GOVERNMENT OF NEPAL

NATIONAL ADAPTATION PLAN (NAP) 2021-2050

Government of Nepal

National Adaptation Plan (NAP) 2021-2050

Government of Nepal
National Adaptation Plan (NAP) 2021-2050

The National Adaptation Plan of Nepal was prepared by the Government of Nepal through the Project 'Building Capacity to Advance National Adaptation Plan Process in Nepal'. The Project has been supported by Green Climate Fund (GCF) and executed by United Nations Environment Programme (UNEP)

Published by
Government of Nepal
Ministry of Forests and Environment
Singhdurbar, Kathmandu Nepal
Telephone: +977-14211567
Email: info@mofe.gov.np

Suggested Citation:
Government of Nepal, 2021. National Adaptation Plan of Nepal.
Singhdurbar, Kathmandu Nepal

Project Team	
Ministry of Forests and Environment	**United Nations Environment Programme (UNEP)**
Climate Change Management Division Dr Buddi Sagar Poudel, Joint Secretary Yam Nath Pokharel, Under Secretary Narayan Prasad Pokhrel, Asst. Scientific Officer Ganga Pandeya, Section Officer	**National Adaptation Plan (NAP) Project Management Unit** Gyanendra Karki, Project Coordinator Binaya Parajuli, National Officer **Contributing Team:** Jessica Troni, Mozaharul Alam, Alexander Forbes, Bunchingiv Bazartseren, Jisun Hwang, Moon Shrestha

Photo Credit: Shalu Adhikari, Mukti Nath Bista, Laxmi Raj Joshi, Gyanendra Karki, Ripu Kunwar, Kabita Mandal, Basanta Paudel

National Adaptation Plan (NAP) 2021-2050

National Adaptation Plan (NAP) Technical Committee

S.N.	Position	Name, Designation, Organisation
1.	Coordinator	Dr Buddi Sagar Poudel, Joint Secretary, Climate Change Management Division, Ministry of Forests and Environment
2.	Member	Mr Ram Singh Thapa, Under Secretary, Planning, Monitoring and Coordination Division
3.	Member	Mr Sharad Babu Pageni, Under Secretary, Climate Change Section, Climate Change Management Division
4.	Member	Mr Naresh Sharma, Under Secretary, Climate Technology Section, Climate Change Management Division
5.	Member	Dr Shiva Khanal, Under Secretary, Emission Inventory Section, Climate Change Management Division
6.	Member	Mr Gyanendra Karki, Project Coordinator, UNEP Nepal GCF NAP Project, Project Management Unit
7.	Member Secretary	Mr Yam Nath Pokharel, Under Scretary, Adaptation Section, Climate Change Management Division

Technical Team

Gyanendra Karki-Climate Change Adaptation Planner and NAP Expert. Binaya Parajuli-GESI and M&E Expert. Deborah Murphy-International Climate Change Expert. Ripu Mardhan Kunwar-National Climate Change Expert. Shalu Adhikari-Research and Capacity Building Expert. Dhruba Gautam-Institutions, Monitoring and Review Expert. Basanta Paudel-VRA Expert. Kabita Mandal-Communications and Outreach. Sristi Khanal-Documentation

Contributors: (in alphabetic order)

Ajay Karki, Arina Dahal, Arinita Maskey Shrestha, Arun Prakash Bhatta, Axit Raj Poudyal, Babu Raj Adhikari, Badri Raj Aryal, Badri Raj Dhungana, Bal Krishna Poudel, Bhagawat Rimal, Bindu Kumari Mishra, Bishnu Hari Devkota, Deepa Oli, Deepak Kumar Kharal, Devendra Adhikari, Dhananjaya Paudel, Dhani Ram Sharma, Dinesh Kumar Shrestha, Gita GC, Hari Prasad Dhungana, Hemant Tiwari, Indira Kadel, Janak Raj Sharma, Karuna Adhikaree, Kedar Prasad Nepal, Krishna Prasad Humagain, Kumar Prasad Koirala, Maheshwar Dhakal, Malin Ahlbäck, Mohammad Harun Rashid, Nanu Thami, Navin Giri, Nishan Raj Gautam, Piyush Chataut, Radha Wagle, Rajaram Pote Shrestha, Rajit Ojha, Rajkumar Dulal, Rana Bahadur Thapa, Raju Pandit Chhetri, Ram Gopal Kharbuja, Ranjana Prajapati, Rishi Raj Acharya, Rita Bhandari, Rudra Prasad Pandit, Samir Kumar Adhikari, Sanjay Tiwari, Sanjaya Uprety, Saraswati Sapkota, Saroj Kumar Pradhan, Shivalal Nyaupane, Shree Bhagavan Thakur, Shreekrishna Neupane, Sindhu Prasad Dhungana, Somnath Gautam, Srijana Shrestha, Suman Salike, Sunil Sun Shakya, Suraj Aryal, Surendra Raj Pant, Suresh Kumar Wagle, Thakur Prasad Devkota, Umeshbindu Shrestha, Upama Malla, Yogendra Chitrakar

KATHMANDU
NEPAL

The Prime Minister

Message

Climate change has become the greatest existential threats to humanity. Adverse impacts of climate change have been occurring earlier than forcasts made by scientists. Those impacts on different sectors of society are interrelated. Drought can harm food production and ultimately to human health leading to increased mortality and negetive effect on workers' productivity. Flood can lead to the spread of diseases and damage on ecosystems and infrastructure. Climate change impacts are seen throughout every aspect of the world we live in from humanity to international stability and security, and more so in case of a country like Nepal having snow capped himalayas, fragile ecosystem, diverse terrain and weather variability.

There is unequivocal evidence that Earth is warming at an unprecedented rate and human activity is the principal cause. Therefore, climate actions are dire and indispensable. The recent reoccurrence and redundancy of climate-induced extreme events and disasters like flooding, landslides, unpredicable rainfall, food shortages and a rapidly changing ecosystem have severely jeopardized all our efforts toward socio-economic transformation. The erratic climate events have seriously impeded national aspirations of peace, prosperity, development and governance. Climate action calls for a new revamped pragmatic strategies to direct our actions towards sustainalble socio-economic growth and environmentally sensitive as well as climate resilient infrastructure development.

Understanding the impacts of climate change can help us prepare for what's here, what's avoidable, and what's yet to come, and to better prepare and protect all communities. Even though everyone is or will be affected by climate change, those living in underdeveloped countries like Nepal which have contributed least to the problem are the most climate vulnerable. Apart from reducing emmissions, we must adapt to climate consequences so we can protect ourselves and our communities. Proactive measures and strategic planning are our strongest defenses against the unpredictable forces of nature. Apart from implementing measures to reduce emissions and tame the impact of climate change, adaptation strategy must take place with high priority. Successful adaptation not only depends on governments but also on the active and sustained engagement of stakeholders, including local communities, national, regional, multilateral and international organizations, public and private sectors, civil society and other relevant actors, as well as an effective management of knowledge.

Climate change is treated as a cross-cutting development issue. The 16th Conference of Parties (COP 16) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2010 established a process to enable Least Developed Countries (LDCs) to formulate and implement National Adaptation Plan (NAP). Nepal has, since then used National Adaptation Program of Action (NAPA) to plan and implement "medium and long-term adaptation needs", building on their experience in addressing short-term "urgent and immediate adaptation needs" through NAPA. I am very happy to know that an intensive nationwide consultative process was involved in the NAP process including the use of best available science, indigenous knowledge and resources. The NAP formulation is a testamony to our commitments towards climate actions and a long journey towards building a resilient and sustainable future. The immediate next step will be to further integrate adaptation into national development processes and gear up NAP implementation to provide benefits to the vulnerable households and communities through improved access and delivery of adequate and predictable climate finance. I take this opportunity to call upon all national and international development partners to join us in accelerating the implementation of the NAP in Nepal.

I acknowledge the support received from the Green Climate Fund (GCF) through the United Nations Environment Program (UNEP) for completing the NAP process. Let me also take this opportunity to appreciate the contributions made by Minister for Forests and Environment Dr. Birendra Prasad Mahato, former Ministers, all the concerned ministries, officials, agencies, and stakeholders who have been involved in the preparation of NAP document.

Prachanda

10 November, 2023

Pushpa Kamal Dahal 'Prachanda'

Government of Nepal
Ministry of Forests and Environment
Government of Nepal Ministry of Forests & Environment Singhadurbar, Kathmandu
Ref.No.
P.O. Box No.3987
Singha Durbar, Kathmandu
Date:-

Foreword

Climate change is one of the biggest challenges, posing a threat to people and ecosystems at present. It has been challenging our sustainability by significantly damaging our heritage, civilization, and development. Although the negative impacts of climate change are seen in all parts of the world, the impacts are hardest in the least developed, and economically weaker countries like Nepal.

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and its Paris Agreement, Nepal recently prepared its Enhanced Nationally Determined Contribution (NDC) in 2020, which reaffirms that the country's energy, agriculture, water resources, forestry and biodiversity and health sectors are the most at risk to climate change. Since 2010, the ·government has been engaged in systematic adaptation planning, through the development and implementation of the National Adaptation Programme of Action (NAPA, 2010), the launching of Nepal's National Adaptation Plan (NAP) process in 2015, the preparation of the Local Adaptation Plans for Action (LAPAs), and the promulgation of National Climate Change Policy (NCCP) in 2019.

The Ministry of Forests and Environment has prepared the National Adaptation Plan that presents a unique opportunity for Nepal to systematically integrate climate change adaptation into existing policies, strategies, and plans and steer Nepal from project-based adaptation to an integrated programmatic approach to build resilience in the long run. It will also mediate focus between immediate and short-term intervention and investment versus medium- and long-term investment to support transformative changes. It will help the country to put in place a system to monitor and review the results of adaptation actions as well as the status of integration of climate change into development planning and implementation at all levels of government.

The NAP document has been prepared following a multi-stakeholder partnership for prior informed decisions. It is a socio-politically inclusive, transparent, and gender-responsive process. To ensure national ownership over the process and outcomes of the Nepal NAP process and to appreciate the learning of the Nepal NAPA process, NAP has adopted the thematic working group approach, considering the eight thematic and four cross-cutting sectors identified by the National Climate Change Policy which has been a very effective and successful model in adaptation planning.

