

Role of Green Plants in Climate Change Mitigation

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Newspaper headlines have read

- “The Global Warming Panic,”
- “Feeling the Heat,” and
- “When Rivers Go Dry and Ice Caps Melt.”
- Then the backlash headlines came along:
- “The Greenhouse Effect May Be Hot Air,”
- “A Faulty Greenhouse?” and “Where’s the Heat?”
- What are the facts?
- What do we know that could confirm or deny the existence of greenhouse warming?

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- **Evidences of Global Warming**
 - **The Earth's Energy Balance**
 - **Greenhouse Gases**
 - **Carbon Dioxide**
 - **What To Do? (Mitigation)**
 - **STRATEGIES**
 - **Into The Future**

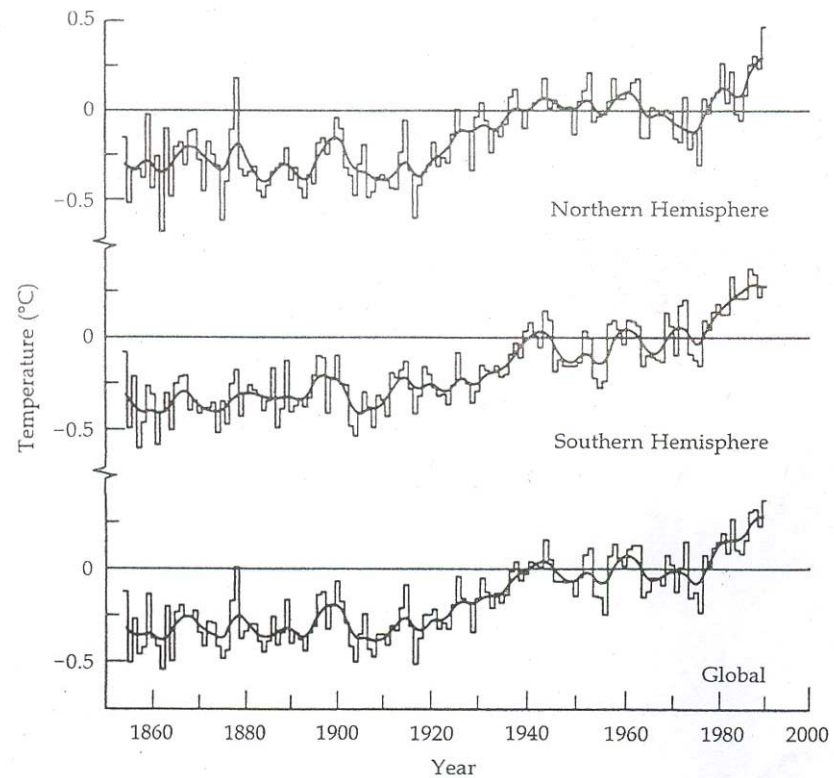
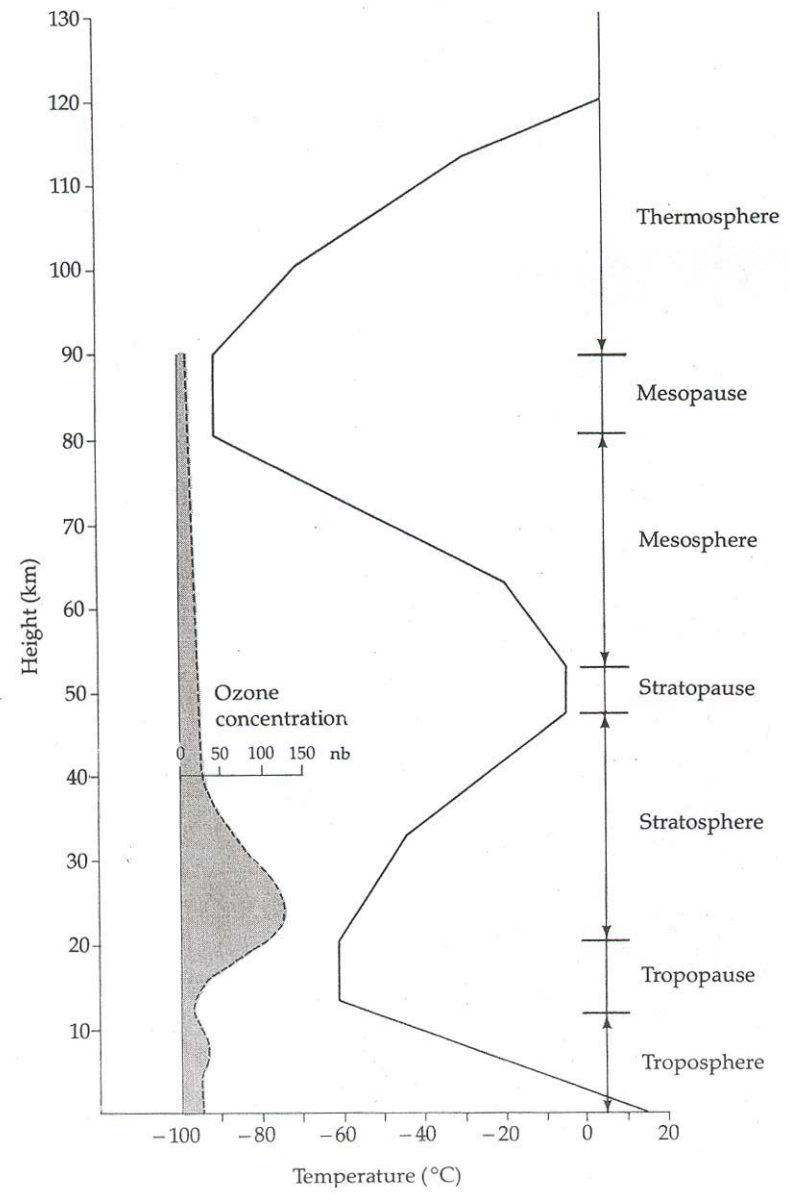


