plants that use coal as their fuel. These plants emit 100 million tons of sulfur dioxide, 70% of that in the world.

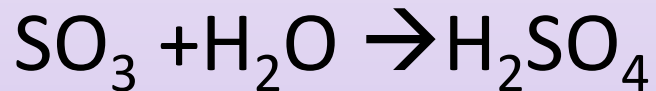
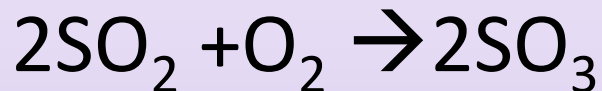
# Automobiles



- Automobiles produce about half of the world's nitrogen oxide. As the number of automobiles in use increases, so does the amount of acid rain.
- Power plants that burn fossil fuels also contribute significantly to nitrogen oxide emission.

# Formation

- Formation of sulphuric acid (60-70%)



- Formation of nitric acid (30-40%)

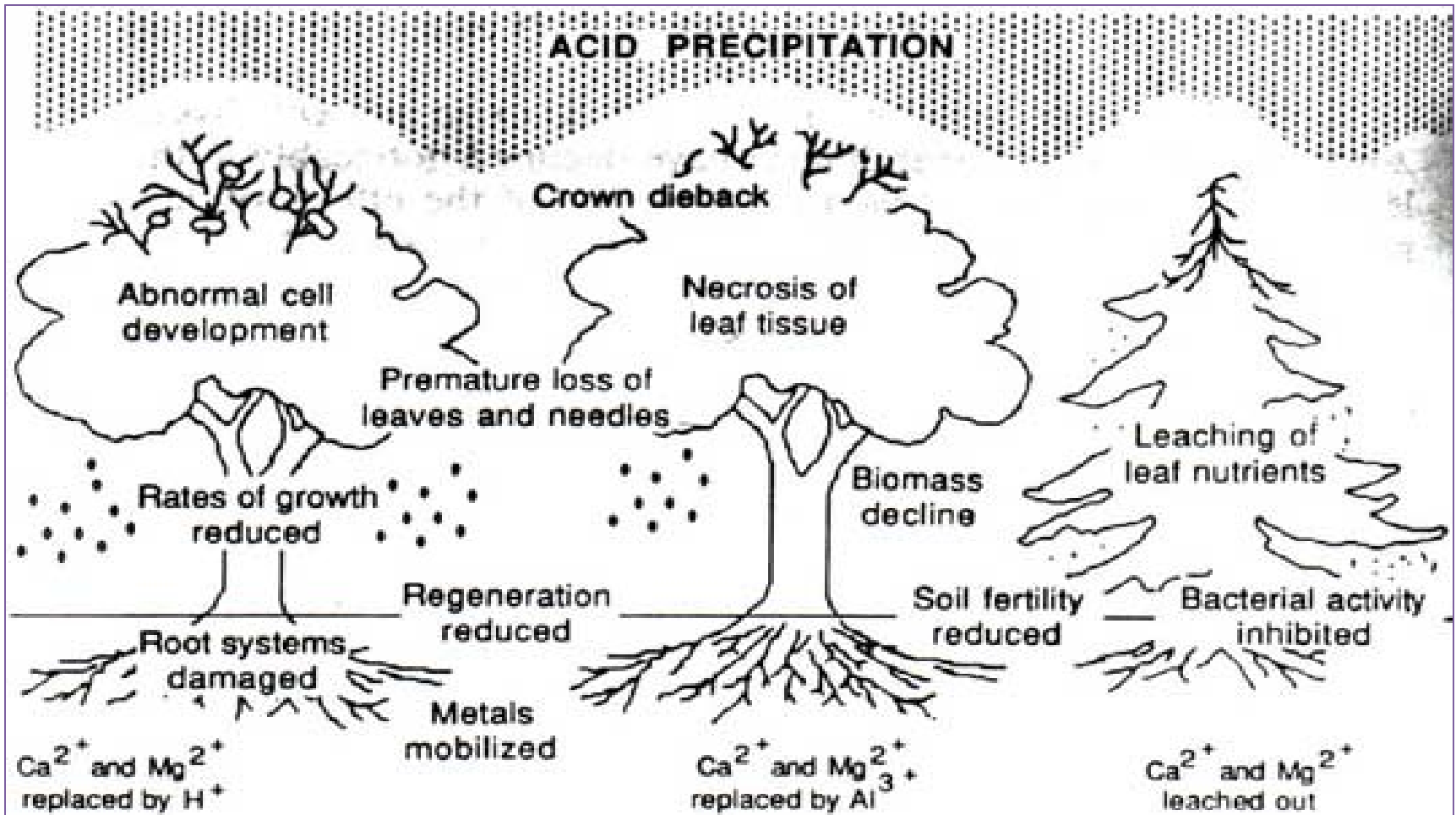


# Acid rain and Humans

## Affects human health

- Respiratory problems, asthma, dry coughs, headaches and throat irritations
- Leeching of toxins from the soil by acid rain can be absorbed by plants and animals. When consumed, these toxins affect humans severely.
- Brain damage, kidney problems.

# Acid Rain and Trees





# Acid rain and aquatic life

- Increased acidity in water bodies
- Stops eggs of certain organisms (e.g. fish) to stop hatching
  - Changes population ratios
  - Affects the ecosystem

**Extinction of fishes in lakes**

# Affect of Acid rain on Taj Mahal

- Causes stone leprosy
- $\text{SO}_2$  and  $\text{NO}_x$  released by Mathura refinery.
- $\text{CaCO}_3$  (marbel) +  $\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$
- $\text{CaCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$

# Preventive measures

- Fit catalytic converters to vehicle exhausts which remove the oxides.
- Use other sources of electricity (i.e. nuclear power, hydro-electricity, wind energy, geothermal energy, and solar energy)
- The process of neutralizing acidity in endangered lakes are through the addition of lime caustic soda, sodium carbonate etc. help to raise the pH of acidified lakes.
- Emission control devices can be attached to smoke stacks at power plants.