I would also like to express my sincere thanks to the Green Climate Fund and the United Nations Environment Programme for their financial and technical support respectively. I appreciate the leadership of Secretary, Dr. Deepak Kharal and former Secretaries at MoFE in completing the NAP document on time. I underscore the continuous hard work of the Climate Change Management Division, and Project Management Unit team. I thank all the Ministries and stakeholders involved in the preparation of the NAP document, whose contributions have been instrumental in the process.

Birendra Prasad Mahato, Phd
Minister
Minister
Forests and Environment

Secretary :- 4211567 Fax:-4211868

Government of Nepal

Ministry of Forests and Environment

Ref.No.

P.O. Box No.3987
Singha Durbar, Kathmandu

Date:-

Acknowledgement

A plethora of scientific studies have clearly articulated a stark message about the reality of climate change impacts: adverse impacts are more pronounced in key economic sectors. Accordingly, Nepal has underscored climate change adaptation as a national priority. Over the last decade, this priority has been reflected in the policy landscape and programs that aim to ensure climate-resilient socioeconomic growth.

I am assured that the NAP provides opportunities to further the country's climate-resilient development pathway through the sectoral strategic adaptation interventions identified in the document. I believe that implementing the NAP document will enhance the country's capacity to build resilience to climate change in the long run. I am also confident that donor agencies and development partners will step in to provide support in translating the NAP vision, goals, and objectives into actions.

This strategic document is an outcome of the collective efforts and contributions from the GCF, UNEP, MoFE, Project Steering Committee, Inter-ministerial Climate Change Coordination Committee, and thematic and cross-cutting working groups (T/CWGs) established at coordinating ministries at the federal level. The contribution and input from provincial and local governments, the Provincial Climate Change Coordination Committee (PC4), government and non-government organizations, academia, youth, and media were contributory in defining the country's priority adaptation strategic interventions for the medium (2030) and long-term (2050).

The NAP process adhered to the guiding principles of gender responsive, socially inclusive, and Leave-No-one-Behind in the adaptation planning. Several stakeholder forums at the federal and provincial level helped enrich the NAP process and outcomes. I would like to extend my sincere thanks to all institutions and individuals who provided their support and contributed to every step of the NAP process in Nepal.

I would like to extend my special thanks to the Green Climate Fund and the United Nations Environment Programme colleagues for their financial and technical support. I highly underscore the continuous hard work of Climate Change Management Division (CCMD) and the NAP Project Management Unit (PMU) team. I would like to thank all the stakeholders involved in the preparation of the NAP document, whose contributions have been instrumental in the process. My special thanks to the members of the Inter ministerial Climate Change Coordination Committee, thematic and cross-cutting working groups, and the Provincial Climate Change Coordination Committee for their valuable inputs through their engagement in the process. I would like to appreciate the leadership and efforts of Joint Secretary Dr. Buddi Sagar Poudel, and former Joint Secretaries at CCMD and the team in successfully completing the NAP document. I also commend the efforts of the Project Coordinator Mr. Yamnath Pokharel, former Project Coordinators and the adaptation team, NAP PMU staff Mr. Gyanendra Karki and Ms. Binaya Parajuli. Furthermore, I would like to express my warm gratitude to all the stakeholders involved in the preparation of the NAP document. Without their support and contribution, this process would never be completed.

Deepak Kumar Kharal, PhD
Secretary

Secretary :- 4211567 Fax:-4211868

Secretary

ABBREVIATIONS

ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Centre
AFS	Agriculture and Food Security
AR5	Fifth Assessment Report
AR6	Sixth Assessment Report
ARCB	Awareness Raising and Capacity Building
CbA	Community-based Adaptation
CBD	Convention on Biological Diversity
CBO	Community-based Organization
CCAFS	CGIAR Research Programme on Climate Change, Agriculture and Food Security
CCMD	Climate Change Management Division
CCDMMRC	Climate Change Data Management Monitoring and Reporting Centre
CCVRA	Climate Change Vulnerability and Risk Assessment
CFUG	Community Forest User Group
COP	Conference of the Parties
Covid-19	Coronavirus disease of 2019
CSO	Civil Society Organization
CWG	Crosscutting Working Group
DHM	Department of Hydrology and Meteorology
DoWSSM	Department of Water Supply and Sewerage Management
DRRM	Disaster Risk Reduction and Management
EbA	Ecosystem-based Adaptation
EIA	Environmental Impact Assessment
EPCCMNC	Environmental Protection and Climate Change Management National Council
EWS	Early Warning System
FBWC	Forests, Biodiversity and Watershed Conservation
GCF	Green Climate Fund
GESI	Gender Equality and Social Inclusion
GESILG	Gender Equality, Social Inclusion, Livelihood and Governance
GLOF	Glacial Lake Outburst Flood
GoN	Government of Nepal
H-NAP	Health National Adaptation Plan
HDI	Human Development Index
HDWS	Health, Drinking Water and Sanitation
IMCCCC	Inter-Ministerial Climate Change Coordination Committee
INGO	International Non-governmental Organization
IP	Indigenous Peoples
IPLC	Indigenous People and Local Community
IPCC	Intergovernmental Panel on Climate Change
ITPI	Industry, Transport and Physical Infrastructure
LAPA	Local Adaptation Plan for Action
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LEG	Least Developed Countries Expert Group
M&E	Monitoring and Evaluation
MDB	Multilateral Development Bank
MDG	Millennium Development Goal

MoALD	Ministry of Agriculture and Livestock Development
MoFE	Ministry of Forests and Environment
MoFSC	Ministry of Forests and Soil Conservation
MoHA	Ministry of Home Affairs
MoHP	Ministry of Health and Population
MIS	Management Information System
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MR&R	Monitoring, Review and Reporting
NAP	National Adaptation Plan
NAP-Ag	National Adaptation Plan-Agriculture
NAPA	National Adaptation Programme of Action
NbS	Nature-based Solution
NCCP	National Climate Change Policy
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NDRRMA	National Disaster Risk Reduction and Management Authority
NGO	Non-governmental Organization
NPC	National Planning Commission
PEPCCMC	Provincial Environmental Protection and Climate Change Management Council
PCCC	Provincial Climate Change Coordination Committee
PES	Payment for Ecosystem Service
REDD+	Reducing Emissions from Deforestation and forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RUS	Rural and Urban Settlements
SDG	Sustainable Development Goal
TNCH	Tourism, and Natural and Cultural Heritage
TWG	Thematic Working Group
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WRE	Water Resources and Energy

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

The emerging climate scenario demands that development plans and programmes be made flexible and resilient enough that they can apply and adapt to all changing situations, specifically to address the future contexts. However, there is a considerable gap in Nepal on measuring climate change impact, adaptation and resilience building. Furthermore, Nepal lacks adequate adaptation capacity to deal with the challenges of climate-induced environmental change due to underdeveloped economies and limited scientific and technical capabilities. Adaptation to the adverse impacts of climate change is thus a priority for Nepal, and this National Adaptation Plan (NAP) helps the country reduce climate vulnerability and increase resilience to climate change. The plan sets out long-term adaptation strategic goals to 2050, as well as medium-term priority programmes to 2040 and short-term priority actions to 2030.

The over-arching goals and priority programmes are informed by the National Climate Change Policy, 2019 and will contribute to the achievement of national economic and development priorities.

The Nepal NAP aims to:

- Inform the planning, coordination, and implementation of adaptation actions needed at all levels of government and across society and ecosystems.
- Provide guidance on integrating adaptation considerations into policies, programmes, and activities.

The short and medium-term programmes are designed to help the Government of Nepal achieve the adaptation actions set out in its Nationally Determined Contribution (NDC), 2020. This NAP document also serves as Nepal's Adaptation Communication, a requirement under the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC).

The NAP sets out a total of 64 priority programmes that address identified climate risks and vulnerabilities. Sixty-one of these programmes include needed actions in the nine sectors set out in the National Climate Change Policy (eight thematic sectors and one gender equality ad social inclusion). The rest three programmes elaborate the actions that are required to coordinate the NAP process (such as capacity building, coordination and oversight, monitoring and review, and climate finance mobilization). These 64 priority programmes have been made Gender Equality and Social Inclusion (GESI) responsive through a multistakeholder and inclusive consultation process. The total budget required to implement these 64 programmes to 2050 is USD 47.4 billion. Nepal will contribute USD 1.5 billion while USD 45.9 billion will be collected from external sources. The government requires USD 2.1 billion per year to implement the priority actions identified in this NAP.

A review of the implementation of the NAP and adaptation programmes will take place every five years, as pertinent to the changing context. The Nepal NAP will be reviewed and updated in 2031, when the long-term programmes will be revisited and restructured to reflect changes in the country's economy, development status, policy frameworks, international commitments, and assessed climate change hazards, vulnerabilities and risks.

The NAP process and the implementation of NAP priority programmes are overseen by the Environmental Protection and Climate Change Management National Council, and the Inter-Ministerial Climate Change Coordination Committee. The thematic and Crosscutting Working Groups provide technical inputs to guide the implementation of the adaptation actions in the priority sectors. The Ministry of Forests and Environment, as the climate change focal point, is responsible for the coordination of, implementation of, and reporting to the NAP. The Ministry delivers on the NAP process through engagement with the National Planning Commission, Ministry of Finance, sectoral ministries and stakeholders including academia, development partners, civil society, media, and the private sector at the federal provincial and local levels.

