

Climate Change Effect on Farming Households' Food Security and their Resilience Strategies in Dry Zones of Sri Lanka: A Qualitative Exploration

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1. Introduction

Climate change substantially complicates global agriculture, influencing agricultural yields, food security, and millions of livelihoods worldwide. Climate change has an extreme effect on agriculture, considerably challenging global food security and affecting supply, stability, accessibility, and food quality (Pratap et al., 2024). A significant threat has been posed to agriculture in Sri Lanka's dry zone due to unexpected warming trends, increased rainfall unpredictably, and an increase in the frequency and intensity of extreme weather events such as floods, droughts, and winds, diminishing the climate suitability for farming (Ratnayake et al., 2023).

In the dry zone, the promised annual rainfall is short, and the sun shines brightly for most of the year. Hence, the climate directly relates to crop yield and food security. The reductions in agricultural production affect the worst food security status among marginalized and vulnerable communities in different regions of the world. Rainfall instability also influences crop growth periods and water conservation for this essential use, making the situation more challenging. In Sri Lanka, 40% of families work in agriculture, farming 4,399,404 acres. Drought and unpredictable rainfall during the Yala and Maha seasons could harm agriculture in the dry zone, which includes Northern, Eastern, and Northwestern provinces, as well as Hambantota and Anuradhapura districts (Department of Census and Statistics, 2017). Of the 2.3 million agricultural operators, 22% and 14% grow paddy during the Maha and Yala seasons, respectively. The Food and Agriculture Organization reports that severe droughts followed by excessive rainfall have impacted cropping areas in Sri Lanka, endangering the food security of over 900,000 people (FAO, 2017). Thus, climate extremes significantly threaten Sri Lanka's food production and rural lives because only 34% of the planted area is irrigated.

Thus, these climate changes worsen food scarcity and present a major concern from the farming family's lives. Also, they are vulnerable to frequent changes in climate and long periods of dry weather that lead to low crop yields, food supply issues that endanger the household food security (FAO, 2015). Food security is the social and economic access to food for adequate, safe and nutritious food. The 1996 World Food Summit defines food security as ensuring that people always have physical and economic access to adequate, safe and nutritious food that meets their dietary needs and preferences for an active, healthy life. Food security has four dimensions: availability, access, utilization and stability (Mah et al., 2014). Thus, various coping strategies could be implemented including early warning systems, planting dates shifting, irrigation with the new rain-fed network and appropriate crop variations to mitigate impacts of climate change on food security. This necessitates using best practices in adapting to climatic changes and applying sustainable agricultural methods. Therefore, the primary purpose of this study is to identify how climate changes influence food security status of farming households and their resilience strategies for sustainable agriculture employed to mitigate climate change effects on food availability and access in the dry zone of Sri Lanka with a specific focus on the farming community.

2. Materials and Methods

This research adopted a qualitative approach due to the nature of the problem. Data were collected through in-depth interviews with 13 farming households in the Mahaweli H zone with a well-developed and pre-tested interview guide. Participants for the interviews were selected via a purposive sampling technique. The responses under the criteria of households in the dry zone of Sri Lanka that engage primarily in farming activities and have more than two years of farming experience have been included in the sample. The farmers with minimum experience below two years and households that do not directly engage in farming activities were excluded from the sample. All interviews were recorded and transcribed. Descriptive and thematic interpretive analytical techniques were employed to analyze the collected data.

3. Results and Discussion

The study investigated the fundamental characteristics of household heads in 13 case studies to identify potential implications for food security and sustainable agricultural methods. Respondents are predominantly male (92%), with the majority being married. Farmers' ages ranged from 35 to 82 years, some older. Except for three, the vast majority of respondents have a secondary education. Household sizes ranged from two to six persons, with monthly revenues ranging from Rs. 40,000 to Rs. 150,000. Primary education is required. Many farmers have over 20 years of experience, some exceeding 50 years.

