

Climate Change and Food Security in India

RAHUL CHOUDHARY

Assistant Professor (Extension)

Department of Geography

Pt. N. R. S. Govt. College, Rohtak (HR)

rcsheoran.02@gmail.com

ABSTRACT: The World Food Summit in 1996 defined food security as: “Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their daily dietary needs and food preferences for an active and healthy life. “According to this definition, there are Three Main Dimensions to Food Security: food availability, access to food, and food absorption. Thus, adequate food production alone is not a sufficient condition for a country’s food security. Climate change has added to the enormity of India’s food security challenges. While the relationship between climate change and food security is complex, most studies focus on one dimension of food security, i.e., food availability. This paper provides an overview of the impact of climate change on India’s food security, keeping in mind three dimensions — availability, access, and absorption. It finds that ensuring food security in the face of climate change will be a formidable challenge

and recommends, among others, the adoption of sustainable agricultural practices, greater emphasis on urban food security and public health, provision of livelihood security, and long-term relief measures in the event of natural disasters. Much of the literature available is on the impact of climate change on food security, which just focused on just one dimension of food security, i.e., food production. But other impact of climate change on the other dimensions of food security like - access and utilization to food- has received little attention. This paper explores the impact of climate change on India’s food security by considering all these dimensions of food security.

KEYWORDS: Climate, Food Security, Agriculture, Nutrition, Food Grain, Rainfall, India.

INTRODUCTION: The impact of climate change on India’s food security has three dimensions — Availability, Access, and Absorption. Food security is one of the

leading concerns associated with climate change. Climate change affects food security in complex ways. It impacts crops, livestock, forestry, fisheries and aquaculture. Climate Change can also cause grave social and economic consequences in the form of reduced incomes, eroded livelihoods, trade disruption and adverse health impacts. However, it is important to note that the net impact of climate change depends not only on the extent of the climatic shock but also on the underlying vulnerabilities. According to the Food and Agriculture Organization (2016), both biophysical and social vulnerabilities determine the net impact of climate change on food security.

As we know the Objectives of the Sustainable Development Goals (SDGs) are targets to end hunger, achieve food security, and improve nutrition which later results in better health and living conditions of human beings. For India, food security continues to be high on its list of development priorities because even the country's relatively high rates of economic growth have not led to a reduction in hunger and undernutrition among its vast population. India's gross domestic product on factor cost and per capita income grew at about 7% and 5% per annum, respectively from 1990-91 to 2013-14. However, the

incidence of undernutrition among masses has dropped only marginally from 210.1 million in 1990 to 194.6 million in 2014, and India has failed to achieve one of its key as well as basic the Millennium Development Goal of reducing half the proportion of people who suffer from hunger. About 12 Indian states fall under the 'Alarming' category of the Global Hunger Index. According to the National Family Health Survey 2015-16, the proportion of children under five years who are underweight is significantly high in states such as Bihar (43.9 %), Madhya Pradesh (42.8 %) and Andhra Pradesh (31.9 %).

While large sections of the Indian population is suffering from acute stage of under nutrition, meanwhile rising incomes and growing urbanization are rapidly changing the composition of the food basket — away from cereals to high-value agricultural commodities such as fish and meat. As a result of which, the total demand for food grains is projected to be higher in the future due to a rapid increase in population as well as a growing indirect demand from the feed. One of the biggest issues we are confronting today in present times is Indian agriculture's low productivity. India's cereal yields are drastically lower than those of developed regions such as North America (6671 kg per

ha), East Asia and the Pacific (5,184 kg per ha), and the Euro area (5855.4 kg per ha).With current production trends,

meeting future demand for food grains through domestic production will be difficult.

Table 1: shows the Cereal yields (kg per ha, 2013)

Country/ Region	Kg per hectare
East Asia & Pacific (developing only)	5,184.0
Central Europe and the Baltics	4,131.1
Sub-Saharan Africa	1,433.5
Europe & Central Asia (all income levels)	3,661.6
Euro Area	5,855.4
North America	6,671.0
India	2,961.6
World	3,851.3

Source: World Bank Database

Table 2: Shows Growth (%) rate of yield per hectare of food grains Source: RBI database

Year	Rice	Wheat	Coarse Cereals	Pulses	Total Food grains
1980-81 to 1990-91	2.7	3.4	2.6	2.0	3.0
1990-91 to 2000-01	0.9	1.7	1.3	-0.6	1.7
2000-01 to 2010-11	1.6	1.0	4.1	2.4	1.7
2010-11 to 2014-15	1.6	-1.0	3.1	1.9	1.8