Priority NAP programmes and budgets - by sector

Agriculture and Food Security

Budget (USD)
11.2 billion

1. National Capacity Building of Agriculture and Livestock Institutions on Climate Change Adaptation Research, Planning and Implementation
2. Strengthening Climate Services and Agriculture Information System
3. Integrated Soil and Nutrient Management for Resilient Agriculture
4. Enhancing Agriculture Productivity through Building Climate-Resilient Water Management Systems
5. Genetic Resource Conservation and Development Programme for Climate-Resilient Agriculture in Nepal
6. Programme on Sustainable Agriculture, Food and Nutrition Security and Climate-Resilient Health and Hygiene
7. Commercial Animal Husbandry for Climate-Resilient Rural Livelihoods (753 Model Demonstration Project)
8. Development of Insurance, and Community and Peasant-Friendly Climate Induced Risk Sharing Model and Expansion in both Agriculture and Livestock
9. Climate Smart Collective Agriculture Promotion in Hills and Mountains

Forest, Biodiversity and Watershed Conservation

Budget (USD)
8.7 billion

1. Forests Fire Preparedness, Prevention and Control
2. Karnali Watershed Management Programme for Reducing Climate Risks and Vulnerabilities and Promoting Irrigation Facilities in the Downstream
3. Restoration of Habitats and Strengthening Ecological Connectivity for Wildlife and Biodiversity
4. Integrated Sub-Watershed Management for Climate Resilience
5. Improvement of Forest Health and Restoration of Rare, Endangered, Endemic, and Threatened Species for Building Resilient Forest Ecosystem
6. Promotion of Multiple Uses of Protected Areas and Natural Heritage and Generation of Climate Adaptation Services
7. Reduce the Impact of Climate Induced Disasters and Extend Forest Networks for Resilient Ecosystems
8. Conserve and Restore Ponds/Lakes in Community-managed Forests for Climate-Resilient Biodiversity (One Community-managed Forest-One Wetland)
9. Wetlands Development and Conservation along the Chure
10. Integrated Green Economy Promotion through Sustainable Forests Management and Non-Timber Forest Products Management, and Circular Economy in the Hills and Mountains
11. Upland Conservation and Climate-resilient Livelihoods Programme in High Mountains

Water Resources and Energy

Budget (USD)
5.35 billion

1. Promoting Climate-informed Decision Making, and Developing Climate-Smart Design and Guidelines for Water Resource Infrastructure
2. Promoting Energy Mix System for Industrial Sustainability and Climate-Resilient Livelihoods
3. Reduce Glacial Lake Outburst Flood (GLOF) Risks in Gandaki, Koshi and Karnali River Basins
4. Promoting Water Pumping Technology in Water Scarce Areas
5. Promoting Climate-Resilient Renewable Energy in Rural Vulnerable Settlements and Institutions
6. Climate-Resilient Flood Control to Protect Livelihoods and Assets at Risk from Climate Induced Flooding
7. Sustainable Run-of-River Systems at Feasible Locations Supported by Reservoir Systems
8. Clean and Efficient Energy Technology Development, and Build Resilient Systems and Infrastructure

Rural and Urban Settlements

Budget (USD)
2.85 billion

1. Promoting Circular Economy for Sustainable Urban Development
2. Developing Integrated Settlements and Urbanization Models for Climate Risk Reduction and Supplying Climate Adaptation Services through Nature-based Solutions
3. Upgrading and Promoting Climate Resilient Building Designs, Codes, Practices and Construction Technologies, and National Capacity Building for Implementation

Industry, Transport and Physical Infrastructure

Budget (USD)
3.05 billion

1. Strengthening Institutions, Technologies, Policies and Resources (Databases), and Building Capacity and Awareness for Climate-Resilient Industry, Transport and Physical Infrastructure
2. Developing and Promoting Resilient, Clean Energy-based Transportation Systems
3. Developing Climate-Resilient Community Infrastructures to address Climate Risks, Hazards and Pandemics
4. Up-Grading, Maintaining and Relocating Vulnerable Industries and Physical Infrastructures to Increase Resilience to Climate Risks
5. Diversifying the Energy Supply for Industrial Districts

Tourism, Natural and Cultural Heritage

Budget (USD)
1.13 billion

1. Climate Resilient Tourism for Ecological Sustainability and Economic Prosperity
2. Climate Risk and Tourism Information System for Resilient, Safe and Sustainable Tourism
3. Develop Climate Resilient Infrastructure and Explore and Enhance Knowledge and Capacities for Resilient Mountain Tourism
4. Promotion of Community-based Adaptation through Eco-and Cultural Tourism and Indigenous and Traditional Knowledge
5. Diversifying and Promoting Alternative Tourism Destinations and Products for Climate-Resilient Tourism Business
6. Establishment and Operation of Emergency Relief and Rescue Services in Adventure Tourism
7. Building Capacity for Resilient Tourism in Nepal
8. Promotion of Climate-Resilient 'One Local Level-One Tourism Destination'

Health, Drinking Water and Sanitation

Budget (USD)
4.75 billion

1. 'Health Promoting Cities': Health, Environment and Life (Heal)
2. Strengthening Climate Sensitive Disease Surveillance System with Emergency Preparedness and Response
3. Research, Innovation and Development of Climate Resilient Preventive Measures/Technologies/ Approaches for Water Supply, Sanitation and Health System
4. Capacity Building of Health and Hygiene Service Providers and Professionals (Institution and Personnel) on Climate-Resilient Health Hygiene Service Planning and Implementation
5. Development of Climate Resilient and Inclusive WASH Service and Facilities through Building Capacities, Developing Institutions and Systems, Adopting Innovative Technologies and Extending Collaboration
6. Promotion and Conservation of Water Sources along with Watershed Management for Sustainable Water Supply Service
7. Integration and Implementation of Climate Change Adaptation in Health and WASH sector through Policy Reform, Strategy Development and National Level Awareness

Disaster Risk Reduction and Management

Budget (USD)
8.05 billion

1. Building Climate Resilience by Developing and Harmonizing DRRM and CCA at Federal to Local Levels through Policy Reforms (Integration of DRR in Local Adaptation Plans)
2. Strengthening Adaptive Social Protection/ Shock Responsive Practices for Transferring Climate Risk
3. Maintaining and Strengthening Early Warning Systems and Multi-Hazard Monitoring Systems to Facilitate Climate Adaptive Function of Key Economic Service Sectors
4. Developing Regulatory Framework and Implementation Strategy for Domestic and Industrial Fire Control and Mitigation, Build National Capacities
5. Promote Culture of Safety and Build Climate Resilience through Climate Risk Sensitive Land Use Plan (RSLUP) Guideline and Standards
6. Developing Federal and Provincial Strategies and Action Plans on Control of Climate Induced (Primarily water borne) Disasters in the Forests Areas of Nepal and Phase-wise Implementation under the leadership of Forest Authorities

Gender, Social Inclusion, Livelihood and Governance

Budget (USD)
0.7 billion

1. Strengthening Gender Equality and Social Inclusion (GESI) Responsive Climate Change Adaptation Planning and Implementation
2. Building Human Capital for Inclusive Climate and Disaster Resilient Society
3. Economic Empowerment through the Usage of GESI Responsive, Climate-Resilient and Smart Technologies
4. Enhancing Resilience to Climate Change through GESI Responsive Livelihood Programmes

National Capacity Building, Research and Awareness Raising

Budget (USD)
0.16 billion

1. Implementation of Nepal NAP including Research on Climate Risks and Vulnerabilities, and Capacity Building of Actors and Stakeholders on Climate Change Issues
2. Establish and Operationalize Climate Change Data Management, Monitoring and Reporting Center at Federal, Provincial and Local Level
3. Strengthen Capacities of Federal Thematic Ministries and Provincial and Local Governments on Nepal NAP Implementation

1. INTRODUCTION

1.1 Context

Nepal is one of the countries most affected by climate change. The country is extremely exposed to the impacts of climate change and highly vulnerable to climate risks because of its mountainous topography and abrupt ecological and climatic transitions, combined with a low level of development, a reliance on natural resource-based livelihoods, and multidimensional poverty. The country is experiencing climate change, reflected in changes in temperature and precipitation. The impacts of these climatic changes range from increasing drought and floods in the Tarai region; to melting glaciers; and reductions in snowfall that impact livelihoods, tourism and ecology in the mountain regions; to changes in the amounts and intensity of rainfall contributing to soil erosion and landslides in the mid-hills and downstream areas. Climate change threatens to undermine the historical socioeconomic achievements of Nepal; with millions of Nepalese at risk from climate impacts that include reductions in agricultural production, food insecurity, forest degradation, damaged infrastructure, and reduced water supply (MoHA, 2017).

Adaptation to the adverse impacts of climate change is a priority for Nepal, and the Nepal government is committed to building climate resilience and integrating adaptation in policies and planning. Since 2010 the government has been engaged in adaptation planning including the development of a National Adaptation Programme of Action (NAPA) in 2010, preparation of Local Adaptation Plans for Action (LAPAs) in 2012 and the launching of Nepal's National Adaptation Plan (NAP) process in 2015. The Fifteenth Plan (Fiscal Year 2019/20 - 2023/24) identified climate change as a crosscutting issue and set the overarching targets for the period of five years between 2019/20 and 2023/24 (GoN, 2020a). It focuses on protecting public life, public and private property, natural and cultural heritages, physical infrastructures and minimising the disaster risk. The Disaster Risk and Management Act, (2017) recognizes earthquakes, fires, storms, floods, landslides, heavy rainfall, drought, famine and epidemics as disasters (MoHA, 2019). The National Climate Change Policy (NCCP), (2019) identified eight thematic sectors and four crosscutting sectors for priority actions on climate change (Box 1).

Box 1: National Climate Change Policy, 2019 – Priority Sectors

Thematic sectors:

- Agriculture and Food Security (AFS)
- Forests, Biodiversity and Watershed Conservation (FBWC)
- Water Resources and Energy (WRE)
- Rural and Urban Settlements (RUS)
- Industry, Transport and Physical Infrastructure (ITPI)
- Tourism, Natural and Cultural Heritage (TNCH)
- Health, Drinking Water and Sanitation (HDWS)
- Disaster Risk Reduction and Management (DRRM)

Cross-cutting sectors:

- Gender Equality and Social Inclusion (GESI), Livelihood and Governance (GESILG)
- Awareness Raising and Capacity Building (ARCB)
- Research, Technology Development and Extension (RTDE)
- Climate Finance Management (CFM)

Source: Government of Nepal. (2019c). National Climate Change Policy.

The Ministry of Forests and Environment (MoFE), Environment Protection and Climate Change Management National Council and the Inter-Ministerial Climate Change Coordination Committee led and coordinated the development of the Nepal NAP. This NAP has been formulated as a component of the country's NAP process and drawn on experience gained through the development and implementation of the NCCP, NAPA, and LAPAs. In addition, the Nepal NAP has been informed by an extensive body of research and guided by inputs from the broad stakeholders' engagement (Annex 1). MoFE led an extensive consultation process to ensure that the Nepal NAP reflects the inputs and priorities of a range of stakeholders at the federal, provincial, and local levels. The methodology to develop the Nepal NAP is summarized in Section 5.2.6 and described in Annex 2 and 3.

