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Socio-Economic Issues of Climate Change

A Livelihood Analysis from Nepal

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Preface

The research leading to this book was conceived at a time when the social and human dimensions were just beginning to find a space in the climate change arena. The few literatures that existed in the topic were almost exclusively focused on the developed countries. Given the circumstances, the research aimed to contribute to the dearth by exploring the socio-economic issues of climate change among one of the highly marginalized rural communities in a developing country. It took almost a decade to give these findings a book form. Meanwhile, the academia has definitely seen a surge in researches dealing with social, cultural, human, and economic aspects of climate change. However, such researches not only form a small proportion of the total climate change-related researches but are also sparse regarding the issues of the Global South. This book analyzes the socio-economic issues of climate change from a livelihoods perspective, taking the case study of a highly marginalized indigenous community called the Chepangs, living in the remote mid-hills of Nepal. Such rural communities are often the ones who have contributed the least in the anthropogenic climate change yet are one of those whose livelihoods are most adversely impacted by the phenomenon. Their extensive dependence on natural resources for livelihoods makes them the most vulnerable to even small changes in the climate, which is further coupled by their poor adaptive capacities owing to lack of assets and access to institutional supports. In this context, the Chepangs form the appropriate representative of the disadvantaged population whose livelihoods are constantly threatened by adversaries associated with the changing climate. Within the scant literature dealing with this topic in developing countries, those focusing on indigenous communities are even scanter. At the current time when the policy-makers and development agencies are looking for ground-level evidences to mainstream climate change for sustainable development worldwide, the authors believe that this book is more relevant than ever before.

The book contains an updated review of how climate change interacts with various aspects of livelihoods including assets and strategies (Chap. 2). Chapter 3 describes the policies and programs related to climate change in the context of Nepal. The conceptual and analytical framework adopted in the book is elaborated in Chap. 4. A brief introduction about the study community and the rationale for

selecting this community as our study population are given in Chap. 5. The study settings including the selection of study sites, methodologies of sampling, and data collection are outlined in Chap. 6. In the introductory analytical chapters (7 and 8), the book sheds important details on the livelihood strategies of the study community. These descriptive chapters are important for the readers to understand the backdrop against which the study community is facing the phenomenon of climate change. Chapter 7 describes how farming and gathering are integrated into the subsistence livelihoods of the Chepang community. Chapter 8 looks into the detail livelihood portfolio of the community. The important finding of this chapter is that farming, forestry, and wage laboring are the major livelihood sources adopted by most of the households, despite the fact that these livelihoods yield comparatively lower income. Only few of the Chepang households are able to undertake remunerative livelihoods sources like salaried jobs, nonfarm skilled jobs, and laboring abroad because they lack the basic education, skills, and capitals required.

The book deals in depth with various aspects of climate change like community perceptions, local-level vulnerability, livelihood impacts, adaptive capacity, and community-based adaptations. Each of these aspects of climate change is discussed in the subsequent chapters, keeping the livelihoods at the center. Chapter 9 on perceptions shows that the majority of the communities are able to correctly perceive the trends of changing climatic variables for the short run of the last 10 years. Analysis of factors affecting perceptions reveals that the access to relevant information is the most important factor enabling correct perceptions for which extension services must be strengthened. Indicator-based vulnerability analysis conducted in Chap. 10 highlights the fact that when households in a locality are exposed to the same climate adversities, those households with least adaptive capacity exhibit the highest sensitivity, thereby resulting in higher vulnerability. Since adaptive capacity is the only component with direct policy implications, efforts should be geared towards improving the community-level adaptive capacity so as to reduce the sensitivity as well as the vulnerability to climate change. Chapter 11 provides evidences of the livelihood impacts of climate change and extreme events experienced by the community. The smaller less dramatic climatic events like mid-season droughts, hails, shifting rainfall patterns, and declining rainfall quantity are very significant for the Chepangs who predominantly depend on subsistence rainfed farming for livelihoods. This chapter provides insights for scientific studies and mitigation policies to focus on the impacts of such climatic events on the livelihoods of highly marginalized communities living in geographically vulnerable areas. The comparison of adaptive capacity and adaptation practices in Chap. 12 reveals that the aggregate adaptive capacity is not the sufficient determinant of adaptation practices. The balanced possession of the different types of assets is a must for households to build their adaptive capacity. Further, without improved human capability and financial capital, it was found that households are unable to utilize other assets efficiently. Thus, to ensure that the inherent adaptive capacity is translated into effective adaptation actions, human and financial capitals must foremost be strengthened. The analysis presented in this chapter also sheds light on the factors determining the choice of adaptation practices by the households. Ability to correctly

perceive rainfall changes, access to information, secure land tenure, access to credit facilities, and skill development training are the most important determinants of adaptation. The concluding chapter discusses why the mainstreaming of climate change into policy and development interventions is a must for sustainable development.

