International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2020): 7.803

Climate Change, Global Warming and Sustainable Development Goals: Issues and Challenges in India

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Abstract: ***Climate change has deeply impacted the life of every individual more or less. Well known as the upshot of global warming, the change in atmospheric characteristics has resulted in a disrupted rainfall pattern, floods, earthquakes, etc. Among the developing nations in the world, India is also facing the catastrophic impact of this change in the form of natural calamities. Though necessary steps have been initiated as to minimize its effect, the endeavour for identification of appropriate solution to this issue is still under process. With innumerable challenges of sustainable development, the country is still in perplexity of mainstreaming adaptation and mitigation of climate change within the political agenda, and integrating the same with ongoing schemes along its applied connotations. The present paper is aimed at addressing the challenges associated with climate change in India. It will also highlight the suggestions for framing the relevant policies for combating the futuristic impact of Climate Change.***

Keywords: Climate Change, Sustainable Development Goals, Global Warming.

1. Introduction

Climate Change has already grabbed the inquisitiveness of the entire globe and for which mankind has been held accountable. The entire problem of climate change has escalated as a result of human interventions in the form of rapid industrialization and urbanization (Posner *et al.*, 2008). According to United Nations Framework Convention on Climate Change (UNFCCC), "a change of climate which is attributed directly or indirectly to human activity has altered the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. " (Source: UNFCCC, 1992).

Climate change is fast emerging as the most defining challenge of the 21st century (Mishra, 2014). It has appeared as the biggest development challenge for the planet (Narain *et al.*, 2009) which has led to the environmental threats facing humanity with implications for food production, natural ecosystem, water supply, health, and energy, etc. (Sathaye *et al.*, 2006). Change in the climate pattern of the earth has resulted at universal as well as on the regional scales and most of it due to human intrusions. The impact would be primarily in the tropical areas, mainly consisting of developing countries like India.

Augmentation in the global average temperature is likely to deteriorate the present condition of human health and safety. A recent press release by the Intergovernmental Panel on Climate Change (IPCC) on 8th October 2018 revealed that limiting global warming to 1.5°C would require rapid, far - reaching, and unprecedented fluctuations in all the characteristics of society. It is anticipated that the increase will have severe impacts on the global hydrological system, eco - system, sea level, crop production, and related processes. It is further assumed that billions of people over the next few decades, largely those living in developing countries will have to face dire consequences in terms of acute shortages of water, food and greater risks to health and life as a result of harmful effects of climate change (Source: UNFCCC, 2007).

India is mainly a developing nation with a majority of its rural population directly dependent on agriculture, forests, fisheries, and natural resources such as water, biodiversity, mangroves, coastal zones, grasslands for their subsistence and livelihoods (Rana *et al.*, 2011). However, the excessive consumption of natural resources and increase in environmental pollution has triggered the detrimental effects of climate change on the lives of people following its diverse terrain (Puthucherril, 2013: Ghosh, 2013). Besides, it is also facing alarming environmental and socioeconomic challenges where the quality of air is getting worst due to the increase in air pollutants posing further challenges to ecosystem, biodiversity, and agricultural productivity (Source: UNFCCC, 2007).

According to World Bank (2013), an increase of 2°C in the world's average temperature in the next few decades will make India's monsoon more unpredictable. Gradual shifts in rainfall patterns across India are predicted to leave a number of areas under water and others without enough water even for drinking. More than 60% of the crop area in India is rain - fed, making it highly vulnerable to climate - induced changes in precipitation patterns.

It is further estimated that by 2050, with an increase in temperature of 2°C – 2.5°C as compared to pre - industrial levels, water for agricultural production in the river basins of the Indus, the Ganges, and the Brahmaputra may reduce and further impact the food adequacy as these rivers mainly depends on snow and glacial meltwater, making them more susceptible to the adverse impacts of global warming. Moreover, this could further increase the risk of floods in low line areas and pose a threat to agriculture (Source: The World Bank Report, 2013).

Climate change is also expected to slow down the poverty reduction rate. Though the change will affect the lives of everyone, it is the poor who will be the most affected as they are the ones largely dependent on rain - based agriculture and have no or minimal resources to sustain their

livelihoods. An increase of 2°C by 2040 is going to hit the crop production in South Asia too and will reduce the crop output by 12%, requiring more imports to meet the demand at home. Also, decreasing food availability would give rise to considerable health problems, especially among women and children (Source: The World Bank Report, 2013).

In the past few years, India has already witnessed the devastating impact of climate change such as Uttrakhand floods in the year 2013, Chennai floods in the year 2016, etc. (Source: National Disaster Management Authority). Also, there are shreds of evidence of a prominent increase in the intensity of extreme weather events such as heatwaves, extended dry spells, and intense rainfall. The adverse impacts of such disasters range from hunger, vulnerability towards diseases, loss of income, and livelihood opportunities (Jha, 2016).