The Nepal NAP (2021 – 2050) is a critical component of the country's adaptation response and is a framework to integrate adaptation across sectors and levels of the government. The plan sets out short-term, medium-term, and long-term adaptation strategic goals; with the aim of assisting Nepal to better integrate priority measures to address climate risk and vulnerability in development planning and implementation. The short- and medium-term measures are designed to achieve the adaptation strategies set out in its Second Nationally Determined Contribution (NDC), (2020). This NAP also serves as Nepal's Adaptation Communication, a requirement of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC).

Delivering the adaptation actions will be a shared responsibility between the national, provincial, and local governments. The NAP will guide the climate change response of all three levels of government, civil society, private sector, and other actors; and will help Nepal advance on securing socio-economic prosperity by building a climate-resilient society and reducing climate change impacts on people and ecosystems.

1.2 Organization of the NAP document

Section 1 presents an introduction along with an overview of the organization of the sections of this document. Section 2 discusses the national circumstances to set context and background for priority adaptation actions; and Section 3 reviews climate trends and projected climate change in Nepal. Section 4 elaborates on climate hazards, risks and vulnerabilities in Nepal. Section 5 depicts the progress on adaptation in Nepal, including the NAP process and alignment with other international agreements. Section 6 sets out the long-term vision, objectives, principles, and expected outcomes that guide this Nepal NAP.

Section 7 explains the priority adaptation programmes and profiles in nine thematic areas. The explanations highlight the key climate risks and adaptation needs, and elucidate how adaptation actions can address these risks. The programmes specify the strategic long-term objective to 2050, describe priority actions and the expected results of undertaking these actions in the short- and medium-terms, and identify priority short-term adaptation actions and projects in the sector.

Section 8 provides the crosscutting enabling actions needed to address adaptation. Section 9 offers the details on the institutional and financial arrangements required to support the implementation of the NAP, including oversight and coordination, roles and responsibilities, and financing. Section 10 includes an action plan for NAP implementation.

The Annexes include a list of technical documents developed under the NAP process, details on the priority adaptation projects, the long list of adaptation actions, and elaboration of the methodology used to identify the priority adaptation actions and develop the Nepal NAP. The Annexes are available at www.napnepal.gov.np

2. NATIONAL CIRCUMSTANCES

2.1 Physiography

Nepal is a small landlocked country that lies along the slopes of the Himalayan Mountains between China and India. It has a land area of 147,516 km^2 spanning 800-850 km from east to west, and 144-240 km north to south. Physiographically, it stretches between 80^{0}04' - 88^{0}12' E and 26^{0}22' - 30^{0}27' N, and has the largest elevational gradient in the world, extending from tropical alluvial plains as low as 67 meters above sea level (m asl) in the lowland Tarai to the Earth's highest mountain, Mount Everest at 8,848.86 m asl (GoN, 2021). The country is divided into five physiographic regions from north to south: i) High Himalaya (above 5,000 m) with 24% area, ii) High Mountains (3,000 - 5,000 m) with 20% area, iii) Mid-Hills (1,000 - 3,000 m) with 30% area, iv) Siwalik (500 - 1,000 m) with 12% area, and v) Tarai (< 500 m) with 14% area (MoSTE, 2014) (Figure 1). Altitudinal and physiographic heterogeneity affects temperature and rainfall patterns.

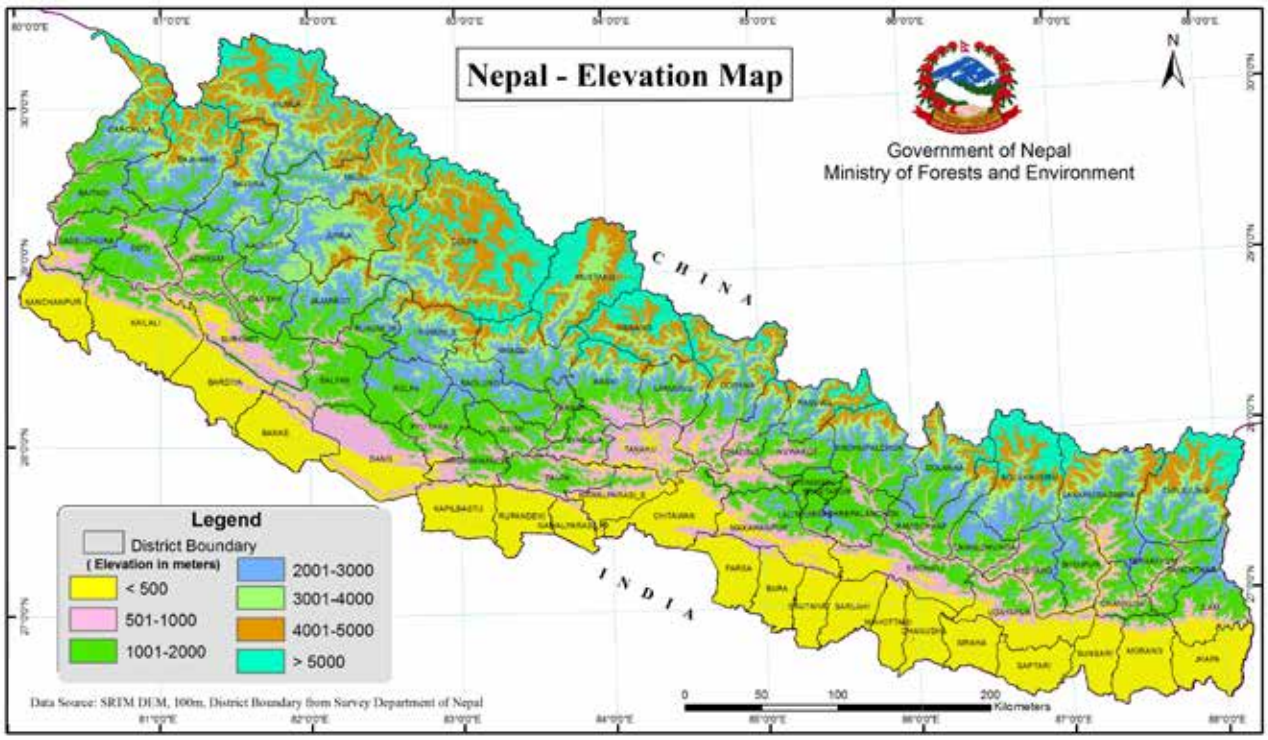


Figure 1: Physiographic map of Nepal

2.2 Environment and Biodiversity

The diverse terrain and topography, along with varied climatic conditions across altitudes means that various regions of Nepal have unique flora, fauna, livelihoods and cultures. According to Nepal's sixth national report to the Convention on Biological Diversity (2018), the contry is home to over 13,000 species of plant and over 17,000 species of animal growing in 118 different ecosystem types, 75 vegetation types, and 35 forest types (MoFE, 2018). The nation-wide forest resource assessment (2010–2014) of Nepal catalogued 5.96 million hectares (ha) of forest (40.36% of total land area) and 0.65 million ha of other wooded land (4.38% of total land area) (DFRS, 2015). Agricultural land comprised 28.75 % of total land area in 2018 (WB, 2021). Agricultural practices, increasing population, aggressive development programmes including construction of roads and hydropower plants, and expanding urban areas are the main drivers of land use changes (Rimal et al., 2017). Land-use changes include a reduction in forest cover, decrease in agricultural land and shrub land, and an increase in built-up and urban areas (Figure 2, Annex 4).

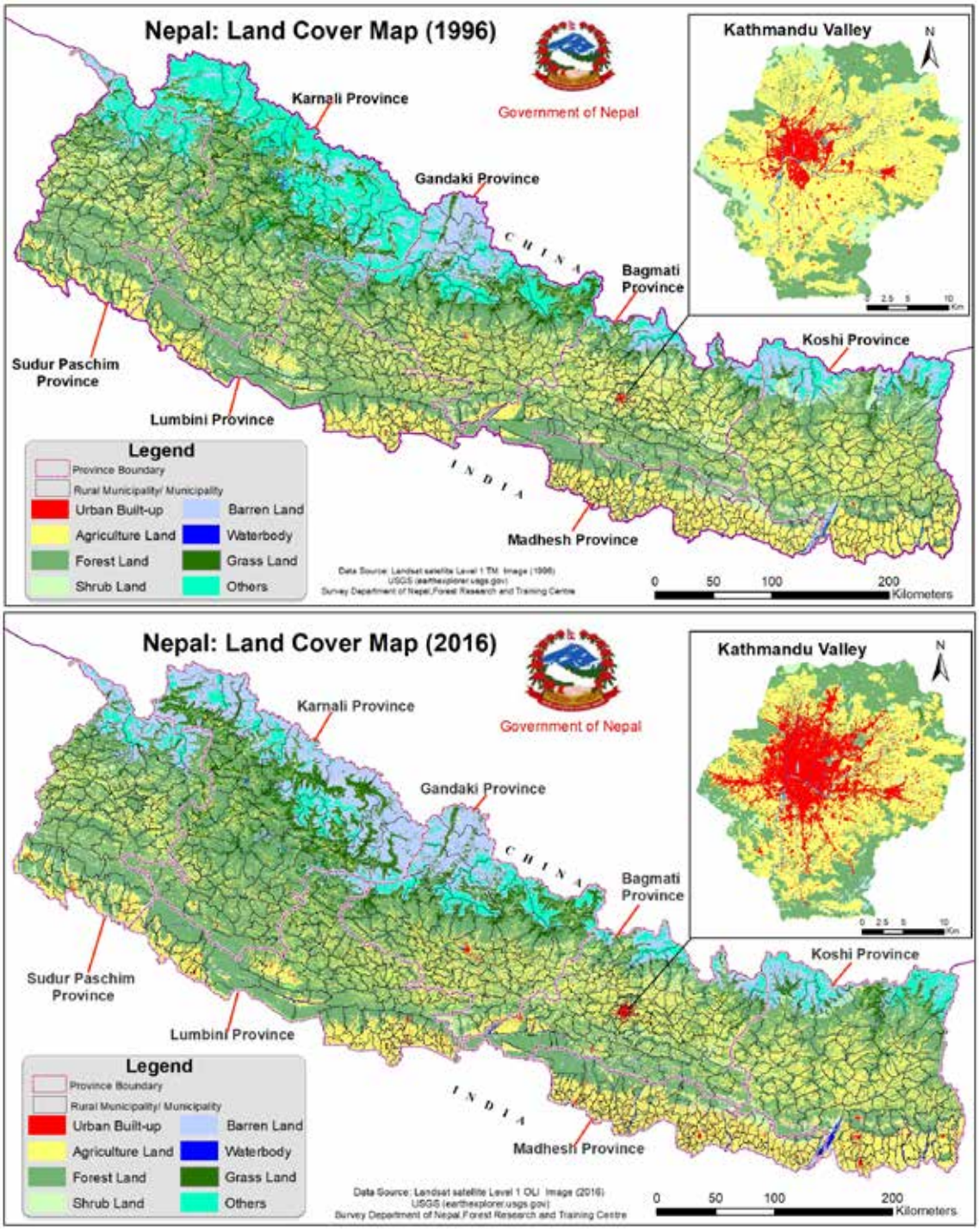


Figure 2: Land use and land cover change map of Nepal at municipal level for the years 1996 and 2016

