sdmimd
Shri Dharmasthala Manjunatheshwara Institute for Management Development, Mysuru, India
11th International Economics Conference on Economic Growth and Sustainable Development: Innovation, Inclusion and Resilience – November 26-27, 2026

Climate Change and Livelihood Vulnerabilities among Tea Plantation Workers – A Systematic Review

Muniaraj K
Research Scholar
muniaraj1997@gmail.com

Abstract

This paper investigates the socio-economic and livelihood vulnerabilities of tea plantation workers amid escalating climate change. Employing a mixed-methods approach, the study integrates a PRISMA-based systematic literature review with qualitative case studies of female tea plantation workers in Munnar, Kerala. Findings reveal that climate hazards—such as erratic rainfall, rising temperatures, and severe landslides like the 2020 Pettimudi disaster—diminish tea yields, directly reducing workdays and wages. Workers face deep structural precarity, including systemic landlessness, substandard colonial-era housing ("layams"), and gendered disadvantages. Lacking financial buffers and institutional support, they resort to negative coping mechanisms like debt accumulation and reduced food intake. The study concludes that mitigating these multidimensional crises demands integrated micro-level solutions alongside gender-responsive, structural macro-level policy interventions.

Keywords: Climate Change, Livelihood Vulnerabilities, Tea Plantation Workers, Socio-Economic Precarity

Introduction

Climate change is an existential and sudden threat to global as well as national agricultural systems, and it disproportionately affects the livelihoods of agriculture and plantation workers. Existing studies show that increasing global temperatures and unpredictable weather conditions are directly related to reduced crop yields and increased occupational health risks across regions. For instance, extreme heatwaves have substantially reduced labour productivity and resulted in increased heat stress among agricultural workers (ILO, 2022; Smith et al., 2023). Among these precarious agrarian populations, plantation workers remain one of the most climatically vulnerable populations since they reside in tropical and subtropical regions that are highly prone to changing climate conditions. Tea (*Camellia sinensis*) is one of the world's most vital cash crops, supporting the livelihoods of millions of estate workers, smallholders, and rural communities, particularly across South and Southeast Asia. The growth and quality of tea plants depend strictly on narrow temperature ranges, consistent rainfall patterns, and specific humidity conditions. However, climate variability has increasingly exposed tea-growing ecosystems to erratic weather, rising temperatures, flash floods, prolonged droughts, and extreme events like landslides (Lokuthula & Geoffrey, 2024).

Despite their foundational role in the agricultural economy, tea plantation workers are exposed to multidimensional challenges. Extreme weather events, including heat stress and cold spells, severe rainfall and hazardous terrain conditions, cause severe physical and occupational health hazards among the workers. These workers face a weak adaptive capacity as they are trapped in cycles of wage dependency with limited financial buffers, negligible savings, reduced working days, low formal education, and an absence of institutional technical training. Women tea plantation workers represent a particularly critical population within this group of workers (Herawati, 2017; Trivedi et al., 2026). Due to the interplay of socio-economic and institutional barriers, female workers bear a double burden of paid field labour and unpaid domestic responsibilities. While much research focuses on the agronomic aspects of tea production, there is a critical need to analyse the human dimensions of

how these climate shocks cause livelihood vulnerability for the workers who are the backbone of the industrial sector.

Objectives

The present study has two major objectives:

To conduct a systematic review of literature in order to identify the major climate-related challenges affecting the socio-economic livelihood of agriculture and plantation workers.

To derive qualitative insights into worker vulnerabilities and adaptation strategies through in-depth empirical case studies among women tea plantation workers.

Methodology

The present study is based on a mixed-methods approach, integrating a Systematic Literature Review (SLR) with qualitative case study analysis. The SLR was carried out according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

Peer-reviewed articles published between 2015 and 2026 were extracted from databases including Scopus, Web of Science, SciSpace and Google Scholar using keywords such as “climate change”, “plantation workers”, “smallholders” and “adaptation”. Out of an initial 231 records identified, 22 duplicates were removed. 100 unique records underwent title/abstract screening, excluding 91 studies that lacked socio-economic focus, targeted non-tea populations, or addressed purely agronomic aspects. Following full-text eligibility assessment of 9 studies, 7 peer-reviewed publications were selected for final analysis. To supplement the review of literature, three case studies were conducted among female tea plantation workers across the Chokkanadu (Chokanad) and Chenduvarai estates in Munnar, Kerala. Primary data for the case studies were collected through semi-structured interviews and focus group discussions with plantation workers.

Discussion

The qualitative synthesis of the 7 included global studies (as shown in Table 1) reveals four major thematic dimensions, namely climate hazards and exposure, livelihood impacts, socio-economic vulnerability and adaptation mechanisms.

