



THE EFFECTS OF CLIMATE CHANGE ON RURAL LIVELIHOOD AND FOOD SECURITY IN INDIA

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ABSTRACT

One of the biggest concerns facing humanity in the twenty-first century is climate change. Any significant long-term shift in the patterns of the entire Earth's regular weather throughout time is referred to as "climate change." Nonetheless, an increase in anthropogenic activities like agriculture, urbanisation, deforestation, industrialization, and changes in land use patterns releases more greenhouse gases into the atmosphere, hastening the pace of climate change. The three main issues related to climate change are food security, livelihood, and sustainable farming methods. Food security and livelihood are complicatedly impacted by climate change. Food security and livelihood are complicatedly impacted by climate change. Its effects on fisheries, aquaculture, forestry, agriculture, and cattle can have serious negative social and economic repercussions, including decreased earnings, diminished livelihoods, interruptions to commerce, and detrimental effects on health. Human decisions about production and consumption are impacted by climate change. The impact is even more on a predominantly agrarian economy like India, creating ripple effects on the entire food production chain. The adaptation and mitigation strategy for climate change requires careful management of resources like soil, water, and biodiversity. To cope with the impact of climate change on food security and livelihood, India needs to adopt an integrated approach at the international, national, regional, and local levels.

KEYWORDS: Climate change, food security, livelihood

1. INTRODUCTION

The climatic condition of a region is the most influencing determinant of its production, productivity and sources of livelihood. The changing climate describes global warming with its effects on earth's climate system. Concern over the effects of this changing climate on India's food security, rural agriculture, and means of subsistence is mounting, and empirical research is needed. In the line of the second Sustainable Development Goal of "End hunger, achieve food security, enhance nutrition, and promote sustainable agriculture, India is planning and executing different programs of food and nutrition security for its people. Despite its quicker economic expansion, India's economy faces a multifaceted problem with food security. A society's level of food security is determined by its adherence to the four pillars of food security: availability, accessibility, utilisation, and sustainability. These factors are related to one another and rely on opportunities and patterns of livelihood in the nation. Since India has an agrarian economy, rural agriculture is the main source of income, therefore using sustainable agricultural practices is more important to achieving food security. Sustainable farming practices, livelihood and food security are the most essential challenges related with climate change. Climate change affects livelihood and food security in various ways. Its effects on fisheries, aquaculture, forestry, agriculture, and cattle can have serious negative social and economic repercussions, including decreased earnings, diminished livelihoods, interruptions to commerce, and detrimental effects on health. Human decisions about production and consumption are impacted by climate change. A country like India, whose economy is based primarily on agriculture, is particularly affected, with repercussions for every link in the food production chain. A lack of water or excessive heat can hinder crop development, lower yields, and have an impact on irrigation, soil quality, and the ecology that supports agriculture. Natural disasters and water scarcity are two elements that affect the risk to food security. Higher temperatures, shifting precipitation patterns, sea level rise, and an increase in the frequency and intensity of extreme weather events like droughts, floods, extreme heat, and cyclones are already decreasing agricultural productivity, upsetting food supply chains, and uprooting communities, according to the International Food Policy Research Institute's (IFPRI) Global Food Policy Report 2022. According to the report, a drop in agricultural productivity and disruptions in the food supply chain caused by climate change could drive a large number of Indians into starvation by 2030. The report also states that around 65 million people worldwide are vulnerable to hunger brought on by



climate change, with India having the highest number of hungry people—17 million—by 2030. The report goes on to say that even if food production increases by 60% globally by 2050, 50% of Indians will still be at risk of starvation. Seven of these 50 cores would experience hunger as a result of climate change.

Food insecurity is a complex issue that affects around 195 million undernourished people in India (UN-India), which accounts for 25% of the world's hunger burden. Focus and attention, together with appropriate action at local, national, and international levels, are required to address the catastrophic effects of climate change on the lives and livelihoods of already impoverished and vulnerable to food insecurity Indian people.

