



Impact of climate change in North-East India

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Abstract: The Northeast region of India has witnessed significant changes in key climatic variables, such as rainfall patterns and temperature. Projections suggest that average temperatures will continue to rise across most districts in the region, while annual rainfall is expected to increase in certain areas. Climate-induced natural disasters, such as droughts and floods, have become major threats, with their frequency and severity escalating in recent years. Climate change has now become a pressing global issue, affecting all forms of life, including humans, and poses a serious risk to the survival of many species. Its impacts are far-reaching, directly influencing agriculture, human health, forestry, biodiversity, water resources, energy, and the infrastructure of rivers and wetlands. According to the IPCC (2007), the global average air temperature has increased by 0.74°C from 1906 to 2005. Climate change is a global phenomenon that affects every country. It is driven by both human activities and various abiotic factors, such as latitude, altitude, topography, ocean currents, as well as biotic factors like transpiration and photosynthesis. Extreme weather events, like droughts and floods, have become more frequent and intense, disrupting the livelihoods of people, particularly in developing nations. This paper aims to examine the changing livelihood dynamics in Northeast India due to climate change-induced events such as droughts and floods. It is reported that climate-sensitive sectors, especially agriculture, are suffering the most from these changes. The communities dependent on these sectors are particularly vulnerable, facing significant livelihood challenges that threaten their well-being and push them into increasingly difficult situations.

Key words-Climate, Global warming, Agriculture, Biodiversity, Environmental.

1. Introduction

Climate change is undeniable, and its effects are clearly observable in Northeast India. This region, situated within the Indo-Burma biodiversity hotspot, is home to a highly fragile and sensitive ecosystem. Due to its unique geographical location and rich biodiversity, any shift in climate becomes highly noticeable. Climate change, a global environmental issue, affects a range of sectors including agriculture, forestry, water resources, wetlands, biodiversity, and human health, all of which are interconnected with human well-being. Research indicates that global warming, driven by human activities such as increased CO₂ emissions and other greenhouse gases, plays a major role in climate change. These gases are primarily released through fossil fuel combustion in energy production, transportation, and industrial activities, along with deforestation and intensive agriculture. Global warming has emerged as one of the greatest threats to humanity, impacting both current and future generations.

Climate change refers to long-term alterations in weather patterns across large regions, typically measured through multi-year seasonal observations. Northeast India is especially vulnerable to climate change due to its unique topography and the interaction between its geography and ecology. The region is already experiencing several impacts, such as rising temperatures, more frequent landslides, and increased instances of cloud bursts and flash floods. These events disrupt the hydrological systems of rivers like the Brahmaputra and its extensive tributary network, which support a diverse ecosystem (Barua et al., 2014). Although the

region typically receives rainfall during both the summer and winter, studies show a slight decline in overall rainfall in recent years (Das, 2004; Mirza et al., 1998; Tiwari, 2006; ASTEC, 2011).

Reports indicate that the annual maximum temperatures in the region have increased by 1.7-1.8°C since the 1970s. Additionally, while the number of rainy days is expected to decrease in Assam, rainfall intensity is predicted to rise (INCCA Report, 2010). This shift in rainfall patterns, along with increasing variability, could result in drought-like conditions in some areas while causing heavy floods in others.

The economy of Northeast India, particularly Assam, is largely dependent on agriculture and agrarian sectors like fisheries, farming, and dairy. Climate change has severely impacted these climate-sensitive activities, with fluctuations in temperature, air pressure, delayed monsoons, excessive rainfall, hailstorms, and cloud bursts affecting local resources and livelihoods. These changes pose both direct and indirect threats to the livelihoods of the people, many of whom are dependent on agriculture. Those working in these sectors are particularly vulnerable and face numerous challenges, often resulting in severe hardship.

Today, climate change is not just a potential threat it is one of humanity's greatest challenges. This paper will specifically address the livelihood problems faced by agricultural communities in Northeast India, focusing on the impacts of drought and unseasonal floods caused by climate change.

2. Objectives

This article aims to highlight, through an extensive review of existing literature, the challenges that climate change poses to agriculture and human livelihoods. To achieve this, we have outlined the following objectives:

- To examine the various detrimental impacts of climate change on the agricultural sector.
- To explore the livelihood challenges faced by individuals involved in agrarian activities and how they are adapting to these issues.

3. Discussion

3.1. Climate change and agricultural related livelihood:

It has been observed that global temperatures are rising, leading to the retreat of Himalayan glaciers at an average rate of 15 meters per year. This glacial melt contributes to water stress in the Brahmaputra basin during the lean season. The retreat of glaciers in the Himalayas may cause significant disruptions to the hydrological systems of the Brahmaputra and its tributaries, such as the Subansiri and Jia-Bharali, resulting in increased rainfall and intensified summer flows (Das, 2009).