Another overwhelming impact of Climate Change was reported in the Southern part of India in the year 2018 where the State of Kerala witnessed 2350 mm of rainfall in just two weeks against the annual rainfall ranging between 2000 - 3000 mm, costing the lives of nearly 483 people with an approximate loss of Rs.40, 000 crores (Source: Kerala flood 'The Human Story' a documentary by Discovery Channel). Such events in India are already costing a huge loss in terms of social, economic, human, infrastructural, environmental, biodiversity, etc. Also, restoring these affected areas may entail heavy economic resources which may go far beyond the estimated cost of the actual financial loss incurred by the State.

2. Factor Contributing to Climate Change in India:

According to the Centre for Research on the Epidemiology of Disasters (2007), the climate has always been linked with disasters, so far, through climate variability manifesting in extreme weather events such as cyclones, storms, floods, droughts, heat waves, windstorms, etc., with the potential for catastrophic loss of human lives, damage to infrastructure and the environment. Such events in the past have already showcased that human interventions with nature, have increased the risk of associated vulnerabilities by transforming natural hazards into man - made disasters (Mishra, 2014). Among the various contributing factors responsible for climate change in India, a few are as under:

1) Global Warming and Green Emission:

It refers to the overall warming of the earth due to the high volume of gases, which otherwise, should dissipate before reaching the atmosphere (Mukherjee, 2017). It upsurges the temperature of the earth by trapping the heat that retains its temperature higher than what it would be if directly heated by the sun, which is otherwise the only source of warming (Kweku *et al.*, 2017). Over the past many years, there has been a tremendous increase in the atmospheric concentrations of anthropogenic greenhouse gases such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), as well as halogenated compounds such as chlorofluorocarbon (CFCs), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) (Hecht, 2007). These anthropogenic gases are mainly responsible for the temperature rise in the environment, with carbon dioxide contributing the most (IPCC, 1996; IPCC 1997a; IPCC 1997b). As the amount of these gases increases, the quantity of heat received from the sun also increases, which is resulting in a consistent rising in the Earth's temperature (Sathaye, 2006). An increase in the emission of these anthropogenic gases can be directly attributed to the change in the pattern of energy, consumption, emission from landfills and septic processes, livestock, rice farming, use of fertilizers, and other human activities. These factors result in the risk of atmospheric temperature and pose a great threat to our environment (Source: IPCC, 2007).

2) Industrialization:

An increase in the greenhouse effect and the devastation of the earth's surface can be attributed to human efforts towards industrialization (Baldasano*et al.*, 2000; Evliyn, 2007). The concept can be understood as a process of transformation in society, socially as well as economically, where the agrarian society has involved technological inventions and innovations, making social change and economic development closely associated with this modern conception (Mgbemene, 2011). However, these attempts have become more industrialized, impacting the environment adversely and aggravate the climate change effects. For instance, anthropogenic activities such as the burning of fossil fuels are evidence of human contribution which is potentially causing an imbalance in the natural cycle by releasing more carbon dioxide into the atmosphere (Shah, 2015). The forest lands are acquired largely by the corporate houses for setting up their giant industries by the way of investing huge finances, the ripening of which is attained through the process of deforestation (Source: PreethiLolakshaNagaveni and Amit Anand, 2017). It is a well - known fact that trees are a good source of carbon sink as it removes the carbon by storing its cellulose in the trunk, branches, leaves, and roots and release oxygen back into the air. However, cutting of trees transfers carbon back from living biomass and cause harm to the atmosphere (Source: Benefits of Trees in Urban Areas, 2011).

3) Urbanization:

According to Kingsley Davis (1962), "Urbanization is an index of transformation from traditional rural economies to a modern industrial one. It is a finite process, a cycle through which a nation passes as they evolved from agrarian to industrial society. " In contrast, he also used the term 'over urbanization wherein both urban misery and rural poverty exist side by side (Davis and Golden, 1954). The views were supported by Breese (1969), as he sees the process of urbanization in India as a pseudo - urbanization where people arrive in cities not due to urban pull but due to rural push. Urbanization in India is followed by some basic problems in the field of housing, slums, transport, water supply, and sanitation, water pollution, air pollution, migration, unemployment, poverty, inadequate provision of social infrastructure like schools and hospitals (Kundu, 1994; Mukherjee, 2001). A synthesis report by Asian Cities Climate Resilience Network (2013) states, "The cities across the developing worlds are facing the challenge of rapid urbanization, growing poverty, and climate change - related risks. Most of the cities are already facing hydro - meteorological risks, both high - intensity disasters like

floods and cyclones as well as perpetual challenges like water scarcity and health." Climate change is likely to amplify the hydro - meteorological risks, where an increasing number of urban people are expected to be exposed to additional risks. These risks and impacts are expected to be different, with some sections of the population able to afford mitigation, coping, and resilience measures, while the rest are exposed to higher risks with little or no protective measures. The impact of urbanization and climate change are expected to simultaneously roll out in the coming decades. With high exposure burden as seen by high - density informal settlements located along with marginal lands (including the stream banks, even inside dry river channels) exposed to seasonal flooding almost every rainy season, and climate change impacts may increase the severity of the exposures (Source: Synthesis report by Asian Cities Climate Resilience Network, 2013).