This book will be of relevance to a multitude of audiences from various backgrounds. The information presented herein is of use for academicians, policymakers, and development workers dealing with rural livelihoods, indigenous communities, and climate change. The book can be used as a source of teaching materials for graduate students. The findings and recommendations provided can form a basis for policy formulations and design of development projects.

We thank the Global Environmental Leaders (GELs) Education Program for Designing a Low Carbon Society and Hiroshima University TAOYAKA Program for creating a flexible, enduring, peaceful society funded by the Program for Leading Graduate Schools, Ministry of Education, Culture, Sports, Science and Technology for providing research funds. We are also grateful to FORWARD Nepal and Nepal Chepang Association for logistic supports in Nepal during fieldworks. Lastly, we are obliged to the Chepang community for their cooperation in our research activities.

Higashi Hiroshima, Japan
December 2018

Luni Piya
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About the Authors

Luni Piya (Ph.D., Hiroshima University) is currently a Researcher at the Graduate School for International Development and Cooperation, Hiroshima University, Japan. Her academic expertise lies in issues related to the livelihoods of rural households in developing economies. Her researches have covered specific topics of rural livelihood trajectories; socio-economic issues of climate change; religio-cultural dynamisms of indigenous communities; migration; and remittances. Her research works have been published in several SCI/SSCI journals. She has co-authored two books and a book chapter namely, *Role of Microfinance in Poverty Alleviation of Women: A Case of Small Farmers Cooperative Limited in Kumroz, Chitwan, Nepal*, Lambert Academic Publishing (2013); *Understanding Maoist Conflict in Nepal: Initiatives of Civil Societies on Social Capital Development for Peacebuilding in Hills*, Lambert Academic Publishing (2013); and *Sources of Climate Change, its Impact and Mitigation Issues in Nepal*, Rawat Publications (2012). She is one of the contributing authors for the book chapter *Adaptation to Climate Change in the Hindu Kush Himalaya: Stronger Action Urgently Needed*, Springer Nature (2019).

Keshav Lall Maharjan (Dr. of Agriculture in Agricultural Economics, Kyoto University, Japan) is currently a Professor at the Graduate School for International Development and Cooperation (IDEC), Hiroshima University, Japan, where he has been teaching, conducting research and chairing various steering and decision-making committees since its foundation in 1994. He gives lectures for graduate students on subjects including Rural Economics, Rural Development, South Asian Studies, International Development and Cooperation Studies. He conducts weekly seminars at the graduate school that address pertinent issues in Agricultural Economics, Rural Development, Sustainable Development, Climate Change and Rural Livelihood Strategies in developing countries. At IDEC, he is also in charge of planning, execution and monitoring of International Explorers to Cross Borders (i-ECBO) program, a unique sandwich-type internship program, in which students after competitive selection process are sent to various institutions such as universities, international organizations, government agencies, INGOs, local NGOs and developing agencies, including private companies around the world. He offers

support for graduate students writing their Master's theses and doctoral dissertations on the related topics at Divisions of Development Sciences, and Educational Development and Cultural and Regional Studies, and at Cultural Creation Course of Taoyaka Program, a special Ph.D. program for leading graduate schools at Hiroshima University, aiming to nurture the graduates who can contribute to flexible, enduring and peaceful society of coexistence among the mankind and the nature, with special attention to disadvantaged regions. The issues concerning natural resource management, food security, poverty dynamics, local governance, rural society and community dynamics are some of the main topics of his expertise. In doing so, he considers agriculture and rural regions as not only the source of cheap labor, cheap food and cheaper intermediate inputs, and subordinate to urbans and centers as marginal sector and peripheral region but also as a dignified way of life for people who are guardians of nature and are more conscious about the earth, humans and their interaction, so as to sustain this culture and civilization for generations hereafter. Rural regions are such places that make these things happen. Hence, fieldwork to grasp the diverse realities of rural regions location specifically before generalizing the research is given importance in his research, lectures and in educating the graduate students in terms of their research, writing journal articles and dissertations. Some 30 students have received their Ph. D. from Hiroshima University under his guidance. He regularly receives research funds from various funding agencies to conduct research.

In order to disseminate research findings, consolidate ideas and concepts, and share knowledge with other professionals, he regularly participates in local, national and international seminars and conferences organized by academic societies, research institutions, various organizations and like-minded individuals, including agricultural economists, development economists, agronomists, ruralogists, sociologists, environmentalists, anthropologists, educationalists, policy makers, development practitioners, farmers, local leaders and opinion shapers.