2.3 Climate

The annual minimum temperature in Nepal varies from -4°C to 19°C while the maximum temperature ranges from 4°C to 31°C. Manang district has the lowest (<5°C) annual average maximum temperature while most of the low-lying southern districts have the highest annual average maximum temperature above 30°C (MoFE, 2021c). Nepal receives average annual rainfall of around 1,600 mm but the distribution of precipitation varies considerably in both north-south and east-west directions. The southern flanks of the Himalayas, such as Pokhara, receive the highest amount of rainfall (3,345 mm), while the rain shadow areas, such as Dolpa and Mustang, receive less than 10% of that amount (295 mm). Total annual rainfall increases with altitude up to approximately 3,000 m asl and then diminishes at higher elevations (MoSTE, 2014).

2.4 Demography, Culture and Society

The population of Nepal was 26.5 million in 2011 and 29.19 million in 2021 with annual growth rate 0.93% (CBS, 2014; CBS, 2021). The major cities – Kathmandu, Pokhara, Lalitpur and the cities of lowland Tarai – have the greatest population density. The highest population distribution records in Kathmandu, Rupandehi and Morang districts (Figure 3). An analysis of human population patterns from 2001 to 2021 shows that the cities – including Kathmandu, Pokhara and Butwal – and the Tarai areas have experienced the highest population gain (MoUD, 2017). Over 50% of the population lives in hills and mountains with a fragile and remote physiography and low economic productivity (Cosic et al., 2017). The proportion of population living in hills and mountains is projected to decrease to 47% by 2031, although the country's landmass in the mountain and hill regions is 74% (CBS, 2018). In 2020, 20.57% of the country's total population resided in urban areas (WB, 2021). Socio-culturally, the country has over 125 ethnic groups and castes including Chepang, Raute, and others, and 123 languages. The Raute, Chepang, Byanshi are semi-nomadic minority groups of people in Nepal (CBS, 2021).

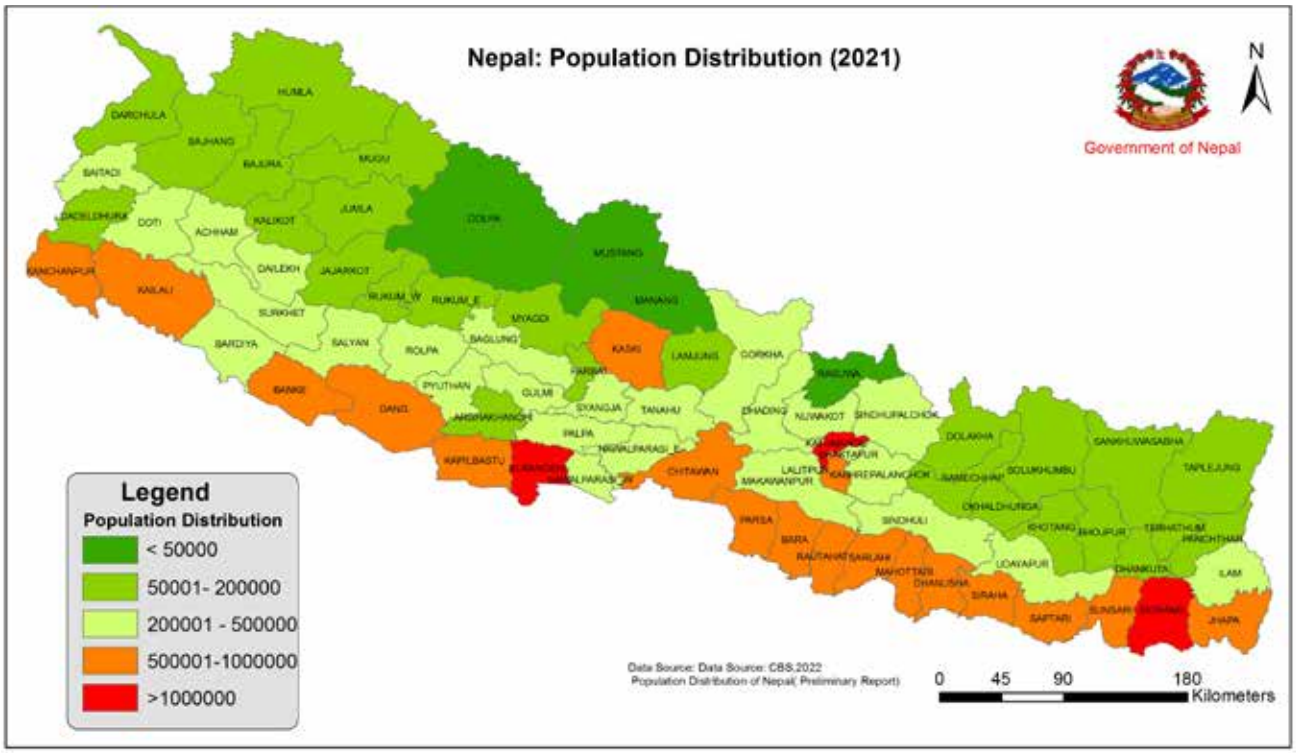


Figure 3: Population distribution map in Nepal

Women, particularly those who are reliant on agriculture, are impacted differently due to climate change than men in Nepal (Sandal, 2021). Climate change will have greater negative effects on women because of their limited, or often lack of, rights, assets, resources and power, which results in their exclusion from decision-making processes that affect their lives (Lohani, 2010; Goodrich et al., 2019). Despite some progress stated in NPC (2020c), gender inequality persists in most sectors, as seen in the wage gap between men and women, women's limited access to productive resources, gender based violence, and low participation of women in the labor force (UN Women, 2021). A geographically dispersed population, limited economic opportunities, diverse castes and ethnic groups, caste-based discrimination, and a reliance on traditional livelihoods lead the socio-economic vulnerability in the country (UNDRR, 2019).

2.5 Economy and Livelihoods

Nepal's economy, which is largely dependent on agriculture and remittances from workers abroad, is growing but the rate of growth varies greatly year to year. The economy is dependent on the use of natural resources, including agricultural land, pastures, and forests. The agriculture sector contributed about 27.65% of Nepal's gross domestic product (GDP) in 2019/20 (Nepal Rastra Bank, 2020), and about 66% of the country's population worked in the agricultural sector in 2020 (GoN, 2021). Informal businesses made up about 50% of enterprises in Nepal in 2019 and were the main source of income for most of the labour force (WB, 2020). Two million Nepalese migrants employed abroad remitted about USD 8.79 billion in 2018-2019, accounting for over a quarter of the country's GDP at that time (MoLESS, 2020). This out-migration is predominantly of males (91.5% of migrant workers) and has resulted in an increase in female-headed household and agriculture; 73% of the female workforce being engaged in this sector (Poudel et al., 2020; MoLESS, 2020).

In 2019, people living in absolute poverty were 18.7%, which was a significant decrease from 42% in 1995 (NPC, 2019). Total 28.6% of Nepal's population was multi-dimensionally poor in 2019, meaning they suffered from under-nutrition or their household lacked any members that had completed five years of schooling (NPC, 2019). Nepal's national Human Development Index (HDI) stood at 0.602 in 2019, which surpassed the 2018 score of 0.587 (UNDP, 2020) and placed the country in the medium human development category. Nepal's per capita GDP in current price was USD 1,074 (approximately NPR 125,660) in 2019 (UN data, 2021). The country is classified as a Least Developed Country (LDC) and is taking action to graduate to lower middle-income country status by 2026, and is also acting to achieve the national goal of Prosperous Nepal Happy Nepali by 2043. This goal has been impacted by the global Covid-19 pandemic, which has the potential to increase levels of poverty (Box 2).

Box 2: Covid-19 pandemic recovery and adaptation

The coronavirus disease 2019 (Covid-19) pandemic has resulted in disruptions to Nepal's economy. As of December 31st, 2021, total cases of Covid-19 patients were over 0.828 million and death toll was 11594. This health crisis and its economic impacts have demanded the attention of the Government of Nepal as the country experienced economic activity decline, with real GDP growth decreasing from 6.7 % in 2019 to -2.1 % in 2020 (ADB, 2021); although GDP growth increased to 2.3% in 2021 (ADB, 2022). The pandemic has left a serious impact on Nepal's economy that relies on the agriculture and tourism sectors (26% and 8% of GDP in 2020 respectively), international remittances (25% of GDP in 2020), and informal labour (UNDP, 2021b). In 2021, remittances declined, jobs were lost, and poverty increased (UNDP, 2021b). Nepal's development has been pushed back by a decade and for those affected by shocks such as the 2015 earthquakes or the 2017 floods or the 2019-2021 Covid-19, their recovery have been halted (Lucas, 2021).

The transition from crisis to recovery remains challenging, but it is crucial for Nepal's economic recovery programme to incorporate and prioritize adaptation and climate resilience (Karki et al., 2022). Decision making requires a longer-term visionary perspective that emphasizes strengthening resilience to the impacts of climate change in infrastructure investments, investing in natural infrastructure to improve climate resilience, and building climate-resilient food and health systems (Murphy & Parry, 2020).

