

Managing climate risks and adapting to climate change in the agriculture sector in Nepal



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Managing climate risks and adapting to climate change in the agriculture sector in Nepal

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ABSTRACT

The agriculture sector plays a critical role in the Nepalese economy, contributing more than 33 percent to Nepal's gross domestic product and engaging more than 65 percent of its population. The sector is highly exposed and vulnerable to extreme climate events and the impacts of climate change. Agricultural production is constrained by frequent natural disasters – floods, droughts, landslides, intense rain, hailstorms and cold and heat waves. Such climate-related events have put fragile agricultural ecosystems at risk. The impacts on agriculture of climate change and related extreme events often lead to food insecurity for poor and marginalized populations groups, including women and children.

Projected future scenarios of climate suggest that climatic conditions in Nepal will worsen, which may imply even more frequent occurrences of climate-related extremes and negative impacts on food production. However, by adopting the right measures, it is possible to adapt effectively to the challenges posed by climate change. Such measures require a comprehensive approach that includes strengthening the capacities of institutions and delivering need-based services to farming communities.

In response to the Government of Nepal's request, FAO assisted the Ministry of Agricultural Development (MOAD) in strengthening capacities for climate risk management and climate change adaptation in the agriculture sector through a project under the Technical Cooperation Programme (TCP) and a joint programme (UNJP) with the United Nations Development Programme (UNDP). The report builds on the experiences and lessons learned from these projects over the period 2008–2012. In addition, the document includes additional details to provide a comprehensive understanding of climate variability and change in Nepal and their impact on agriculture. The report also highlights technical and policy options for coping with and adapting to the impacts of climate variability and change.

Chapter 1 presents an introduction, outlining gaps and need-based interventions for improving climate risk management and adaptation. **Chapter 2** explains climate and its variability in Nepal, including past trends and future climate change projections. The chapter also highlights the uncertainties of climate change projections, and issues associated with practical decision-making. **Chapter 3** describes the vulnerability and impacts of climate change

on the agriculture sector, including the impacts of recent extreme climate events, and highlights the need to base interventions in climate risk management and adaptation on local communities' perceptions of climate risks.

Chapter 4 provides a detailed description of the institutional context for managing climate risks and adaptation. Enhanced technical capacities, linkages to research and development, improved coordination mechanisms and inclusiveness are considered key aspects for the successful delivery of need-based services to farmers. **Chapter 5** highlights the need to strengthen the collection and analysis of data and information for managing climate risks and advancing adaptation. The chapter provides an overview of data and information requirements, existing data and information systems in Nepal and ways and means of improving data and information for the planning of climate risk management and adaptation.

Chapter 6 provides a comprehensive typology of coping and adaptation strategies and practices for managing current risks and building the necessary knowledge and good practices for advancing adaptation over the longer term. The good agricultural practices demonstrated to farmers highlight the need for a fundamental shift in approach from reactive emergency response to proactive climate risk management in the short to medium term, and to adaptation in the medium to long term.

Chapter 7 presents the features of existing policies, plans, strategies and programmes that are relevant to agriculture and food security, disaster risk management and climate change adaptation. The chapter also examines the issues and opportunities for mainstreaming climate change concerns into broader agriculture and food security policies, plans and strategies; and agriculture and food security priorities into disaster risk management and climate change policies and plans.

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EXECUTIVE SUMMARY

The climate of Nepal varies greatly in both time and space. Observed climate data from the 1960s onwards indicate consistent warming and increases in maximum temperatures averaging 0.04–0.06° C per year. Warming is more pronounced in high-altitude regions than in the *terai*. Annual precipitation data show large inter-annual variability. Monsoon (June – September) precipitation data for raingauge stations of Nepal showed both increasing and decreasing trends and do not show consistent long-term trends.

Climate change is expected to bring additional threats of greater magnitude. Climate change projections forecast that mean annual temperatures will increase by an average of 1.2° C by 2030 and 1.7° C by 2050, compared with the pre-2000 baseline. Regional circulation models project even greater increases in mean annual temperatures: 1.4° C by 2030 and 2.8° C by 2060 – and both rises and falls in mean annual precipitation rates, with no clear trends. Climate change projections indicate that the main impacts are likely to include significant warming and uneven and erratic distribution of precipitation, leading to increased frequency of extreme weather and climate events, including floods and droughts. It is likely that new areas will be affected by a variety of different climate-induced threats, exacerbating the negative impacts of climate events.

