

A review on the issues of climate change and it's impact on North Eastern region with special reference to various socio--economic parameters.

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ABSTRACT

Study revealed that manifestations of climate change like erratic weather pattern, rainfall deficiency and high-intensity floods are seriously affecting the socio-economic development of marginalized and rural women in India. Agriculture production is direct dependence on climate change and weather, is one of the widely studied sector in the context of climate change. There are two ways to climate change can affect the food production system. Climate change over forestry turn to have profound implications for traditional livelihood, industry, biodiversity, soil and water resources and these leads to changes in agricultural productivity. Climate change will affect biological, biogeochemical and hydrological functions of wetlands. Based on the estimates made by Annual average runoff in the river Brahmaputra will decline by 14% by the year 2050, the assessment scenarios developed from Hadley Center Model Simulations. One of the major direct health impacts of climate change would be an increase in heart-related deaths and illness (primarily from cardio respiratory failure).Bit the global climate change will lead to a reduction in the goods and services that ecosystem provides, as well as decline in genetic and species diversity. There are direct and indirect effects on human infrastructure and habitats caused by climate change. Changes in temperature, precipitation, and sea level or extreme weather events can directly damage physical infrastructure. An increase in the average global temperature will results in a rise in sea level, due to the thermal expansion of the oceans and the melting of glaciers and ice sheets. In the 21st century Climate Change is the most persistent tropic that is talked and discussed in almost all International, national and state level conferences and meetings. In India, the policy makers are yet to focus deeply on the issues of climate change in North Eastern region. North East is one of the most fragile and environmentally sensitive regions of the world and is regarded as one of the ecological hotspot of the world because of the presence of rich flora and fauna. The impact of climate change has also started affecting education of the girl child in rural areas as once the mother decides to go out in search of work, the responsibility of the house usually rests on the girl child and she is asked to leave school. The findings also point out that in some areas, the adverse effects of climate change have also pushed many prosperous families to take up work as domestic helps and daily wage labourers.

Keywords: climate change, erratic weather pattern, rainfall deficiency, high-intensity floods, social security, Marginalized women, eco-system, Agriculture production

1) INTRODUCTION:

The report was released at the 18th UN Conference of Parties (COP) on Climate Change in Doha, quoting Regional Meteorological Centre (RMC), the study pointed out that between 2001 and 2011, rainfall deficiency in the Assam-Meghalaya meteorological subdivision ranged between 21 per cent (2002 and 2010) and 37 per cent (2006).² The rainfall data in Assam since 1950 till 2010 shows that there has been a steady decline in the annual rainfall in the state, while monsoon rainfall deficient years in the northeast has been growing since 2001 and the Assam-Meghalaya meteorological subdivision of the region have already recorded six monsoon rainfall deficient years since then. The income of families who are solely dependent on agriculture for their livelihood, has declined and there was a rise in the frequency of drought-like situation in the north eastern region. As a result of the decline in the income, the women folk, who were basically homemakers, now have started to work to supplement the families' income and in many places they have even started working as daily wagers. Skinner et.al.(2011) In hundreds of households, women are now compelled to take up weaving, daily wage labour and other related activities to make ends meet, and in many areas, women of the households are taking up fishing to make up for lost agricultural produce. The impact of climate change has also started affecting education of the girl child in rural areas as once the mother decides to go out in search of work, the responsibility of the house usually rests on the girl child and she is asked to leave school.

North East is one of the most fragile and environmentally sensitive regions of the world and is regarded as one of the ecological hotspot of the world because of the presence of rich flora and fauna. India's climate could become warmer under conditions of increased atmospheric carbon dioxide (Longerman S, 1998). The average temperature change is predicted to be in the range of 2.33° C to 4.78° C with the doubling in CO₂ concentrations (IPCC 1998).