Some of his earlier books in English include *Sustainability of Organic Farming in Nepal*, Singapore: Springer Nature, 2017; *Assessing Community-Based Adaptation in Central and Far-Western Nepal,* Balti: LAMBERT Academic Publishing, 2017; *Decentralization and Rural Development in Indonesia*. Singapore: Springer Nature, 2017; *Community Seed Production Sustainability in Rice-Wheat Farming*. Tokyo: Springer Japan, 2015; *Communities and Livelihood Strategies in Developing Countries.* Tokyo: Springer Japan, 2014; *Climate Change, Agriculture and Rural Livelihoods in Developing Countries*, Tokyo: Springer Japan, 2013; *Understanding Maoist Conflict in Nepal: Initiatives of Civil Societies on Social Capital Development for Peacebuilding in Hills*, Germany: Lambert Academic Publishing, 2013; *Peasantry in Nepal: A Study on Subsistence Farmers and Their Activities Pertaining to Food Security*, Hiroshima: Research Center for Regional Geography, Hiroshima University, 2003; and *Impacts of Irrigation and Drainage Schemes on Rural Economic Activities in Bangladesh,* Hiroshima: Research Center for Regional Geography, Hiroshima University, 1997. He has also contributed chapters to publications including *Microfinance, Risk-taking Behaviour and Rural Livelihood*, New Delhi: Springer India, 2014, *Geography of governance: Dynamics for local development*. International Geography Union Commission on Geography

of Governance, Slovakia, 2013, *Climate Change: Asian Perspective*, Jaipur: Rawat Publication, 2012; *Globalization and Cultural Practices in Mountain Areas: Dynamics and Implication*. Sikkim: INDUS, 2012, *Public Policy and Local Development – opportunities and constraints*, International Geographical Union Commission on Geography and Public Policy, 2008; *Political and Social Transformation in North India and Nepal*, New Delhi: Manohar Publishers, 2007; *Contentious Politics and Democratization in Nepal*. New Delhi: Sage Publications, 2007, *Small-Scale Livelihoods and Natural Resource Management in Marginal Areas of Monsoon Asia*, Dehra Dun: Bishen Singh Mahendra Pal Singh, 2006; *New Challenges Facing Asian Agriculture under Globalization.* Selangor: Malaysian Agricultural Economics Association, 2005; *Translating Development: The Case of Nepal*, New Delhi: Social Science Press, 2003; and *Sustainable Agriculture, Poverty and Food Security*, Jaipur: Rawat Publications, 2002. He contributes to various related academic journals including SCI, SSCI journals and has more than hundred and eighty-five peer reviewed articles to his credit. He has also produced numerous books and journal articles in Japanese. He was awarded **Jyapu Ratna**, Gem of Jyapu, for his achievements and contribution to the society by K. P. Sharma Oli, the prime minister of Federal Democratic Republic of Nepal on December 12, 2015.

Niraj Prakash Joshi (Ph.D., Hiroshima University) is currently working as an Associate Professor (Special Appointment) at Hiroshima University under the TAOYAKA program. He is involved in teaching and conducting research. He gives lectures for graduate students on subjects including rural economics, developing debating skills/developing designing ability and onsite education related courses. He is involved in designing and implementing overseas onsite-trainings for post-graduate students of Hiroshima University in collaboration with the University of Texas at Austin and Tribhuvan University, Nepal. He has also been advising students on research project development and implementation. He is engaged in researches related to poverty, food insecurity, rural livelihoods and climate change in developing countries, with a particular focus on poverty-ridden region of the far-western rural hills of Nepal as well as the impoverished and marginalized Chepang community in Nepal's remote central hills. Besides, he is also engaged in research on production and trade of agricultural commodities in the Northern Indian subcontinent.

He has presented the related research outcomes in several national and international conferences and seminars. He has published several papers in various peer-reviewed journals. He has also published some books. Some of his earlier books include *Climate Change, Agriculture and Rural Livelihoods in Developing Countries,* Springer Japan (2013); *Understanding Maoist Conflict in Nepal: Initiatives of Civil Societies on Social Capital Development for Peacebuilding in Hills*, Lambert Academic Publishing, (2013); *Role of Microfinance in Poverty Alleviation of Women: A Case of Small Farmers Cooperative Limited in Kumroz, Chitwan, Nepal*, Lambert Academic Publishing, (2013) and *Poverty and Food-Insecurity Analysis in Far-Western Hills of Nepal: A Case of Baitadi District,* Lambert Academic Publishing (2011). Besides, he has also contributed chapters to publications including *Climate Change: An Asian Perspective,* Rawat Publication (2012).