The agriculture sector is highly exposed to climate extremes. Several factors make Nepalese agriculture particularly vulnerable to increasing climate variability and climate change. Increasingly frequent and intense hydro-meteorological hazards, high dependency on agriculture – with few opportunities for diversifying income sources – rapid population growth, shrinking farm size in the *terai* region, and continued unplanned agriculture in areas prone to climate risks are likely to increase the exposure and loss of livelihoods, unless countermeasures are put in place. High exposure and low adaptive capacity pose a major challenge to the agriculture sector, which is expected to suffer livelihood losses and the reduction of crop and livestock production.

Climate change is likely to affect agriculture-dependent livelihoods and – ultimately – food security. Per capita food availability is declining over the years, because the population continues to increase while the performance of the agriculture sector remains almost stagnant. The average per capita agricultural landholding is less than 0.8 ha, enabling farmers to produce only about six months' food consumption from their farms in low-production environments; about 42 of the country's 75 districts face food deficits every year. According to calculations based on models, the likely impacts of climate change on agricultural production include a 17.3 percent drop in production from a temperature increase of 2.5° C, and these figures do not include the additional negative impacts of extreme climate events. Observation of the impacts of recent extreme climate events suggests that clear production declines result from even slight changes in temperature and rainfall regimes. Nepal's vulnerable farming economy is facing risk because the reliability of stream flow is declining; rainfall deficits from November to April adversely affect winter and spring crops; rice yields are particularly sensitive to climatic conditions; and climate change poses a threat to food security through the loss of local landraces and traditional crops, while also having negative effects on biodiversity.

Communities adopt various coping mechanisms to deal with the impacts of climate change. In recent years, seasonal and permanent migration has become more common, leading to increased workloads for family members left behind – particularly the elderly, women and children. The fear of losing crops and agricultural livelihood assets to various risks is causing many rural people to shift from on- to off-farm occupations, with repeated crop failure forcing them to sell their land at low prices and divert to small-scale businesses. There is also evidence that the increasing trend in climatic risks is resulting in conflict over resource sharing between indigenous and migrant populations. The coping practices adopted by communities to reduce these impacts are not enough to address the challenges.

Comprehensive approaches to climate risk management and climate change adaptation are essential for Nepal's agriculture sector. As climate impacts are highly localized, responses should be adapted to the local context of

natural resource endowments, livelihood activities, vulnerability patterns and adaptive capacity. Efforts to respond to climate change should build on local perceptions of climate risks and existing coping strategies. A comprehensive approach should be adopted to address current problems through climate risk management in the short to medium term, slowly switching to adaptation interventions in the medium to long term.

It is therefore important that policy-makers and agriculture support services assess current and future climate-related risks, vulnerability patterns, and livelihood groups to identify suitable risk management and adaptation practices and contribute to the preparation of plans and frameworks for action. Institutional innovations, participation and inclusiveness, strengthened technical capacity of government and local institutions, and enabling environments at the national, district and local levels – with clear roles and responsibilities for coordination, local implementation of actions and monitoring and evaluation – are crucial.

Efforts to manage climate risks and adaptation require data and information on crops, cropping systems, soil, water, livestock, fisheries, socio-economic conditions and the impacts of climate variability and climate change. Existing data and information systems provide a starting point for building robust systems that provide information on hazards, vulnerability and risks, for the monitoring of food security and weather and climate events. Promoting proactive risk management at the local level requires the standardization of data collection, enabling institutional mechanisms, technical capacity development and systematic updating of databases. Advances in weather and climate forecasting provide opportunities for managing risks proactively at the local level, but people-centred and localized climate services need to be strengthened by building user interface platforms. Improvement of climate observation and monitoring networks in vulnerable areas is essential to enhance weather and climate information services.

The community-driven, bottom-up approaches clearly demonstrate that concrete actions for managing current risks and addressing underlying vulnerabilities are a priority in preparing for future risks and enhancing adaptation. Good practices for climate risk management include promotion of agricultural service systems to facilitate community-based seed storage and maintenance, adoption of drought- and high temperature-tolerant

crop varieties, management of high- and low-temperature stress, crop diversification, and integrated approaches to hazard risk reduction.

Resource conservation is pivotal to promote adaptation and resilience in agriculture. Resource conservation practices include rainwater harvesting and soil moisture conservation; improvement of degraded land; protection from riverbank cutting and inundation; slope stabilization and management; conservation of biodiversity and traditional crops; promotion of conservation agriculture in rice–wheat systems, improved crops and cropping systems, multi-storey cropping and agroforestry systems; sustainable use of forest resources through community forest user groups; and alternative energy sources for households.

