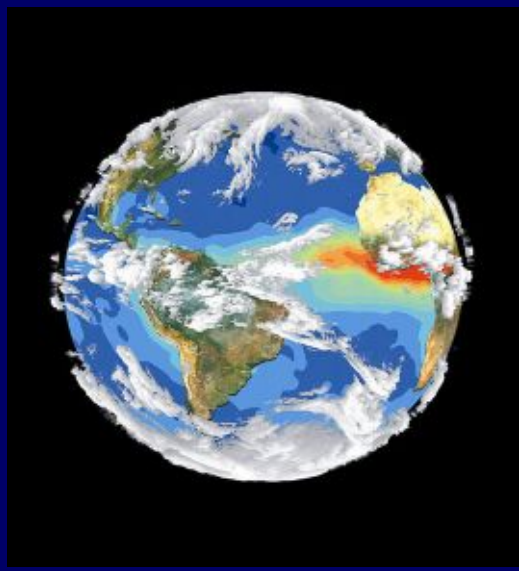
Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

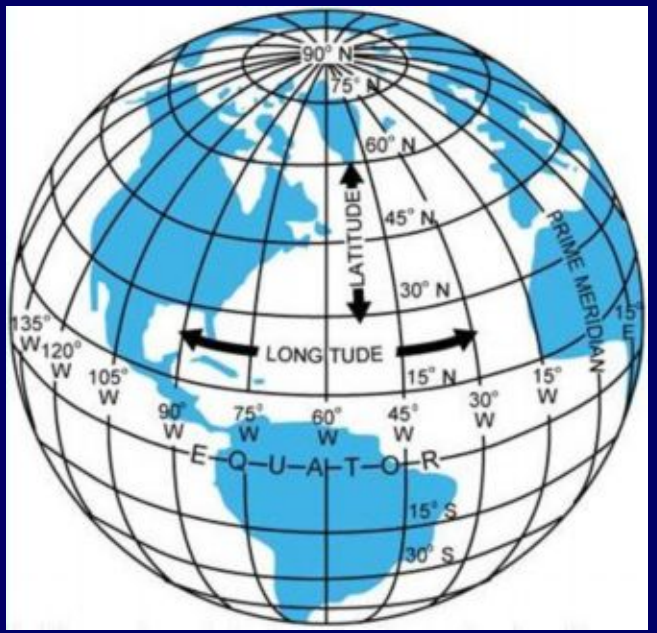
Introduction

- Climate is the pattern of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables in a given region over long periods.
- Climate can be contrasted to weather, which is the present condition of these variables over shorter periods.
- Weather change quickly from hour to hour, day to day, season to season and year to year at a given location or region, even within an unchanging climate.



Climatic Controls

- There are six major controls of the climate of any place. They are:
  - Latitude
  - Altitude
  - Pressure and wind system
  - Distance from the sea
  - Ocean currents
  - Relief features
- Relief plays a major and important role in determining the climate of the place, neither a high mountains nor the deep sea.



Climate change

- Climate change is a significant change in the distribution of weather patterns over periods ranging from decades to millions of years.
- It may be a change in average weather conditions, or in the distribution of weather around the average conditions.
- Climate change is caused by factors that include **oceanic processes** (such as oceanic circulation), **biotic processes**, variations in solar radiation received by Earth, plate tectonics and volcanic eruptions, and human-induced alterations of the natural world.
- "climate change" is often used to describe human-specific impacts.

Plate Tectonics

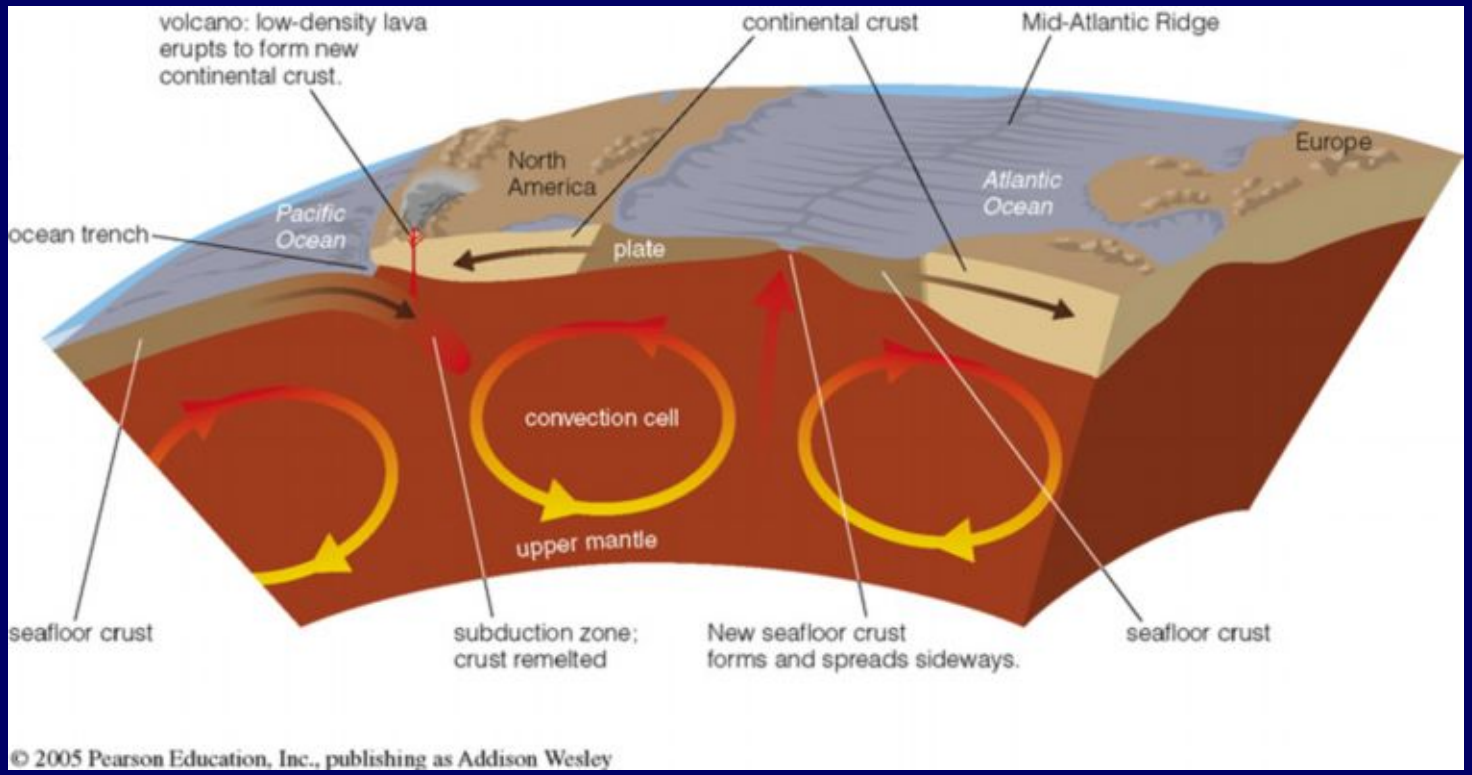


Plate tectonics helps to carry the carbonate rocks into the mantle, which are then released again by volcanic activities.

- Earth's lithosphere is broken into pieces (the plates).
- These plates float on top of the mantle, interacting with each other to produce the geological features we see and feel today.

