

REVIEW ARTICLE

Climate Change and Food Security in Rural Asia: A Systematic Review of Governance Systems and Livelihood Adaptations

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Received: 30 September 2025

Accepted: 15 December 2025

Published: 13 July 2026

DOI: <https://doi.org/10.51200/bjms.v20iSuppl.7998>

Keywords: *Climate change, Food security, Rural Asia, Adaptation strategies, Governance, Health impacts*

ABSTRACT

Climate change has emerged as a major threat to food security, particularly in rural regions of Asia where communities rely heavily on agriculture for their livelihoods. Variability in temperature, shifts in precipitation patterns, and increased frequency of extreme weather events disrupt agricultural productivity and food accessibility, intensifying vulnerabilities among rural populations. This study aims to systematically assess the direct and indirect effects of climate change on rural food security in Asia and to explore adaptation strategies implemented by rural communities. A systematic review was conducted following PRISMA guidelines, and searches were performed in ProQuest, Semantic Scholar, and PubMed. Eligibility criteria included qualitative or mixed-methods studies involving rural Asian populations and addressing food security outcomes. Five studies met the inclusion criteria. The review found that climate change directly threatens crop yield stability, livestock productivity, and food availability, while indirect effects include economic shocks, migration pressures, and heightened gender disparities. Identified adaptation strategies included climate-resilient agricultural practices, community-based governance mechanisms, cooperative systems, and local livelihood diversification. Strengthening governance systems, promoting climate-smart agriculture, and ensuring inclusive adaptation, particularly for women and marginalized farmers are crucial for building rural resilience



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and securing sustainable food systems.

INTRODUCTION

Climate change is increasingly recognized as one of the most significant threats to global food security, with disproportionate impacts on rural regions where livelihoods are closely tied to agriculture. According to the 1996 World Food Summit, food security is achieved when all individuals, at all times, have physical, social, and economic access to safe and nutritious food that meets their dietary needs and preferences for an active and healthy life. Variability in climate parameters, including temperature rise, shifting precipitation patterns, and intensification of extreme weather events such as floods and droughts, disrupts agricultural output, increases food prices, and reduces access to nutritious food among vulnerable communities.

Asia remains the region most affected by hunger, with approximately 425 million people experiencing food insecurity in 2021, more than all other regions combined (Pickson et al., 2023). Recent case studies have underscored the urgency of climate-resilient agricultural technologies, improved water resource management, and stronger regional cooperation to protect food systems (Taniushkina et al., 2024).

Research Gap. While numerous studies have examined climate impacts on agricultural productivity, fewer have synthesized how governance systems and cross-sectoral adaptation strategies shape rural resilience in Asia. Existing literature often focuses on technical or biophysical impacts, with limited examination of how local institutional arrangements, cooperatives, or community-based governance influence adaptation outcomes. This review addresses this gap by integrating evidence on climate impacts with insights into governance and livelihood strategies.

This systematic review aimed to:

1. Assess the influence of climate change on food production in rural Asia, including crop yields and livestock productivity.
2. Evaluate its impact on food availability and accessibility among vulnerable populations.
3. Examine health and nutritional outcomes associated with climate-related food insecurity.
4. Identify adaptation strategies and governance mechanisms implemented by rural communities.

Review Questions:

1. How does climate change affect agricultural productivity and food security in rural Asia?
2. What adaptation measures and governance systems mitigate these impacts?
3. How does climate-induced food insecurity influence health and nutrition outcomes?

MATERIALS AND METHODS

Study Design

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (McKenzie et al., 2021). The Joanna Briggs Institute (JBI) critical appraisal tools for qualitative and mixed-methods research were used to evaluate study quality (Lockwood et al., 2015).

Eligibility criteria

The eligibility criteria for this systematic review defined the requirements for inclusion in the analysis. These criteria were established to ensure that the review remained focused, relevant, and methodologically sound, as follows.