FOOD PRODUCTION: Climate change presents an additional stress on India's

long-term food security challenges as it affects food production in many ways. For

one, it may cause significant increases in inter-annual and intra-seasonal variability of monsoon rainfall. According to World Bank estimates, based on the International Energy Agency's current policy scenario and other energy sector economic models, for a global mean warming of 4°C, there will be a 10 % increase in annual mean monsoon intensity and a 15 % increase in year-to-year variability in monsoon precipitation. The World Bank (2013) also predicts that droughts will pose an increasing risk in the north-western part of India while southern India will experience an increase in wetness.

The impact of climate change on water availability will be particularly severe for India because large parts of the country already suffer from water scarcity, and largely depend on groundwater for irrigation. According to Cruz et al. (2007), the decline in precipitation and droughts in India has led to the drying up of wetlands and severe degradation of ecosystems. About 54 % of India faces high to extremely high water stress. Large parts of north-western India, notably the states of Punjab and Haryana, which account for the bulk of the country's rice and wheat output, are extremely water-stressed. About 54 % of India's groundwater wells are decreasing, with 16 % of them decreasing by more than

one meter per year. North-western India again stands out as highly vulnerable; of the 550 wells studied in the region, 58 % had declining groundwater levels. With increased periods of low precipitation and dry spells due to climate change, India's groundwater resources will become even more important for irrigation, leading to greater pressure on water resources. According to the World Bank projections,

'The impact of climate change on water availability will be particularly severe for India because large parts of the country already suffer from water scarcity, to begin with, and largely depend on groundwater for irrigation.'

Indian agriculture or we can say India's food production, is highly vulnerable to climate change because the sector continues to be highly sensitive to monsoon variability. After all, about 65 % of India's cropped area is rain-fed. Most districts with very high and high vulnerability to climate change are in Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Karnataka and Uttar Pradesh. Wheat and rice, two crops central to nutrition in India, have been found to be particularly sensitive to climate change. Lobell et al (2012) found that wheat growth in northern India is highly sensitive to temperatures greater

than 34°C. The Intergovernmental Panel on Climate Change (IPCC) report of 2007 echoed similar concerns on wheat yield. The Report says that 0.5°C rise in winter temperature is likely to reduce wheat yield by 0.45 tons per hectare in India. So we can say acute water shortage conditions, along with thermal stress, will affect rice and wheat productivity even more severely.

FOOD ACCESS: While there has been considerable progress in understanding the sensitivities of crop production to yield, there are relatively few models which assess the impact of climate change on access to food. According to the Fourth Assessment Report of the IPCC, depending on the climate change scenario, 200 to 600 million more people globally could suffer from hunger by 2080. It also makes the projection that climate change will have significant effects on future undernutrition, even when the beneficial effects of economic growth are taken into account. According to their model predictions, there will be a 62-percent increase in severe stunting in South Asia and a 55-% increase in east and south sub-Saharan Africa by 2050.

It is more difficult to find similar, modeling -based studies on the impact of climate change on food access and nutrition

specifically focusing on India. However, noted experts like Nira Ramachandran have underscored the importance of factoring climate change in the discourse on nutrition in the country. Ramachandran warns that climate change can slow down, and even drastically reduce, the improvements in food security and nutrition that India has managed to achieve so far.

Climate change amplifies the economic drivers of food insecurity. Variation in the length of the crop growing season and higher frequency of extreme events due to climate change and the consequent growth of output adversely affect the farmer's net income. India is particularly vulnerable because its rural areas are home to small and marginal farmers who rely heavily on rain-fed monocropping, which provides barely a few months of food security in a normal year. According to Ramachandran (2014), food stocks begin to run out three or four months after harvest, farm jobs are unavailable and by the next monsoon/sowing season, food shortages peak to hunger. Climate change will also have an adverse impact on the livelihoods of fishers and forest-dependent people. Landless agricultural laborers wholly dependent on agricultural wages are at the highest risk of losing their access to food.

Such a large fall in income is likely to have a huge impact on child nutrition because poor households typically spend the bulk of their earnings on food.

