



## Climate Change and Indian Agriculture


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Climate change is one of the most significant challenges of the 21st century. It refers to long-term shifts in temperatures and weather patterns. While some of these shifts are natural, human activities have been the primary driver of climate change since the 1800s. Climate change in India is no longer a localized environmental issue but a defining economic variable. It has become an everyday reality having enormous consequences for food security and economic growth. Economic Survey (2025-26) revealed that the country has crossed a threshold and extreme weather has become near-daily occurrence impacting GDP by 4-6% annually. India is among the top 10 most climate-vulnerable nations globally. With substantial population dependent on agriculture for livelihood and increase in extreme weather days, erratic precipitation, erosion of productivity. India has a reason to be concerned about climate change, as a vast population depends on climate-sensitive sectors like agriculture, forestry and fishery for their livelihood. The adverse impact of climate change in the form of decline in rainfall and rise in temperature has resulted in increased severity of livelihood issues in the country. Climate driven migration is also emerging as a related trend. For instance, in coastal areas of Odisha and West Bengal, farmers are leaving agriculture due to increasing salinity and loss of arable land, contributing to growing populations of internal migrants who face new vulnerabilities. India stares at a disastrous scenario unless timely action plan and strategies are implemented to counter the effects of climate change.

**Keywords:** agriculture, food security, productivity, global warming

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## 1. Introduction

Farming is a way of life in India. Farming practices are twined with cultural festivities and rituals across the country making them a part of country's tradition and folklores. Till today, agriculture remains backbone of Indian economy. Agriculture is an important sector contributing not just as a source of food but an important link for services and industrial sectors essential for country's growth and prosperity. India remains one of the top nations globally; with nearly 54% of its land being potentially "arable" (cultivable), though not all of it is actively farmed every year. Approximately 140–141 million hectares (about 43% of the total area) is currently classified as "Net Sown Area." However, the gross cropped area is around 219 million hectares. This number is higher than the net area because many farmers practice "double cropping" (growing more than one crop on the same land in a year). Agriculture continues to be the largest employer in the country, though technology is gradually shifting the workforce dynamics. Nearly 26 crores (260 million) i.e. approximately 42–46% i.e. of India's total workforce is directly engaged in agriculture and allied activities. However, 58% of the total population—roughly 850 million people—depends on agriculture for their primary livelihood when including family members and dependents. States like Bihar (32%) and Uttar Pradesh (28%) have the highest percentage of their total workforce in agriculture. It is important to understand a fact that majority of farmers i.e. 85% are small and marginal farmers owning less than 2 hectares of land. It is this group that is most vulnerable to climate change and associated consequences impacting food security and issues of livelihood in the country.

## 2. Objectives

1. To study the nature and importance of Indian agriculture.
2. To assess the impact of climate change on agriculture and allied activities threatening the food security and livelihood of Indian farming community.

## 3. Methodology

The research presented in this study follows a mixed-method research design to observe the interconnections agriculture as a means of livelihood and impact of climate change on millions of farmers in India.

The research paper through descriptive and analytical research design identifies the issues facing agriculture, impact on food productivity and actionable strategies to mitigate impact of climate change on agriculture

## 4. Contribution of Agriculture to Indian Economy

The monsoon dependent Indian agriculture plays a pivotal role in economy. Its contribution to different sectors of economy and resultant growth of economy is in itself remarkable. The agriculture sector provides an important forward linkage for secondary and tertiary sectors, whose contribution to GDP has been on the rise in recent years. The figures in Economic Survey (2025-26) show that agriculture and allied sectors are estimated to contribute approximately 17–18% of India's Gross Value Added (GVA) at current prices. Growth is increasingly driven by the Livestock (7.1%) and Fisheries (8.8%) sub-sectors, which provide a stable income cushion when traditional crops face weather stress. In India, nearly half of the population depends on agriculture and allied sectors for income; a good monsoon season leading to good harvest provides impetus for consumption across broad sectors of economy reflecting growth in GDP numbers. The food processing industry accounting 32% of India's total food market relies entirely on agriculture for supply of raw materials. Dairy, fruits and vegetables, edibles, textiles, snacks, edible oils, sugar etc are important food processing industries that transform raw agricultural products into consumable goods. Similarly, chemical and equipment manufacturing industry caters to huge demands for fertilizers, pesticides, insecticides and agricultural equipments (ploughs, tractors, sprayers, threshers, harvesters) benefitting the manufacturing and allied sectors. Agriculture sector supports India's Green Energy goals by providing feedstock for ethanol and bio-gas. The demand of newer technology for agricultural innovations and increased productivity, precision farming, satellite data and AI driven advisory has opened up new Agri-Tech market opening up a new multi-billion market. A good harvest spurs massive rural consumption contributing to huge FMCG demand which directly benefits major consumer brands in the country.

## 5. Agriculture as a Source of Livelihood

Indian farmers since centuries have been regarded as provider of food. Agriculture seasons and activities are intricately linked to daily life of millions of farmers encompassing rituals, festivities and togetherness. Agriculture scenario in the country is dominated by 'small and marginal' farmers owning less than 2 hectares of land comprising over 86% of Indian farmers. These farmers who are dependent on their small land for livelihood encounter innumerable problem making farming untenable and non-remunerative. High input costs, lack of storage, middlemen dependency, distress sale, lack of formal credit and lack of government investment are major hurdles facing the farming community in India. The income from agriculture varies drastically across states due to cropping pattern, infrastructure and availability of other resources. The lack of availability of credit from formal credit system dampens the spirit of small farmers forcing them to lend from private money lenders at usurious interest rate. Informal lending systems have disproportionately targeted the poorest of India's rural farmers, creating an even heavier burden of debt. While 44% of large-scale farmers have access to formal credit, 87% of small or landless farmers do not (Basu & Srivastava, 2005). High interest rates charged on loans and diversion of loans for non-productive purposes or crop failure results into debt trap, generating economic hardships and thereby creating pressure for suicides (Gill, 2006).