The United Nations Framework Convention on Climate Change (UNFCCC) describes climate change as change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods, and also describes it as a long-term shift in the statistics of the weather (including its averages). According to climate scientists as a result of climate change billions of people, particularly those in developing countries could face shortages of water and food, and also face greater risks to health and life as a result of climate change. The UNFCCC, and the Intergovernmental Panel on Climate Change (IPCC,1991) reports also mention that the developing countries are the most vulnerable to climate change impacts because they have fewer resources to adapt: socially, technologically and financially. The IPCC reports also points out that even with a temperature rise of around 1–2.5°C there could be serious effects including reduced crop yields in tropical areas leading to increased risk of hunger, spread of climate sensitive diseases such as malaria. Assam is highly vulnerable to floods, river bank erosion, sand casting, landslides, cyclonic storms, and the exposure to such hazards is also aggravated because of the location of the state in the North Eastern region which is one of the most seismically active regions in the world.

Climate-induced disasters such as droughts, floods, and landslides are frequent in this region. It is affecting the availability of water resources, and biodiversity and ecosystems, hence challenging people's livelihoods, health, security, and wellbeing. The World Disasters Report recognizes that women and girls are at a higher risk of sexual violence, exploitation and abuse, trafficking and domestic violence in disasters. Biodiversity loss can also increase insecurity for women with the additional problem of household food hierarchies in some cultures. Bharati Borah, a social scientist based in the island Majuli on the Brahmaputra river in Assam, observes that limited opportunities for women as wage labourers in the rural areas was also forcing women to go to the nearby towns which in turn was making them vulnerable to the social problems. Borah, et.al., (2012). Women are left alone to face the natural disasters and the burden on women and girls to look after the sick in times of environmental disasters further limits their time and energy for self-development.¹ Moreover, the collapse of the tea plantations (due to unusual rain), decline in tea production and the lack of adequate jobs in this sector was also found to be responsible for girls being forced into flesh trade. Kieran, Cooke (2013), one finds that women's vulnerability is perceived as an issue of physical weakness. However it is primarily due to lack of assets and power, which in turn leads to lack of capable resilience.

2) Causes and its Impacts on various socio-economic aspects

a. Agriculture and Food:

Agriculture production is direct dependence on climate change and weather, is one of the widely studied sector in the context of climate change. The possible changes in temperature, precipitation and CO₂ concentration are expected to significant impact on crop growth. There are two ways to climate change can affect the food production system. One is direct and another is indirect. In direct changes through temperature, water balance and atmospheric composition as well as extreme weather events and indirectly changes through in the distribution, frequently and severity of pest and disease outbreaks, incidence of fire and in soil properties. These direct and indirect effects on agricultural system will not only responding to climate change but through fluctuating yield have a negative impact on production and distribution. Agricultural and allied activities constitute the single largest component of India's economy. Indian's agricultural activity continues with fully dependence of the weather. Saseendran et al.,(2004) have reported decrease in rice yields by 3% to 10% under a scenario of 1.5°C rise in temperature and a 2 mm day⁻¹ increase in precipitation. Matthews et al. (1994a) have estimated the impacts on rice yield for many countries in Asian region. Kumar and Parikh (1998) examined the impact on agricultural yields, output, income and prices in India.

b. Forests:

Climate is an important determinant of the geographical distribution, composition and productivity of forests. Forest area would be affected by climate depends on various factors like species and age of trees, possibilities for forests to migrate, and quality of forest management (Suthir Sharma and K.S.Kavikumar 1998). Climate change over forestry turn to have profound implications for traditional livelihood, industry, biodiversity, soil and water resources and these leads to changes in agricultural productivity. But some forests are also likely to

disappear due to higher temperature and an increase in the number of pests and pathogens. But temperature first will be affected to a lesser extent and tropical forests will be least affected under climate change condition (Catrinus J. Jepma and Mohan Munasinghe, 1998). Ravindranath N H and Sukumar R (1998) studied the impacts of climate change scenario on tropical forests in India. Their study dealt with green house gas forcing and incorporating the effects of sulphate aerosols. First scenario associated with increased temperature and rainfall, could result in increased productivity. Second scenario involved in increased temperature and a decreased precipitation, could have adverse effect on forests.