2. OBJECTIVES

Against this backdrop, the study aims

- (i) To examine the effect of climate change on rural livelihood and food security .
- (ii) To identify the effective measures for reducing the adverse effects of climate change and thereby maintaining sustainable agriculture and food security.

3. METHODOLOGY

The approaches adopted in this study are both analytical and descriptive in nature. We gathered secondary data from the body of existing literature. To investigate and accomplish the goals of this study, national and international reports have been consulted.

4. DISCUSSION & RESULT

It is difficult to identify and attribute the effects of climate change on food security due to numerous non-climatic forces (Porter et al., 2014). Key components of food security, including food pricing, household income, food safety, and the nutrition of vulnerable groups, are all impacted by the effects of climate change on food provisioning (fig. 1) (Peri, 2017; Ubilava, 2018).

4.1. Effect of climate change on food availability and productivity:

There is evidence in literature that severe food insecurity is often a result of extreme climate occurrences (FSIN, 2021). A lack of long-term data and the complexity of food systems continue to limit the detection and attribution of food insecurity to anthropogenic climate change, despite mounting evidence that human-induced climate warming has intensified climate extreme events (Seneviratne et al., 2021). (Phalkey et al., 2015; Cooper et al., 2019).

To satisfy the desire for high-quality meals, one must consume enough energy from food. Eighty percent of the dietary energy supply is provided by grains, vegetables, fruits, roots, tubers, oil seeds, and sugar (FAO, 2019). The inhabitants rely heavily on these crops for both sustenance and revenue. Crop productivity varies greatly as a result of climate fluctuation. Crop losses resulting from climate-related hazards are on the rise everywhere in the world, including India.