Majority of small and marginal farmers work as agricultural labour to supplement their income. The data from Economic Survey (2025) reveals that the e-shram portal has recorded over 31 crore (310 million) registered unorganized workers, a vast majority of whom are from the agricultural sector. According to PLFS 2023-24, approximately 38% of rural households classified as agricultural or non-agricultural labourers who do not own land. Similarly, the share of women in the agricultural workforce has risen sharply, from 57% in 2017-18 to 64.4% in 2023-24. Conversely, male participation has declined as they migrate to other sectors. The non-remunerative nature of agriculture, unreliable monsoons, increasing feminization has overall changed the composition of farmer's income.

The income from crop cultivation now accounts only 35-37% of household's total income complemented by wages and salaries gained from working on other's farms or non-farm labour (40-44%), livestock/animal farming (15-16%) and non-farm business (6-8%). In the context of increasing neo-liberalism on one hand and protectionism of national interests by developed nations on the other, the profession of farming getting sidelined is a warning signal for food security and sovereignty of the country.

## 6. Climate Change and its Impact on Agriculture

The issue of climate change is threatening food security of billions across the globe. The earth's climate system is altering due to anthropogenic activities like burning of fossil fuels leading to accumulation of carbon dioxide and methane resulting in increase in overall temperature. The Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report observed that "warming of climate system is now unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level" (Soloman et al., 2007). The rampant changes in climatic conditions over fast few decades have impacted the agricultural systems in India. It is increasingly besieged by 'extreme weather days' "—which occurred on nearly 90% of days in 2024—and a steady rise in mean temperatures. The threat of climate change is imminent. Farmers across India have been witnessing varied weather conditions irrespective of seasons adversely impacting agricultural practices, productivity and income. Heat stress, erratic monsoon and dry spells, cyclonic storms, unseasonal rain, glacial melt, sea-level rise have made Indian agriculture more vulnerable to such weather conditions. Climate change has now started to severely impact wheat productivity, soil erosion and salinization, increased vulnerability of rain-fed pulses, paddy and legumes and disruption of traditional fruit/hill farming.

Dell et. al. (2012) in their study of impact channels finds the most significant impact of climate change through the agriculture sector. The vulnerability of the agriculture sector to climate change is well documented and it is found to be one of the important channels through which to be one of the

important channels through which climate change increases the susceptibility of low income developing countries which are highly dependent on agriculture. In Indian context, due to a 2 to 3.5 C rise in temperature accompanied by a 7% to 25% change in precipitation, farmers may be losing a net revenue between 9% and 25% which may adversely affect the GDP by 1.8% to 3.4% (Kavi Kumar and Parikh, 1998) Fisher et al., (2001) claims that there will be serious consequences for food security in the south and India stands to lose a massive 125 metric tonnes equivalent to some 18% of its rainfed cereal production. Sinha and Swaminathan (1991) reported that an increase in winter temperature can lead to a 10% reduction in wheat output in the northern states of Punjab, Uttar Pradesh and Haryana.

The Indian agricultural scenario is dominated by 'small and marginal farmers'; a majority of whom are currently in debt affecting adoption of new climate-technology without government subsidies a daunting task. Crop failures have led to higher indebtedness in climate change agricultural hotspots affecting regional bank loan portfolios making it more difficult for banks to lend for agricultural activities. It is estimated that low adaptation of agriculture mitigation strategies would reduce India's rain-fed rice yields by 50% by 2050 threatening national food security. Input costs are going to rise exponentially as warmer and more humid conditions are going to expand pests surges requiring higher spending on pesticides etc. Elevated carbon dioxide levels are found to reduce protein, iron, and zinc content in staples, potentially fueling a "hidden hunger" crisis despite stable caloric yields. The crisis of climate change has not only endangered agriculture; in fact it has threatened the very existence of mankind on the planet.

## 7. Conclusion

World Economic Outlook by IMF (2017) finds that a 1 degree Celsius increase in temperature, estimated at the median temperature prevailing in low-income developing countries, reduces agriculture gross value added and crop production India has a reason to be concerned about climate change, as a vast population depends on climate-sensitive sectors like agriculture, forestry and fishery for their livelihood.

The adverse impact of climate change in the form of decline in rainfall and rise in temperature has resulted in increased severity of livelihood issues in the country Climate change would represent additional stress on the ecological and socioeconomic systems that are already under tremendous pressure due to rapid industrialization, urbanization and economic development (Balasubramanian & Birundha, 2012). As climate variability continues to affect agricultural systems across India, it is important to understand how these changes intersect with nutrition, livelihoods, and local ecologies. Climate adaptive crops and climate sensitive technology suited for local practices not only create environmental awareness, but end up building climate resilience thereby addressing nutrition gaps and ecological degradation. The linking of self-help groups (SHGs) to local governance has been found transformative. These collectives are reviving traditional knowledge, diversifying crops grown, and accessing entitlements to secure nutrition and income. There is need to innovate and strengthened various adaptation and mitigation strategies for climate change for ensuring food security, nutrition and livelihood issues of billions across the planet.

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