FIGURE 1 Hemispheric and global average mean air temperatures for land plus marine regions, 1854–1990. Data are expressed as departures from the 1950–1979 average. The smooth line is a running ten-year average to show the long-term trends. (From Jones and Wigley, 1991.)



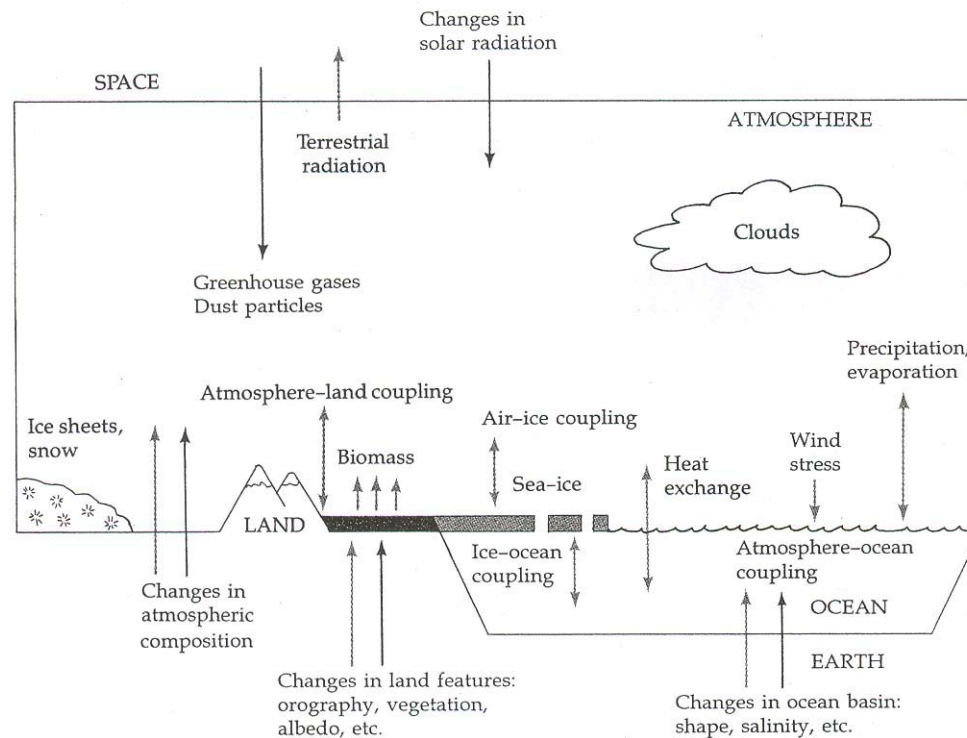


FIGURE 4 Schematic illustration of the flow of energy and water between the land, sea, and atmosphere.

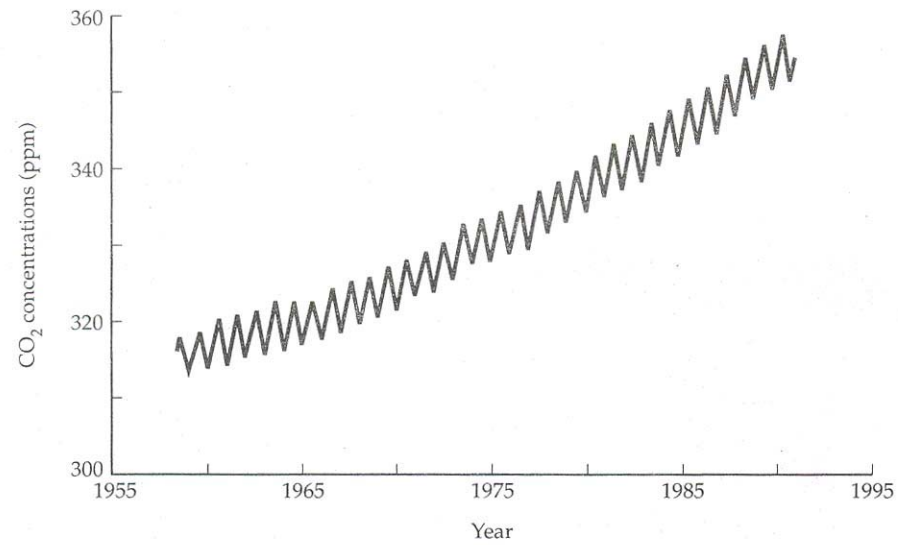


FIGURE 5 The atmospheric carbon dioxide concentration measured at Mauna Loa, Hawaii from 1958 to 1991. (Courtesy of C. D. Keeling.)