The impact of climate change on food access is not limited to rural areas. Urban food insecurity is also a critical issue because poor households from rural and coastal regions typically migrate to urban areas for livelihood options. Ramachandran observes that hunger often triggers off a wave of migration towards cities, relocating entire families to urban slums. These

migrants mostly join the ranks of poorly paid workers in the urban informal sector, where there is no security of tenure and wages fall below the legal minimum. India's urban food insecurity indicators present an alarming picture. For example, over 30 % of children below five years are underweight in urban Bihar, Madhya Pradesh and Karnataka (See Table 3). The proportion of urban children who are stunted and wasted is high even in Karnataka and Maharashtra, which are relatively prosperous states.

Table 3: Child nutritional status in urban India (2014-15)

Name of State	Proportion of children under 5 who are stunted (%)	Proportion of children under 5 who are underweight (%)	Proportion of children under 5 who are wasted (%)
Andhra Pradesh	28.3	28.4	15.5
Assam	22.3	21.4	13.2
Bihar	39.8	37.5	21.3
Goa	18.3	25.3	27.7
Haryana	33.4	28.5	21.0
Karnataka	32.6	31.5	24.8
Maharashtra	29.3	30.7	24.9
Manipur	24.1	13.1	6.4
Meghalaya	36.5	22.9	13.7
Madhya Pradesh	37.5	36.5	22.0
Pondicherry	24.7	23.3	26.1

Sikkim	22.9	12.0	13.2
Telangana	20.9	22.2	14.6
Tamil Nadu	25.5	21.5	19.0
Tripura	17.2	21.7	13.4
Uttarakhand	32.5	25.6	18.6
West Bengal	28.5	26.2	16.7

Source: *Compiled from National Family Health Survey Database*

Climate change will enhance India's existing problems of urban food insecurity. The highest risks related to climate change are likely to be concentrated among the low-income groups residing in informal settlements which are often located in areas exposed to floods and landslides and where housing is especially vulnerable to extreme weather events such as wind and water hazards. Mumbai and Chennai are especially prone to bear the brunt of climate change. Dasgupta (2012) add Kolkata to the list of cities that are particularly vulnerable to climatic risks, as climate change is likely to intensify the frequent flooding in the Hooghly River during monsoon. The poor inhabitants of Kolkata are most vulnerable as their homes are located in low-lying areas or wetlands that are particularly prone to tidal and storm surges.

Given that food is the single largest expenditure for poor urban households,

displacement, loss of livelihood or damage to productive assets due to any such extreme weather event will have a direct impact on household food security. The urban poor has also been identified as the group most vulnerable to increases in food prices following production shocks and declines that are projected under future climate change.

FOOD ABSORPTION: There are many potential impacts of climate change on food absorption but there is a lack of quantitative studies on the subject which focus on India. Overall, the global threat is that climate change could lead to a reduction of production and consumption of certain foods that play a critical role in the diets of rural poor and indigenous populations of India such as fish, fruits, vegetables, and wild foods. Change in climatic conditions could lead to a reduction in the nutritional quality of foods (reduced concentration in proteins and minerals like

zinc and iron) due to elevated carbon dioxide levels. In India, here pulses are the main source of proteins rather than meat. Then these changes in the quality of food crops will accelerate the largely neglected epidemic known as “hidden hunger” or micronutrient deficiency. Then this micronutrient deficiencies increase the risk of acquiring an infectious disease which in turn worsens the problem of undernutrition, creating a vicious circle. Evidence from Botswana suggests that changes in climate that lead to an increase in temperature and a decrease in precipitation are associated with an increase in diarrhoeal disease in children. In India, children living in poor rural areas and urban slums are at higher risk of morbidity and mortality from diarrhoeal diseases. Projection made by Moors says that climate change will lead to an average increase of about 13.1 % in diarrhea in the Ganga Basin. Ramachandran (2014) also argues that climate change could lead to a reversal of India’s achievements in reducing diarrhea-related deaths.

The impact of climate change on vector-borne diseases is fairly well documented. Climate change will lead to the emergence of new patterns of pests and diseases which will affect human health and lower the capacity to utilise food

effectively, thereby posing new risks for food security. For instance, more people will be exposed to vector-borne diseases such as Malaria, Dengue and Chikungunya. According to Dhara, Schramm and Luber (2013), the entire population of India except those living in areas above 1700 m above sea level are at risk of contracting malaria. The viral diseases like Chikungunya and Dengue may also be influenced by climate as both are transmitted by the common vector *Aedes Aegypti*. The urban poor living in informal settlements are particularly vulnerable, absent the basic facilities such as piped water, sanitation, clean drinking water, drainage systems, and health facilities. High incidence of undernutrition due to poverty exposes the urban poor to diseases linked to climate impacts, which in turn aggravates undernutrition and ill-health and reduces the ability to adapt and build resilience to climate change. Children have been found to be at greater risk when food supplies are restricted.