Acronyms and Abbreviations

˚C	Degree Centigrade
AE	Adult Equivalent
ANOVA	Analysis of Variance
AR4	Fourth Assessment Report
AR5	Fifth Assessment Report
CBO	Community-Based Organization
CBS	Central Bureau of Statistics
CCDN	Center for Community Development Nepal
CCODER	Center for Community Development and Research
CDM	Clean Development Mechanism
CEEPA	Centre for Environmental Economics and Policy in Africa
CEN	Clean Energy Nepal
CH_4	Methane
Chap.	Chapter
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide Equivalent
DFID	Department for International Development
DHM	Department of Hydrology and Meteorology
et al.	et alii
FAO	Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility
FORWARD	Forum for Rural Welfare and Agriculture Reform for Development
GCM	General Circulation Model
GELs	Global Environmental Leaders Education Program for Designing a Low Carbon Society
GHG	Greenhouse Gas
GLOF	Glacial Lake Outburst Flood
h	hour
HH	Household
HHH	Household Head
HiCEC	Hiroshima International Center for Environmental Cooperation

IAAS	Institute of Agriculture and Animal Sciences
IFPRI	International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate Change
ISET-N	Institute for Social and Environmental Transition-Nepal
Km	Kilometer
KP	Kyoto Protocol
LAPA	Local Adaptation Plan for Action
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
LSU	Livestock Standard Unit
LUCF	Land-Use Change and Forestry
LULUCF	Land Use, Land-Use Change, and Forestry
masl	Meters Above Sea Level
MDI	Manahari Development Institute
mm	Millimeter
MNL	Multinomial Logit
MoAC	Ministry of Agriculture and Cooperatives
MoE	Ministry of Environment
MoPE	Ministry of Population and Environment
MVP	Multivariate Probit
n	Number of Sample Households
N_2O	Nitrous Oxide
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NCA	Nepal Chepang Association
NCCSP	Nepal Climate Change Support Programme
NCVST	Nepal Climate Vulnerability Study Team
NEFIN	Nepal Federation of Indigenous Nationalities
NFDIN	National Foundation for Development of Indigenous Nationalities
NGIIP	National Geographic Information Infrastructure Programme
NGO	Non-Governmental Organization
NIRS	Nepal Integrated Research System
NORAD	Norwegian Agency for Development Cooperation
NPC	National Planning Commission
NRs.	Nepali Rupees
NTFP	Non-Timber Forest Product
PASW	Predictive Analytics Software
PCA	Principal Component Analysis
PDD	Project Design Document
RCM	Regional Circulation Model
RCPs	Representative Concentration Pathways
REDD	Reduced Emissions from Deforestation and Forest Degradation
R-PP	Readiness Preparation Proposal
SAPPROS	Support Activities for Poor Producers of Nepal
SAR	Second Assessment Report
SD	Standard Deviation

STATA	Data Analysis and Statistical Software
TAR	Third Assessment Report
TU	Tribhuvan University
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US$	United States Dollars
VDC	Village Development Committee
WHO	World Health Organization

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Chapter 1
Introduction

Abstract Anthropogenic global warming is unequivocal. Climate science has progressed tremendously in terms of the understandings of the related biophysical processes. However, studies of the human and social dimensions of climate change are gaining pace only recently. Climate change is a global phenomenon with local manifestations and impacts. This calls for the need of an assessment of local vulnerabilities, impacts, and adaptation options at the micro-level. Climate change also has glaring inequities in terms of its causes and impacts. Rural marginalized communities in developing countries are one of the most affected communities due to higher dependence on natural resources compounded by their limited adaptive capacity. In this regards, this book focuses on the Chepang community, one of the highly marginalized indigenous nationalities from the remote mid-hills of Nepal.

Keywords Anthropogenic climate change · Intergovernmental Panel on Climate Change (IPCC) · Human and social dimensions · Nepal · Chepang

1.1 Evolution in Climate Change Studies

As per the assessments presented by the Intergovernmental Panel on Climate Change (IPCC), it is unequivocal that the Earth's climate system is warming (Burkett et al. 2014), and this fact is confirmed by the rising sea levels, melting glaciers and snow covers, retreating Arctic ice sheet, warming ocean, and increasing global average air temperature. Science has given enough proof that the current phenomenon of global warming is not entirely a part of the natural cycles, but rather human activities are responsible for most of the warming seen over the last six decades (IPCC 2014, 2007a). Only the models that incorporated both natural and anthropogenic forcing better simulated the past trend of rising land and ocean temperatures, which has thus provided a stronger evidence of human influence on climate (Hegerl et al. 2007). The fourth assessment report (AR4) of the IPCC established the anthropogenic activities as the major cause of current climate change with very high confidence. The evidences have further been strengthened in the fifth assessment report (AR5), which states that the impact of anthropogenic causes on

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