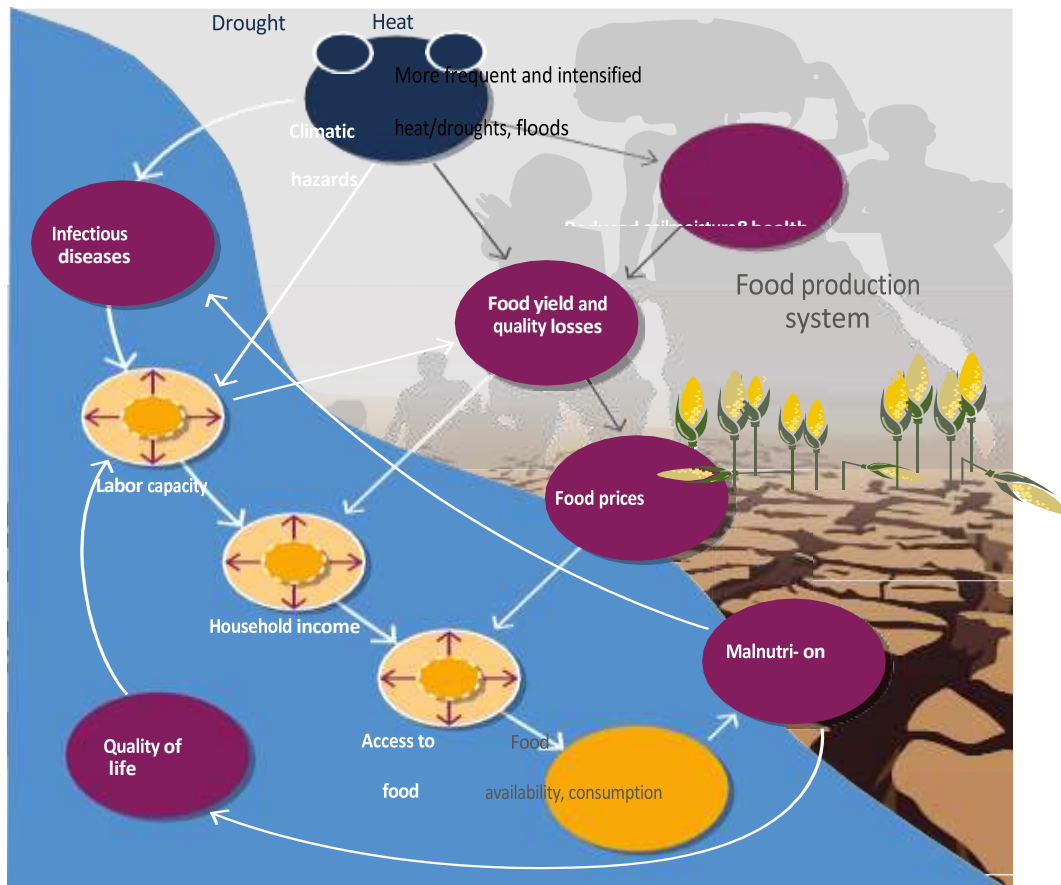


Fig. 1: Cascading Impacts of Climate Hazards on Food and Nutrition

Source: The factors involved the impacts on crop production and prices (black arrows) and interaction among food-health interaction (white arrows). Adapted from (IPCC Sixth Assessment Report, Chapter 5).

Roughly 75% of the world's harvested land has experienced yield losses due to drought (Kim et al., 2019), and these losses have been worse recently. The yields of rice (Liu et al., 2019) and wheat (Zampieri et al., 2017) have decreased due to heat waves. Global average yields of maize, soybeans, and wheat were reduced by 11.6%, 12.4%, and 9.2%, respectively, as a result of the combined effects of heat and drought (Matiu et al., 2017).

Countries like India, which rely heavily on agriculture despite having little arable land, are projected to be particularly affected by climate change due to their lack of resources and inadequate technology for both mitigating and adapting to the phenomenon. Climate change has been linked to a rise in the frequency of natural disasters such as heat waves, cyclones, floods, and droughts in recent times. The country's agriculture productivity may suffer greatly as a result of drought or floods brought on by an abundance of rainfall. The World Bank claims that local food prices have increased in tandem with the rise in global food prices, which has been made worse by droughts. The surge in food prices in India has affected other neighboring countries, such as Bangladesh, Bhutan, Nepal, and Sri Lanka. India's domestic demand increased during the 2008 inflationary period and was further exacerbated by the El Nino weather pattern in 2009, which led to a drought and food shortages.

The yield of staple crops such as rice and wheat has fallen dramatically along with the decline in nutritional content as a result of climate change. The damage caused to agriculture and food security by the ongoing heat wave is multi-dimensional. It damaged the wheat crop, and affected the food supply, prompting a phenomenal rise in the price of wheat products. The loss to wheat is both qualitative as well as quantitative as besides the low output, the grain is also of poor quality. India's recent ban on wheat export stands as another witness to the spiral effect of the heat wave. In order to control domestic food security, the Indian government has chosen to halt wheat shipments abroad. The price of wheat, which was already high due to Russia's invasion of Ukraine, a key wheat exporter, reached 435 euros (\$453) per tonne, primarily hurting underdeveloped nations. Nevertheless, because non-climatic elements are involved, it is challenging to pinpoint the actual influence of climate change



on crop productivity. Farmers utilise excessive amounts of fertilisers and pesticides in response to heat waves and droughts, which accelerates the depletion of groundwater and raises production costs while lowering food quality.

