

Greenhouse gases and Global Warming

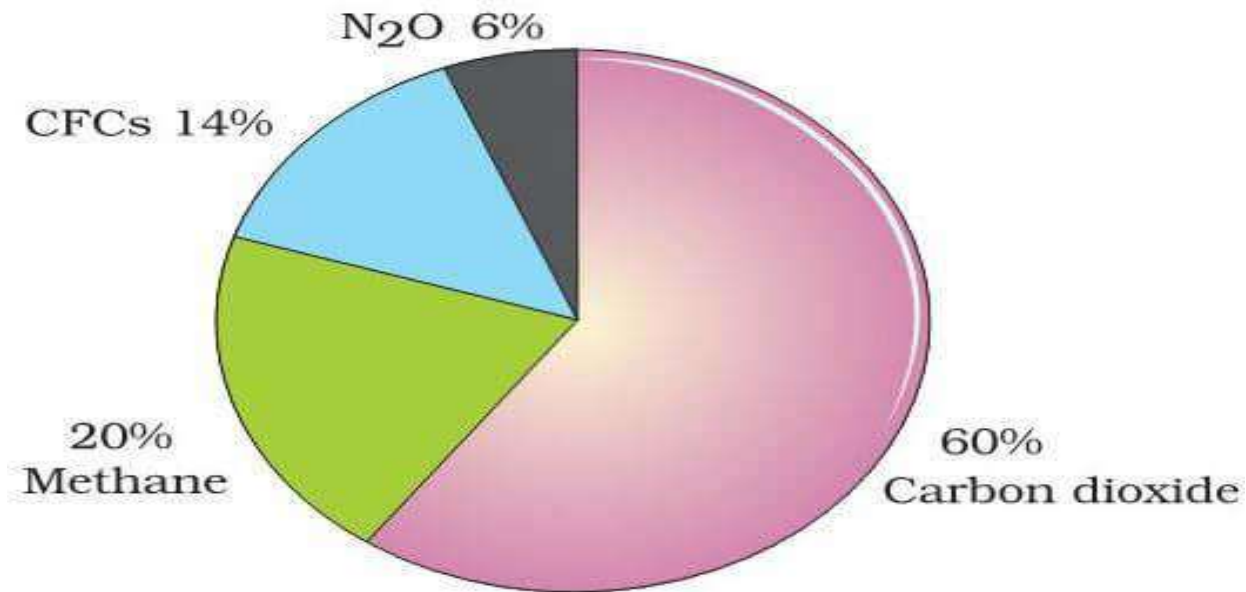
Greenhouse Gases and their sources-

- The relative GWP values show the main greenhouse gases to be CO₂, CH₄, N₂O and CFCs .
- It may be pointed out that water vapor is an important greenhouse gas, but is not considered because human activities have little control or contribution to its atmospheric concentration.
- **Carbon Dioxide, CO₂** – CO₂ has largest amount in atmosphere among all greenhouse gases. The major obvious manmade contribution is the combustion of fossil fuels. Deforestation is another. The trees and plants work as carbon bank by storing carbon. The biological processes release CO₂ and fortunately, this amount is balanced by photosynthesis. It is in equilibrium with oceans, which absorb and release it.

- **Methane CH₄** - Methane is continuously rising since the later part of 20th century, primarily due to increase in number of cattle and paddy fields. Methane is released by ruminants as stomach gas. In water-filled paddy fields, anaerobic biodegradations release methane. Municipal waste disposal landfills and coal- mines are other important sources.
- **Nitrous Oxide, N₂ O** - The microbiological processes in soil and ocean are the main sources. Increased use of nitrogen –based fertilizers is believed to be another cause. Other sources are change in agricultural practices and industrial manufacture of nylon.

- **Chlorofluorocarbons, CFCs-** These are manmade compounds and there is no known natural source. These are inert and non-toxic and have a long lifetime of about 100 years.
- Since their synthesis in 1930s, these are widely used as coolant, insulator in refrigeration, blowing agents in foams, in cleaning of electronic equipment, and propellants for aerosols.
- There is no removal mechanism for these in troposphere, so their concentration has continued to increase and some of it passed into stratosphere leading to ozone depletion.