STEPS FOR MINIMIZING EFFECT OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTIVITY

□ *ADOPTION OF SUSTAINABLE AGRICULTURAL PRACTICES:* The main problem of Indian agriculture is low productivity. To meet India’s growing

food demand, there is an acute need for increasing productivity in all segments of agriculture. But given the vulnerability of Indian agriculture to climate change, farm practices need to be reoriented to provide better climate resilience. India needs to step up public investment in development and dissemination of crop varieties which are more tolerant of temperature and precipitation fluctuations and are more water-and nutrient-efficient. Agricultural policy should focus on improving crop productivity and developing safety nets to cope with the risks of climate change.

- *BETTER MANAGEMENT OF WATER RESOURCES:* Management of Water resources is a key feature of sustainable agriculture. Water supply management options such as new storages and water harvesting are important, especially in the water-stressed regions of north-western India. Water use efficiency in agriculture needs to be enhanced. India's irrigation infrastructure needs to be upgraded; particular attention needs to be given to north-western India. A four-pronged strategy is recommended for the water sector:

- Increase irrigation efficiency
- Promote micro irrigation in water-deficient areas
- Better water resource infrastructure planning
- Restoration of water bodies in rural areas
- Stronger emphasis on public health

- *ENHANCE LIVELIHOOD SECURITY:* Achieving food security in the context of climate change calls for an improvement in the livelihoods of the poor and food-insecure to not only help them escape poverty and hunger but also withstand, recover from, and adapt to the climate risks they are exposed to. India's National Rural Employment Guarantee Act (NREGA) of 2005 marked a global milestone in the history of poverty alleviation. NREGA has had several positive effects: increasing rural wages, reducing gender wage gaps, enabling better access to food, and reducing distress migration from rural areas. Although some gaps have been observed in the implementation of NREGA, the scheme has various benefits for the rural poor, particularly for the marginalized sections, women,

scheduled castes and scheduled tribes.

Given the level of urban poverty, undernutrition, and lack of remunerative employment, there is a strong case for providing guaranteed employment on the lines of NREGA in urban areas as well. Such a scheme should be tailored to not only provide livelihood security to the urban poor but also create climate-resilient urban infrastructure in Indian cities.

- *GREATER EMPHASIS ON URBAN FOOD INSECURITY:* Urban India is not only an important contributor to global greenhouse gas emissions but also a victim of climate change as poor people account for the bulk of its population. As observed earlier, climate change will have an enormous impact on urban food insecurity. Therefore, urban food insecurity deserves serious attention. The approach towards tackling urban food insecurity must take into account both the access and absorption dimensions of food insecurity. To improve access to healthy food, effective public distribution systems need to be put in place. Efforts must be made to learn from states such as Tamil Nadu

which has an effective public distribution system and has better nutritional outcomes. The Swachh Bharat Mission, which aims to construct 10.4 million individual toilets and 0.5 million public toilets and adopt scientific solid waste management in 4,041 towns, may be regarded as a step in the right direction.

- *LONG-TERM RELIEF MEASURES IN THE EVENT OF NATURAL DISASTERS:* India's disaster-management strategies are mostly inadequate, short-lived and poorly conceived. Also, much of the emphasis is laid on providing quick relief to the affected households as opposed to developing long-term adaptation strategies. Little effort is made towards addressing the long-term impacts of natural disasters on agricultural productivity and undernutrition. A recent report by NITI Aayog suggests that "the government should transfer a minimum specified sum of cash to affected farmers and landless workers as an instant relief". For richer farmers who may want insurance above this relief, the report recommends a separate

commercially viable crop insurance programme. Additional efforts must be directed towards reducing the risk in agriculture. Such schemes should be specially targeted towards small farmers.

- *NEED FOR MORE IMPACT ASSESSMENT STUDIES:* To develop climate-resilient strategies and make adequate policy interventions, there is a need for an integrated assessment of the impact of climate change on India's food security. So far, there are fewer studies on the impact of climate change on other dimensions of food security besides production. Research efforts should be directed towards assessing and quantifying where possible the impact of climate change on undernutrition and food absorption.

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