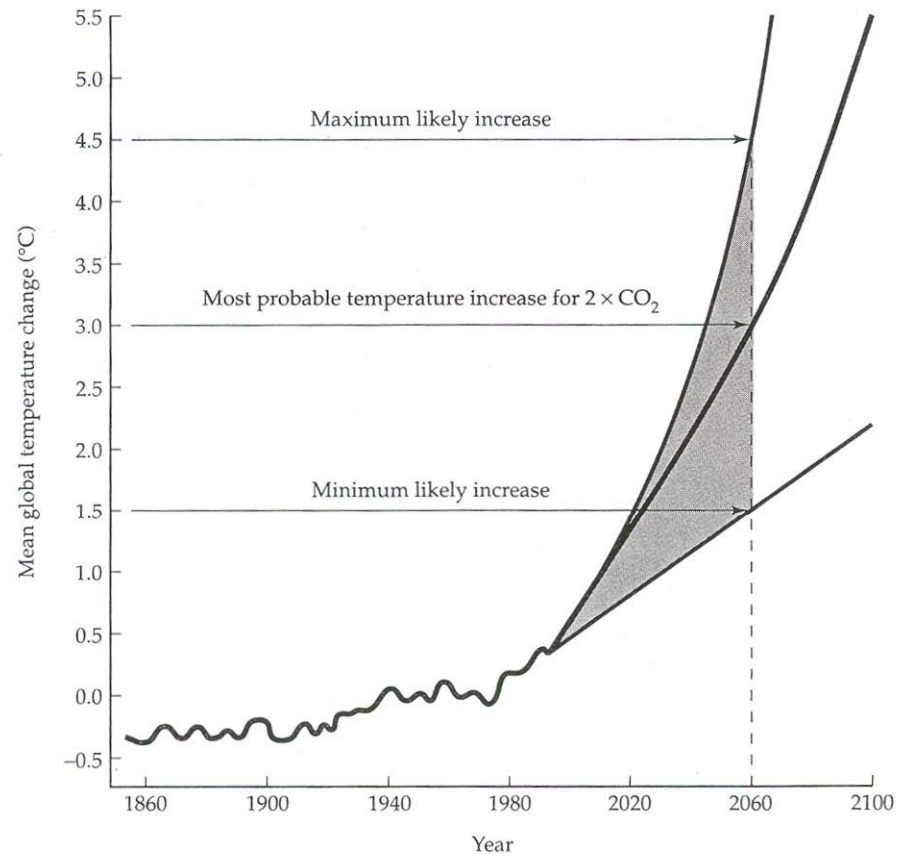


FIGURE 9 Mean global temperature change versus year showing past temperatures and projected most probable temperatures with increasing atmospheric carbon dioxide concentration. $2 \times \text{CO}_2$ is assumed to occur around the year 2060. Because of uncertainties with modeling and in our knowledge of the carbon cycle, maximum and minimum temperature extrapolations are also shown