The recovery response needs to address the environmental determinants of health - including water, sanitation, and nutritious food - and the expected impact of climate change on these sectors. Factoring climate adaptation needs into public investments can help to build resilient and sustainable communities and systems that encourage economic and social development (Hammill, 2020). Natural resource-based job creation in agriculture, forestry, and eco-tourism is one of the ways of combating impacts of Covid-19 and climate crises.

In 2021, Nepal adopted the Green, Resilient and Inclusive Development (GRID) approach to address the impacts of Covid-19 and structural challenges, including slow domestic job creation, large infrastructure gaps, and a high vulnerability to climate change and environmental degradation. The GRID approach builds on Nepal's NDC and the 15th Development Plan. Development partners have pledged USD 3.2 billion in resources and identified up to USD 4.2 billion in potential future support in GRID relevant sectors, which include agriculture, forestry, eco-tourism, water resource management, renewable energy, urban development and transportation (Shrestha, 2021). This NAP plays an important role in providing guidance on ways in which these GRID investments can advance adaptation efforts.

2.6 Government and Governance

The Constitution of Nepal created the devolved system that includes seven provinces' government and 753 local levels (urban and rural municipalities). The provincial and local governments have key roles in implementing adaptation action, having jurisdiction over sectors including agriculture, physical infrastructure, landslide control, forestry, and watershed conservation that are impacted by climate change and subjected to adaptation (MoFE, 2020c). Provincial and local governments are allocated about 40% of public sector finance on an annual basis (in 2018-19 local governments received about 24% and provincial governments about 16% of total public sector finance) (Boex, 2019), implying that they have considerable scope to influence adaptation investment. The Constitution also advances gender equality. Women hold at least one-third of the seats in government and various ethnic groups, minorities, and deprived communities are represented. The 15th Plan (2019/20-2023/24) recognized that addressing issues of gender equality and social inclusion (GESI); marginalized people; backward regions, classes and communities; and excluded groups requires consolidated efforts to address the sustainable and equitable generation and distribution of resources, and to increase the adaptive capacities of society (GoN, 2020a).

3. CLIMATE CHANGE TREND AND SCENARIO

3.1 Global Climate Change

3.1.1 Observed global climate change

The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) on the physical basis of climate change concluded that human influence has warmed the climate and has contributed to many observed changes in weather and climate extremes (IPCC, 2021). Human influence is a significant cause of the increase in global surface temperature, a contributor to changing precipitation patterns, and a main driver of the global retreat of glaciers and the decrease in Arctic sea ice (IPCC, 2021). Increasing levels of greenhouse gases (GHGs) in the atmosphere due to human activities are the main cause of the warming of the earth in the industrial era. The best-known indicator for tracking climate change is global mean surface temperature (GMST), or the average temperature for the world, which is derived from measurements of sea surface temperatures and of near-surface air temperatures above the land. GMST was 1.11°C higher in 2021 than pre-industrial (1850-1900) levels; and the warmest seven years on record have been since 2015 (World Meteorological Organization, 2022).

AR6 reported that climate zones have shifted pole ward, and the average growing season has been lengthened by up to two days per decade since the 1950s in the Northern Hemisphere. Hot extremes have become more frequent and more intense over land areas, and the chance of compound extreme events has increased (such as concurrent heat waves and drought) (IPCC, 2021). Rising global temperature has impacts on the hydrological (water) cycle, although the effects of increasing atmospheric greenhouse gases on precipitation are more complex than for temperature. AR6 reported that globally averaged precipitation over land has increased since 1950, with a greater rate of increase since the 1980s (IPCC, 2021). Increases in atmospheric water vapour can lead to increased intensity of extreme precipitation events, and the frequency and intensity of heavy precipitation events has increased since the 1950s (IPCC, 2021).

Global mean sea level increased by 0.20 m between 1901 and 2018 from the expansion of ocean waters caused by warming as well as from the addition of water previously stored on land in glaciers and ice sheets (Hartmann et al., 2013). Climate warming is associated with declines in snow and ice cover, and cryosphere changes in high mountain regions due to climate change include declines in low-elevation snow cover, glaciers, and permafrost (Lempert et al., 2003; Hock et al., 2019). Global temperature rise to date has had significant impacts on human and natural systems including increases in droughts, floods, heavy precipitation events, heat extremes, sea level rise, and biodiversity loss (IPCC, 2014). The most affected people live in low- and middle-income countries, and high mountain ranges are among the areas most impacted (IPCC, 2018).

3.1.2 Projected global climate change

Climate models project patterns of change in the future, with the amount of warming dependent on future GHG emissions. Global warming is likely to reach 1.5°C above pre-industrial levels between 2030 and 2052 (IPCC, 2018). Global mean temperatures are expected to continue to rise over the 21st century if GHG emissions are not reduced (IPCC, 2014).

The IPCC AR6 used five Shared Socio-economic Pathways (SSPs) to predict future increases in temperature and sea level rise (Table 1). Warming will be similar under the five pathways over the next two decades globally. Efforts to reduce GHG emissions will have an increasing impact on global warming from 2040 onward. A low emission scenario (SSP1-1.9) would see additional warming of about 1.4^{0}C by the late 21st century; while a high emission (business as usual) scenario (SSP5-8.5) would see global annual mean temperature increase by an additional 4.4^{0}C in the same time period (IPCC, 2021).

Table 1: Changes in global surface temperature, which are assessed based on multiple lines of evidence, for selected 20-year periods for five emissions scenarios

	Short-term, 2021-2040		Mid-term, 2041-2060		Long-term, 2081-2100	
Scenario	Best estimates (°C)	Very likely range (°C)	Best estimates (°C)	Very likely range (°C)	Best estimates (°C)	Very likely range (°C)
SSP1 - 1.9	1.5	1.2 – 1.7	1.6	1.2 – 2.0	1.4	1.0 – 1.8
SSP1 - 2.6	1.5	1.2 – 1.8	1.7	1.3 – 2.2	1.8	1.3 – 2.4
SSP2 - 4.5	1.5	1.2 – 1.8	2.0	1.6 – 2.5	2.7	2.1 – 3.5
SSP3 - 7.0	1.5	1.2 – 1.8	2.1	1.7 – 2.6	3.6	2.8 – 4.6
SSP5 - 8.5	1.6	1.3 – 1.9	2.4	1.9 – 3.0	4.4	3.3 – 5.7

Source: IPCC (2021), p. 17.

Climate-related impacts and risks grow with increasing amounts of global warming. AR6 reports that every additional 0.5^{0}C of global warming is expected to increase the intensity and frequency of heavy precipitation, hot extremes including heat waves, and of agricultural and ecological droughts in some regions. Rare weather events are expected to occur more frequently, and the frequency and intensity of extreme precipitation events will increase. Precipitation and surface water flows are projected to become more variable over most land regions, and an earlier onset of snow cover melt is expected.

The IPCC (2021) reports that monsoon precipitation is projected to increase in the mid to long-term over South Asia; and heavy precipitation and associated flooding are projected to intensify and be more frequent in most regions in Asia. Mountain glaciers will continue to shrink for decades or centuries, permafrost in the high mountain areas will continue to thaw, snow line elevations are projected to rise, and landslides triggered by rainfall are expected to increase.

3.2 Climate Change in Nepal

This section that describes observed and projected climate change in Nepal.

3.2.1 Observed climate change

Nepal's climate has warmed, and temperature has increased in all climate zones in the country from the Tarai region in the south at altitudes of less than 500 m asl to the high Himalayas region in the north at altitudes of over 5,000 m asl. Data from the Berkeley Earth Dataset estimated historical warming in Nepal at between 1.0°C and 1.3°C between the periods 1900-1917 and 2000-2017 (World Bank Group & ADB, 2021).

The DHM's study on observed climate change for the period between 1974 and 2014 suggested a significant positive trend in annual maximum temperature data, indicating warming at the rate of 0.056°C per year (DHM, 2017). Warming occurred in all regions of Nepal, with the highest rate of

increase at higher altitudes in the high Mountain and high Himalaya regions (Figure 4). The number of warm days, warm nights, and warm spell duration significantly increased in the majority of districts. The number of cool days per year decreased in most districts, with a significant decrease noted in the high mountains and high Himalayas districts (DHM, 2017).

The DHM study showed that precipitation decreased in all seasons in the 1974-2014 period, but the trends were insignificant. Among the five physiographic regions of Nepal, trends of decreasing precipitation were observed mainly in the high mountains and high Himalayas in all seasons. Pre-monsoon precipitation showed a significant upward trend in the Tarai and Siwalik regions, and demonstrated a significant negative trend in the high Himalayas, with a higher rate of decrease in the east. Monsoon precipitation increased in the mid and central high mountains. Post-monsoon precipitation significantly decreased across all regions of Nepal, and winter precipitation decreased in the western mid-mountain region (Karki et al., 2017). The number of rainy days increased significantly in the north-western districts; and very wet and extremely wet days decreased significantly in the northern districts. Extreme precipitation showed spatial variability and inconsistent trends (DHM, 2017).