Search Method

Searches were conducted in ProQuest, Semantic Scholar, and PubMed between 2014 and 2024. A total of 1243 records were

Table 1: Eligibility Criteria for the systematic review

Criteria	Inclusion	Exclusion
Study population	Studies focusing on rural populations or agricultural communities dependent on farming	
Geographic scope	Rural areas in Asian countries	Studies focusing on urban areas or regions not affected by climate change
Language	Studies published in English	Studies published in non-English languages without accessible English translations.
Timeframe	Studies published in the last 10 years to ensure relevance to current climate change impacts.	
Document type	Journal articles of qualitative studies or mixed-methods	Non-peer-reviewed literature (e.g., reports, opinion pieces, conference abstracts)
Outcomes	Food security outcomes (availability, accessibility, utilization, and stability), agricultural productivity (crop and livestock yields), health and nutritional outcomes (malnutrition, food-related diseases).	Studies that do not provide data on food security or agricultural outcomes.

retrieved (ProQuest = 909, Semantic Scholar = 296, PubMed = 38).

PICO-Derived Keyword Strategy

To generate the search string, PICO elements were mapped to relevant search terms:

1. P denotes "Population or group of patients" - have the researchers delineated the specific population or patient cohort under investigation? P may also denote the issue under examination.
2. I denotes "Intervention" - Did the researchers explicitly delineate the

intervention administered to the intervention group?

3. C denotes "Comparison" - did the researchers incorporate a control group? What intervention was administered to the control group?
4. O signifies "Outcome/s" - whatever outcomes of interest the researchers evaluated to determine the intervention's efficacy, and what methods were employed to measure these outcomes?

This framework in Table 2 below organises the focus of this review (Icahn School of Medicine at Mount Sinai, 2021), allowing for a structured analysis of this systematic review.

Table 2: PICO Framework for this systematic review

Full review question:	
"How does climate change impact the health outcomes associated with food security in rural communities in Asian countries?"	
Population	"rural", "agricultural communities", "farming households", "Asian countries".
Intervention	"crop diversification", "technology adoption", "water management", "climate-smart agriculture", "livelihood diversification".
Comparison	"urban", "non-agricultural", or left blank where not applicable.
Outcome	"food availability", "food accessibility", "nutrition", "malnutrition", "agricultural productivity".

This systematic review focused on the nexus between climate change and food security, specifically looking at outcomes such as agricultural productivity, crop and livestock yields, and food availability in Asia's rural areas. The search terms employed in this evaluation were designed to collect research that addressed these core topics, focusing on rural and agricultural populations directly affected by climate change consequences.

Although governance systems and livelihood adjustments are essential to climate change and food security, they were not specifically included in the initial search approach. Rather, these themes are

incorporated as secondary considerations and examined when they arise organically within the identified studies. This method guarantees that the evaluation concentrates on its key aims while recognising the more significant, linked dimensions of governance and livelihood policies.

Quality Assessment

All selected articles will undergo a quality assessment prior to data extraction. The quality of studies will be evaluated using the Joanna Briggs Institute (JBI) critical appraisal tools for research (Lockwood et al., 2015). Five reviewers will conduct the assessments independently to ensure objectivity. Any disagreements in quality ratings will be resolved through discussion until a consensus is reached.

The JBI tools feature a ten-question checklist that reviewers systematically address for each study, corresponding to the study design. Each question in the tool offers four response options; 'yes', 'no', 'unclear' and 'not applicable'.

Each 'yes' response earns one point, while all others receive zero points. The total score is calculated by summing the points for each study, providing a quantitative measure of study quality. To meet the critical appraisal criteria, a study must score at least 50% of the possible points.

Data Extraction

The reviewers assessed independently all eligible studies to ensure unbiased evaluation. For each selected study, a data extraction form was used to systematically record general and specific information relevant to the research.

The data extraction form captured the following details: general information (authors, year of publication, country, study population, study design) and specific information (paper aims, relevance, and findings). The extraction is focused on adaptation strategies, describing any interventions or adaptations implemented

to cope with climate change impacts.

Synthesis of Result

The themes identified in each study were tabulated to provide a clear overview of the key findings. Both themes and subthemes emerging from the studies were extracted and organised systematically. These thematic patterns were then analysed and further discussed to highlight commonalities, differences, and contextual insights across the included studies.

This thematic synthesis ensures that the review captures nuanced insights into the interconnected impacts of climate change on food security and agricultural productivity outcomes in rural Asian communities. It provides a comprehensive understanding of adaptation strategies, governance challenges, and health implications, highlighting the universal and context-specific factors shaping resilience and vulnerability in these regions.