# GLOBAL WARMING



# What is global warming?



- The increase in temperature of earth's surface due to blanketing effect of man made gases like  $\text{CO}_2$ ,  $\text{CH}_4$ , CFC,s in the atmosphere.
- The increasing concentration of greenhouse gases in the atmosphere leads to global warming.

# Contribution of Green House Gases

Gases and their contribution	Atmospheric concentration	Increasing @
CO <sub>2</sub> (52%)	356ppm	0.04%
CH <sub>4</sub> (19%)	1.7ppm	1.5%
CFC's (17%)	2.3×10 <sup>-4</sup>	6%
O <sub>3</sub> (8%)	0.02ppm	1%
N <sub>2</sub> O (4%)	0.31ppm	0.02%

# Global Warming Potential (GWP)

- It is the potential of green house gas to cause global warming.
- $\text{CFC} > \text{N}_2\text{O} > \text{CH}_4 > \text{CO}_2$
- CFC is 38 million times stronger,  $\text{N}_2\text{O}$  is 3800 times and  $\text{CH}_4$  is 25 times stronger than  $\text{CO}_2$ .

# Consequences of Global Warming

**Sea level rise**



**Habitat Damage and Species Affected**





## Contd....

- Effects human health
- The thickness of sea ice in the arctic has decreased by 40%.
- The largest glacier on Mount Kenya has lost 92% of its mass.
- Floods occur at some areas and drought at another areas.
- Winter will be shorter and warmer and summer will be longer and hotter.

# Measures to Check Global Warming

- Cut down the current rate of use of CFCs and fossil fuels.
- Use energy more efficiently.
- Shift to renewable energy resources.
- Trap and use methane as a fuel.
- Plant more trees.
- Reducing deforestation
- Stabilizing world's population

## Contd....

- Sequester CO<sub>2</sub> emitted from burning fossil fuels by capturing it at the site of emission converting into liquid CO<sub>2</sub> and pumping it into the deep oceans where the low temp and high pressure presume it as a solid mass.