4) Stubble Burning:

India is an agrarian nation that generates a large quantum of agricultural wastes. These residues (also known as paddy straw) are burnt each year, which has a significant impact on greenhouse gas emissions (Sidhu *et al.*, 2015). The burning of these residues leads to loss of precious nutrients as nearly 25% of nitrogen and phosphorus, 50% of sulfur, and 75% of potassium uptake from the soil that are retained in the crop residues. It has also been estimated that the burning of 1 tonne of paddy straw accounts for the loss of 5.5 kg of nitrogen, 2.3 kg of phosphorus, 25 kg of potassium, and 1.2 kg of sulfur, besides organic carbon. An estimated 12 megatons of greenhouse gas, mainly CO2 is released into the air through this process (*ibid.)*.

Stubble burning is becoming a common practice in the north - western part of India comprising of States such as Punjab, Haryana, and Uttar Pradesh. The other States consume paddy straw as cattle feed, thatching for houses in rural areas, fuel for domestic cooking and industry, mulching material, compost making, power generation, biofuels, and in boilers for parboiling paddy (Koopman, 1997). The burning of stubble also results in a depletion of air quality due to the presence of aerosol and trace gas emission which plays a vital role in global climate change and may further lead to a regional increase in the levels of aerosols, acid deposition, increase in tropospheric ozone and depletion of the stratospheric ozone layer (Ramanathan*et al.,* 2008; Ioannidou *et al.*, 2007).

It is evident that among the various reasons for stubble burning, shortage of labor increased wage rate, falling numbers of livestock can be seen as the major cause for adopting this malefic practice. Also, the progressive shift from the traditional use of manure and animal power to electric and mechanical move can be perceived as the supporting factors (Singh *et al.*, 2011; Sidhu *et al.*, 2015; Jat*et al.*, 2011).

3. The Way Forward

The United Nations Sustainable Development Goals 13 emphasizes taking urgent action for combating climate change and its impacts by the way of incorporating the ideas of adaptation and mitigation (Source: UN Sustainable Development Goals Report). It further requires the strengthening of resilience and adaptive capacity of government, non - governmental organizations, stakeholders, etc. to combat climate - related hazards and natural disasters. Also, by integrating climate change measures into national policies, strategies, and planning, by improving the standard of education, improve awareness, and improving the institutional capacity on climate change by the way of capacity building, effective results can be anticipated. India is among the fourth largest energy consumers and third largest carbon emitter in the words (Source: US Energy Information Administration, and India International Energy Data and Analysis). The country is also adding itself to the most vulnerable countries of the world that can bear the devastating impacts of climate change in the near future (Bhalla, 2014). After UNFCCC COP 19 was held in Warsaw, the Government of India took few measures to work towards the Intended Nationally Determined Contributions (INDC) on mitigation, adaptation, finance, technology, and capacity building. These contributions were taken into account not just for fulfilling India's domestic obligations on poverty alleviation, but also toward the growing challenges of food security, nutrition, and universal access to education, health, gender equality, women empowerment, water and sanitation, energy, employment, sustainable cities and human settlement for achieving the UN Sustainable Development Goals 2030 (Source: India's Progress in Combating Climate Change).

India is also vulnerable to natural disasters and extreme weather conditions. After witnessing the horrors of the Indian Ocean Tsunami in the year 2004 killing more than 10, 000 people, the Central and State governments in India started investing in the early warning systems. Considering the fact that nearly one - third of the country's population lives in the coastal regions and is prone to natural disasters like cyclones and storm surges, an early warning system may be prudent in saving the lives of millions.

Climate change adaptation has been placed on high priority by the Indian government keeping in view the high vulnerability of the population living in rural areas with limited infrastructure. In view of the same, the Government of India had launched the 'Climate Change Adaptation in Rural Areas of India' (CCA - RAI) in 2009 with the aims and objectives of integrating adaptation to climate change in various sectors falling under the ambit of Central and State governments (Source: German Federal Ministry for Economic Cooperation and Development).

Adaptation and mitigation measures have also been acknowledged as effective and equitable means to deal with the impacts of climate change, but are high in terms of technology and capital. While developed economies, choose to mitigate climate change by making heavy investments, the developing economies may focus on the process of adaptation. However, a joint approach in addressing the issues of adaptation and mitigation together can be the most appropriate measure for countries like India (Source: Climate Change Mitigation in India).