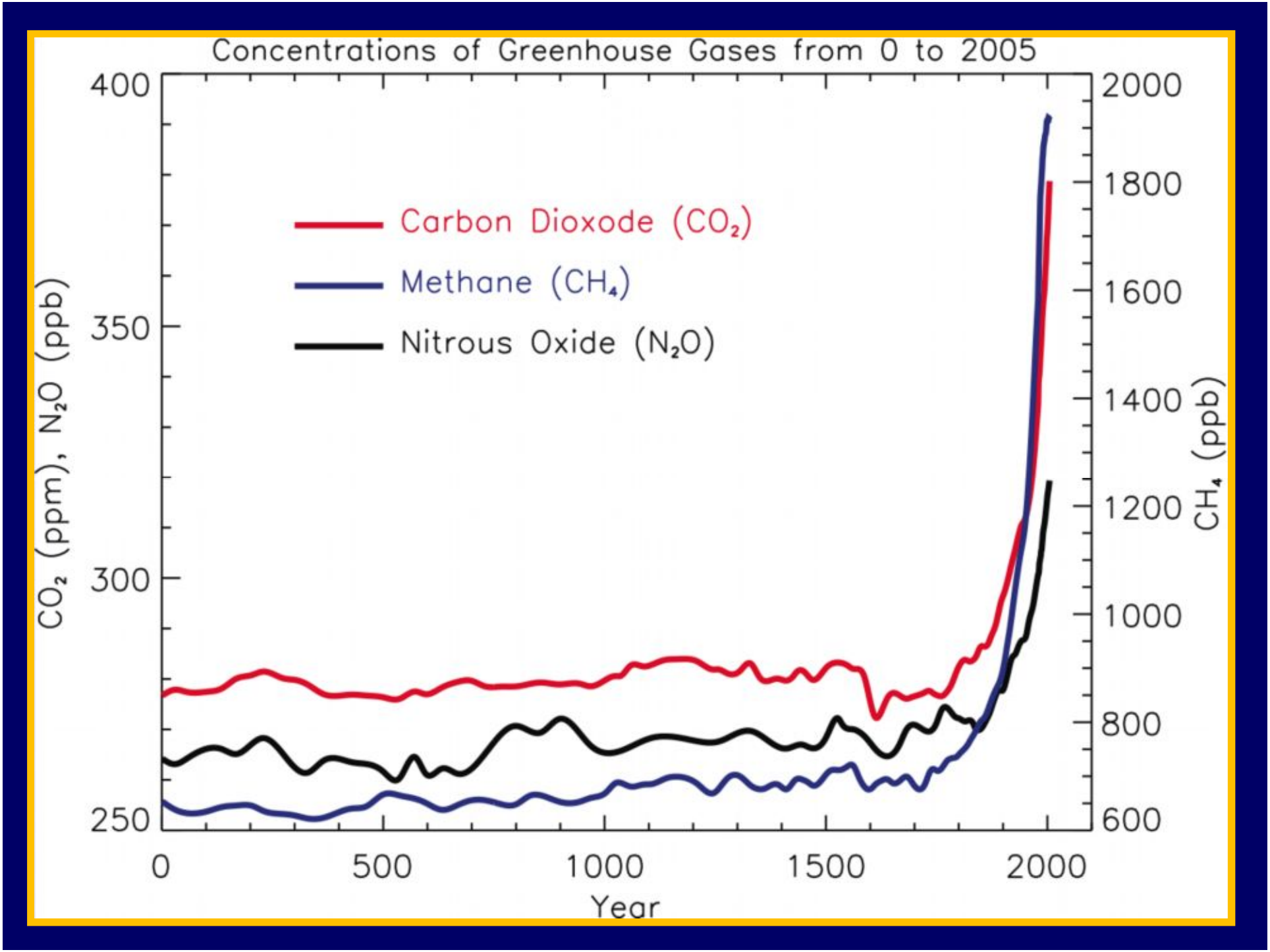
Global warming

Human Activities

Emission Sources

- **Carbon Dioxide**
  - Fossil fuel combustion
- **Methane**
  - Fossil fuels
  - Landfills, agriculture
- **Nitrous Oxide**
  - Agriculture, cars
- **Hydrofluorocarbons**
  - Refrigerants, solvents

- **Transportation** — 41%
- **Industrial** — 23%
- **Electric Power** — 20%
- **Ag & Forestry** — 8%
- **Others** — 8%


Concentrations of Greenhouse Gases from 0 to 2005
Carbon Dioxode (CO_2)
Methane (CH_4)
Nitrous Oxide (N_2O)
CO_2 (ppm), N_2O (ppb)
CH_4 (ppb)
400
350
300
250
2000
1800
1600
1400
1200
1000
800
600
0
500
1000
1500
2000
Year

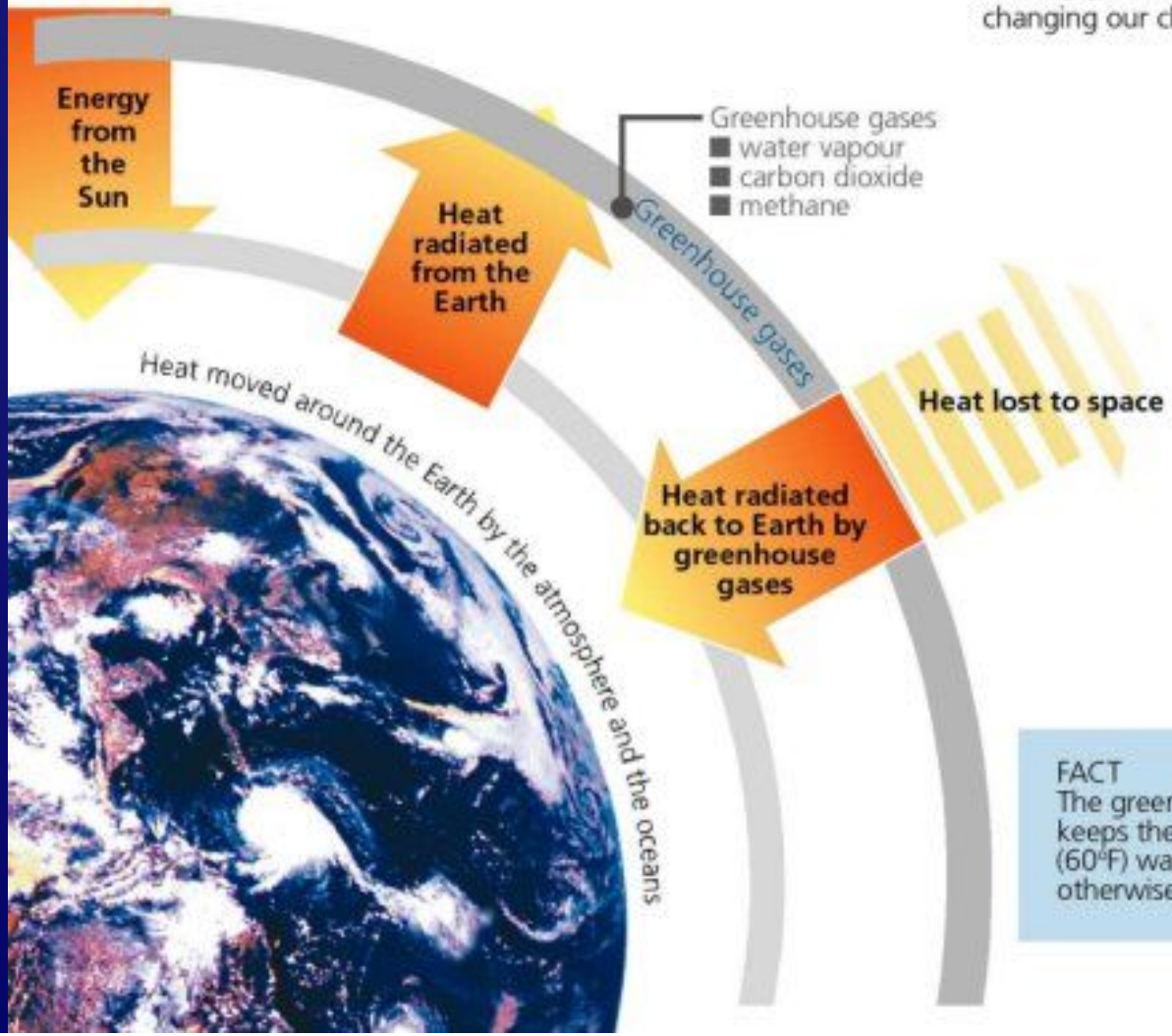
Green House Effect

- The greenhouse effect is a naturally occurring process that aids in heating the Earth's surface and atmosphere.
- It results from the fact that certain atmospheric gases, such as carbon dioxide, *water vapor*, and methane, are able to change the energy balance of the planet by absorbing longwave radiation emitted from the Earth's surface.
- Without the greenhouse effect life on this planet would probably not exist as the average temperature of the Earth would be a chilly -18° Celsius, rather than the present 15° Celsius.

