

Climate Change Impacts on Indian Agriculture

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Abstract

Climate change has emerged as one of the most critical challenges affecting agricultural sustainability in India. Variations in temperature, rainfall patterns, and the increasing frequency of extreme weather events have significantly influenced crop productivity, soil health, and farmers' livelihoods. Indian agriculture, which is largely dependent on monsoon rainfall, is highly vulnerable to climate-induced stresses such as droughts, floods, and heat waves. These changes threaten food security and economic stability, particularly for small and marginal farmers. This article examines the major impacts of climate change on Indian agriculture, including crop yield variability, water stress, soil degradation, and socio-economic consequences. It also highlights the urgent need for adaptive strategies to ensure sustainable agricultural development in the changing climatic scenario.

Keywords: Climate change, Indian agriculture, crop productivity, monsoon variability, food security

Introduction

Agriculture is the backbone of the Indian economy, supporting nearly half of the country's population and playing a crucial role in ensuring food security and rural livelihoods. However, agricultural production in India is highly sensitive to climatic conditions due to its strong dependence on monsoon rainfall and temperature stability. In recent decades, climate change has significantly altered weather patterns, leading to rising average temperatures, erratic rainfall, and an increased frequency of extreme climatic events such as droughts, floods, and heat waves [1]. These changes have introduced new uncertainties into agricultural planning and productivity across different agro-climatic regions of India. The impact of climate change on crop growth and yield has become increasingly evident, with studies reporting yield reductions in major crops such as rice, wheat, and maize due to heat stress and water scarcity [2]. Variability in monsoon onset and distribution has disrupted traditional sowing and harvesting cycles, causing crop failures and reduced farm incomes. In addition, higher temperatures accelerate evapotranspiration, leading to soil moisture deficits and increased irrigation demand, which places further stress on already limited water resources [3]. Climate change has also intensified the prevalence of agricultural pests and diseases, as warmer conditions create favorable environments for their rapid spread and survival [4]. These biotic

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stresses increase dependency on chemical inputs, raising production costs and contributing to environmental degradation. Small and marginal farmers, who constitute the majority of India's agricultural workforce, are particularly vulnerable due to limited access to technology, credit, and climate-resilient infrastructure. Beyond biophysical impacts, climate change poses serious socio-economic challenges by increasing income instability, food price volatility, and rural distress [5]. The combined effects of climatic uncertainty, declining productivity, and resource degradation highlight the urgent need to understand and address climate change impacts on Indian agriculture. Developing adaptive strategies and resilient agricultural systems is essential for sustaining food production and securing farmer livelihoods in the face of ongoing climatic changes.

Conclusion

Climate change poses a serious threat to the sustainability of Indian agriculture by affecting crop yields, water availability, soil fertility, and farmer livelihoods. Without timely intervention, these impacts could intensify food insecurity and socio-economic inequalities in rural areas. Strengthening climate-resilient agricultural practices, improving water management, promoting crop diversification, and enhancing farmer awareness are essential steps toward reducing vulnerability. Policy support, scientific innovation, and community participation will play a crucial role in ensuring that Indian agriculture adapts effectively to the challenges posed by climate change and continues to support national development goals.

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