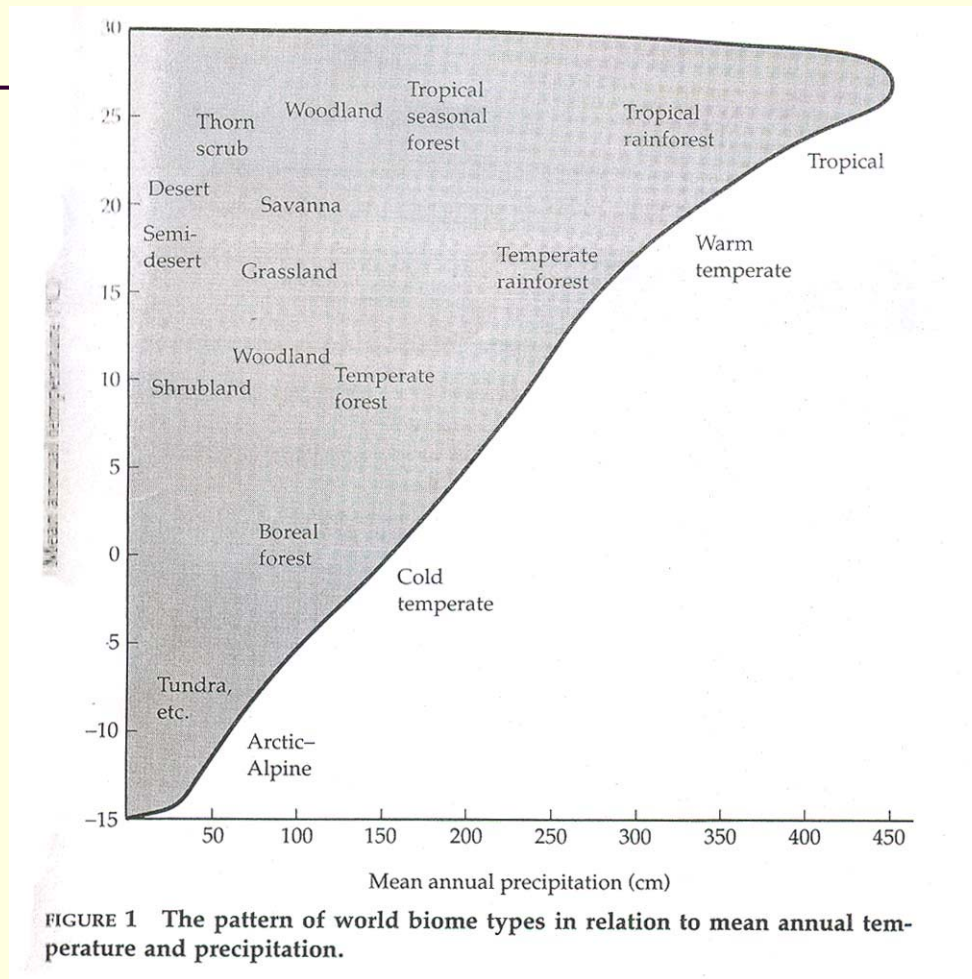


FIGURE 1 The pattern of world biome types in relation to mean annual temperature and precipitation.

Methane source	Amount of methane produced (Tg/yr) ^a	Methane sink	Amount of methane in sink (Tg/yr) ^a
<i>Methane from biotic sources:</i>		<i>Fixed methane:</i>	
Ruminants	80	Reaction with OH	420
Landfills	50	Soil uptake	30
Ocean production, termites	30	Stratospheric reactions	10
Tropical:		SUBTOTAL	460
Wetland	245	Methane in atmosphere	45
Rice production			
Burning			
SUBTOTAL	405		
Fossil fuel methane production	100 ^b		
Total methane from all sources	505	Total methane into sinks	505

(Data from Crutzen, 1991.)

^aAmounts are in teragrams; 1 Tg = 1 trillion (10¹²) grams = 1 million (10⁶) metric tons.

^bAt least 70 Tg/yr of this methane is from leaks in natural gas distribution systems and from gas and oil wells.

What To Do? (Mitigation)

Violence has always been a part of the natural world. Windstorms, hurricanes, tornados, fires, floods and droughts are episodic, chaotic and patchy. The greatest climate and ecosystem changes are likely to occur at high latitudes. Mean annual global warming may average 30C with a 2xCO₂ climate change, but high latitudes may increase as much as 6 to 80C, all in less than 70 years.

Will rising temperatures increase the rate of release of CO₂ by respiration or suddenly release methane that has been buried in Polar Regions? We do not know.

STRATEGIES

➤ It is too late to begin mitigation of the green house effect. ~~Several possible scenarios for reducing the rate of~~ greenhouse gas warming. Phasing out the production of chlorofluorocarbons; halt of deforestation; reduce fossil fuel carbon emissions by 20% by 2005 and by 50% by 2030. All these actions are satisfactory to absorb 1.65Gt of carbon by 2020. These measures are drastic, but would stabilize the equivalent concentration of carbon dioxide at 375 ppm by 2020. With this scenario, concentration of temperatures is projected to rise only 20Ccarbon or less by the end of this century.