Relative Contribution of different Greenhouse Gases-

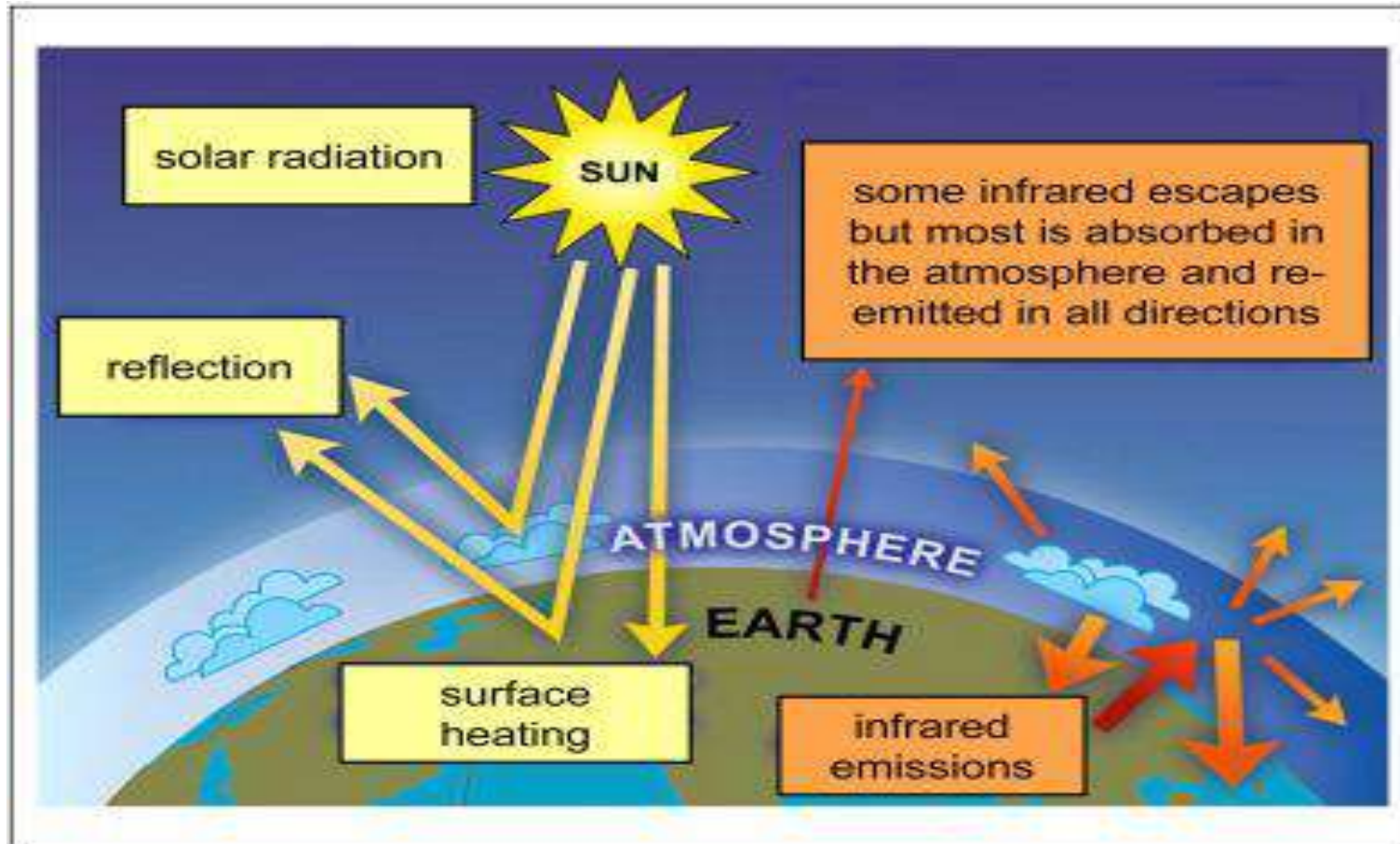


Relative contribution of various greenhouse gases to total global warming

Global warming-

- Warming on earth or **global warming** due to re-emission of sun's energy absorbed by the earth followed by its absorption by CO_2 molecules and H_2O vapor present near to earth's surface and then its radiation back to the earth is called **greenhouse effect**.

