6. Literature Review of the Impact of Climate Change on Food and Water Security

Rishabh Deogam, B.A. English (2022-26)

Abstract

Climate change has emerged as one of the most critical challenges of the twenty-first century, affecting both natural and human systems. Its influence on food and water security is particularly alarming, as rising temperatures, erratic rainfall, prolonged droughts, floods, and extreme weather events undermine agricultural productivity and disrupt water availability. These consequences are especially severe for low-income and rural communities that depend heavily on climate-sensitive livelihoods and possess limited adaptive capacity. This article reviews scientific literature, government publications, and international reports to examine how climate change affects agricultural production, nutritional outcomes, and freshwater resources. It identifies major concerns such as declining yields, reduced nutritional quality of staple crops, disruption of supply chains, and growing water scarcity. The review also highlights resilience strategies, including sustainable agricultural practices, improved water management, climate-resilient crop varieties, and supportive policies. Overall, the findings emphasise the urgent need for coordinated, long-term interventions to safeguard food and water security in a rapidly warming world.

Keywords

Climate change, food security, agriculture, nutrition, resilience, sustainable farming, water scarcity

Introduction

Food security is increasingly threatened as climate change continues to alter global environmental patterns. Higher temperatures, unpredictable monsoon cycles, droughts, and extreme weather conditions directly affect agricultural yields and livestock health, while indirect consequences such as soil degradation, altered pest cycles, and reduced water availability further destabilise food systems. Major institutions like the FAO and IPCC highlight that these impacts are uneven, affecting low-income nations and rural populations disproportionately due to their limited economic and technological capacity. Understanding the multifaceted link between climate change and food security is essential for developing adaptation strategies that can support vulnerable communities. This literature review aims to synthesise existing research on how climate change influences food and water systems and to identify policy-relevant insights that can guide sustainable responses.

Methodology

The study follows a qualitative research design to explore the relationship between climate change and food and water security. Since the work relies exclusively on secondary sources, no field surveys or primary data collection were undertaken. Data for the study were collected from peer-reviewed journals, government reports, books, and publications by international organisations. Academic platforms such as Google Scholar, ScienceDirect, and ResearchGate were used to identify relevant literature.

Only studies published between 2010 and 2025 in the English language were included to ensure the information is recent and reliable.

Discussion and Analysis

Climate Change and Agriculture: Climate change affects agriculture through both direct and indirect pathways. Direct impacts include heat stress on crops, irregular monsoon rainfall, droughts, and floods, all of which reduce crop yields and affect livestock productivity. Indirect impacts arise from increased pest infestations, declining soil fertility, altered pollinator patterns, and reduced freshwater availability for irrigation. Numerous studies indicate that staple crops such as wheat, maize, and rice have shown signs of declining productivity in several regions due to climatic variations. Fisheries, forests, and livestock systems also face significant stress, reflecting the widespread vulnerability across different components of the food system.

Effects on the Four Pillars of Food Security: Climate change affects all four pillars of food security as defined by the FAO. Food availability is compromised when agricultural output declines due to extreme weather patterns. Access to food becomes difficult for vulnerable populations when prices rise, and household incomes fall. Utilisation is affected as the nutritional content of crops decreases due to increased carbon dioxide concentrations, making diets less nutritious. Finally, stability is threatened as frequent climate shocks cause market volatility and unreliable food supplies. These impacts are particularly visible in drought-prone regions and smallholder farming communities, where even minor climatic disturbances can lead to significant food insecurity.

Climate Change and Food Systems: The broader food system is also disrupted by climate change. Environmental stress leads to decreased agricultural output, which undermines livelihoods and contributes to instability in food markets. This chain of events can be understood as a continuous cycle where climate impacts disrupt ecosystems, which in turn reduce production, alter market dynamics, and ultimately heighten food security risks. Such interconnected effects highlight the need for interventions that address not only agricultural practices but also market systems, ecological conservation, and social welfare programs.

Strategies for Enhancing Resilience: The literature identifies several strategies that can help communities adapt to the challenges posed by climate change. Social protection mechanisms such as climate-based insurance schemes, public distribution systems, and disaster relief programs play an important role in supporting vulnerable households. Sustainable agricultural practices—including water harvesting, micro-irrigation, crop diversification, and climate-resilient seed varieties—help strengthen long-term resilience. Cross-sector adaptation measures, such as the introduction of heat-resistant livestock breeds, improved aquaculture management, and forest regeneration, contribute to broader ecological and economic stability. These strategies collectively enhance the adaptive capacity of communities while promoting sustainable development.

Policy and Institutional Support: Policy frameworks are essential for creating climate-resilient food systems. Effective policies include targeted support for smallholder farmers, investment in climate-smart infrastructure, promotion of public–private partnerships for innovation and strengthening early warning systems. Integrating climate resilience into national policies such as the National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs) ensures that government actions align with long-term sustainability goals. Strong institutional support can improve coordination and ensure timely responses to climate-induced challenges.

The literature consistently demonstrates that climate change influences multiple dimensions of human and environmental systems, making it one of the most complex challenges facing global societies. It intensifies existing inequalities by disproportionately affecting marginalised groups and exacerbating issues such as poverty, hunger, and limited access to natural resources. Despite growing research, several gaps remain, particularly in areas such as quantifying economic losses, understanding community-based adaptation models, and exploring shifts in global food trade. Addressing these gaps will require interdisciplinary research and coordinated policy interventions.

Conclusion

Climate change poses a significant threat to food and water security across the world. Its effects on agricultural productivity, freshwater availability, and ecosystem stability highlight the urgency for collective and sustained action. Strengthening sustainable agricultural practices, improving water management, and formulating robust policies can significantly reduce vulnerabilities. Ensuring the resilience of global food systems will require cooperation between governments, international organisations, researchers, and local communities. By adopting long-term adaptive strategies, societies can better protect themselves against the escalating risks associated with climate change.

Limitations of the Study

This study is based entirely on secondary data drawn from existing literature, reports, and publications, which means its findings are dependent on the accuracy, reliability, and completeness of those sources. Since no primary data were collected, the review cannot capture real-time community experiences or localised variations in climate impacts.

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