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Clock Ticks "Are We Moving Towards the Right Global Cooling"

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Abstract

Climate change happenings over the few decades have altered the global precipitation. Increase in temperature due to land form change, deforestation, moving towards agriculture, uncontrolled urbanization and development etc., leads to decrease in precipitation. Various case studies referring to the above and the measures to restore the climate change with right global cooling has been addressed. Clear variation needs to be drawn in relation to increasing precipitation due to rising concentration of anthropogenic greenhouse gases in the atmosphere, to that by checking precipitation by increasing the tree cover. Which precipitation would really bring about a balance in the disturbed environment and which precipitation would be useful /beneficial to mankind in the long run is the real question?

Keywords: Climate change, GHG, global cooling, afforestation, reforestation, plastic, stubble

1. Introduction

Climate change is the variations which occur in the mean state of the climate or its variability persisting for a long period of time. This may be due to natural internal processes or external forcing or due to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC 2001).

In the recent climate change happenings, this example shows how devastating climate change happenings could be. Japan was hit by an enormous earthquake on March 11, 2011, that triggered a deadly 23-foot tsunami in the country's north. The giant waves deluged cities and rural areas alike, sweeping away cars, homes, buildings, a train, and boats, leaving a path of death and devastation in its wake. With a magnitude from 8.9 to 9.0 in Richter scale which is the largest in Japan's history. The earthquake struck about 230 miles northeast of Tokyo. As of June, thousands of people were still in temporary shelters and over 24,000 were confirmed dead or missing.

The paper discusses the causes, consequences and ways to cool the earth.

1.1 Causes & Consequences of Climate Change

Climate change can be attributed to changes in atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation alter the energy balance of the climate system.

Climate change has its consequences. Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

The potential future effects of global climate change include more frequent wildfires, longer periods of drought in some regions and an increase in the number, duration and intensity of tropical storms. Strong greenhouse effect will warm ocean, partially melt glaciers and ice and increasing sea level (IPCC 2007).

Most climate scientists agree the main cause of the current global warming trend is human expansion of the "greenhouse effect”. Gases that contribute to the greenhouse effect include water vapour, Carbon dioxide, Methane, Nitrous Oxide and Chlorofluorocarbons. Global GHG emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004. Global atmospheric concentrations of CO_2, methane (CH_4) and nitrous oxide (N_2O) have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. Global increases in CO_2 concentrations are primarily due to fossil fuel use. The global atmospheric concentration of CO_2 increased from a pre-industrial value of about 280ppm to 379ppm in 2005. It is very likely that the observed increase in CH_4 concentration is predominantly due to agriculture and fossil fuel use. CH_4 growth rates have declined since the early 1990’s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. The increase in N_2O concentration is primarily due to agriculture.

The Intergovernmental Panel on Climate Change concluded: Human beings are exposed to climate change through changing weather patterns (for example, more intense and frequent extreme events) and indirectly through changes in water, air, food quality and quantity, ecosystems, agriculture and economy. At this early stage the effects are small but are projected to progressively increase in all countries and regions. The IPCC has concluded that, overall (globally), negative climate-related health impacts are expected to outweigh positive health impacts during this century.

The IPCC has noted that the global population at risk from vector-borne malaria will increase by between 220 million and 400 million in the next century. While most of the increase is predicted to occur in Africa, some increased risk is projected in Britain, Australia, India and Portugal.

Higher temperatures are expected to further rise in sea level by expanding ocean water, melting mountain glaciers and small ice caps, and causing portions of Greenland and the Antarctic ice sheets to melt. The IPCC estimates that the global average sea level will rise between 0.6 and 2 feet (0.18 to 0.59 meters) in the next century (IPCC, 2007).

Land cover change has also contributed to global increase in CO_2 levels significant though to a smaller extent. Change in land form leads to reduction in rainfall and the effect of land cover change (1788 and 1988) on the Australian regional-scale climate using a mesoscale model, and this provide further evidence of large-scale reductions in rainfall following land cover change (Narisma and Pitman 2003). The impact of land cover change on local air temperature is statistically significant at a 99% confidence level. Furthermore, there are indications that the observed increase in local maximum air temperatures in certain regions of Australia can be partially attributed to land cover change. The results are evidence of statistically significant changes in rainfall and the sign of these changes over effects of both land cover change and increasing CO_2 concentrations since both types of anthropogenic forcing exist in long-term observational records (Narisma and Pitman, 2003).

Avissar and Liu (1996), Pielke (2001), Chase et al. (1996, 2000) Weaver and Avissar (2001) and Baidya Roy and Avissar (2002) have shown that fragmentation of the landscape can affect convective flow regimes and rainfall patterns locally and globally. Land surface changes on the order of 10 km on a side can cause changes in the local pattern of rainfall.