### THE KYOTO PROTOCOL

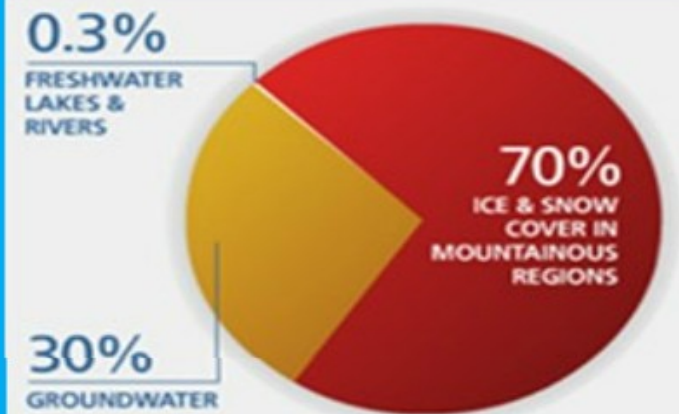
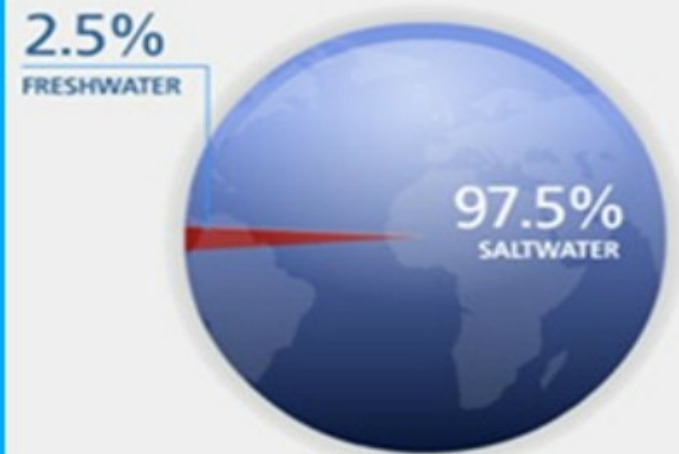
Held at Kyoto, Japan in December 1997.

# WATER CONSERVATION



# The Global Situation

- Less than 3% of the world's water is fresh – the rest is seawater and undrinkable.
- Of this 3% over 2.5% is frozen, locked up in Antarctica, the Arctic and glaciers, and not available to man.
- Thus humanity must rely on this 0.5% for all of man's and ecosystem's fresh water needs.



# The Indian Situation

- India has 16% of world's population and 4% of it's fresh water resources.
- Ground water is the major source of water in our country with 85% of the population dependent.
- Ground water table decline-33 cm per year.
- Surface water-polluted
- Ground water-depleted
- Rain water-wasted

# Challenges

- 2020 India will become water stressed nation.
- 66 million Indians in 20 states are at risk due to excess of fluoride.
- 10 million due to excess of arsenic in ground water.
- Half of all Indian children are undernourished and half of all the adult women suffer from anemia.

# Challenges

- 37.7 million Indians are affected by waterborne disease annually.
- 1.5 million children are estimated to die of diarrhea alone.
- 195813 habitations in the country are affected by poor water quality.
- 161 out of approx. 600 districts in India have been declared drought.
- 50% of the sewage discharged by Municipal corporations goes untreated.



# Water Management

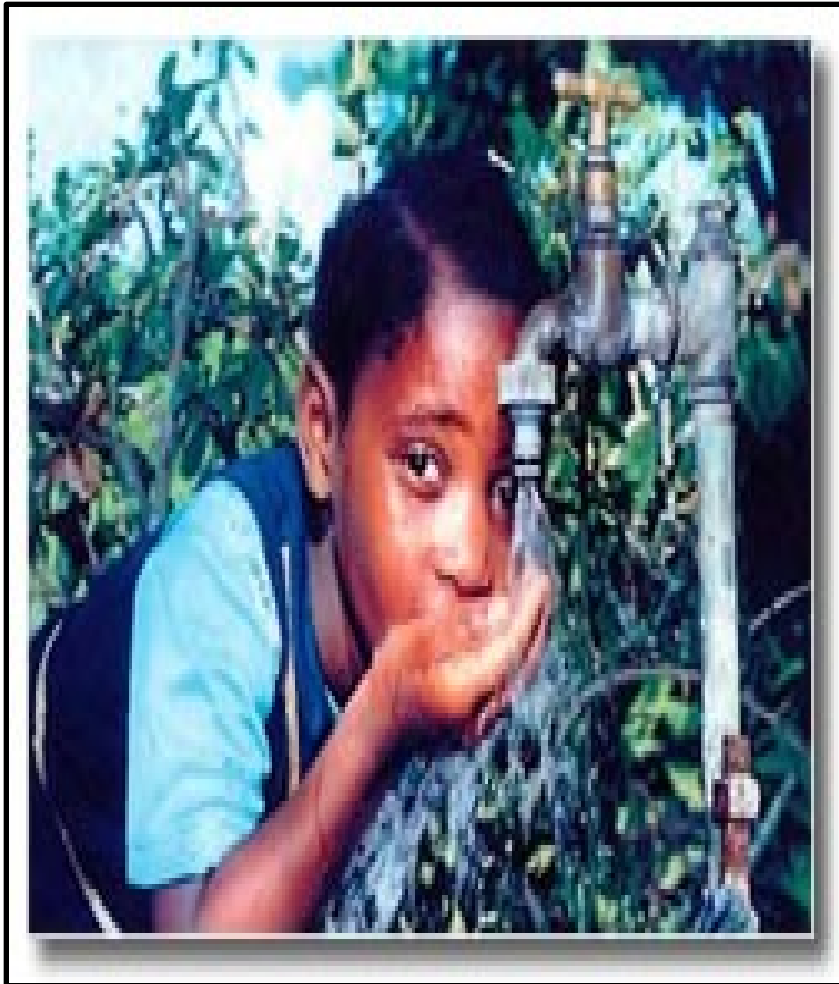
- Preventing wastage of water
- Building of dams and reservoirs.
- Diversion of water.
- Better irrigation methods.
- Increase price
- Rainwater harvesting
- Reuse & recycling of water
- Proper implementation of govt. policies.
- Rain water harvesting.

