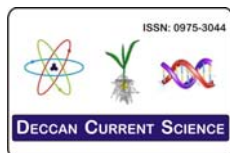


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Climate Change in India: Challenges and Prospects

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Abstract

Climate change is variation in climatic variables such as rainfall, temperature and relative humidity over a period of time, leading to the extremities like drought, floods and so on. Climate change due to natural causes which is in small amount is inevitable, but climate change due to human induced causes has made it the issue of concern world over. Climate change, although a global phenomenon will have serious implications for the poor in India, making them more vulnerable to food insecurity and hunger. As a result it poses the greatest challenges to sustainable development of all sectors of the economy. So it should be addressed by all countries with a narrow perspective.

Key words: Climate change, agriculture, and food security.

Introduction:

Climate change is not a new phenomenon in the history of Earth, which has gone through many episodes of change. Though change in climate over a long period of time is a natural phenomenon, human activities in the last few decades have hastened the process of climate change (Brajesh Jha and Amarnath Tripathi). Several studies including the International Panel on Climate Change (IPCC) have observed increasing trends in the global surface temperature and sea levels; many of these studies have also found significant changes in precipitation trend across regions, countries, continents and globe (IPCC, 2007). Indian metrological Department (IMD) also observed increase in temperature and changes in the pattern changes in climatic factors and time in India (GOI, 2010). The above changes in Climatic factors directly affect physiology of human beings. India faces a major threat from changes in climate since its economy is closely tied to natural-resource-base

and climate-sensitive sectors such as agriculture, water and forestry that happen to be the most vulnerable sectors.

The intergovernmental panel scientists found that the burning of fossil fuels, some agricultural practices and changes in land use have been generating green house gases (GHG) like carbon dioxide, methane and nitrous oxide that trapped heat and produced runaway global warming.

If the production of these green house gases continued to soar, global temperatures would rise up to 6.4 °Celsius by the end of this century with far-reaching consequences for the climate, warned the IPCC (Velu Suresh Kumar)

Climate Change Trends:

Global Warming

Human activities during the last decades of industrialization and population growth have polluted the atmosphere to the extent that it has begun to seriously affect the climate. About 75% of the solar energy reaching the earth is absorbed by

the earth's surface, which increases its temperature. The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by greenhouse gases, mostly carbon dioxide. As carbon dioxide is released by various human activities, it is rapidly increasing. This is causing Global warming. Global warming adversely affects human health, leading to increase in heat-related diseases and deaths. Besides, it also indirectly affect human health due to higher incidence of malaria, dengue and viral encephalitis caused by expansion of mosquitoes and other disease carriers to warm areas. And also adverse effect on agricultural production due to droughts and increased incidence of pests, causing shortage of food.

Rainfall:

In India high temporal and spatial variability in rainfall distribution. Many extreme rainfall indices have shown significant positive trends over the west coast and northwestern parts of Indian Peninsula. The greater variability in rainfall could mean more frequent and prolonged periods of high or low ground water levels, and saline intrusion in coastal aquifers due to rise in sea level and reduction in resources. Groundwater resources are related to climate change through the direct interaction with surface water resources, such as lakes and rivers, and indirectly through the recharge process. The direct effect of climate change on groundwater resources depends upon the change in the volume and distribution of groundwater recharge (Singh and Kumar, 2009)

Acid Rain:

When fossil fuels such as coal, oil and natural gas are burned, chemicals like sulfur dioxide and nitrogen oxides are produced. These chemicals react with water and other chemicals in the air to form sulfuric acid, nitric acid and other harmful pollutants like sulfates and nitrates. These acid pollutants spread upwards into the atmosphere, and are carried by air currents, to finally return to the ground in the form of acid rain, fog or snow. The corrosive nature of acid rain causes serious

environmental damage which in turn impairing the quality of life of this and future generations.

Extreme Events:

Extreme events such as cold waves, heat waves, floods and high intensity single day rainfall events were on increasing trend from the last decade. For example, the 2002 drought across the country during kharif, the heat wave of 2003 in Andhra Pradesh and abnormal temperature during January-February 2007 in North are some of the extreme weather events which had significantly impacted the economy.

Ozone Layer Depletion:

Ozone is formed by the action of sunlight on oxygen. It forms a layer 20 to 50 kms above the surface of the earth. This action takes place naturally in the atmosphere, but is very slow. Ozone is a highly poisonous gas with a string odor. It is from of oxygen that has three atoms in each molecule. It is considered a pollutant at ground level and constitutes a health hazard by causing respiratory ailments like asthma and bronchitis.

Nuclear Accidents and Nucleat Holocaust:

Nuclear energy was researched and developed by man as an alternate source of clean and cheap energy compared to fossil fuels. Although this did happen, along with the benefits of nuclear energy came its downfalls. In the short history of nuclear energy there have been a number of accidents that have surpassed any natural calamities or other energy source extractions in their impacts. A single nuclear accidents cause's loss of life, long term illness and destruction of property on a large scale and for a long period of time.

Impact of Climate Change:

Worldwide it is agreed that one of the greatest challenges to sustainable development in this century is climate change. Climate change poses a serious threat to development and poverty reduction in the poorest and most vulnerable regions of the world. Its impact is already being experienced across the globe.