4.2: Effect of climate change on livestock production

A significant obstacle to the growth of India's cattle industry is climate change. The total area where high-yielding dairy cattle can be economically raised is expected to decrease as a result of the predicted rise in temperature between 2.3 and 4.8°C across the entire nation and increased precipitation brought on by climate change. These factors are likely to exacerbate heat stress in dairy animals, negatively impacting their reproductive and productive capacities. The livestock industry would be severely impacted by more intense extreme events, especially in low-income rural regions, especially as India is highly vulnerable to sea level rise. The anticipated detrimental effects of climate change on Indian agriculture will exacerbate feed and fodder shortages, which would have a severe influence on cattle productivity as well. Methane emissions from the cattle industry, which will be negatively impacted by climate change, are a significant source of emissions. Livestock supply chains account for 14.5% of all human greenhouse gas emissions (FAO, 2017). Both human health and the biosphere are negatively impacted by it. Together with feed availability, climate has an impact on animal growth rates, milk and egg production, reproductive health, illness, and mortality. The availability of livestock is reduced for consumers as a result of climate change, but it also significantly affects livestock keepers and the ecosystems that provide them with commodities and services.

4.3. Effect of climate change on food production and susceptibility

Food preparation, food quality, and intra-household distribution are all included in food utilisation, which is the term used to describe how the body uses food most efficiently.

Table 1. Climate Vulnerability Index of Indian States

State	Overall Vulnerability Index Score	Rank
Assam	0.616	1
Andhra Pradesh	0.483	2
Maharashtra	0.478	3
Karnataka	0.465	4
Bihar	0.448	5
Manipur	0.424	6
Rajasthan	0.423	7
Arunachal Pradesh	0.408	8
Sikkim	0.370	9
Odisha	0.368	10
Nagaland	0.365	11
Tamilnadu	0.339	12
Himachal Pradesh	0.329	13
Jammu & Kashmir	0.328	14
NCT Delhi	0.290	15
Gujarat	0.280	16
Uttar Pradesh	0.269	17
West Bengal	0.257	18
Tripura	0.250	19
Kerala	0.226	20

Source: Mohanty and Shreya Wadhawan (October 2021) Mapping India’s Climate Vulnerability- A District-Level Assessment

Climate change has an impact on food consumption in a number of ways, including food safety, dietary diversity, and food quality. The availability and accessibility of a wide variety of affordable and diverse foods for both small-scale rural producers and net consumers in rural markets has decreased due to weather variability and extreme events (Seneviratne et al., 2021). This is especially true for landlocked and low-income countries like India. Due to a number of factors including possible reduction in food quantity and quality due to heat impacts, increased exposure from outdoor play and agricultural activities, and an increased risk of heat exhaustion and vector-borne and diarrheal diseases, rural children in India are particularly vulnerable to under nutrition as a result of climate change.



The Climate Vulnerability Index (CVI) is a useful tool for mapping population vulnerability to climate change. The CVIs of Assam, Andhra Pradesh, Maharashtra, Karnataka, and Bihar are in the high range (Table 1), making them the five most vulnerable states in India, according to an estimate of the CVI of India and its districts (Mohanty and Wadhawan, 2021).

4.4. Impact of Climate Change on Food Safety & Nutrition

Climate change has a significant impact on future food safety and nutrition. Increasing temperatures and drought stress are expected to lead to greater aflatoxins contamination of food crops. Aflatoxins, a major food-borne hazard, contaminate staple crops and are associated with various health risks, including stunting in children and cancer (Koshiol et al., 2017). Children with high exposure to aflatoxins were found to be more likely to suffer from micronutrient (zinc and vitamin A) deficiencies (Watson et al., 2016). Reduces in the micro- and macronutrient content of food due to climate change are predicted to increase the burden of infectious diseases, diarrhoea, and anaemia; by 2050, disability-adjusted life years (DALYs) linked to undernutrition and micronutrient deficiencies are expected to rise by 10%. These various effects of climate change, such as decreased food availability, quality, and safety as well as an increased risk of diarrheal illness, would put children in low-income countries at higher risk of undernutrition (Aberman and Tirado, 2014). The UN SDG-2 is at a standstill and is unlikely to be accomplished by 2030 due to the impact of climate change. This goal is impeded by the influence of climate change on various factors that contribute to food security and nutrition, such as Africa and India. To increase the chance of achieving SDG2 targets, integrated policy initiatives that take into account trade-offs and synergies across various food system components are required.