# What is Rainwater Harvesting.

- It is an effective technique of conserving water by guiding the rain water that falls on rooftops to storage tanks or underground sumps for future usage.
- Ground water recharging on the other hand is undertaken by guiding water through pipes to wells, bore wells or recharge pits to ensure recharging water in the underground aquifers, for later use ,when ever the need arises.

# RAINWATER HARVESTING

## WHY ?



- Surface water is inadequate to meet our demand and we have to depend on ground water.

# RAINWATER HARVESTING

## WHY ?



- Due to rapid urbanization, infiltration of rain water into the subsoil has decreased drastically and recharging of ground water has diminished.

# RAINWATER HARVESTING

## WHY ?



- Because water should never be wasted and allowed to flow out of any village or community facing a drinking water shortage.

# RAINWATER HARVESTING

## WHY ?



- Because it costs less to collect rainwater than to exploit groundwater.

# RAINWATER HARVESTING

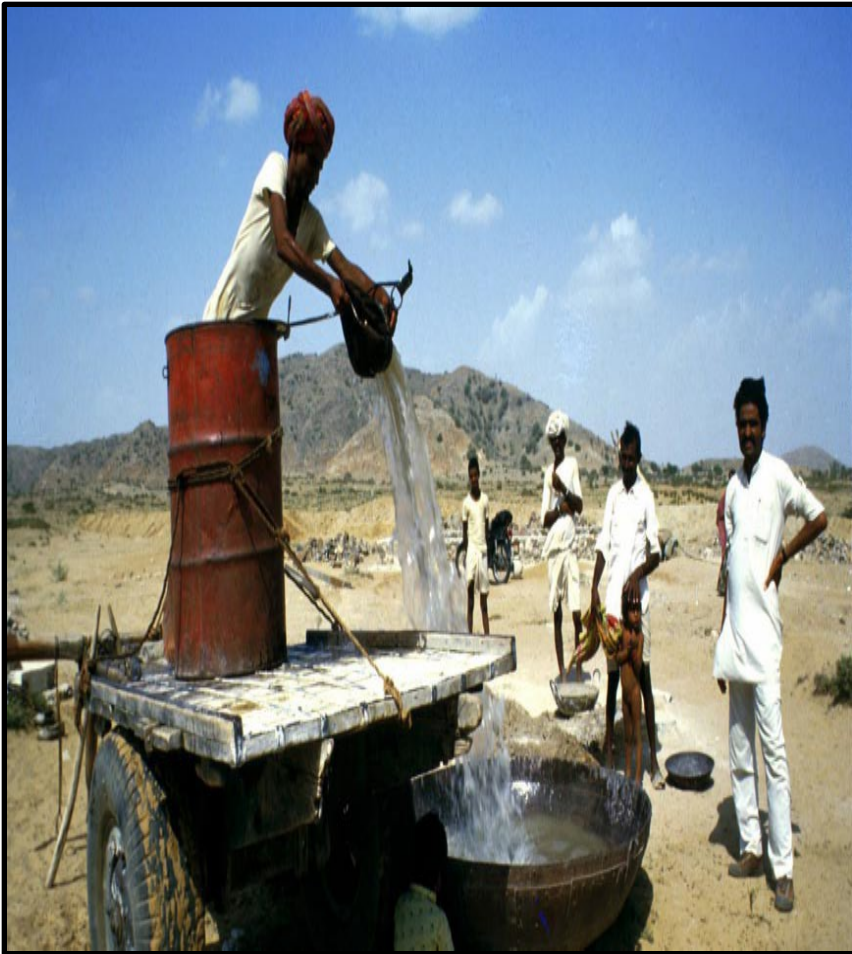
## WHY ?