Ethical Approval

All studies included in this review received ethical approval from their primary investigators prior to data collection. However, ethical approval is not required because the data used in this systematic review were obtained from previously published research in journals.

RESULTS

Search Outcomes

A total of 1243 records were identified. After removing duplicates and screening titles and abstracts, 25 full-text articles were assessed. Nineteen were excluded due to lack of relevance, insufficient information on food security outcomes, or inaccessible full texts. Five studies met all inclusion criteria.

Study Quality

Table 3 presents JBI appraisal scores, showing that studies had moderate to high methodological quality (scores 8–10), with

most demonstrating clear methodology, appropriate data interpretation, and coherent reporting.

Study Characteristics

Table 4 summarizes key features of the included studies. The studies were conducted in Bangladesh, Cambodia, and Nepal, and explored themes including agricultural resilience, governance systems, cooperative models, flood vulnerability, and the socioeconomic effects of crises such as COVID-19.

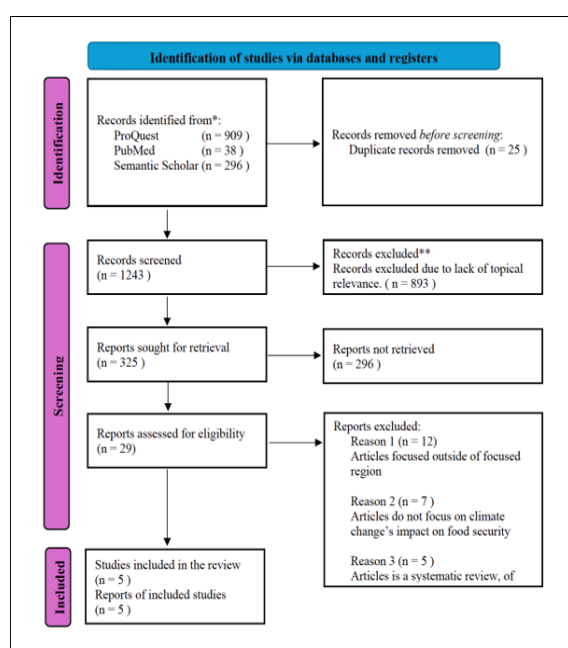


Figure 1: PRISMA 2020 flow diagram for new systematic reviews which included searches of

DISCUSSION

The five included studies provide valuable insights into the intertwined impacts of climate change, governance structures, and livelihood adaptations in rural Asia. Although limited in number, they collectively highlight several key themes.

1. Impacts on Agricultural Productivity

Climate variability, especially erratic rainfall, temperature extremes, and drought—consistently reduced crop yield stability

and livestock productivity (Al Mamun et al., 2024; Chhinh et al., 2023). Modern irrigation systems and drought-resistant crop varieties were associated with improved resilience, with some regions experiencing up to a 20% increase in yield stability. However, the success of these approaches depended on consistent resource availability and institutional support.

2. Governance and Institutional Adaptation

Robust governance systems were critical for managing water resources, allocating agricultural inputs, and coordinating climate responses. Agricultural cooperatives in Cambodia played a substantial role in drought risk management by improving collective decision-making and resource distribution (Chhinh et al., 2023). Conversely, governance weaknesses, such as inequitable access to land, gender-related disparities, and fragmented policy implementation, limited adaptation capacity.

Effective governance also supports progress toward Sustainable Development Goals (SDG 2: Zero Hunger, SDG 3: Good Health and Well-Being, SDG 13: Climate Action), emphasizing the need for integrated, multi-sectoral approaches.

3. Health and Nutrition Implications

Climate-induced food insecurity increases risks of malnutrition, micronutrient deficiencies, and foodborne illness. Studies from Nepal reported up to a 30% rise in childhood malnutrition following flood events (Guragain & Doneys, 2022). Short-term coping strategies, such as reducing meal frequency or dietary diversity, heighten long-term health vulnerabilities.

Strength

This review incorporated comprehensive database searches, adhered to PRISMA guidelines, and applied rigorous JBI appraisal methods. The focus on qualitative and mixed-methods studies provides context-rich insights into community-level experiences.