The recent floods in Assam are a clear indication of the impact of climate change on Northeast India. The people of Assam are grappling with the effects of extreme weather events on their livelihoods. Agriculture, food security, and ecosystems are adversely affected, with a reduction in forest cover that indirectly contributes to rising flood levels, riverbank erosion, and the loss of agricultural land. Additionally, the productivity of natural fisheries has declined, threatening the livelihoods of those dependent on this sector.

Climate change is altering the region's normal weather patterns, including changes in rainfall and temperature, and an increase in the frequency of extreme events such as droughts and floods. These changes are creating significant livelihood risks for the local population.

For example, the flood conditions in Merer Char, Bongaigaon District, affected approximately 130 hectares of land and caused the loss of assets and crops for over 1,100 people. It has also been reported that around 10% of the population in this area has migrated to other places such as Delhi, Tamil Nadu, and Bangalore in search of work. This situation is not unique to Merer Char; many flood-affected people in Assam, particularly those living near embankments, lose their land, occupations, and incomes linked to water resources. Many are forced to migrate to distant places like Kerala, Bangalore, and Mumbai to work as laborers or in agriculture (Das, 2009).

The evidence of climate change in agriculture is becoming more evident, particularly in the last four to five years, and will continue to increase in the future (Das, 2009). In Abhayapuri, Bongaigaon District, the rainy season has been changing, with larger hailstones causing extensive damage to paddy fields, leading to severe livelihood issues. Additionally, the emergence of pesticide-resistant pests, driven by climate change, is further compromising crop yields and threatening livelihoods.

Climate change poses a significant challenge to the rural livelihoods of billions of poor people in the Asia-Pacific region. Agriculture is especially vulnerable to climate change, as more than 60% of the population in rural areas is engaged in this sector, making them highly susceptible to climate impacts (S. Mahendra Dev, 2011). Poverty is closely linked to repeated exposure to climate risks, and climate change is expected to exacerbate these risks, further stretching already limited coping strategies and deepening inequalities, especially based on gender and other social disadvantages (UNDP, 2007).

The short-term impacts of climate change on agriculture, such as reduced incomes and livelihoods due to extreme events like droughts, floods, and cyclones, are well recognized. These events can have devastating effects on human development. Long-term impacts, though less visible, are equally destructive. Climate shocks affect livelihoods by destroying crops, reducing employment opportunities, driving up food prices, and damaging property. While the wealthy may use private insurance, asset sales, or savings to cope, the poor have few alternatives but to cut consumption, reduce nutrition, withdraw children from school, or sell off productive assets necessary for recovery. These choices limit human potential and reinforce inequalities (UNDP, 2007).

The shift in insect-pest dynamics, driven by climate change, is another major threat to agricultural production and farmer livelihoods, especially in countries where a large portion of the workforce depends on climate-sensitive sectors like agriculture (Chahal et al., 2008; Deka et al., 2008).

Although agriculture has historically been the primary source of livelihoods, there has been a significant rise in income from off-farm activities and remittances due to migration, which may be linked to climate change. Rural households rely on agriculture, rural labor markets, and self-employment in the rural non-farm economy, with many others migrating to towns, cities, and abroad for work. Migration has become an important source of income.

3.2. Climate change and fisheries:

Fisheries and aquaculture provide livelihoods for 520 million people worldwide (FAO, 2009a), with 98% of them living in developing countries (World Bank, 2005). The number of fishers has increased by 400% since 1950, while the number of agricultural workers has grown by just 35% over the same period (FAO,

2005). As a result, many poor people are turning to fishing for their livelihoods. However, climate change negatively affects both aquaculture and wild fisheries, posing a threat to these livelihoods.

Unseasonal floods in Assam can have a severe impact on wetlands and fisheries, sectors that are particularly vulnerable to climate change. Even areas that typically experience high rainfall are facing drought-like conditions in recent years. Droughts and floods, resulting from insufficient or excessive rainfall, respectively, are increasingly common. Low water levels in wetlands, ponds, and rivers, combined with higher temperatures, hinder fish breeding, particularly in shallow water bodies. For instance, the drought situation in Son Beel (Karimganj, Assam) has led to a decrease in fish populations, forcing fishermen to seek alternative sources of income as daily wage earners. This climate-induced decline in fish stocks is making it increasingly difficult for people to sustain their livelihoods from fisheries.

4. Conclusion

The declining trends in agricultural production and fish populations are forcing people to shift their livelihoods. In Assam, where more than 60% of the population relies on agriculture and fisheries, these communities are especially vulnerable to the impacts of climate change. It is therefore crucial to address the issue of climate change and its far-reaching consequences. As a global challenge, it can only be tackled through collective action across all sectors of society. Raising mass awareness and promoting technological advancements are key strategies to mitigate the harmful effects of climate change. On a positive note, researchers from Melbourne's Monash University have recently uncovered a new mechanism that enables plants to flower in response to higher temperatures (Assam Tribune, 3rd May, 2016). Such innovative research offers hope and encouragement in the face of the climate crisis.

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