Table 1. Climate Change Impacts on Household Food Security and Resilience Strategies of Farmers Confronting Climate Change

Thematic Areas	C1	C 2	C 3	C 4	C 5	C 6	C 7	C 8	C 9	C1 0	C1 1	C1 2	C1 3
Impact of Climate Change on Household Farming & Food Security													
1. Food Production and Yield	*	*	*	*	*	*	*	*	*	*	*	*	*
2. Income and Economic Stability	*	*	*	*	*	*		*	*	*	*	*	*
3. Water Resources and Management	*	*		*	*	*		*			*		*
4. Food Availability and Access	*	*	*	*	*	*	*	*	*	*	*	*	*
5. Nutrition Quality and Dietary Diversity		*	*	*			*	*	*	*			*
6. Other		*	*	*				*					*
Resilience Strategies of Farmers													
1. Rainwater Harvesting			*		*				*	*			*
2. Practicing No-Tillage Farming		*											
3. Stay Updated with Weather Forecasts	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Adopting Organic Farming	*			*			*	*	*	*	*	*	
5. Improving Soil Health											*		
6. Crop Rotation	*	*	*	*	*	*	*	*	*	*	*	*	*

Source: Survey data - 2023/2024

According to Table 1, this study examined 13 cases to identify the impact of climate change on farming and food security. Key themes included food production and yield, income and economic stability, water resources and management, food availability and access, nutrition quality and dietary diversity, and coping strategies. The findings reveal that climate change significantly influences farming land and household food security. Climate change has caused significant variations in crop yields, with many regions experiencing declines in agricultural productivity, reducing staple food availability, resulting in higher prices and limited access to nutritious food. Water security is a critical issue for farming communities, affecting irrigation practices and the sustainability of agricultural activities. This affects crop production and household water availability, adding to the food security challenge.

Farmers have adapted their practices to address climate change and promote sustainable food production, including sustainable agriculture. The findings suggest a multifaceted approach to understanding farmers' resilience strategies in dry zones. The adaptive measures fall into three categories: agricultural practices, resource management, and socio-economic strategies. Climate change mitigation relies heavily on agricultural practices, including crop diversification and drought-resistant varieties. Farmers can reduce the risk of crop failure by cultivating a diverse range of crops. Drought-resistant crops can withstand more extended periods of water scarcity, leading to a more consistent yield. Mulching, contour plowing, and cover crops are crucial for preserving soil health and fertility, ensuring long-term agricultural resilience. Effective resource management, particularly water management, is essential for sustaining agricultural activities in dry zones. Efficient water use practices such as rainwater harvesting, drip irrigation, and the construction of small-scale water storage facilities are critical in addressing water. Households use various coping strategies and sustainable agricultural practices, including switching to drought-resistant crop varieties and implementing water conservation techniques, to mitigate the adverse effects of climate change.

4. Conclusion

This paper examines the influence of climate change on farming household food security and the sustainable agricultural methods of farmers employ to enhance their resilience against climate change effects in the dry zone of Sri Lanka. The study was conducted in the Mahaweli H zone and adopted a qualitative, case study-based methodology through in-depth interviews with 13 households. The results reveal that climate change significantly impacts food security in the farming households in the research area.

Adaptation measures are necessary to address this issue of climate change effect on food security of farming households. Participants reported issues with food availability owing to irregular weather, lengthy droughts, and decreased agricultural productivity. These climate-related difficulties have restricted family food supplies, making it challenging for families to get nutritious food regularly. In response to these challenges, households have adopted various sustainable agricultural practices to improve their resilience against the adverse impact of climate change. There is an urgent need for policy interventions that promote sustainable agricultural practices tailored to the specific needs of dry zones to mitigate these impacts effectively. Considering the findings to ensure food supply, policymakers should prioritize adaptation efforts such as upgrading water management systems, increasing access to climate-resilient seeds, and supporting community-based projects that promote local food production.

This study further recommends encouraging rural farmers to embrace sustainable agricultural practices and climate change adaptation measures. Sustainable agricultural practices, including crop diversification, soil conservation, drought-resistant varieties, and efficient resource management techniques such as rainwater harvesting and drip irrigation, have improved productivity and stability. Implementing social-economic methods, such as loan access and community knowledge exchange, enhances the adaptability and sustainability of farming systems.

Governments and stakeholders should invest in agricultural extension services to share information and best practices, especially for water management and sustainable farming approaches. Policies that provide farmers with inexpensive credit and financial resources can help them adopt and implement resilience strategies. Collaborating among farmers, research institutions, and local people can improve information sharing and innovation, strengthening the resilience of farming systems in dry zones. Government and stakeholders should invest in agricultural extension services to share knowledge and best practices, especially for water management and sustainable farming techniques.

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6. Keywords

Climate Change, Farming Households, Food Security, Sustainability

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