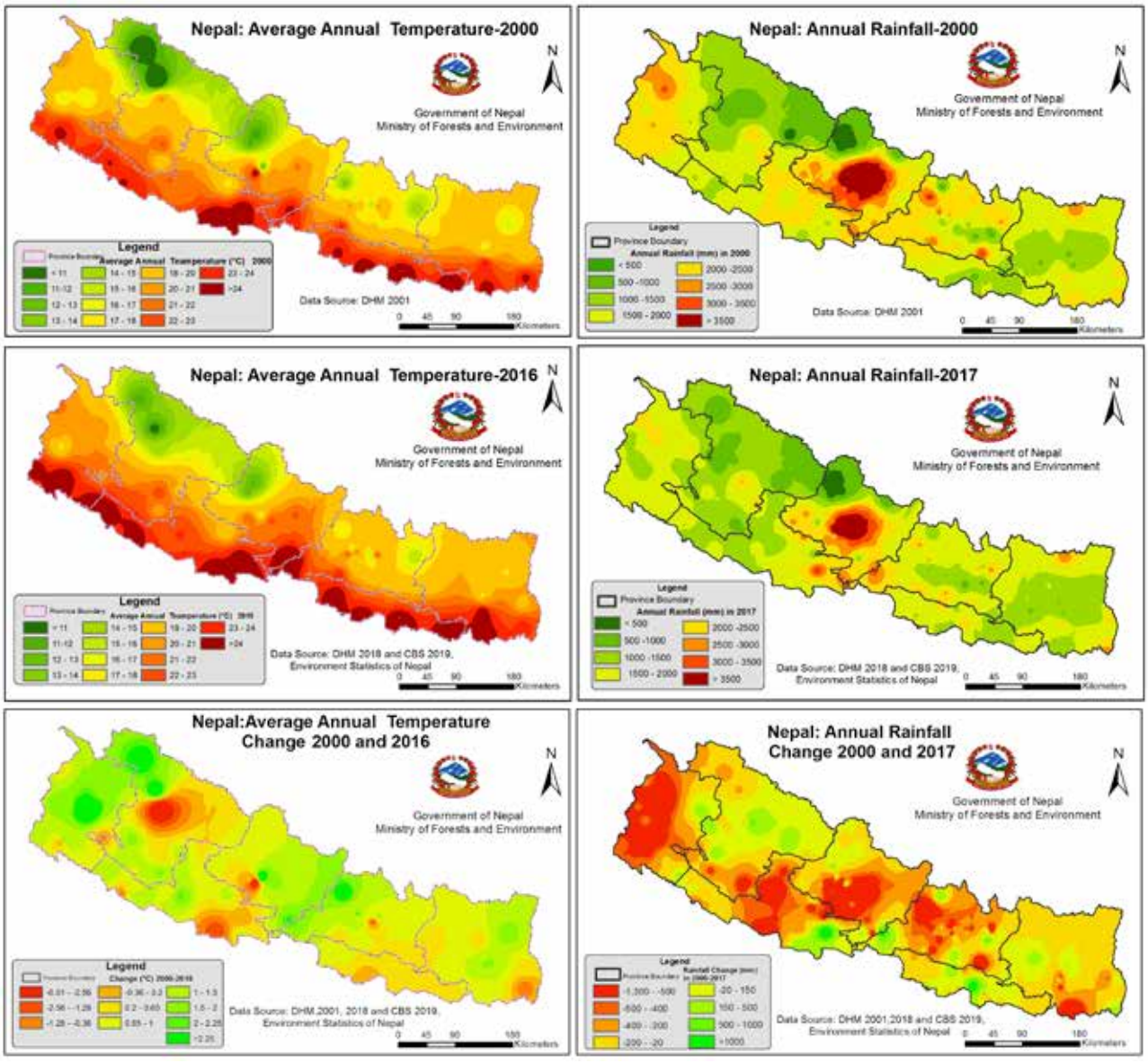


Figure 4: Average annual temperature and rainfall and their changes

Nepal has already experienced a range of climate hazards. More than 80% of property loss due to disasters is attributable to climate hazards, particularly water-related events such as floods, landslides, and glacial lake outburst floods (GLOFs) (MoFE, 2018). Water-related disasters claim more than 300 lives a year, displace people, and destroy homes, farmland, and other essential infrastructure (Bishokarma, 2017). Extreme rainfall in 2020 caused 445 flooding and landslide incidents that claimed about 430 lives and displaced more than 5,000 people (NDRRMA, 2020). Most households in Nepal have observed changes in temperature and precipitation over the past 25 years (Box 3).

Box 3: Perceptions of climate change in Nepal

In 2016, Central Bureau of Statistics (CBS) of Nepal conducted a survey to better understand how people across the country were experiencing the impacts of climate change. The process collected both qualitative and quantitative information from over 5,060 households in both rural and urban areas. Over 90% of surveyed households indicated that the monsoon rainfall had decreased over the last 25 years. A similar proportion reported that they felt a temperature rise. Respondents also reported shifts in the timing of the seasons. The most concerned climate hazards were drought, hailstorms, and floods; however, there were regional variations. Almost all respondents felt increase in the occurrence of drought (CBS, 2017).

When the survey results were compared with available data on rainfall and temperature trends, there was a high degree of convergence between the perceptions of the respondents and the scientific information. The study highlighted the value of incorporating local perspectives in climate change vulnerability and impact assessments to complement scientific data, fill information gaps and inform assessment of vulnerability to climate change.

Source: MoFE (2018).

3.2.2 Projected climate change

Nepal's climate will warm further, with increases in temperature projected for all seasons. MoFE's report on climate change scenarios for Nepal analyzed the future climate change scenarios for two possible trajectories – representative concentration pathways (RCP) 4.5 and RCP 8.5 for the medium-term (2016-2045), long-term (2036-2065), and end of century with respect to the reference period (1981-2010). The analysis suggested that the climate in Nepal will be significantly warmer and wetter in the future, but for a decrease in precipitation during the pre-monsoon season (MoFE, 2019) (Table 2).

Table 2: Mean of change in precipitation and temperature in the medium- and long-term periods for Nepal compared to the reference period 1981-2010

Climatic variable	Medium-term (2016-2045)		Long-term (2036-2065)		End of the century (2071-2100)	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Change in precipitation (%)	2.10	6.40	7.90	12.10	10.70	23.00
Change in temperature (°C)	0.92	1.07	1.30	1.82	1.72	3.58

Source: MoFE (2019), p. 20.

The highest temperature increase is projected for the post-monsoon season for both the medium- and long-term periods. The high mountains region is likely to warm at a higher rate than other regions in the RCP 4.5 scenario, with the Tarai and Siwalik regions expected to experience slightly greater warming in the RCP 8.5 scenario (Table 3).

Table 3: Projected range of mean change in temperature (°C) compared to the reference period 1981-2010 in the five physiographic regions of Nepal

Physiographic regions	Medium-term (2016-2045)		Long-term (2036-2065)		End of the century (2071-2100)	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
High mountains	0.95	1.09	1.36	1.86	1.79	3.61
Middle mountains	0.89	1.04	1.27	1.76	1.66	3.44
Hill	0.90	1.06	1.26	1.80	1.69	3.56
Siwalik	0.94	1.10	1.29	1.87	1.72	3.66
Tarai	0.93	1.11	1.29	1.87	1.73	3.69

Source: MoFE (2019), p. 20.

Warm extreme events (determined by the number of warm days and warm nights, and the duration of the warm spell) are projected to increase, while cold extremes are projected to decrease in both the medium- and long-term periods (MoFE, 2019). The increase in warm days and nights is expected to be more pronounced in the middle mountains and high Himalayas (Agrawal et al., 2015). The higher temperature increase in the mountains is consistent with projections across the Hindu Kush Himalaya region. Even if global warming were kept to 1.5°C, warming in the Hindu Kush Himalaya region would be at least 1.8°C and up to 2.2°C because of elevation dependent warming, a phenomenon where mountains experience rapid changes with an increase in temperature (Krishnan et al., 2019).

Average annual precipitation in Nepal is likely to increase by 2-6% in the medium-term and 8-12% in the long-term relative to the 1981-2010 reference period, although there is considerable uncertainty in the precipitation projections (Table 4). Annual, monsoon, and post-monsoon precipitation projections indicated an increase in precipitation in all time periods for both RCPs, while pre-monsoon precipitation is projected to decrease for both RCPs and for all time periods (except for RCP 8.5 in the long-term period). Winter precipitation is projected to increase in the long-term and at the end of the century for both RCPs. Maximum precipitation increase is observed during the post-monsoon season followed by the monsoon season. The end of the century data suggests an increase in precipitation for all seasons except the pre-monsoon season. The frequency of heavy precipitation events is likely to increase in the future (MoFE, 2019) (Table 4).

Table 4: Projected range of mean change in precipitation (%) for different seasons compared to the reference period 1981-2010

Seasons	Medium-term (2016-2045)		Long-term (2036-2065)		End of the century (2071-2100)	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Winter	-5.8	7.2	13.6	5.0	24.4	20.9
Pre-monsoon	-5.0	-4.0	-7.4	4.2	-7.8	-3.1
Monsoon	2.7	7.8	9.4	13.6	12.4	27.1
Post-monsoon	18.6	6.0	20.3	19.0	16.5	22.9
Annual	2.1	6.4	7.9	12.1	10.7	23.0

Source: MoFE (2019), p. 21.

Annual precipitation is projected to increase in the order of 5% to 20% over the 21st century in mountain regions, including the Himalaya (Hock et al., 2019). Across the Himalayan Mountains, the frequency and intensity of extreme precipitation events are projected to increase through the 21st century, particularly during the summer monsoon (Sanjay et al., 2017). The IPCC's report on oceans and the cryosphere in a changing climate noted that increased snowfall is projected at higher elevations; while snowfall is projected to decrease at lower elevations with more precipitation falling as rain. The snow depth or mass at lower elevations of mountain regions is projected to decline by 25% between 1986–2005 and 2031–2050, regardless of the GHG emission scenario. By the end of the century, reductions in snow depth or mass at lower elevations of mountain regions are expected, with up to 80% reductions under RCP 8.5 and 50% reductions under RCP 4.5 (Hock et al., 2019).

The UNDRR (2019) reviews the future of disaster risk in Nepal, stating, "when it comes to climate change, the future projections are dire." These climate change projections suggest that Nepal will be more exposed to climate hazards in the future (Figure 5, Annex 5). Warming in Nepal could trigger biophysical and socio-economic impacts that will affect livelihoods and well-being, including biodiversity loss, increased glacial melting, and less predictable water availability (Shrestha & Shrestha, 2019). A major concern is the potential for changes to the flow and quality of water derived from glaciers, snowmelt, and rainfall, leading to excess water at certain times of the year and prolonged dry periods and extreme drought in others (Bartlett et al., 2010). These climate hazards, as well as climate vulnerabilities and risks in Nepal, are discussed in Chapter 4.