Table 1: Thematic Dimensions of Literature Review

Author(s) & Year	Geographic Area	Population	Key Themes & Findings
Yallarawa & Prasada (2020)	Sri Lanka (Badulla)	Smallholders	Crop insurance valuation, willingness to pay (WTP)
Thuy & Anh (2021)	Vietnam (Lam Dong)	Smallholder farmers	Determinants of vulnerability, 50–70% yield loss

Rahaman et al. (2021)	Bangladesh	Gardeners & workers	Rainfall patterns, flash floods, job instability, wage loss
Lokuthula & Geoffrey (2024)	Global	Rural communities	Systematic review of resource-dependent livelihoods.
Herawati (2017)	Indonesia (West Java)	Women tea pickers	Gender intersectionality, labour burdens, double exposure

ISBN code 978-81-999803-3-4

Trivedi et al. (2026)	Global / General	Women & Indigenous groups	Ecotourism diversification,	income indigenous knowledge
Sen et al. (2026)	Vietnam (Thai Nguyen)	Smallholder households	Adaptation priorities, AHP decision modelling	SWOT-

Source: Author's Compilation

The review identified that in Bangladesh (e.g., Sylhet, Rangpur), gardens face high flash-flood frequencies alongside incremental dry spells. This resulted in workers suffering reduced daily pay, wage delays, decreased working days, and provident fund disruptions. In Vietnam (Thai Nguyen, Lam Dong), rising temperatures, prolonged droughts, severe frosts, and erratic precipitation persist, causing yield to decline (50 – 70 %) and thus inducing severe income collapse. Across Sri Lanka (Badulla) and Indonesia (West Java), high rainfall variability and heat waves threaten tea bush health. Studies also revealed that female workers face structural disadvantages due to intersectional social norms, lower land ownership, and heavy household labour. They often tend to rely on single-source daily wage employment, which exacerbates the indices of vulnerability. Finally, the literature highlights a significant deficit in institutional adaptation support. Lack of agricultural extension, limited climate-risk training and social safety nets further deteriorate their already poor living conditions. While macroeconomic agricultural policies exist, they rarely reach the micro-level labourers, leaving them reliant on autonomous, often inadequate, coping mechanisms.

The following excerpts of interviews with three female tea plantation workers in the Munnar region of Kerala examine how the climate-related challenges have affected their day-to-day employment and livelihood.

Case Study 1: Muthulakshmi — Chokkanadu Estate (Highly Vulnerable)

Muthulakshmi, aged 55, having no formal education, has worked in the Chokkanadu tea plantation, Munnar, for over 20 years. Her household is entirely reliant on tea plucking, and they earn a monthly wage of ₹5,001–₹10,000. She faces intense climate exposure, reporting severe impacts from irregular rainfall, heavy downpours, prolonged drought, and localised landslides. As tea leaf growth drops, her available working days have decreased significantly, severely shrinking her monthly income. Whenever work is halted due to bad weather, she immediately loses her daily wage. Furthermore, extreme weather conditions cause physical

fatigue and skin problems, hindering her ability to complete daily plucking targets. With zero financial savings, her primary coping strategies are informal borrowing and cutting essential household food expenditure. Although eager to undergo climate adaptation training, she faces insurmountable barriers in financial capital, technical skills, and job availability.

Case Study 2: Paravai Muniyammal — Chenduvarai Estate (Moderately Vulnerable)

Paravai Muniyammal, aged 45–54, resides in the Chenduvarai estate, bringing over 20 years of field experience and an upper-primary education level. Her monthly income ranges between

₹5,001–₹10,000, derived solely from tea wages. She observes wide-ranging weather changes, including irregular heavy rain, dry spells, cold spells/frost, strong winds, and landslides. While she notes a

moderate reduction in working days and a slight decline in leaf availability, her primary stress stems from compounding financial obligations—food inflation, loan servicing, healthcare costs, and children's education. She experiences high occupational health distress, citing dehydration, physical fatigue, breathing difficulties, skin ailments, and terrain injuries during harsh weather. With limited savings, she copes by reducing household expenses, utilising small emergency savings, seeking family support, and attempting additional casual work. She expressed high interest in receiving targeted adaptation and skill training.

Case Study 3: Kaliyammal — Rajmalai Estate (Pedimudi) (Highly Vulnerable)

Kaliyammal, aged 55 or above with no formal education, represents the lowest income tier among plantation workers, earning below ₹5,000 per month after more than two decades in the sector. As a second- and third-generation Tamil-speaking Dalit migrant, she faces systemic landlessness and exclusion; because historic land reforms exempted large private tea plantations like Kanan Devan Hills Plantations (KDHP), workers remain propertyless and are disqualified from many government housing and rehabilitation schemes.