The Greenhouse Effect

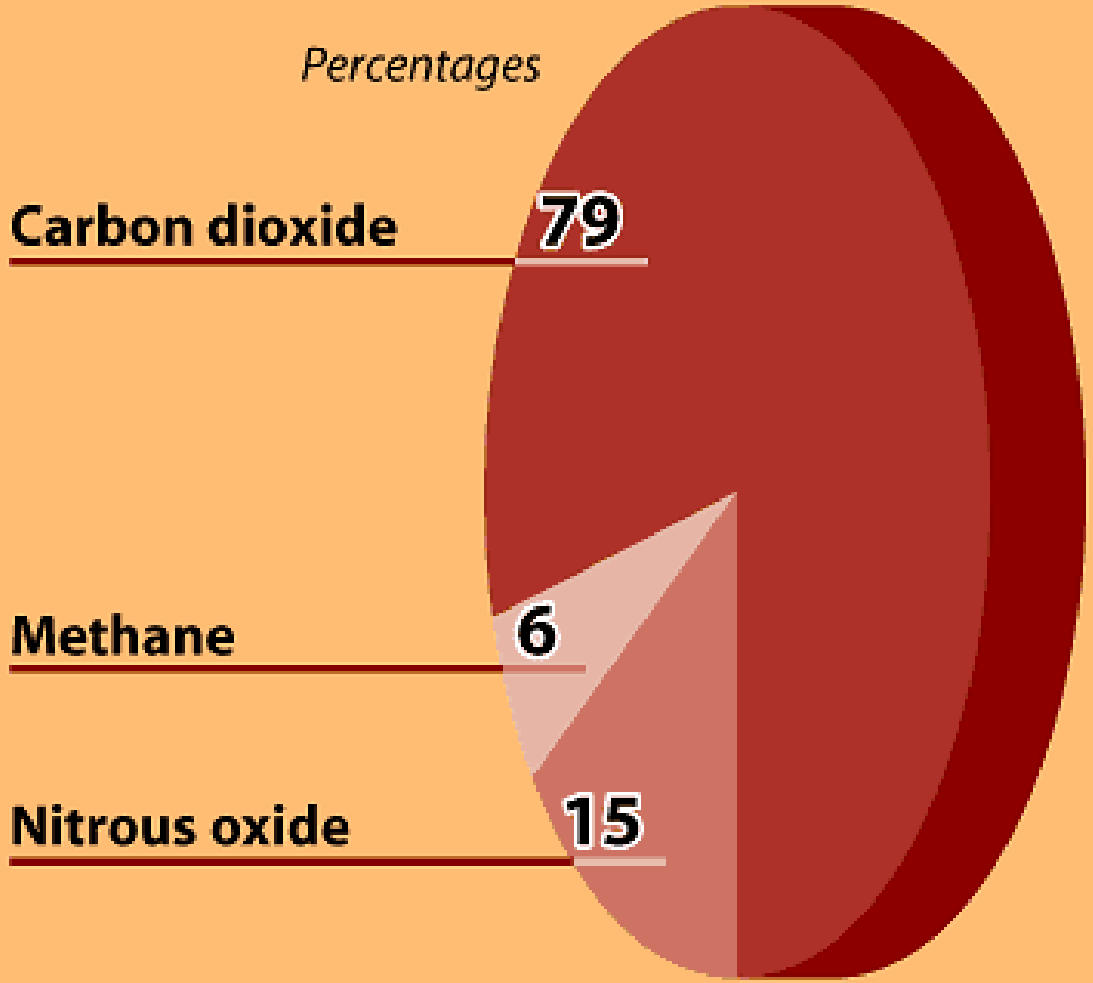
...it's a good thing as long as we don't add to it

Burning fossil fuels pollutes our atmosphere, increasing the greenhouse effect, causing global warming and changing our climate.



FACT
The greenhouse effect keeps the Earth 33°C (60°F) warmer than it otherwise would be.

Contribution of greenhouse gases to global warming, 1980-1990



Agricultural activities are responsible for large-scale emissions of greenhouse gases. Tropical land use (mainly deforestation) contributes some 25 percent of carbon dioxide. Fertilizer use is one of the main humanmade sources of nitrous oxides.

Source: Food and Agriculture Organization of the United Nations (FAO), 1997

Emission Sources

- **Carbon Dioxide**
  - Fossil fuel combustion
- **Methane**
  - Fossil fuels
  - Landfills, agriculture
- **Nitrous Oxide**
  - Agriculture, cars
- **Hydrofluorocarbons**
  - Refrigerants, solvents

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- **Others** — 8%

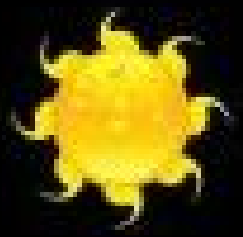
Climate change

- Climate is average weather of an area
- Control temperature, evaporation rate, seasons, moisture content.
- Conditions if prevail for 30 years...its said to be the climate of an area
- Currently Climate is Changing

Climate change Evidence

- Intergovernmental Panel On Climate Change.
- Published evidence of climate change
- Observed that earth's climate has changed over years.
- Average temperatures have fluctuated by 0.5 to 1 ^{0} C.
- Anthropogenic activities are affecting climate
- Its not uniform in all places. Poles will be more warmer

Potential Climate Change Risks



Temperature increase as much as 3°C by 2070

A drop in average rainfall of 20%-40% by 2070

Sea level increase in conjunction with storm events

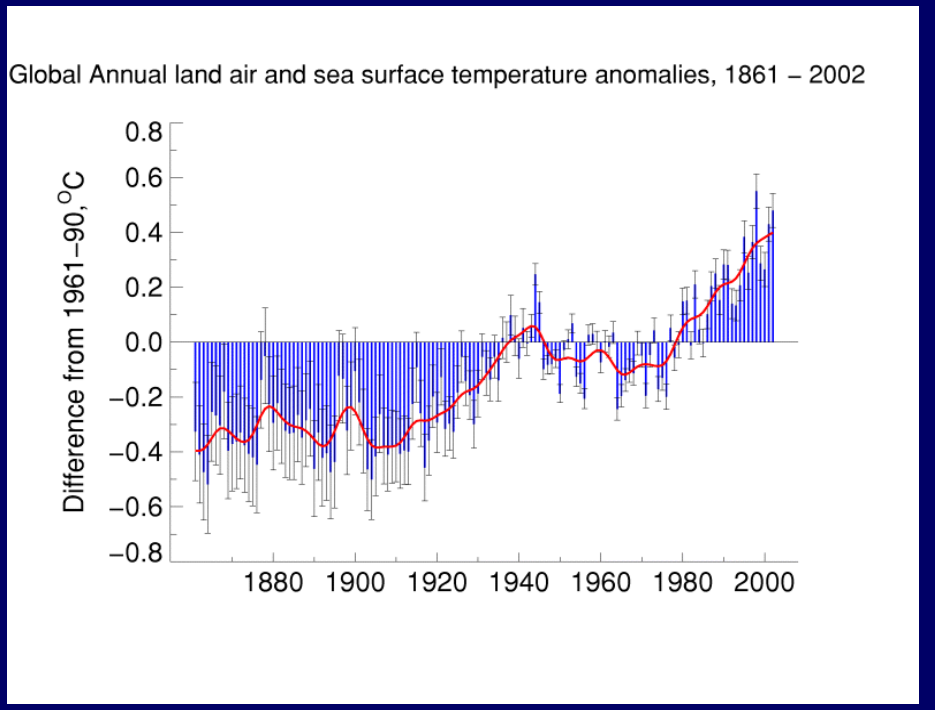
Increase in frequency and severity of storm events in the region