➤ To achieve the goal of sequestering 1.65 Gt. Of carbon per year, 0 million hectares of forest, an area almost the size of New York State, would need to be planted each year for the first two decades of the 21st century.

➤ Various technological schemes have been suggested for mitigating global warming. One idea is to place huge mirrors in space to reflect sunlight. To achieve a 3.5% reduction incoming sunlight, equivalent to compensating for a temperature increase of 2.50C, a minimum mirror area of 4.5×10^6 Km² would be required. Not very feasible.

➤ Many technological mitigating methods have been proposed for minimizing the emissions of carbon dioxide in to the atmosphere. Most of these methods attack the problem at the power plant stack, using physical and chemical reduction techniques. These are impractical.

Into The Future

- ~~Is to develop possibly safe nuclear reactors. But the nuclear option is a difficult one for society.~~
- Another option is the energy conservation. The energy conservation and efficiency option is economically sensible, resource wise and environmentally comfortable.
- Reduce the use of fossil fuels. This can be done by using alternative energy sources such as solar, wind, biomass, ocean thermal electric conversion, geothermal, tidal and wave energy.
- How to maintain agricultural productivity? How to manage forests in a continuing state of health? How to adjust for rising sea levels and coastal inundation? How to help all peoples of the world understand the problem and how they themselves can manage to live with climate change, and at the same time, understand what to do about it.