- Because collecting rainwater is the only way of recharging water sources.

# RAINWATER HARVESTING

## WHY ?



- Because traditional knowledge, skills and materials can be used to collect the water and no government technical assistance is required for repair and maintenance.



# RAINWATER HARVESTING PRACTICES

- Storage of rainwater on surface for future use and structures used are:
- underground tanks
- ponds
- dams
- surface tanks etc.

- Recharge of ground water and structures used are:
- pits
- dug wells
- hand pumps
- recharge wells
- trenches etc.

# BENEFITS

- It saves water
- Improves the water table quality of water
- Reduce soil erosion
- Improves soil moisture
- Increase ground water level
- Save energy required to lift water
- Reduces flooding of roads.
- Allows drought proofing.

# A FEW SUCCESS STORIES.

- RWH in IIT, Delhi and JNU Campus has led to a rise of 0.51 to 1.00cm in ground water level
- Rashtrapati bhawan, New Delhi
- Shram Shakti Bhawan, New Delhi
- Lodhi Garden, New Delhi

# Consumerism and Waste products

# What is Consumerism

- It refers to the consumption of natural resources by men.
- Related to :
  - Increase in population size
  - Increase in our demands

# Two Types of Conditions of Population and Consumerism exists

- People over- population:

## Occurs in LDC's

- Population size is more than available resources.
- Per capita consumption of resources is low but overall consumption is high.
- Waste generation is less than or equal to MDC's

- Consumerism over- population:

## Occurs in MCD's

- Population size is less than available resources.
- Per capita consumption of resources is very high.
- Waste generation is high

# Comparison of Consumerism and Waste generation

Parameter	USA(%)	INDIA(%)
Population	4.7	16
Production of goods	21	01
Energy use	25	03
Waste generated	25	03
CFC's production	22	0.7

# Paul Ehrlich and John Hodlren equation

Number of people × Per capita use of resources  
× Waste generated per unit of resource used  
= Overall Environmental Impact



Government of India has taken various steps to solve the problem of waste generation due to high rate of consumerism one of them is

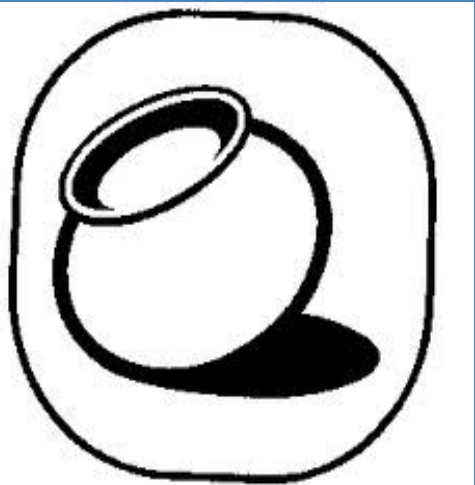
**ECOLABELLING**

# ECO LABELLING

- Eco label is an environmental claim that appears on the packaging of a product .It is awarded to manufacturer by an appropriate authority. ISO 14020 is a Guide to the award of Eco-labels. The government of India launched an Eco-mark Scheme in 1991 to increase consumer awareness in respect of environment friendly products. The aim of the scheme is to encourage the customers to purchase those products which have less harmful environmental impact.

# ECOMARK LOGO

- An earthen pot has been chosen as the logo for the Ecomark scheme in India. The familiar earthen pot uses a renewable resource like earth, does not produce hazardous waste and consumes little energy in making. Its solid and graceful form represents both strength and fragility. The logo for the Ecomark Scheme, signifies that the product which carries it does the least damage to the environment.