Living historically in substandard, colonial-era "layams"—old 50- to 90-year-old single-room row houses lacking basic safety standards and situated directly on high-risk, landslide-prone hill slopes—she experienced acute exposure to extreme weather and severe geological hazards, a danger starkly underscored by the catastrophic Rajmalai Estate (Pettimudi) disaster 2020. Following her relocation to another estate, she continues to endure deep economic exploitation, low daily wages, and persistent poverty with minimal socio-economic mobility.

The ongoing reduction in tea leaf production severely restricts her working days and cuts her household income drastically. Operating on daily wage loss during rain stoppages, she

encounters constant difficulty fulfilling basic nutritional and living needs. Weather exposure further exacerbates her health problems, including severe fatigue, respiratory difficulties, and field injuries. Lacking any financial savings, her coping mechanisms rely heavily on debt accumulation, cutting meal expenses, and seeking secondary labour. Furthermore, her pathway out of vulnerability is severely constrained by structural isolation, poor infrastructure (such as non-motorable roads and delayed emergency communication during storms), a lack of formal skills, heavy domestic burdens, and an absence of adequate institutional support or awareness of government welfare schemes.

Conclusion

The literature confirms that climate change is not merely an environmental or agronomic issue, but a critical socio-economic crisis for tea-dependent labour forces. Climate change poses an increased threat to the livelihoods, economic security, and physical well-being of tea plantation workers. While integrating the systematic review of existing literature with localized empirical case studies in Munnar, it has been observed that agronomic vulnerability directly converts into human suffering. Climate shocks such as erratic rainfall, temperature rise, etc., diminish crop yields, and this in turn immediately results in the loss of workdays and daily wages. Because workers operate without adequate financial buffers, they are often caught in indebtedness and negative coping mechanisms, such as reducing caloric intake. Furthermore, gendered inequalities lead to female workers bearing disproportionate health and economic burdens. Therefore, an effective response requires integrated frameworks connecting micro-level solutions with macro-level institutional, financial, and gender-

responsive policy instruments.

Scope of the further study

Look at Regions: Check how climate change affects tea workers in Munnar Kerala.

Use Numbers and Surveys: Conduct large-scale surveys to measure exact financial losses, wage drops, and deep debt cycles.

Test Insurance and Aid: Find ways to bring proper climate insurance, financial training, and government safety nets to daily-wage workers who currently miss out on them. Focus on Women Workers: Create better support systems for women, who carry a heavy double burden of field labor and unpaid household chores.

References:

Herawati, E. (2017). Gender Relation in Tea Plucking Workers: A Case Study of Gender Division of Labour and Gender Relation in Gambung Tea Plantation, West Java. *Sodality: Jurnal Sosiologi Pedesaan*.

ILO. (2022). *Decent Work in Nature-based Solutions 2022*. International Labour Office.

Lokuthula, M., & Geoffrey, M. (2024). An Assessment of the Perceptions of Local Communities in the Eastern Free State Region of South Africa regarding the Impacts of Climate Change on Livelihoods. *Transactions of the Royal Society of South Africa*, *79*(1), 51-65.

Rahaman, M. S., Reza, S. M. A., Rahman, M. M., & Solaiman Chowdhury, M. (2021). A Deplorable Community in Bangladesh: Tea Garden Workers. *Journal of Enterprising Communities: People and Places in the Global Economy*, *15*(4), 548-566.

Sen, L. T. H., Chi, N. N. L., & Nguyen, D. T. (2026). Determinants of Livelihood Diversification among Climate-vulnerable Rice Farming Households: An Integrated Multi-theoretical Approach from Central Vietnam. *Journal of Agribusiness in Developing and Emerging Economies*, 1-20.

Smith, K. E., Burrows, M. T., Hobday, A. J., King, N. G., Moore, P. J., Sen Gupta, A., ... & Smale, D. A. (2023). Biological Impacts of Marine Heatwaves. *Annual Review of Marine Science*, *15*(1), 119-145.

Soutar, C., & Wand, A. P. (2022). Understanding the Spectrum of Anxiety Responses to Climate Change: A Systematic Review of the Qualitative Literature. *International Journal of Environmental Research and Public Health*, *19*(2), 990.

Thuy, N. N., & Anh, H. H. (2021). Determinants of Livelihood Vulnerability of Smallholder Tea Farmers in Lam Dong Province, Vietnam. *Conference Series: Earth and Environmental Science*, *653*(1), 012-094.

Trivedi, A., Juyal, S. A., Kandpal, V., & Yildirim, S. (2026). Leaves of Change: Women and Indigenous Communities in Tea-Based Ecotourism. In *Green Heritage of Tea* (pp. 98-116). Routledge. Yallarawa, Y. S. M. M. P., & Prasada, D. V. P. (2020). Demand for Crop Insurance by Tea Smallholders in Badulla District: An Analysis of Willingness-to-Pay. *Tropical Agricultural Research*, *31*(3).