Greenhouse effect-



Global Warming Potential of Gases-

- The relative warming effect of different greenhouse gases is terms of global warming potential (GWP), which is defined as the total global warming expected from 1 kg of a gas over a 100 year period.

GHG	GWP for 100 years
CO ₂	1
CH ₄	23
N ₂ O	296
HFC - 23	12 000
HFC – 134a	1 300
SF ₆	22 200

Source: *IPCC Third Assessment Report* (2001).

Consequences of Global Warming-

- **Effect on Vegetation** - The yield from some plant species may increase their due to increase in CO₂ and its greater availability during the photosynthesis. This is called CO₂ - fertilization. The expected increase in case of plants, trees and C₃ – crops is as follows: biomass = 40%, yield = 26%. These values are subject to the effect of climate change.
- There is strong likelihood of alteration in distribution of the species. Some species may be able to adapt the changed climate. For others, the change may be too rapid to cope up with and they may be unable to adapt genetically or migrate. In the whole process, some species are likely to vanish.
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- New species, including weeds and pests, may be introduced.
- In colder areas, the growing season for grasses and trees could increase. This could help increase the viability of grasslands, animal farming and forestry.
- Change in rainfall pattern and increase in frequency of draughts might seriously affect the agricultural production.
- The climate change is likely to affect seriously the soil and consequently its workability. This will affect the growth of trees, plants and crops.

Sea Level Rise-

- Sea level rise will result in the following two important processes.
- Thermal expansion of the oceans, water is known to expand when temperature is raised.
- Glaciers and land ice sheets will melt.

Sea level rise has several implications, some of which are:

1. Increased frequency of storm surges and consequent flooding.
2. Reduction in quality of groundwater due to salination.
3. Loss and or disruption of coastal ecosystems.

Global Climate Change: The IPCC Report

- The Intergovernmental Panel on Climate Change, the Nobel Laureate(2007), has unequivocally reaffirmed that the warming of our climatic system is real, and is linked to human activity. The conclusions, based on solid scientific studies, are as follows.
- Warming of the Earth climate is real as evidenced by observations of increase in global average air and ocean temperatures, wide-spread melting of snow and ice and rising global average sea level.
- Observational evidence exists from all continents and most oceans that the many natural systems are being adversely affected by regional climate changes, particularly temperature increases.
- The concentrations of greenhouse gases have increased markedly in global atmosphere owing to human activities since 1970 and now far exceed the pre-industrial values determined from ice cores spanning many thousands of years.

Global Climate Change: The IPCC Report

- This century the temperatures are likely to increase by 1.1 – 6.4 °C and sea levels by 18 – 59 cm.
- Even if the concentrations of greenhouse gases are to be stabilized at the current level, the warming and sea level rise would continue for centuries due to time scales associated with climate processes and feedbacks.
- Climate change is likely to affect Africa, the Arctic, small islands and Asian mega-deltas.
- If the future temperature rise exceeds 1.5 – 2.5 °C, about 20 – 30 % species will face extinction.
- Some abrupt or irreversible impacts are likely to occur due to warming.

Kyoto Protocol-

- It is an international treaty, which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gases emissions, based on the premise that (a) global warming exists and (b) man-made CO₂ emissions have caused it.

Strategies to deal with global warming-

- Increasing the vegetation cover particularly forest for photosynthetic utilization of CO₂.
- Replacing CFCs with substitutes having little effect on global warming and ozone.
- Limited use of fossil fuels to reduce the emission of green house gases.
- Developing alternate renewable sources of energy e.g.- solar and wind energy.
- Minimizing the use of nitrogen fertilizers by relying more and more on nitrogen fixation.

THANKYOU