Environment protection Act,1986

India is the first country in the world who made the provisions for protection and conservation of environment in its constitution.

**Article 48A** –The state shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.

**Article 51A(g)** – It shall be duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creature.

# EPA, 1986

- Established on 23 May, 1986
- Implemented on 19 November, 1986
- Enacted under article 253 of the constitution
- It includes 4 Chapters and 26 sections
- Chapter 1- Preliminary (sec 1-2)
- Chapter 2 - General powers of the central government. (sec 3-6)
- Chapter 3 – Prevention, Control, and Abatement of Environmental pollution. (sec 7-17)
- Chapter 4 – Miscellaneous (sec 18- 26)

# Chapter 1- Preliminary (sec 1-2)

## Section-1

### Short title, Extent and Commencement

- This Act may be called the Environment (protection) Act, 1986.
- It extends to the whole of India.
- It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint and different dates may be appointed for different provisions of this Act and for different areas.

## Section-2

### Definitions

1. **Environment**: (Includes water, air & land and the inter-relationship which exists among and between water, air & land, & human beings, other living creatures, plants, micro-organism and property.)
2. **Environmental pollutant**: (Any solid, liquid & gaseous substance present in such concentration as may be, or tend to be, injurious to environment)
3. **Environmental pollution**: (Presence in the environment of any environmental pollutant.)
4. **Handling**
5. **Hazardous substance**
6. **Occupier** : (In relation to any factory or premises, means a person who has, control over the affairs of the factory)
7. **Prescribed** : (means prescribed by rules made under this Act.)

**Chapter 2 - General powers of the central government. (sec 3-6)**

**Section-3**

**Power of central government to take measures to protect and improve environment.**

- Following are the powers of central government
- 1. Setting standards for quality of air, water and soil for various purposes and area.
- 2. Laying down procedures and safeguards for the handling of hazardous substances.
- 3. Laying down procedures and safeguards for the prevention of accidents which may cause pollution and remedial measures for such accidents.
- 4. Inspection of any plant, equipment, machinery, materials or substances, to take steps for the prevention, control and abatement of environmental pollution.
- 5. Carrying out and sponsoring investigations and research relating to problems of env. Pollution.
- 6. Restriction of areas in which any industries, operation or processes, shall not be carried out subject to certain safeguards.



## **Chapter 2** - General powers of the central government. (sec 3-6)

### Section-4

Appointment of officers and their powers and functions.

### Section-5

Power to give directions.

### Section-6

Rules to regulate environmental pollution.

# Chapter 3 – Prevention, Control, and Abatement of Environmental pollution.( sec 7-17)

- Section-7 Persons carrying on industry operation, etc., not to allow emission or discharge or environmental pollutants in excess of the standards.
- Section-8 Persons handling hazardous substances to comply with procedural safeguards.
- Section-9 Furnishing of information to authorities and agencies in certain cases.
- Section-10 Powers of entry and inspection
- Section-11 Power to take sample and procedure to be followed in connection therewith.
- Section-12 Environmental Laboratories.
- Section-13 Government Analysts
- Section-14 Reports of government analysts
- Section-15 Penalty for contravention of the provisions of the Act and the rules, orders and directions.
- Section-16 Offences by companies
- section-17 Offences by Government departments

## Power to take sample and procedure to be followed in connection therewith.(sec-11)

- The central government or any officer empowered by it in this behalf, shall have power to take samples of air, water, soil or other substance for the purpose of analysis from any industry.
- He serve on the occupier or his agent, a notice, then and there, of his intention to have it so analyzed.
- In the presence of occupier or agent, collect a sample for analysis.
- Place the sample in a container which shall be marked and sealed and shall also be signed both by the person taking the sample and the occupier or his agent.
- Send without delay, the container to the laboratory established or recognized by the central government.

## CONTD.....

- In case where the occupier or his agent willfully absents himself or refuses to sign the marked and sealed container, then the container is signed by the person taking the sample and send without delay to the government laboratory and inform the government analyst in writing, about the willful absence of the occupier or his refusal to sign the container.