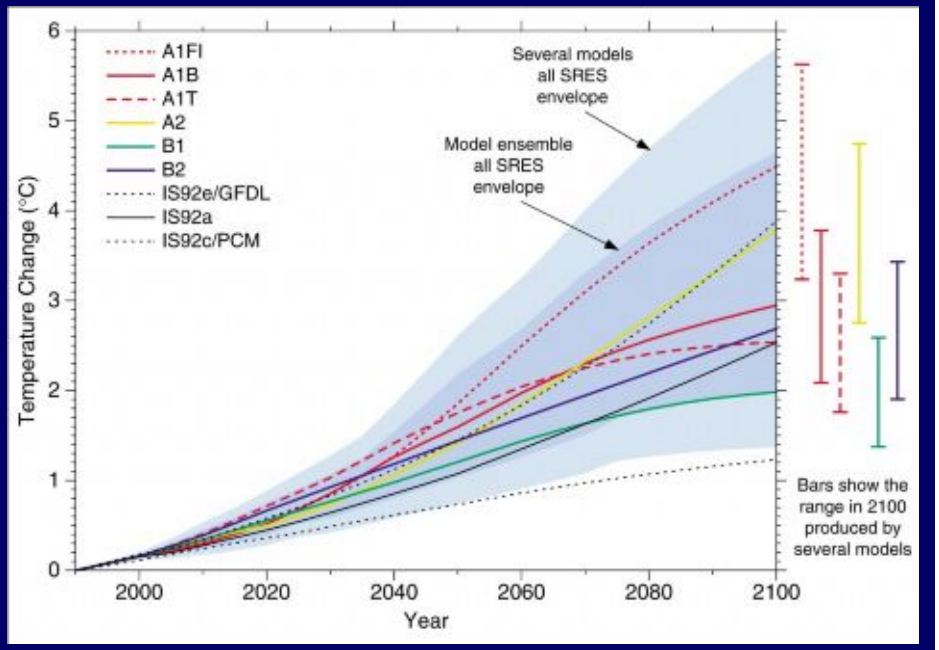
Global warming

- Over the 20th Century, the global average Surface Temperature has increased by 0.6 ± 0.2°C (IPCC, 2001)

  (Where most of the warming has occurred between 1976 and 2000)

- Further it is projected to increase by 1.4 to 5.8 °C over the period of 1990 - 2100.





GLOBAL WARMING

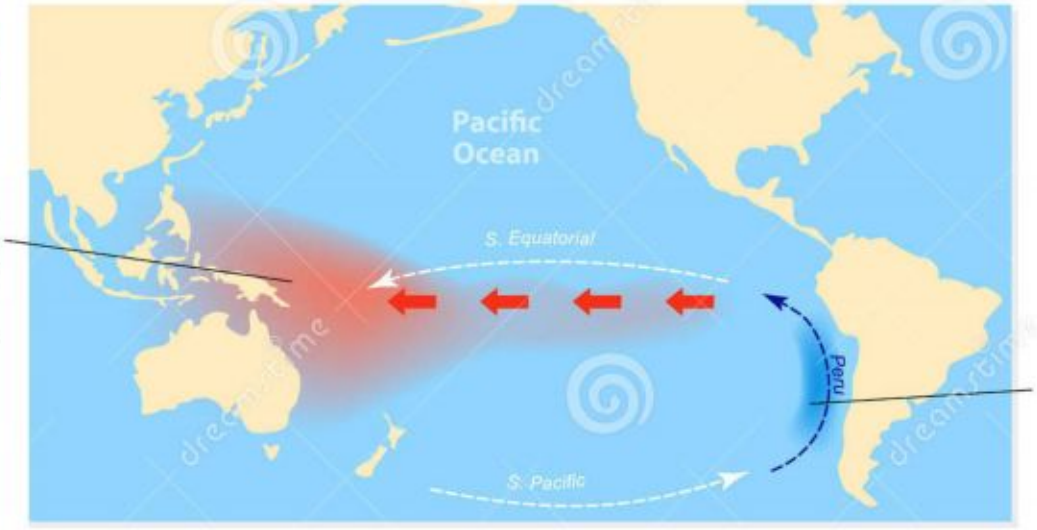
- Overall increase in temperature by a few degrees.
- It happens when greenhouse gases (carbon dioxide, water vapor, nitrous oxide, and methane) trap heat and light from the sun in the earth's atmosphere, which increases the temperature.
- This hurts many people, animals, and plants.
- Many cannot take the change, so they die.

Effects

- Change in Wind current patterns
- Ocean currents will change
- Hydrological cycle will intensify
- Sea level rise: submergence of areas.
- Changed agricultural production
- Cases of flood, droughts, cyclones on a rise.

THE EL NIÑO PHENOMENON

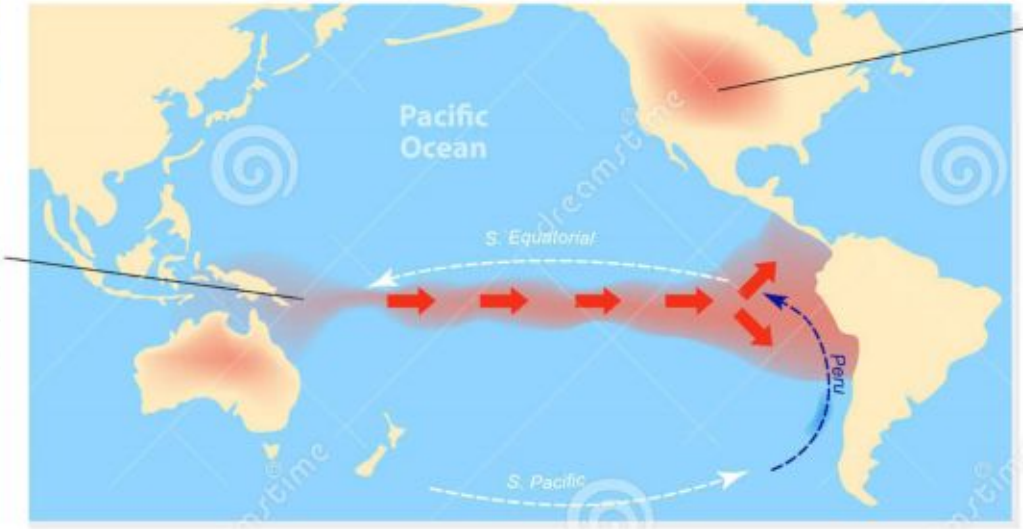
NORMAL YEAR



Equatorial winds gather warm water pool toward the west.

Cold water along South American coast.

EL NIÑO YEAR



Warmer winter

Easterly winds weaken. Warm water to move eastward.