c. Aquatic Ecosystems:

Aquatic ecosystems include lakes and streams, non-tidal wetlands, coastal environs, and oceans. Temperature increases caused by climate change may due to the diversity and geographical distribution of species, the productivity of organism in ecosystem and the mixing priorities of lakes. Most favourable effects of warming will be felt at high latitude, where biological productivity and species diversity are likely to increase. Most significant negative effect will be experience by cold or cool water species in low latitudes where extinction is likely to increase and biodiversity will decline. Climate change will affect biological, biogeochemical and hydrological functions of wetlands. An increasing our temperature could affect the wetland by thawing permafrost, which is crucial for maintaining the water table in ecosystem. Economically and ecologically important coastal ecosystems are significantly damaged from climate change effects, such as sea level rise, changes in atmospheric temperature and variation in the rainfall patterns. The greatest impacts of climate change on many aquatic ecosystems would be the exacerbation of already existing stresses resulting from human activity. Over the past few decade's coastal wetlands, saltwater marshes, and mangrove systems have disappeared at a rate of 0.5 to 1.5% per year in some regions. Temperature changes and sea level rise will accelerate these trends. UNEP identifies India as a one of the country among the 27 countries that are most vulnerable to sea level rise. Asthana (1993) estimated that a 1 m rise in sea level would place 7.1 million people are risk of displacement or other server disruption in India. IPCC (1992) carried out the study at Orissa and West Bengal, that the absence of protection, a one-meter sea level rise would inundate 1700 km² of predominantly prime agricultural land.

d. Water Resources:

Impact estimation of water resources is complex because of the interaction of various climate as well as non-climate factors. Hydrological models show that water availability could vary widely among nations and within nations. Experts not able to project whether the human water supply system will advance sufficiently to counteract the anticipated negative impact of climate change and increased demand. Some of the factors such as vegetation, projected water demand, population complicate to assess the impact of climate change on water resources. Based on the estimates made by Annual average runoff in the river Brahmaputra will decline by 14% by the year 2050, the assessment scenarios developed from Hadley Center Model Simulations. Impacts will be observed more in the western Himalayas as the contribution snow to the runoff major rivers on the western side is about 60% compared to 10% on the eastern side (IPCC. 2001). Singh (1998) suggests that an increase in the surface temperature will lead to a rise in the snowline, increasing the risk of floods in North India during the wet season.

e. Human Health:

As the quality of life strongly depends on climate, climate change would affect the human amenity. Though warm climate is generally preferred over cooler climate, if the warming were beyond optimal temperature, it would have adverse effects. The vulnerability of human health is depends on function of causative factors. But the causative factors depend on nutrition status, population health, and health infrastructure. One of the major direct health impacts of climate change would be an increase in heart-related deaths and illness (primarily from cardio respiratory failure). Studies have been shown that heart related deaths could increase because of climate change, at the same time deaths due to cold weather conditions would decrease as a result of global warming. The indirect effect of climate change would expansion of the area under the influence of the malaria mosquito, these leads to increased global population exposed to malaria from current 45% to 60% by the latter half of the next century.

f. Ecosystem and Natural Habitats:

Human societies are mainly depends upon goods and services provided by the terrestrial and aquatic ecosystem. Bit the global climate change will lead to a reduction in the goods and services that ecosystem provides, as well as decline in genetic and species diversity. Mean annual temperature and precipitation can be correlated with the distribution of biological habitats throughout the world. Fluctuations and temperature and precipitation caused by climate change affect the geographical distribution of biological habitats. Adaptation tom such changes will vary among the animals and species of the plants. Some of the species will be able to migrate or adopt, those who cannot adopt quickly enough may become extinct. Pearce (1993) and Fankhauser (1995), estimate the total costs of species and habitat loss from climate change to be about US \$40 billion per annum for the whole world.