5. THE WAY FORWARD

In addition to having an adverse effect on health and the process of development as a whole, India's high vulnerability to climate change is expected to slow economic growth and threaten food security, according to the UN Intergovernmental Panel on Climate Change (IPCC), 2022. This will make the task of reducing poverty even more challenging. An integrated strategy is required to lessen the detrimental effects of climate change on rural livelihood and food security.

(i) Sustainable Farming Methods

In the Indian agricultural sector, more output and productivity are required. Increasing productivity across the board in agriculture is vital to fulfil India's rising food demand. However, agricultural techniques need to be reoriented to create improved climate resilience, given how vulnerable Indian agriculture is to climate change. Based on the region's climate, crop diversity is necessary. Reorienting farming operations is necessary to improve climate resilience by making them more resilient to swings in temperature and precipitation and by using less water and fertiliser.

(ii) Livelihood Security Measures :

The people's ability to eat depends on their security of livelihood. Adopting robust measures is necessary to achieve food security in the context of climate change. Climate change poses a threat to the accessibility, utilisation, and sustainability components of food security in addition to the availability of food through domestic production and consumption. The livelihood security of the population can be improved by raising rural salaries, closing gender wage inequalities, improving food access, decreasing distress migration from rural areas, building small-scale and cottage enterprises in rural areas, developing non-farm sector development programmes, etc. Decreases in hunger and poverty as well as advancements in health and education are indicated by the rising income.

(iii) Modification and Reduction of Animal Production System

An essential part of the nation's economic development is livestock. According to Sirohi and Michaelowa (2007), the sector employs 18 million people in major or subsidiary roles and makes up more than one-fourth (26%) of the nation's agricultural GDP. Developing suitable adaptation and mitigation strategies for the industry is essential to addressing the challenge posed by climate change. The conservation of natural marine and terrestrial ecosystems, as well as the identification of protected zones where species display genetic variability, are critical steps that society must take in order to assist wildlife in adapting to the effects of climate change.

Restoring habitat and practicing agroforestry are two practical ways to shield the livestock industry from the effects of climate change. Agroforestry systems benefit from the trees' ability to shade better areas, lessen the



intensity of droughts, and give wildlife habitat and food supplies. In a similar vein, the restoration of mangroves and wetlands provide refuge, breeding grounds, and nesting places to numerous marine and bird species, safeguards coral reefs, and serves as nurseries for the world's seafood supply.

(iv) **long-term natural catastrophe relief**

The government's usual response to natural disaster victims, which is usually swift relief, is insufficient to lessen the negative impacts of these calamities on human health, nutrition, and way of life. Long-term solutions are required to lower the rate of undernutrition among the local population and increase agricultural productivity in the disaster-affected area. The production and productivity of these disaster-affected areas are boosted by loan-weaver schemes, input supplies, irrigation infrastructure, crop insurance for small farmers, and other initiatives.

(V) **Integrated Impact Assessment**

An increasing concern for sustainable development is climate change, which calls for coordinated action. Despite being a worldwide phenomenon, its effects are being seen locally. India must step up its efforts to combat climate change at the sub-national and local levels in order to lessen the toll that extreme weather events take on millions of people's lives and means of subsistence.

6. CONCLUSION

one of the biggest risks facing humanity in the twenty-first century is climate change. The effects of global warming are felt everywhere. In a developing nation like India, the issue of food insecurity and livelihood has been made worse by cyclonic disturbances that occur frequently, intense monsoons, unpredictable rainfall, sea level rise, and an increase in the frequency and severity of heat waves, floods, and droughts (IPCC, 2018). Soil, water, and biodiversity need to be managed carefully as part of the adaptation and mitigation strategy for climate change. India must take an integrated strategy at the global, national, regional, and local levels to address the effects of climate change on food security and livelihood.

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