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Climate Change Indicators

- **Average temperature changes**
  - Earth's temperature increased by 1.5ºF during the 20th century
  - 10 warmest years of the last century all occurred with the last 15 years
  - 2001, 2002 and 2003 were three of the hottest years ever recorded
- **Rising sea level** – 7 inches in California since 1850
- **Shrinking snow pack** – Spring runoff decreased by 10%
- **Glacial retreat**

Threatened deltas

Relative vulnerability of coastal deltas as indicated by the indicative population potentially displaced by current sea-level trends to 2050 (Extreme ≥ 1 million; high 1 million to 50,000; medium 50,000 to 5,000)

WMO

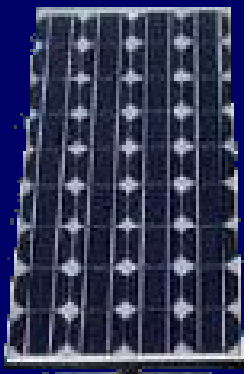
UNEP

Solutions

- Renewable energy
- Biofuels
- Afforestation
- Reduce the current rate of CFCs use
- Trap methane for fuel
- Potential of algae in Carbon dioxide utilization
- Sustainable agriculture

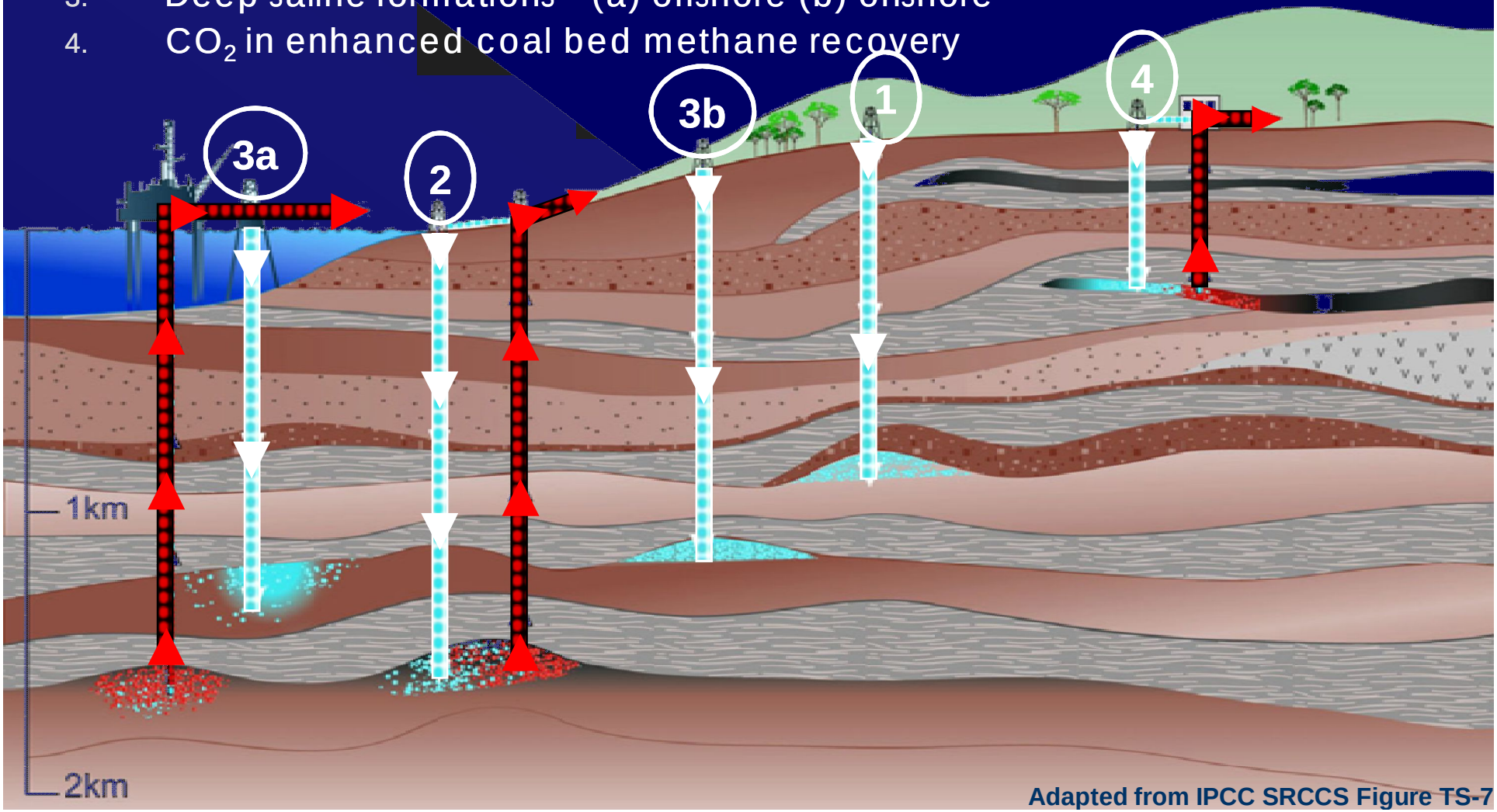
Mitigation of Global Warming

- Conservation
  - Reduce energy needs
  - Recycling
- Alternate energy sources
  - Nuclear
  - Wind
  - Geothermal
  - Hydroelectric
  - Solar
  - Fusion?



Storage of CO_2 in Geological Formations

1. Depleted oil and gas reservoirs
2. CO_2 in enhanced oil and gas recovery
3. Deep saline formations – (a) offshore (b) onshore
4. CO_2 in enhanced coal bed methane recovery



Adapted from IPCC SRCCS Figure TS-7

Could your house "go green"?

Yes, it is possible. Houses have already gone to solar power. They put solar panels on their roof to collect sunlight and have batteries in their basement to store the reserve power. Some have even put up solar panels in their yards.

Solar lantern

Each solar lantern:

- Saves about 40-60 litres of kerosene per year
- Mitigates 145 kg CO_2 emissions per year

Alternately:

- Saves about 182.5 kWhr of electricity per year
- Mitigates 157 kg CO2 emissions per year

Reduction of Plastics Products

The Kyoto Protocol - background

1992: UN Framework Convention on Climate Change http://unfccc.int/

- recognized there is a problem: CO_2 emissions are warming the planet

- stabilize CO_2 at "at a level that would prevent *dangerous* anthropogenic (human induced) interference with the climate system. "

  goals: 1) ensure that ecosystems can adapt to climate change
  2) make sure that food production not threatened
  3) allow sustainable economic development

- requires precise and regularly updated inventories of greenhouse gas emissions from industrialized countries

-"Parties to the Convention " agree to develop national programs to slow climate change; meet at "Conference of Parties" (COP's); where binding international treaties (i.e. Kyoto) can be made

- establishes a "framework" document -- something to be amended or augmented over time

The Kyoto Protocol - background

1992: UN Framework Convention on Climate Change http://unfccc.int/

- places the heaviest burden for fighting climate change on industrialized natio
  Annex 1: industrialized economies and economies in transition
  Annex 2: the richest Annex 1 countries
  (aka the Organization for Economic Cooperation and Development (O

- general target: collectively reduce emissions to 1990 levels by 2000
  (but no mechanisms, enforcement proposed)

- support developing countries' climate change activities (granting body)

- developing countries ' emissions will grow before they shrink

- developing countries will have largest climate change impacts; work to mitiga

The Kyoto Protocol

Dec 1-11, 1997: representatives from 160 countries agreed to enter into binding limits on emissions of greenhouse gases

TARGETS:

Total: reduce developed nation emissions to 5% below 1990 levels during "commitment period" 2008-2012
(most countries need -18% reduction in BAU by 2008)