## Penalty for contravention of the provisions of the act and their rules, orders and directions. (sec-15)

- The person shall be punishable with imprisonment for a term which may be extend to five years with a fine which may extend to one lakh rupees or both, and in case of failure or contravention continues after conviction, additional 5 thousand rupees for every day should be imposed.
- If the failure continues beyond a period of one year after the date of convection, the offender shall be punishable with imprisonment for a term which may extend to seven years.

# Chapter 4 – Miscellaneous (sec18- 26)

- Section-18 Protection of action taken in good faith.
- Section-19 Cognizance of offences
- Section-20 Information, reports or returns.
- Section-21 Members, officers and employees of the authority constituted under section-13 to be public servants.
- Section-22 Bar of jurisdiction.
- Section-23 Powers to delegate.
- Section-24 Effects of other laws.
- Section-25 Power to make rules.
- Section-26 Rules made under this act to be laid before parliament.

# The legal and regulatory framework for environmental protection in India

## Legislation for environmental protection in India-

- *Water (Prevention and Control of Pollution) Act, 1974*
- *Water (Prevention and Control of Pollution) Cess Act, 1977*
- *Air (Prevention and Control of Pollution) Act, 1981*
- *The Air (Prevention and Control of Pollution) Rules formulated in 1982*
- *The Wildlife (Protection) Act, 1972, Amendment 1991*
- *The Forest (Conservation) Act, 1980*
- *Environment (Protection) Act, 1986 (EPA)*
- *The Environment (Protection) Rules, 1986*
- *The National Environment Appellate Authority Act, 1997*
- *Hazardous Wastes (Management and Handling) Rules, 1989*
- *Factories Act, 1948 and its Amendment in 1987*
- *Public Liability Insurance Act (PLIA), 1991*
- *National Environment Tribunal Act, 1995*

# WASTELAND RECLAMATION



# What is Wasteland?

- A land that is at present lying unused.
- Land, that is incapable of sustaining greenery.
- Land, that is badly eroded.
- Land that is economically unproductive and presently not in use due to various deteriorating factors.
- In India out of total land area almost half occur as wastelands
- Rajasthan being the state with maximum wasteland area.

# Types of Wasteland

## Barren land

- Sandy and stony desert, hilly or mountainous areas where no land is under cultivation, represent barren and uncultivated land.
- Conversion of these lands into cultivable lands is not easy as it involves huge expenditure to be incurred to develop the fertility on land.

## Culturable land

- It is a land that has been raising crops for some period of time but has not brought under cultivation for the last 5 years.
- The land potential is good and only marginal efforts are needed for its development. These are not being used at present due to such constraints as lack of water, salinity or alkalinity of soil, soil erosion water logging etc.

# Causes of Wasteland Formation

## Natural causes

- Volcanic eruptions
- Storms
- Earthquakes
- Floods
- Salinity
- Snow covering etc

## Human causes

- Mining
- Bad agricultural practices
- Deforestation
- Overgrazing
- Deposition of solid waste and chemical wastes etc

# Wasteland Reclamation

- Afforestation and Reforestation
- Changing agricultural practices
- Development of industries and residential areas on wasteland

# Erosion Affected Areas

# Generally, the cause of erosion may be wind and water flow. In both the cases, the requirement is to bind the soil to ground. For the same following methods may be adopted:

- Counter ploughing
- Strip farming
- Terrance farming
- Mulching

# Providing Ground Cover

# Salinity Affected Areas

- Salinity is a important land degradation problem.
- One way to prevent excess of salination is the use of humic acid.
- A type of plant that is of particular interest is saltbush, which is able to tolerate saline condition and draw salt up.
- The salt deposited on earth's surface are removed by scrapers.

# Salinity Affected Areas

- The extra salt in soil are removed by using excess water which pushes the excess of salt downward.
- Underground horizontal drainage technique is applied which consist of under lying porous pipes that pick up salt water and drain the same to the outside.
- Application of green manure of plants like ***sesbania sps*** and ***sun hemp*** have reported to improve salt affected soils.
- High salt tolerant crops like barley, sugar beet etc show good results in terms of yield in salt containing soils.

# Acidity Affected Areas

- Acidic soil have pH less than 5 due to high rainfall which leaches more soluble bases ( $\text{Ca}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ).
- It can be cured by addition of lime, limestone etc.



# Alkalinity affected areas

- Addition of gypsum
- It absorbs free Sodium and form neutral salt sodium sulphate