Short-term risk management practices in the livestock sector include vaccination against contagious animal diseases, deworming against internal parasites, and the use of animal relief camps during disasters. Livestock performance can be improved by introducing new grass and legume species, planting multipurpose tree species, improving support services in livestock areas, cultivating fodder grasses and legumes (summer and winter perennials), and improving animal sheds. Opportunities to facilitate adaptation and mitigation synergies in the livestock sector include improving manure management and promoting the production and use of biogas at the community level.

The practices identified at the local level and through the involvement of agricultural research and extension systems are not completely new, but capacity building is needed to ensure that climate issues are considered in the planning and implementation of these practices. The participation of agricultural support institutions and farming communities is essential in facilitating policy advocacy, especially for the implementation of a national priority framework of action for climate change adaptation and disaster risk management, and of local risk reduction plans. Field-level actions contribute significantly to mainstreaming the priority agriculture sector interventions in programmes and plans, especially the National Adaptation Programme of Action and the Priority Framework for Action of the Ministry of Agricultural Development. Cross-cutting elements – capacity building, gender considerations and policy advocacy – are central to successful planning for managing climate risks and advancing adaptation in the agriculture sector.

ACRONYMS

ADB	Asian Development Bank
ADS	Agricultural Development Strategy
APP	Agricultural Perspective Plan
BRCH	Building Resilience to Climate-related Hazards
CAP	community action plan
CBA	community-based adaptation
CBO	community-based organization
CBS	Central Bureau of Statistics
CBSPS	Community-Based Seed Production and Storage
CCA	climate change adaptation
CCCM	Canadian Climate Change Model
CFUG	community forestry user group
CIMMYT	International Maize and Wheat Improvement Center
DADO	district agricultural development office
DDRC	district disaster relief committee
DDRMP	district disaster risk management plan
DHM	Department of Hydrology and Meteorology
DISSPRO	District Seed Self-Sufficiency Programme
DLS	Department of Livestock Services
DLSO	District Livestock Services Office
DOA	Department of Agriculture
DRR/M	disaster risk reduction/management
FAT	Farmers' acceptance test
FFS	Farmer Field School
FMD	foot-and-mouth disease
FNSP	Food and Nutrition Security Plan of Action
GCM	General Circulation Model
GDP	gross domestic product
GLOF	glacial lake outburst flood
HFA	Hygo Framework for Action
HMRP	Hill Maize Research Project

ICIMOD	International Centre for Integrated Mountain Development
IFC	International Finance Corporation
IPCC	Inter-Governmental Panel on Climate Change
IPM	integrated pest management
JT	Junior Technician
JTA	Junior Technical Assistant
LAPA	local adaptation plan of action
MOAD	Ministry of Agricultural Development
MOE	Ministry of Environment
MOEST	Ministry of Environment and Science and Technology
MOFSC	Ministry of Forest and Soil Conservation
MOHA	Ministry of Homes Affairs
MPFS	Master Plan for the Forestry Sector
MPI	Max Planck Institute for Meteorology
NAPA	National Adaptation Programme of Action
NARC	Nepal Agricultural Research Council
NCVST	Nepal Climate Vulnerability Study Team
NeKSAP	Nepal Food Security Monitoring System /Nepal Khadhya Surakshya Anugaman Pranali)
NFC	Nepal Food Corporation
NLFS	Nepal Labour Force Survey
NLSS	Nepal Living Standard Survey
NRRC	Nepal Risk Reduction Consortium
NSC	National Seeds Company
NSDRM	National Strategy for Disaster Risk Management
NSSD	National Strategy for Sustainable Development
NTIS	Nepal Trade Integration Strategy
PFA	Priority Framework for Action
PPCR	Pilot Programme on Climate Resilience
PVS	participatory varietal selection
RCM	regional climate model
REDD	Reducing Emissions from Deforestation and Forest Degradation
RIMS	Resource Identification and Management Society

SALT	slope agriculture land technology
SDC	Swiss Agency for Development and Cooperation
SPCR	Strategic Programme for Climate Resilience
SPI	standardized precipitation index
SRI	System of Rice Intensification
TCP	Technical Cooperation Programme
TPS	True Potato Seeds
TWG	Thematic Working Group
TYIP	Three-Year Interim Plan
UMMB	Urea Molasses Mineral Block
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VDC	village development committee
WFP	World Food Programme
WUA	water user association

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