

# **Human Ecological Implications of Climate Change in the Himalaya: Investigating Opportunities for Adaptation in the Kaligandaki Basin, Nepal**

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## **Abstract**

Climate change and associated impacts are pressing issues for the twenty-first century. The climatic impacts and associated adaptation responses are altering complex interrelationships between people and the environment. Although the problems generated by such change are global, the intensity of impacts varies spatially. This research examines the implications of climate change on the local social-ecological systems of the Kaligandaki Basin, Nepal; it maps the adaptation efforts of communities; and assesses food and livelihood (in)security and vulnerability of the social-ecosystems to inform adaptation policy and practice.

The study applies a geographical approach to explain human-environmental interrelationships by drawing from both social and natural scientific methodologies inherent to the discipline. The concepts of human ecology and social-ecology, climatic and environmental change, vulnerability and adaptation, are explored and applied in the research. The Sustainable Livelihood Approach (SLA) is integrated with the Drivers-Pressure-State of Change-Impacts-Response (DPSIR) analysis framework to explain the complex local human-environmental interactions with climate change. Case studies are drawn from three different ecological zones: the Tarai, the Middle-Mountains and the Trans-Himalaya to inform a comparative analysis in the Kaligandaki Basin. Climate change in the Kaligandaki Basin is assessed by analysing both meteorological data for the past 40 years and social perceptions of change in the last decade. Primary data on impacts and adaptation responses were collected through face-to-face interviews with household heads from 360 households, 24 focus group discussions, 7 historical timeline calendars, 75 key informant interviews, and 9 crop calendar sketches.

The findings suggest that the social-ecological systems of the Himalaya are highly sensitive to both climatic and non-climatic stressors. Climate sensitive livelihood capitals are increasingly exposed to climate change, as both scientific and social analyses indicate increased temperatures and more extreme weather events. The changes and variability in the climate system have negatively impacted all social-ecological systems, particularly in the Middle-Mountains. Consequently, many local communities are trapped in a situation of multiple livelihood constraints associated with ecological, economic, social and political environments. To respond to those constraints and reduce the negative implications of change, people are trying to adopt adaptation strategies, mostly at the individual household or community levels.

The studied communities demonstrate significant adaptation knowledge; however, such knowledge is not sufficiently translated into adaptation actions. Many households are losing hope of agricultural adaptation due to climate change impacts and unfavourable political-economic environments. Cash income is now the preferred option for many, and young adults are leaving

communities and the country in search of paid employment. The poor quality of livelihood capitals; increasing climate change impacts; and poor adoption of adaptation strategies together have significant negative implications for local food and livelihood security.

The research has important implications for policy that aims to integrate disaster management, agricultural development, livelihood diversification, and community empowerment in relation to climate change adaptation in Nepal. The research supports theoretical discussions on the value of undertaking complex social-ecological analyses to generate knowledge that is both holistic and directly applicable for local adaptation planning and practice. By applying similar approaches in other contexts, especially in the developing world, the issues inhibiting broader development processes could be integrated with an understanding of climate change impacts for targeted, comprehensive adaptation policy outcomes.

### **Declaration**

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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Rishikesh Pandey

15 February 2016



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## Acronyms

ACAP	Annapurna Conservation Area Project
ACI	Adaptive Capacity Index
AR	Assessment Report
CBO	Community Based Organization
CBS	Central Bureau of Statistics, Nepal
CDMC	Community Based Disaster Management Committees
CNP	Chitawan National Park
CI	Cropping Intensity
CPI	Crop Potential Index
COP	Conference of the Parties
DDC	District Development Community
DHM	Department of Hydrology and Meteorology, Nepal
DPSIR	Drivers-Pressures-State of Changes-Impacts-Responses
EI	Exposure Index
ENSO	El Niño Southern Oscillation
FANTA	Food and Nutrition Technical Assistance Project
FGD	Focus Group Discussions
GHG	Green House Gas
Gg	Giga gram
GLOF	Glacial Lack Outburst Flooding
GM	Genetically Modified
GoN	Government of Nepal
HDI	Human Development Index
HDR	Human Development Report
HED	Himalayan Environmental Degradation
HFIAS	Household Food (In)Security Access Scale
HTC	Historical Timeline Calendars
HYV	High Yielding Varieties
ICIMOD	International Centre for Integrated Mountain Development
I/NGOs	International/Non-governmental Organizations
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informants Interviews
KSL	Kailash Sacred Landscape
LARC	Lumle Agriculture Research Centre
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
NAPA	National Adaptation Plan of Actions
LAPA	Local Adaptation Plan of Actions
PRA	Participatory Rural Appraisal
SI	Sensitivity Index
SLA	Sustainable Livelihood Approach
SVI	Social-Ecological Vulnerability Index
TAR	Third Assessment Report
UNFCCC	United Nations Framework Convention on Climate Change
UoA	the University of Adelaide
VDC	Village Development Community
WCED	World Commission on Environment and Development
WMO	World Meteorological Organization