4. Suggestions

In order to combat the futuristic impact of Climate Change and Global Warming in India, a number of positive actions have already been initiated. Moreover, finding an appropriate solution to this problem as well as addressing the United Nations Sustainable Development Goals, lots of collaborative efforts, deliberations, and negotiations are required at large. Considering the ongoing scenario, it is vital to have some of the ground policies which may vary from State to State in India with some commonalities. The suggested measures have been divided primarily into two parts which are as under:

1) Role of Governmental Organizations:

a) For reducing the growing impact of climate change and global warming, the government should emphasize strict enforcement of the existing policies. The National Green Tribunal is already taking care of such issues at the Central level, but considering the quantum, it is essential to have the State chapters of the Green Tribunal.
b) Government should keep a check on unauthorized and unplanned urbanization as well as industrialization, which is increasing the burden of overall problems.
c) A strong check on the inappropriate rise in commercial as well as personal vehicles may be considered. In case if the government cannot put a ban on the purchase of diesel vehicles which is largely contributing to climate change by polluting the air, the prices of diesel vehicles may be kept on a higher side. Electric vehicles may also be promoted for intercity commutation.
d) Also, the Government may ensure that all the existing departments should refrain from the use of diesel vehicles and may shift to the use of petrol vehicles which will reduce carbon emission.
e) Under its Flagship scheme 'Atal Mission for Rejuvenation and Urban Transformation', the government has already endeavored to promote the use of non - motorized transportation. For effective results, a subsidy scheme may be introduced for households having bicycles with them.
f) The government must encourage and enable its citizens to adopt the use of solar energy. The same should be made mandatory for all upcoming residential societies/ govt. or private colonies and buildings/ industrials and corporate houses etc.
g) Alongside, emphasis should also be given to increasing the green cover. Also, conservation of the forest may help in reducing and reversing the given impacts of Climate Change and Global Warming on the mother earth.
h) Last but not least, strong political will and their mutual consensus, are the need of the hour.

2) Role of Non - Governmental Organizations/ Civil Society Organizations:

a) NGOs/ CSOs may assist in supporting the cause of climate change adaptation by generating awareness among the citizens at various fronts, including educational institutions along with the parents and guardians.
b) Through the efforts of NGOs/ CSOs, individual social responsibility may be promoted for adopting alternate methods like vehicle pooling, public transport, non - motorized transport like bicycles which will somewhere reduce the rate of carbon emission.
c) It is evident that under the umbrella of development, many trees are being chopped off and the natural habitat is compromised. NGOs/ CSOs have the capability to defend and take the initiative through discussion and activism in finding an alternative solution of tree transplantation where the same can be uprooted and replanted at the desired location. It will also promote the spirit of plantation drive.
d) At any stage of disaster, women, and children are the ones to suffer the most as the mortality rate among them remains high as compared to their male counterparts and can be associated with various social, economic, and cultural factors. Therefore, it is significant to promote gender sensitization and mainstreaming through the efforts of NGOs/ CSOs wherein women should be involved in the climate action plans. Once a woman is trained and involved in the programs, the entire family vis - à - vis society is directly or indirectly gets involved.

5. Conclusion

In the year 2015, United Nations General Assembly adopted 17 Sustainable Development Goals (SDGs) with a theme of 'Leaving no one behind. The main aim of these goals is to set attainable targets that can be achieved by 2030 as it will stimulate action over the next 15 years in different areas for promoting the importance for humanity and the planet (Source: United Nations, 2015). The SDGs are further divided into 169 targets and about 230 indicators further for realizing the worth of these targets. The World Commission on Environment and Development (1987) defined Sustainable Development as, "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. "

On the contrary, global conflicts are deepening with the passage of time, resulting in adverse environmental impacts of economic development. The policymakers are even more irresolute than before when it comes to environmental issues (Ghosh, 2013). Moreover, various schemes on climate projections are based on trend analysis and inherit a high spectrum of uncertainty. Hence, a fresh interpretation is required to evaporate the confusion and make policy planners more aware of the ground realities. Although natural disasters are far beyond the control of humans, their impacts can always be reduced by setting up an advanced system of warning (Mishra, 2014).

In order to address the fostering issue of climate change in India, adaptation and mitigation are so far the most sustainable and effective pathways as they will enable individuals to shift to environmentally sustainable technologies for developing resilience. It will also reduce the vulnerability of the natural ecosystem, shifting to renewable energy and promoting the concept of energy efficiency, forest conservation, reforestation and water conservation, etc. by fulfilling the development needs of the present without compromising the ability of future generations for meeting their own needs.

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