Climate change would have the effect of the rise in the mean sea level. 1 meter sea level rise leads to welfare loss of \$ 1259 million on India and -0.36% of GNP. By 2050, cumulative mean sea level elevation in the Bay of Bengal, near the Indian Sundarbans may be closer to one meter with an anticipated loss of 15% land area by 2020. The United Nations Environment Programme included India among the 27 countries that are most vulnerable to a sea level rise. India has a vast coastal line and the rising sea levels caused by climate change would cause an ecological disaster. A study conducted by Jawaharlal Nehru University indicate that is the sea- level rose by just 1 meter as many 7 million people would be displaced and 5,764 sq km of land and 4200 km of roads would be lost. Besides, much of the coastal region has fertile agricultural land. An increase in sea level would lead to salt water entering the ground water aquifers on which people depend for drinking water and to irrigate their fields. Valuable marine and coastal ecosystem including mangrove forests, coral reefs and sea grasses would also get adversely affected by sea level rise.

It is generally recognized that climate change has an impact on agriculture and food security across the globe, as agriculture is highly sensitive to changes in climate. Agriculture is the main source of livelihood for more than half of world's population, and constitutes the cornerstone of the economy of many developing countries. Drought, floods, tropical cyclones, heavy precipitation events, hot extremes and heat waves are known to negatively affect agricultural in greater instability in food production and threaten livelihood security of poor people. Most of the studies conclude that in many instances, agriculture will be disadvantages and some predicts unequal impacts of global warming on agriculture across regions. Climate change, although a global phenomenon will have serious implications for the poor in India, making them more vulnerable to food insecurity and hunger.

Climate change adversely affect human health To a large extent, public health depends on safe drinking water, sufficient food, secure shelter and good social condition. All these factors are affected by climate change. Freshwater supplies may be seriously affected, reducing the availability of clean water for drinking and washing during drought as well as floods. Water can be contaminated and sewage systems may be damaged. The risk of spread of infectious diseases such as diarrheal diseases will increase. Food production will be seriously reduced in vulnerable regions directly and also indirectly through an increase in pests and plant or animal diseases. The local reduction in food production would lead to starvation and malnutrition with long term health consequences, especially for children. Changes in climate may affect the distribution of vector species which, in turn, will increase the spread of disease, such as malaria and filariasis, to new areas which lack a strong public health infrastructure. The seasonal transmission and distribution of many diseases that are transmitted by mosquitoes and by ticks may spread due to climate change.

Climate impact on forest vegetation and biodiversity has adverse implications for the livelihood of forest dependent communities. The degradation of natural resources especially the forest resources has been observed to be more rapid as compared to land, water and other resources in almost all the sub-regions especially in tribal dominated areas. During the 1970s farmers observed that there is no severe effects of climate change on natural resources. In the 1980s decade the rate of degradation of land, water, biodiversity, forest and mineral resources were very fast in almost all the sub-regions due to mismanagement of common pool resources, climate change, market influence, rapid growth of population and social conflicts at the grassroots level.

Climate change can impact water availability through several channels. The amount of water availability per persons in India is increasing steadily from 3450cm in 1951 to 1250cm in 1999 and is

expected to decline further to 760 per persons. By the year 2050, the average annual run off in river Brahmaputra will decline by 14%. Lower rainfall and more evaporation lead to less run off and substantially changing the availability of fresh water in the watersheds, and decline of soil moisture. The Hydrological zone cycle is likely to be altered and the severity of drought and intensity of floods in various parts of India are likely to increase.

Impact of Climate Change on Economy:

Unless the trends of rising global temperatures and continued environmental destruction can be reversed, this will lead to economic decline. The poverty challenge becomes more severe when compounded with climate change. The effects of climate change include food insecurity, water scarcity, ill health, migration, loss of biodiversity and an increase in the frequency and severity of extreme weather events, all of which hit the poorest hardest (Singaraj and Kumar 2010).

A study by the (OECD/IEA 2008) concludes that the required expenditure to meet carbon reduction targets reflects activity a redirection of economic activity and employment and not necessarily a reduction of GDP. The degree to which net employment is expanded as a result of climate change policy will be in part affected by the size of the pool of unemployed labour and the natural rate of unemployment in the economy. This natural rate can be reduced through improving the skills of the workforce. However, some workers may still be hurt by restructuring due to climate change policy, and there may be geographical differences across the nations.

In developing countries like India, climate change is an additional burden because ecological and socioeconomic systems are already facing pressures from rapid population, industrialization and economic development. (Pradeep Hadke and Surendra Jichkar). By 2080, agricultural output in developing countries may decline by 20 per cent due to climate change, while output in industrial countries is expected to decrease by 6 percent. Also due to climate change, yields in developing

countries are expected to further decrease by 15 per cent on an average by 2080. The climate is a primary determinant of agricultural productivity. In turn, food and fiber production is essential for sustaining and enhancing human welfare. The United Nations Framework Convention on Climate Change (UNFCCC) cites maintenance for societal ability for food production in the face of climate change as one of the key motivations for its existence and for its efforts in stabilizing greenhouse gas emissions.

Some countries' GDP is severely affected as a result of natural disasters. Cyclones that struck Samoa in 1990 and 1991, for example, caused an estimated total loss of \$416 million dollars, which was four times the country's GDP (UNEP 1999). Global economic losses from climate related disasters are rising fast. Reported economic losses have been risen from \$ 131 billion in the 1970s to \$ 629 billion in the 1990s.

Conclusion:

Climate change is no longer a distance concern, but a serious threat to development and poverty eradication. There is a probability of 10 to 40 per cent loss in crop production in India with increase in temperature by 2080-2100 and decrease in irrigation water. Climate change, although a global phenomenon, have serious implications for the poor in India, making them more vulnerable to food insecurity and hunger. Therefore efforts are needed to define the strategies for adoption to climate changes. For developing countries like India, adoption requires empowering them to build their lives and to cope with climate uncertainties in the long term. Efforts are being made by the Indian government to mainstream the climate impacts into sectoral policies. Climate change is perhaps the greatest challenges to sustainable development of all sectors of the economy including agriculture so it should be addressed by all countries with a narrow perspective.

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