Hansen et al. (1998) estimated that since the start of the industrial era (about 1750), anthropogenic changes in land cover have created a global and annual mean climate forcing of -0.21 W.m2 (with a global cooling effect of 0.14^0C). Most of the global cooling effect is from land surface changes at high latitudes where snow cover is frequent.

Changes in land use and land cover, especially when coupled with climate variability and change, are likely to affect ecosystems and the many important goods and services that they provide to society. The National Research Council (NRC) identified land-use dynamics as one of the grand challenges for environmental research (NRC, 2001b).

Progressive removal of the forest cover is also one of the causes of climate change. According to Sen et al (2004), a comparison of the modeled changes with the observed rainfall trends suggests that the deforestation in the Indochina Peninsula could be one of the major factors causing changes in the climate of the region." Defries et al 2002, used the IMAGE 2 model to look at future climate change between 2007 and 2050. They found that deforestation, by decreasing latent heat fluxes, could increase regional surface air temperatures by 1-2^{0}C. Sud and Smith (1985) modelled deforestation in India and found that it leads to a major weakening of the monsoon.

In Florida the draining of marshes and cutting down of forests with replacement by agriculture and replacing of wetland and forest by agriculture has been shown by Marshall et al., (2004a) to reduce rainfall and increase temperatures at the surface: providing evidence that the advent of agricultural production on the Florida Peninsula may have contributed to a significant decrease in warm-season rainfall across the region during the 20th century."

According to Ravindranath et al, (2006), Climate projection for the year 2085, 77% and 68% of the forested grids in India are likely to experience shift in forest types under A_2 (740 ppm CO_2) and B_2 scenario (575 ppm CO_2), respectively. This assessment is based on climate projections of Regional Climate Model of the Hadley Centre (HadRM3).

2. Cooling the Earth

Ways in disposing waste and managing our lands for agriculture have a profound impact on greenhouse gas emissions. Ways to reduce Fossil fuel and GHG emission would include:

Sustainable practices and going for Renewable energy practices (Solar, Wind, Tidal, Geothermal etc.). Waste reducing, reusing and recycling solid waste, decreasing the amount of heat-trapping greenhouse gases released by us.

2.1 Agriculture and Forest Land

Different management practices for agricultural land areas and forest lands can affect greenhouse gas emissions. Plants remove carbon dioxide from the air through a process known as carbon sequestration. Planting trees, practicing sustainable forestry, using conservation tillage on croplands and other agricultural and forestry practices can help slow the growth of greenhouse gas concentrations in the atmosphere. Many state and federal programs support land use practices that help capture carbon dioxide as a by-product of cropland management of soils or forest management for timber.

Deep roots tend to improve the rates of percolation of water from upper soil horizons into lower substrates (Virendra et al., 2011). Identification of the species belonging to family Leguminaceae and Caesalpinaceae are regarded as good ground water indicators and may suggest ground water discharge sites (Rinku et al 2015). Work related to Mountain regions of Uttarakhand has shown these tree families to be helpful in aquifer recharges.

Right step in ground water conservation would also include the right tree species planting and right family leading to the management of ground water table in the ecologically water stressed regions. Species like Leguminaceae/Fabaceae and Caesalpiniaceae have deeper roots hence better the rate of percolation and discharge of rain water there by helping in maintaining of the water table and are referred as water indicators (Rinku et al., 2015).

Environment Protection Agency (EPA's) Carbon Sequestration in Agriculture and Forestry: Provides an overview of EPA-supported analyses of regional, U.S. and international sequestration mitigation options, their potential greenhouse gas and other benefits including their estimated costs.

2.1.1 Biofuel/ Biodiesel Production

Biodiesel are renewable fuels that can reduce greenhouse gas emissions from the vehicles. E85 is a fuel blend containing 85% ethanol that can be used in certain vehicles called Flex Fuel Vehicles (FFVs). FFVs can be fueled with E85 or with traditional gasoline. There are approximately 6 million FFVs on the road today. To find out it can be checked inside the car's fuel filler door for an identification sticker or consult manual. If owning a diesel vehicle, consider filling up with a biodiesel blend such as B5, a fuel blend containing 5% biodiesel. Biodiesel is a renewable fuel made from agricultural resources such as vegetable oils (USEPA).