37 industrialized nations and the EU subject to binding emissions targets

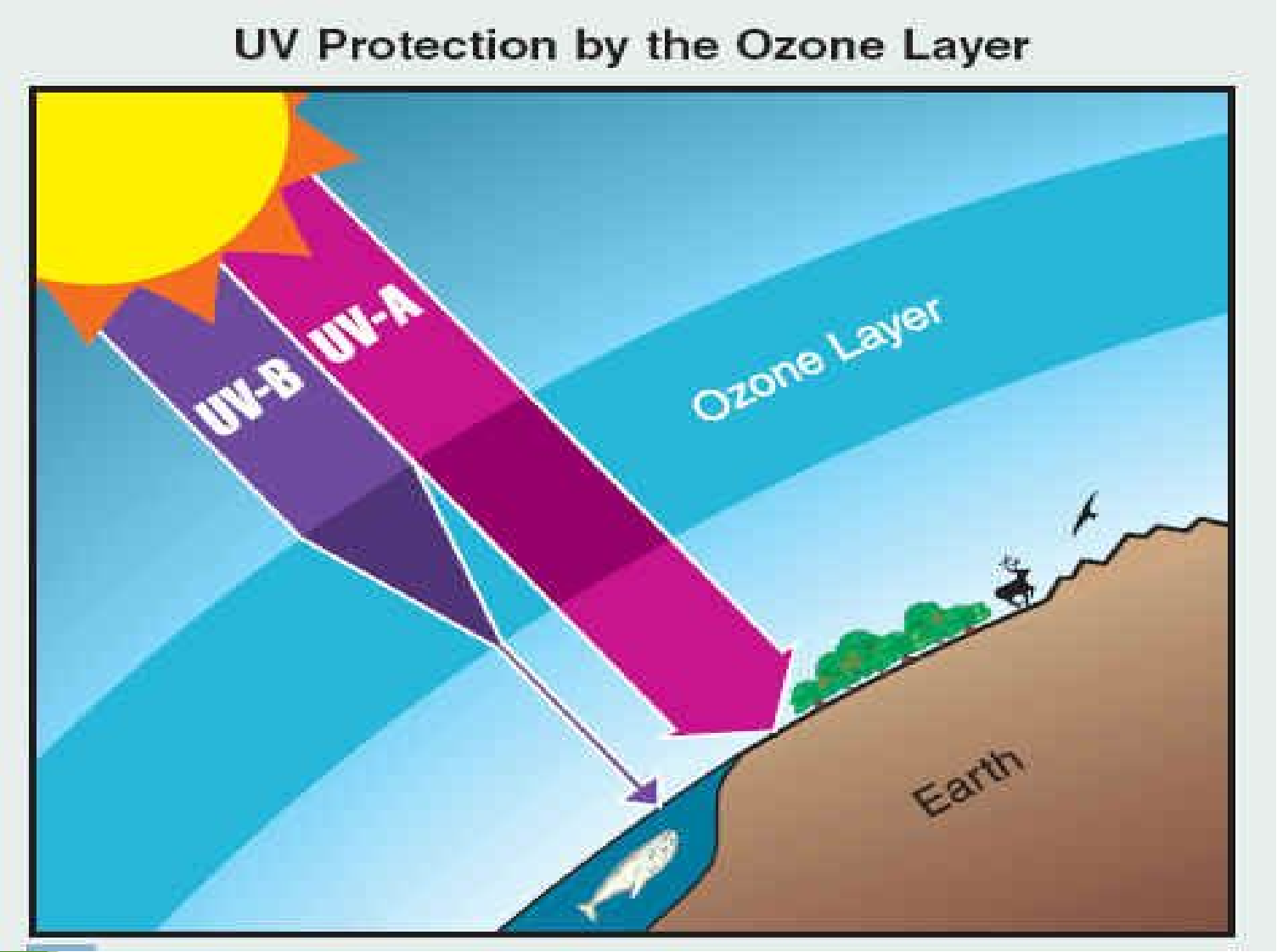
Greenhouse gases: CO2, CH4, N2O, HFCs, PFCs, and SF6

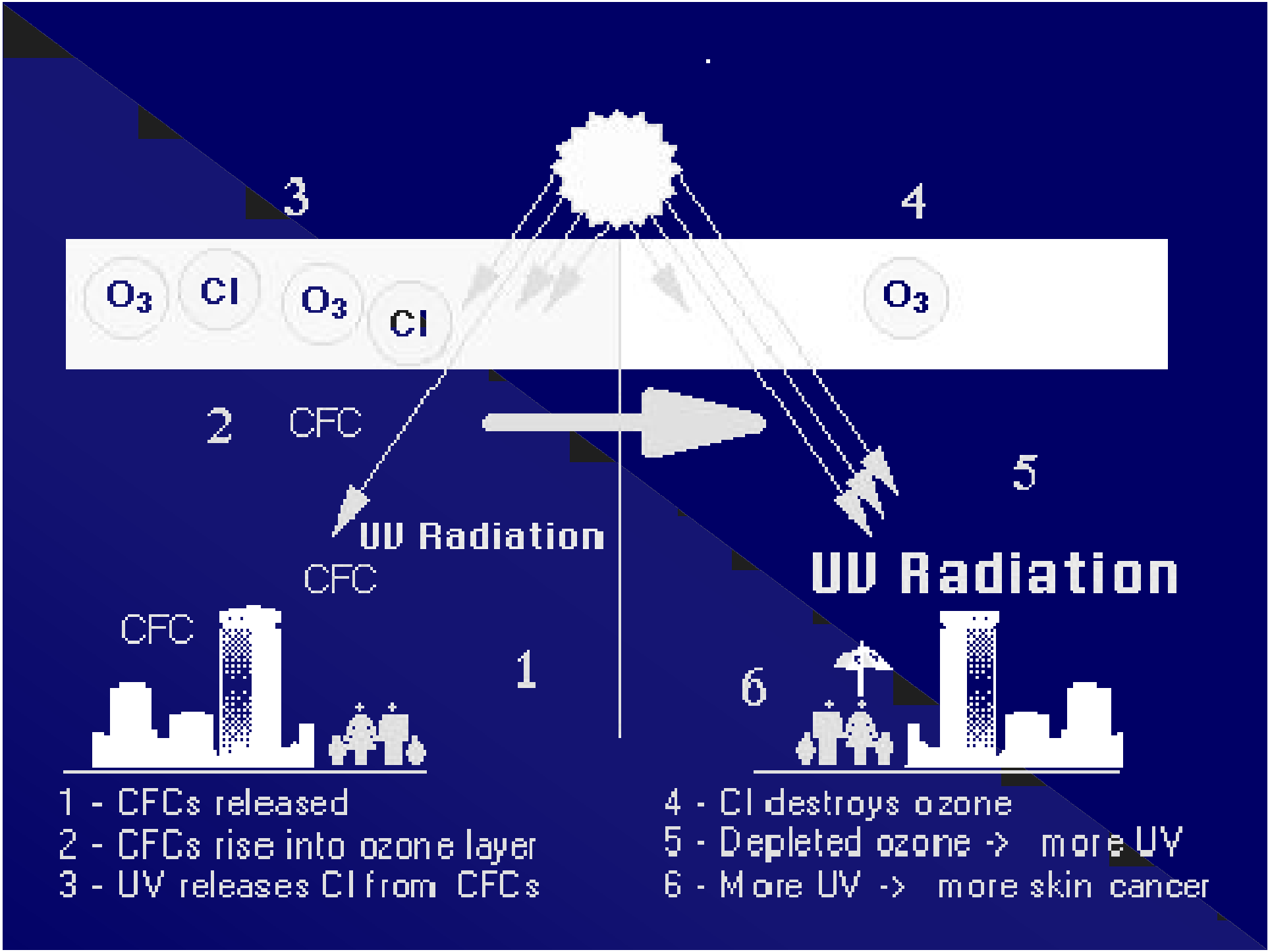
PENALTY:

Non-compliant countries will have to reduce emissions by 1.3 units for every unit of emissions "overshoot" in subsequent commitment period.