g. Human Infrastructure and Habitat:

There are direct and indirect effects on human infrastructure and habitats caused by climate change. Changes in temperature, precipitation, and sea level or extreme weather events can directly damage physical infrastructure. Indirect effects are likely to be felt through market sensitive to climate change. Effects on human infrastructure could be exacerbated by human migration caused by large-scale flooding, destruction of crops, droughts, or spread of disease. The impact of climate change on agricultural and ecosystem will be higher than the hard infrastructure sectors such as energy, transport, and industry. The impact on hydroelectric power generation will depend on frequency and quantity of rainfall and evaporation. Deforestation and other effects of climate change on forests will reduce the availability of fuel wood. Many nations will face the risk of losing capital valued at over 10% of GDP. Coastal communities will be vulnerable in erosion due to the sea level rise. Assuming no increase in population and no adaptive behaviour, a 50 cm rise in sea level would be affect the more than 90 million individuals.

h. Sea-level rise:

The rise in global sea level is the major impact of global warming after the temperature changes due to climate change. An increase in the average global temperature will results in a rise in sea level, due to the thermal expansion of the oceans and the melting of glaciers and ice sheets. The global average sea level has already increased by 10 to 25 cm during the past century. Based on the model calculation, IPCC estimates a mean value of sea level rise by 46 at the time of 2100. This rise is 2 to 5 times greater than rise experienced over the past 100 years. Fankhauser (1995) estimated the annual loss to land loss to be about \$ 45.6 billion world as whole, followed by a 50 cm rise in sea level.

i. Marginalized Women

The study, "Impact of Climate Change on Marginalized Women", conducted by Guwahati-based Centre for Environment, Social and Policy Research (CESPR), Rashtriya Gramin Vikas Nidhi (RGVN) and Indian Network on Ethnic and Climate Change (INECC) said more and more women, who were already marginalized, are bearing the brunt of climate change in the form of decline in livelihood and social security. The climate change and its impact on the marginalized women in various areas in Assam which are fragile and more vulnerable to the adverse impact of climate change. They are forced to move out of home to seek employment elsewhere because agriculture has become unsustainable. Women feel the challenge brought by climate change more acutely than others because they are more intimately associated with keeping food on the table, albeit not in the same way as men does.

The term marginalized women defines those women who are financially weak, and also weak socially, which means they don't have adequate decision making power both within their household and also in the society. In the last 60 years there has been a decline in the annual rainfall in the state, and there has been a rise in the minimum temperature by over one degree Celsius. During the climate change it is generally perceived by the marginalized women as the presence of more diseases, change in rainfall, change in climatic conditions and loss of agricultural output. The excessive floods, communication is disrupted for long period of time and this broods

ill more for girls who are often forced to drop out of schools and colleges. Besides, the adverse impact of the flood on the income of the family often forces the women of the house to step out and seek work elsewhere.

3) Conclusion:

The effects of global climate change could be potentially serious over the next century include regional increases in floods and droughts, inundation of coastal areas, high-temperature events, fires, outbreaks of pests and diseases, significant damage to ecosystem, and threats to agricultural production. Climate change will also pose a major risk to human health and safety, especially among poorer communities with high population densities in areas like river basins and low-lying coastal plains, which are vulnerable to estimate related natural hazards such as storms, floods, and droughts. The world's leading experts working under the aegis of the IPCC have recently concluded that increases in global mean surface temperature during the past century are unlikely to have been caused entirely by natural effects, and that changes in both average temperature and the geographic, seasonal, and vertical patterns of temperature indicate the influence of human actions on global climate. In IPCC's report it mentioned that Climate change is a reality, CO₂ Weeds will become more competitive from carbon fertilization, Mitigation strategies need to be studied to meet the challenge posed by climate change on agriculture productivity, Water management practices such as alternate wetting and drying, mid-season drainage helps in reducing CH₄ emission from rice fields and Increase humidity and higher temperature will result in more infestation of disease.

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