Betts (2000) noted that increasing the area of tropical forests can cool the local environment by enhancing transpiration, adding to the greenhouse gas benefit of afforestation. He makes a first attempt at this and the IPCC Third Assessment report, showing the albedo effects (Ratio of the light reflected by a planet to that received by it.) of land use change on the same scale of global mean radiative forcing as changes in greenhouse gas concentrations (IPCC, 2001). According to Pielke (2001) vegetation phenology, has a seasonal component associated with the annual cycle of greening and senescence while land cover change alters interactions with the atmosphere indefinitely. These studies suggest that local, regional, and global effects of land surface changes ought to be considered in climate mitigation efforts. Human have substantially altered land cover type, ecosystem structure, natural disturbance regimes and caused a fragmentation of the landscape (Marland et al., 2003).

2.1.2 Afforestation and Reforestation would Decrease near Surface Temperature / as the Way to go

Afforestation with establishment of a new forest where there did not exist any forest before and Reforestation with restocking of existing forests according to various studies are promising to decrease near future temperature raise. A comprehensive review of the importance of land use including tropical forests has been done by Roger Pielke 2001, Observational studies, spanning several decades and numerical modelling studies both show that tropical deforestation influences cloud formation and rainfall. Observational studies report a wide range of changes in rainfall associated with deforestation (1–20% decrease). Regional-scale modelling results show that the eastern Asian summer monsoon is sensitive to deforestation in the Indochina region, in general, observations and modelling studies agree that (afforestation and reforestation) would decrease near-surface temperature.

Afforestation and reforestation (A&R) are proposed as possible tools to mitigate desertification (FAO, 1989) and to reduce atmospheric concentrations of CO_2 by sequestering carbon in forest biomass (UNDP, 2003).

Beltrán, (2005) and Xue et al., (1996) demonstrated that tree plantation establishment may affect the hydrological cycle. In the Clean Development Mechanism (CDM) only afforestation and reforestation are eligible to produce certified Emission Reductions in the first commitment period of the Kyoto Protocol (2008- 2012).

2.1.3 Increase Rainfall and Reduction in Surface Temperature

In the late 1980s, the NASA Earth Radiation Budget Experiment (ERBE) proved conclusively that on an average, clouds tend to cool the planet (Ramanathan et al., 1989).

An increase in cloudiness can lead to an increase in rainfall and soil moisture and in semiarid regions this change from dry to moist soils leads to an increase in vegetation i.e. a carbon sink. Niyogi (2001) has examined this effect using a process-based model, showing that the impact is significant, through an impact on greenhouse gas absorption.

Los et al., (2006) looked at the Sahel (model) and used satellite evidence and models to establish that vegetation can increase rainfall by as much as 30% as compared to non-vegetated areas. Irrigation had led to a reduction in regional maximum temperatures and an increase in rainfall (Pielke et al., 2007).

De Ridder and Galle (1998) found significant increase in convective rainfall in southern Israel associated with irrigation and intensification of agricultural practices, while De Ridder (1998) found that dense vegetation produces a positive feedback to precipitation.

Bounoua et al., (2000) used a coupled biosphere-atmosphere model to look at the impact of realistic changes in vegetation on global and regional surface temperatures and rainfall. They found that an increase in vegetation produced an increase in surface albedo in the tropics and a decrease in surface temperatures (0.5 and 0.8^{0}C in January and July respectively). A number of researchers have established that elevated moisture fluxes within the planetary boundary layer can enhance daytime cloud cover Holt et al., (2002), Douglas et al., (2006), Pielke (2001), Stohlgrenet et al., (1998) and Alapaty (1997).

"According to Pielke (2001), an increase in irrigation or surface wetness reduces sensible heat flux while increasing physical evaporation and transpiration. The resulting additional moisture flux can enhance the moist static energy within the convective boundary layer (CBL) and consequently become thermodynamically more conducive to an increase in rainfall (Betts et al., 1994 and Segal et al., 1988).

3. Conclusion

Reduction in usage of fossil fuels and increase in vegetation achieved also, through afforestation and reforestation and forest cover would help cool the globe. Moving towards sustainable development and population control would be very effective to mitigate the problem. This is the need of the hour which the world has to think off and bring as, international policies, is very much needed. Reduction in plastic consumption, non-burning of plastic waste nor should it make its entrance into water bodies should be seriously addressed. Agricultural stubble waste should be dealt with care with utilizing byproducts using various green technologies. Water bodies need to be protected and no waste discharge into it, to be allowed. Afforestation and Reforestation are the simplest to do. It helps decrease near surface temperature with an increase in cloudiness, leading to an increase in rainfall and soil moisture. Dense vegetation produces a positive feedback to precipitation there by going the sustainable way. The need is of strong international laws which may address this issue of Climate Change for Asian countries is very important and also the whole world.

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