Ex: if your emissions target is 7Gtons per year by 2012, and you end up at 10Gtons/yr, in the next commitment period (2013-2020) you will have to reduce by 4Gtons/yr (in addition to any new targets) to be

Natural sunscreen: Ozone layer




3
4
O_3
Cl
O_3
Cl
O_3
2
CFC
5
UV Radiation
CFC
UV Radiation
CFC
1
6
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

- The production and emission of CFCs, chlorofluorocarbons, is by far the leading cause.
- CFCs in the stratosphere. There, the chlorine atom is removed from the CFC and attracts one of the three oxygen atoms in the ozone molecule. The process continues, and a single chlorine atom can destroy over 100,000 molecules of ozone.
- In 1984, ozone layer hole was discovered over Antarctica

HAZARDS OF OZONE DEPLETION

- **Human - Skin cancer & premature aging, cataracts, and weakened immune systems**
- **Plants developmental processes of plants are affected which reduce crop yield.**
- **Marine Ecosystems - affect both orientation mechanisms and motility in phytoplankton.**
- **Change the atmospheric life times of gases such as methane**
- **Production of particulates as cloud condensation nuclei from the oxidation and subsequent nucleation of sulphur**
- **Increased level of solar UV radiation produce adverse effects on synthetic polymers, naturally occurring biopolymers and other materials of commercial interest**
- **Global warming**

Main uses of ODS

Refrigerants (gases)

Fire extinguishers

Fumigants, pesticides

Foam-blowing agents

Cleaning solvents

Aerosol propellants

Air-conditioning systems (and components)

Refrigerators/freezers

Compressors

Vehicles (mobile air-conditioning systems)

Insulating boards/pipe covers

Metered-dose inhalers (medical inhalers

- MONTREAL PROTOCOL
- Phase out the use of CFC's
- Increase risk of Skin cancer
- Loss of phytoplankton: they are sensitive to UV.
- Fair people at higher risk

The Montreal Protocol

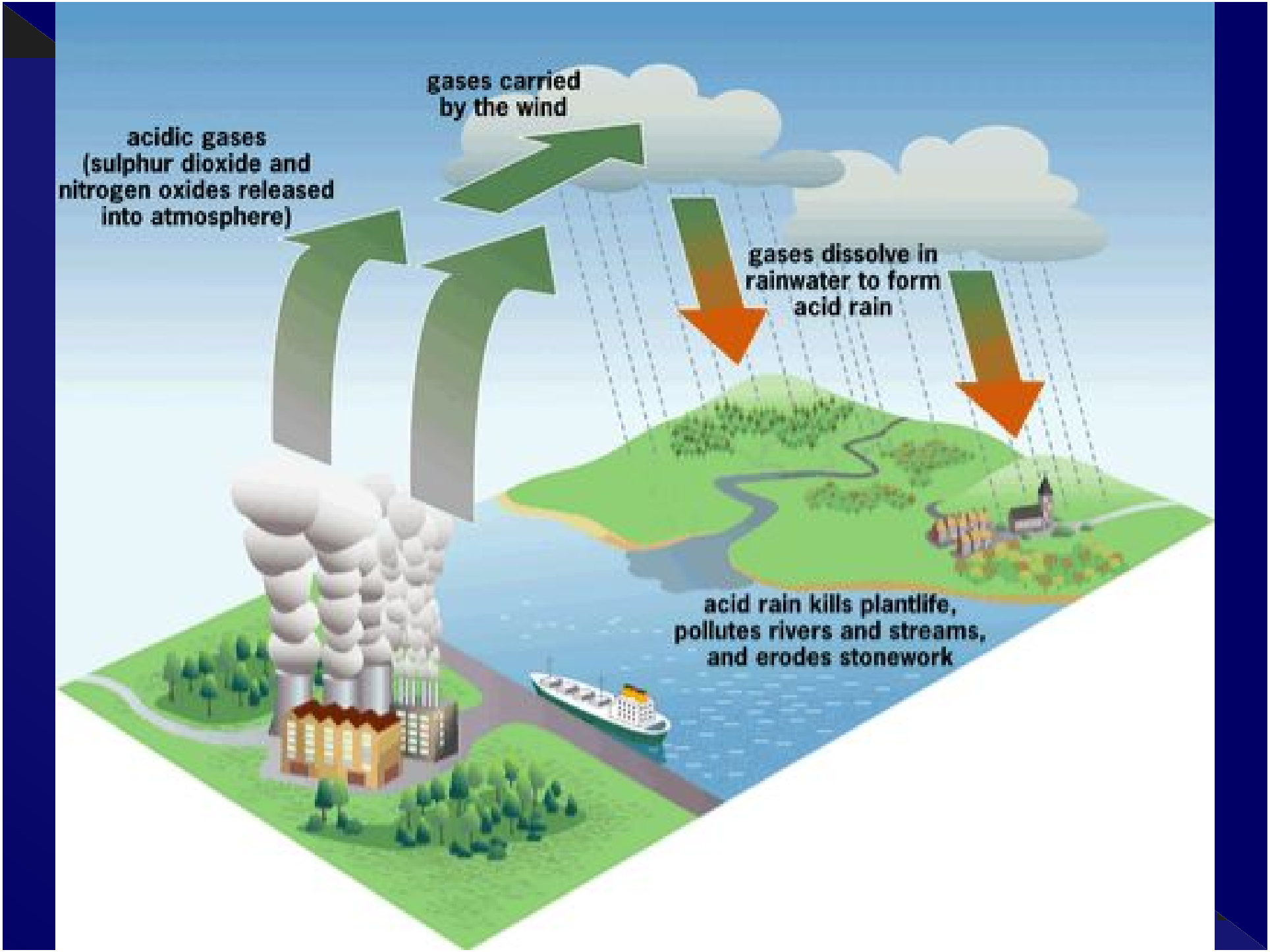
- The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion.
- The treaty was opened for signature on September 16, 1987, and entered into force on January 1, 1989, followed by a first meeting in Helsinki, May 1989. Since then, it has undergone seven revisions, in 1990 London, 1991 Nairobi, 1992 Copenhagen, 1993 Bangkok, 1995 Vienna, 1997 Montreal, and 1999 Beijing.
- It is believed that if the international agreement is adhered to, the ozone layer is expected to recover by 2050.
- Developed and developing countries have different phase out schedules .

Phase-out Schedule for INDIA as per Montreal Protocol

Ozone-depleting substance	Total Phase-out by
CFCs	2010
Halons	2010
HBFCs	1996
CTC	2010
Methyl Chloroform	2015
Methyl Bromide	2015
HCFCs	2040

ACID RAIN

- Rainwater typically has a below pH value of 5.6, due to the presence of dissolved carbon dioxide (forming carbonic acid).
- Acid rain results from the emission into the atmosphere of various pollutant gases, in particular sulphur dioxide and various oxides of nitrogen, which originate from the burning of fossil fuels and from car exhaust fumes, respectively.
- These gases dissolve in atmospheric water to form sulphuric and nitric acids in rain, snow, or hail (wet deposition). Alternatively, the pollutants are deposited as gases or minute particles (dry deposition).
- Both types of acid deposition affect plant growth – by damaging the leaves and impairing photosynthesis and by increasing the acidity of the soil, which results in the leaching of essential nutrients.


gases carried
by the wind
acidic gases
(sulphur dioxide and
nitrogen oxides released
into atmosphere)
gases dissolve in
rainwater to form
acid rain
acid rain kills plantlife,
pollutes rivers and streams,
and erodes stonework

- "Acid rain" is a broad term referring to a mixture of wet and dry deposition (deposited material) from the atmosphere containing higher than normal amounts of nitric and sulfuric acids.
- Acid rain occurs when these gases react in the atmosphere with water, oxygen, and other chemicals to form various acidic compounds. The result is a mild solution of sulfuric acid and nitric acid.
- When sulfur dioxide and nitrogen oxides are released from power plants and other sources, prevailing winds blow these compounds across state and national borders, sometimes over hundreds of miles. pH less than 5.6