Table 3: JBI critical appraisal checklist

No	Author	1	2	3	4	5	6	7	8	9	10	Score
1	Climate-adaptive strategies for enhancing agricultural resilience in southeastern coastal Bangladesh: Insights from farmers and stakeholders	+	+	+	+	-	-	+	+	+	+	8
2	Food System Governance in the Cambodian Mekong Delta: Food Production, Food Security, Migration, and Indebtedness	+	+	+	+	+	+	+	+	+	+	10
3	Roles of Agricultural Cooperatives (ACs) in Drought Risk Management among Smallholder Farmers in Pursat and Kampong Speu Provinces, Cambodia	+	+	+	+	-	-	+	+	+	+	8
4	The Impact of COVID-19 on Vegetable Farmers in Bangladesh	+	+	+	+	+	-	+	+	+	+	9
5	Social, Economic, Environmental, and Physical Vulnerability Assessment: An Index-Based Gender Analysis of Flood Prone Areas of Koshi River Basin in Nepal	+	+	+	+	+	un-clear	+	+	+	+	9

Table 4: Summary of included literature

No.	Article Title, Author, Year	Study Design	Participants	Objective	Theme
1.	Climate-adaptive strategies for enhancing agricultural resilience in southeastern coastal Bangladesh: Insights from farmers and stakeholders (Al Mamun et al., 2024)	Mixed-Methods	Smallholder farmers in Bangladesh	To explore adaptation strategies and their effects on agricultural resilience and productivity.	Agricultural resilience and adaptation strategies
2.	Food System Governance in the Cambodian Mekong Delta: Food Production, Food Security, Migration, and Indebtedness(Sithirith et al., 2024)	Qualitative	Farming households in Cambodia	To analyse governance systems and their role in achieving food security amidst climate change.	Food system governance and food security
3.	Roles of Agricultural Cooperatives (ACs) in Drought Risk Management among Smallholder Farmers in Pursat and Kampong Speu Provinces, Cambodia (Chhinh et al., 2023)	Mixed-Methods	Members of agricultural cooperatives in Cambodia	To investigate the role of co-operatives in supporting rural communities during droughts.	Governance and institutional adaptation to climate change
4.	The Impact of COVID-19 on Vegetable Farmers in Bangladesh (Alam et al., 2023)	Mixed-Methods	Vegetable farmers in rural Bangladesh	To assess the impact of the COVID-19 pandemic on rural resilience and food availability.	Rural resilience and food security during global challenges
5.	Social, Economic, Environmental, and Physical Vulnerability Assessment: An Index-Based Gender Analysis of Flood Prone Areas of Koshi River Basin in Nepal (Guragain & Doney, 2022)	Mixed-Methods	Rural communities in flood-prone areas of Nepal	To evaluate vulnerability and adaptation strategies to mitigate flooding impacts.	Flood vulnerability, social equity, and adaptation

Limitations

Only five studies met the inclusion criteria, limiting the breadth and generalizability of findings. The English-language restriction and exclusion of grey literature may have omitted relevant regional evidence. Governance and livelihood strategies emerged as secondary themes because the initial search strategy prioritized food security outcomes.

Recommendation

1. Strengthen Local Governance: Empower community-based organizations and cooperatives to enhance equitable resource distribution and improve climate response coordination.
2. Integrate Climate Adaptation into Policy: Develop cross-sectoral strategies that link agriculture, public health, disaster management, and environmental

governance.

3. Prioritize Vulnerable Populations: Implement targeted support for marginalized groups, particularly women and smallholder farmers.
4. Enhance Capacity-Building: Provide training, financial incentives, and technology transfer to support climate-resilient agricultural practices.
5. Improve Nutrition-Sensitive Interventions: Expand community nutrition programs, school feeding initiatives, and primary health services in climate-affected areas.

CONCLUSION

Climate change significantly undermines food security and health outcomes in rural Asia. The findings from this review highlight the importance of integrating governance, climate-smart agriculture, and livelihood diversification into adaptation strategies. Although the number of available studies is limited, the evidence underscores the urgent need for inclusive, context-specific, and health-centered approaches to climate resilience. Strengthening governance systems and supporting vulnerable rural communities are vital steps toward achieving sustainable food security and long-term societal resilience in Asia.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

We express our sincere gratitude to all individuals and organisations who contributed to the development of this manuscript, providing valuable support, insights, and assistance throughout the research and writing process.

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