Tropentag, September 10-12, 2025, hybrid conference

"Reconcile land system changes
with planetary health"

Water insecurity and agrarian fragility in Nepal's highlands: Navigating climate change and governance challenges

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Abstract

Nepal's mountainous regions, particularly Sudurpaschim and Karnali provinces, sit at the confluence of cascading climatic, ecological, and socio-economic challenges. These areas are emblematic of the Hindu Kush Himalaya's vulnerability, facing erratic rainfall, glacial retreat, and prolonged droughts—factors that exacerbate food insecurity, water scarcity, and social inequalities. This study explores how climate change and socio-economic shifts intersect to shape water and food security, gender roles, and local adaptation strategies in rural Nepal. Combining the analysis of multi-scalar secondary evidence with data collected from stakeholder dialogues and focus group discussions with the communities living in the mountains, we trace how biophysical stressors (e.g., glacial lake outburst floods, seasonal water shortages) and institutional shortcomings reinforce social precarity. We examine how water security intersects with food systems, agrarian transitions, and socio-institutional dynamics. It highlights the fragmented and reactive nature of adaptation responses, dominated by short-term coping rather than long-term planning.

Despite being rich in freshwater resources, Nepal faces a paradox of scarcity and contamination, especially in rural upland settings. The water-related challenges directly compromise household food security, dietary diversity, and agricultural productivity, disproportionately affecting marginalised groups. Women, who shoulder increasing responsibilities in male-absent households, face persistent barriers in accessing land, extension services, and water governance spaces. At the household level, women are increasingly central to adaptation efforts due to male out-migration and labour shifts. Yet, their access to land, knowledge networks, and decision-making remains constrained by entrenched caste and gender hierarchies. Labour migration, while improving remittance flows and in some cases women's agency, has also intensified feminised labour burdens and agricultural land abandonment.

By centring the rural agricultural landscape as a space of both vulnerability and transformation, this work calls for climate-resilient water systems, recognition of gendered labour and knowledge, and stronger institutional coherence. Social learning—through participatory governance, local knowledge integration, and equitable access—emerges as central to ensuring sustainable food and water futures in Nepal's rural highlands. The case of Nepal's

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highlands calls for a rethinking of adaptation not just as a technical fix but as a socio-political process, requiring equity in voice, access, and power.

Keywords: Climate change adaptation, feminisation of agriculture, Food and nutrition security, governance, highlands of Nepal, irrigation, rural agricultural landscapes, smallholder farming, water security