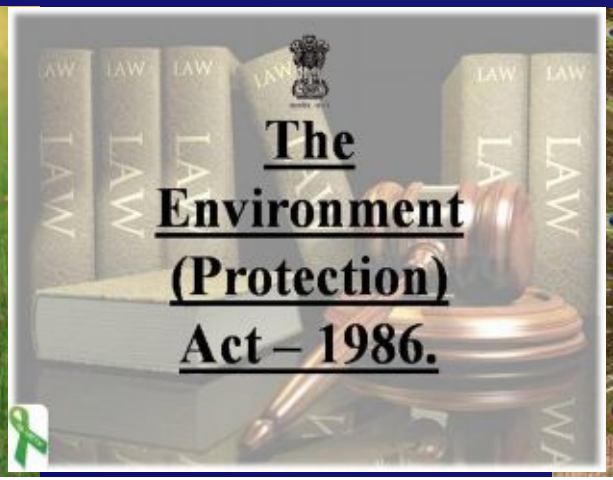
- If The acid chemicals in the air are blown into areas where the weather is wet, the acids can fall to the ground in the form of rain, snow, fog, or mist.
- As this acidic water flows over and through the ground, it affects a variety of plants and animals.
- The strength of the effects depends on several factors, including how acidic the water is.
- In areas where the weather is dry, the acid chemicals may become incorporated into dust or smoke and fall to the ground through dry deposition, sticking to the ground, buildings, homes, cars, and trees.
- Taj Mahal in Agra

ENVIRONMENTAL LEGISLATION

- India first country to have made provisions for environment protection in its constitution
- After Stockholm Conference , 1972, Many laws and rules have been made
- Article 48- A : *The state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country.*
- Article 51 A (g): - *It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compasion for living creatures*

Environmental Legislation

- The Environment (Protection) Act 1986
- The Air (Prevention and Control of Air Pollution) Act, 1981
- The Water (Prevention and Control) Act, 1974
- The Wildlife (Protection) Act, 1972
- The Forest (Conservation) Act, 1980



ENVIORNMENT PROTECTION ACT

(passed in March 1986 and came into force on 19 Nov. 1986)

- The Constitution of India clearly states that it is the duty of the state to 'protect and improve the environment and to safeguard the forests and wildlife of the country'. The Department of Environment was established in India in 1980.This later became the Ministry of Environment and Forests in 1985
- The EPA (Environment Protection Act), 1986 came into force soon after the Bhopal Gas Tragedy and is considered an umbrella legislation as it fills many gaps in the existing laws. Thereafter a large number of laws came into existence as the problems began arising, or example, Handling and Management of Hazardous Waste Rules in 1989.

SCHEME OF THE ACT

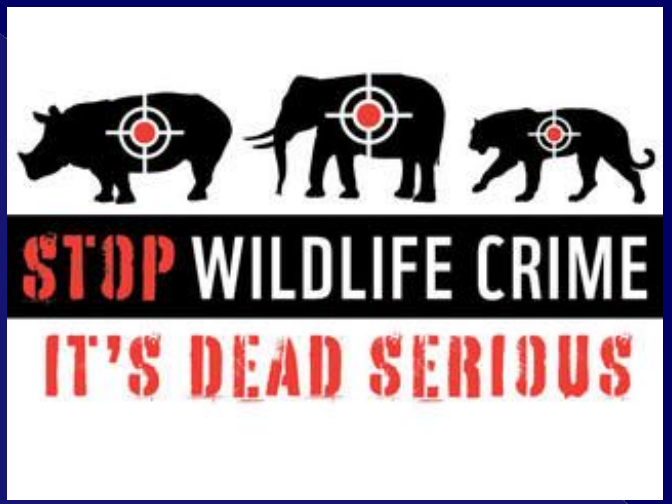
- The Environment (Protection) Act, 1986 has 26 Sections and it has been divided into four chapters relating to
- i) Preliminary,
- ii) General Powers of the Central Government,
- iii) Prevention, Control, and Abatement of Environmental Pollution,
- iv) Miscellaneous.

PENALTIES

- One of the objectives of EPA is to provide for deterrent punishment to those who endanger human environment, safety and health.
- Sec 15 of the EPA provides that any person who fails to comply or contravenes any of the provisions of the Act, or the rules made or orders or directions issued under the act or rules, then for such failure or contravention, he shall be punishable:-
- a) With imprisonment for a term which may extend to 5 years,
- b) With fine which may extend to one lakh rupees,
- c) With both.
- In case the failure or contravention continues after the conviction for first failure or contravention, an additional fine which may extend to five thousand for every day can be imposed for a period during which failure or contravention continues.
- If the failure or contravention continues beyond a period of one year after conviction, the offender shall be punishable with imprisonment for a term which may extend to seven years.

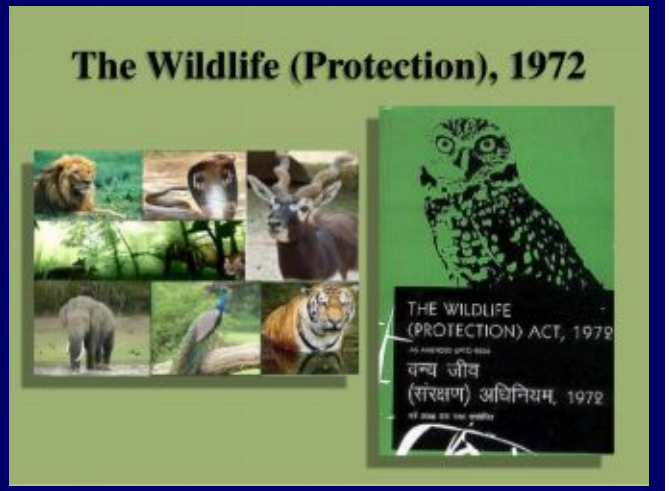
The Wildlife Protection Act (1972)

- The Wildlife Protection Act, 1972 is an Act of the Parliament of India enacted for protection of plants and animal species.
- the Act established schedules of protected plant and animal species - hunting or harvesting these species was largely outlawed.
- It extends to the whole of India, except the State of Jammu and Kashmir which has its own wildlife act.
- It has six schedules which give varying degrees of protection



The Wildlife Protection Act (1972)

- Schedule I and part II of Schedule II provide absolute protection - offences under these are prescribed the highest penalties.
- Species listed in Schedule III and Schedule IV are also protected, but the penalties are much lower.
- Schedule V includes the animals which may be hunted. The plants in Schedule VI are prohibited from cultivation and planting.
- Up to April 2010 there have been 16 convictions under this act relating to the death of tigers.



Wild Animals of India

The **Forest Conservation Act 1980**

- The **Forest Conservation Act 1980** was enacted to help conserve the country's forests.
- It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government.
- The Act lays down the pre-requisites for the diversion of forest land for non-forest purposes.
- It extends to the whole of India except the State of Jammu and Kashmir.
- Based on the Section 2, offender shall be punishable with simple imprisonment for a period which may extend to fifteen days.

Air: Prevention and Control of Pollution Act 1981

- Aims and objectives:

1. Prevention, control of air pollution
2. Maintaining the quality of air
3. Establishing of the Boards to prevent and to control the air pollution

Water: Prevention and control of pollution act: 1974

- Aims and objectives:

1. Prevention and control of water pollution
2. Maintaining and restoring the wholesomeness of water
3. Establishment of Boards of prevention and control of water pollution

Penalties for violation of the act:

- Penalty is imprisonment for a period of three months or a fine up to Rs. 10,000 or both