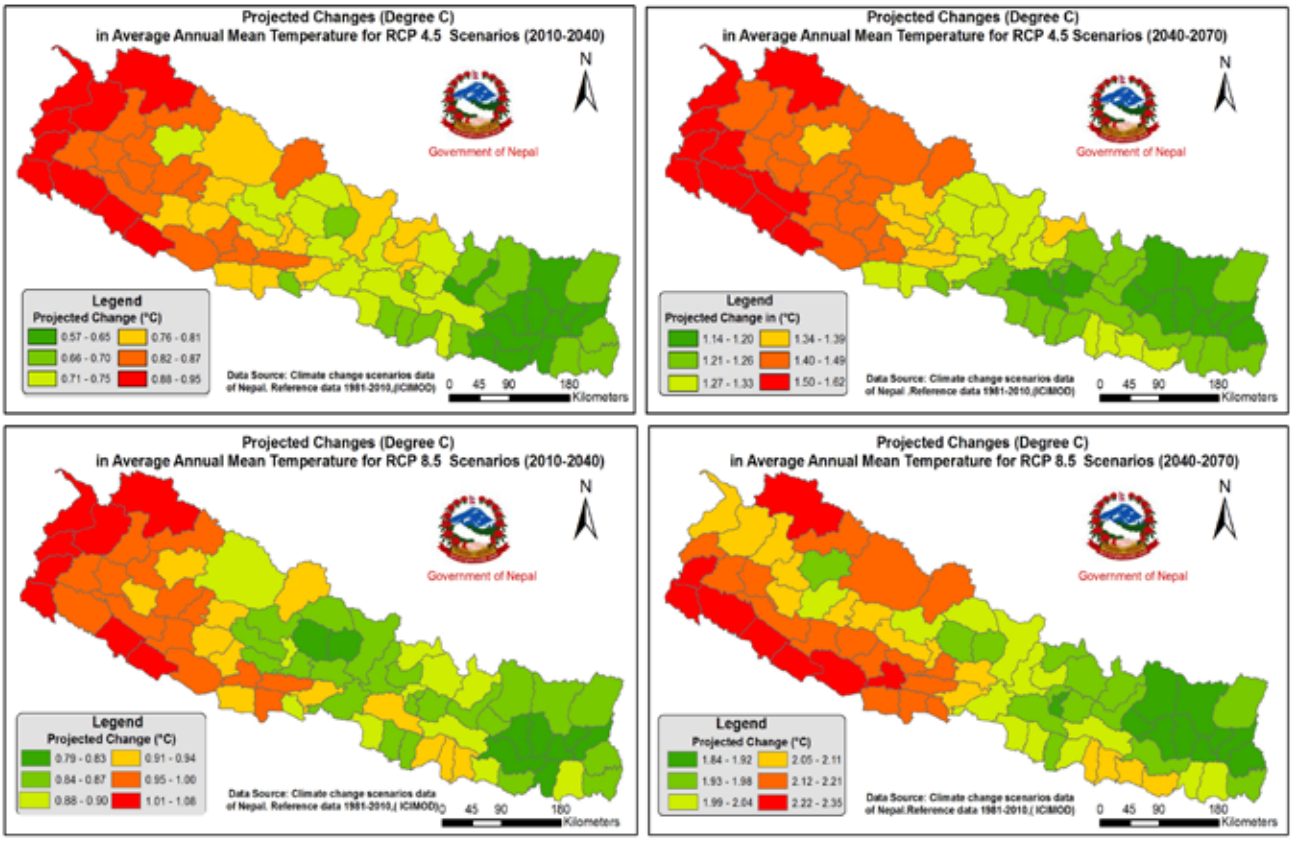


Figure 5: Projected changes in temperature for RCP scenarios 4.5 and 8.5 for years 2040 and 2070

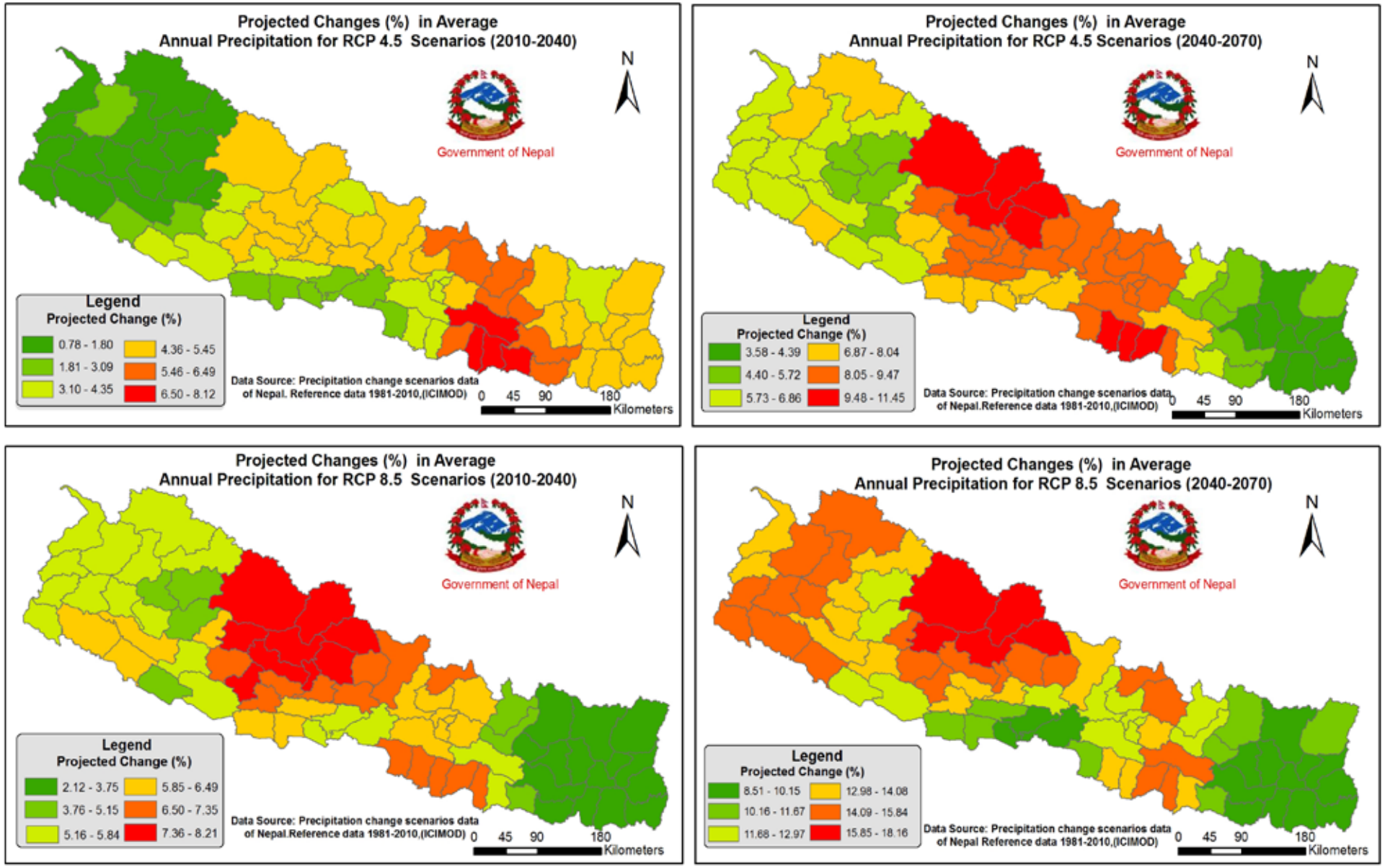


Figure 6: Projected changes in rainfall for RCP scenarios 4.5 and 8.5 for years 2040 and 2070

4. CLIMATE HAZARDS, VULNERABILITIES, RISKS AND IMPACTS

Nepal, experiencing the impacts of climate change combined with political, geographical, and social transformations, connotes that Nepal is particularly vulnerable to climate change (World Bank & ADB, 2021). This section provides an overview of climate vulnerabilities, risks, and impacts in Nepal, informed by reports developed under the NAP process (see for example MoPE, 2017a), the 2021 vulnerability and risk assessment (MoFE, 2021c) and Nepal's Third National Communication to the UNFCCC (GoN, 2021).

4.1 Climate Hazards and Vulnerabilities

Nepal was the 10th most affected country from 2000 to 2019 on the long-term Global Climate Risk Index, reflecting that the country was highly impacted by extreme weather events and was highly vulnerable to climate risks (Eckstein et al., 2021). It was ranked 127th out of 182 countries in the 2021 index of the University of Notre Dame Global Adaptation Initiative (ND-GAIN), which assessed a country's vulnerability to climate change as well as its readiness to improve resilience. Nepal was the 46th most vulnerable country and the 74th least ready country to address the climate impacts (ND-GAIN, 2021). Nepal ranked 51st out of 163 countries on the UN Children's Fund's (UNICEF) climate risk index that measures children's exposure and vulnerability to climate change (UNICEF, 2021). Exposure to the impacts of climate change can negatively affect nutrition, education and health, with long-term development outcomes.

Climate variability and extreme events have estimated economic costs in Nepal equivalent to an annual cost of 1.5% to 2% of GDP in 2014 (MoSTE, 2014). NPC (2017) estimated that Nepal lost about NPR 60 billion in 2017. Nepal's disaster risk profile is one of the worst in the world (Khanal, 2019). Nepal has one of the highest fatality rates in the world from landslide events; between 1972 and 2016, 5,190 people lost their lives in 3,419 landslide events (Bhushal, 2020). The heavy rainfall that accompanied the 2020 monsoon season caused flooding and landslides that killed at least 132 people in Nepal (Khairat, 2020). More than 80% of the population is exposed to the risk of natural hazards (MoHA, 2017), including earthquakes, droughts, floods, landslides, extreme temperatures, and GLOFs (UNDRR, 2019). Tornados are likely to be added to this list of natural hazards, despite there not being a Nepali word for tornado. In 2019, Nepal recorded its first tornado; the hail, rain and winds killed at least 28 people, injured more than 1,100 people, damaged about 2,600 houses, and damaged a national park that is listed as a World Heritage Site (Mallapaty, 2019).

The MoFE's 2021 climate vulnerability and risk assessment reported that on an average, Nepal loses 647 lives and sustains economic loses of over NPR 2,778 million each year to climate-induced disasters (MoFE, 2021c). The report asserted that floods, droughts and forest fires are common hazards in the country that occur more frequently in the low-lying south-west regions and cause severe harm to ecosystems and livelihoods. Forest fire in Nepal burned around 0.17 million ha forests annually, leading to 7.07 million tonnes biomass loss resulting in 3.30 million tonnes carbon emission (Bhujel et al., 2022). Over 55,000 active forest fires were observed in a period of 20 years between 2000 and 2020 (ICIMOD, 2022) and over 50% were recorded between 2012 and 2020 (Figure 7). The government's Forest Monitoring and Detection System recorded 5,626 forest fires incidents across the country from November 2020 to April 2021 (Mandel, 2021).

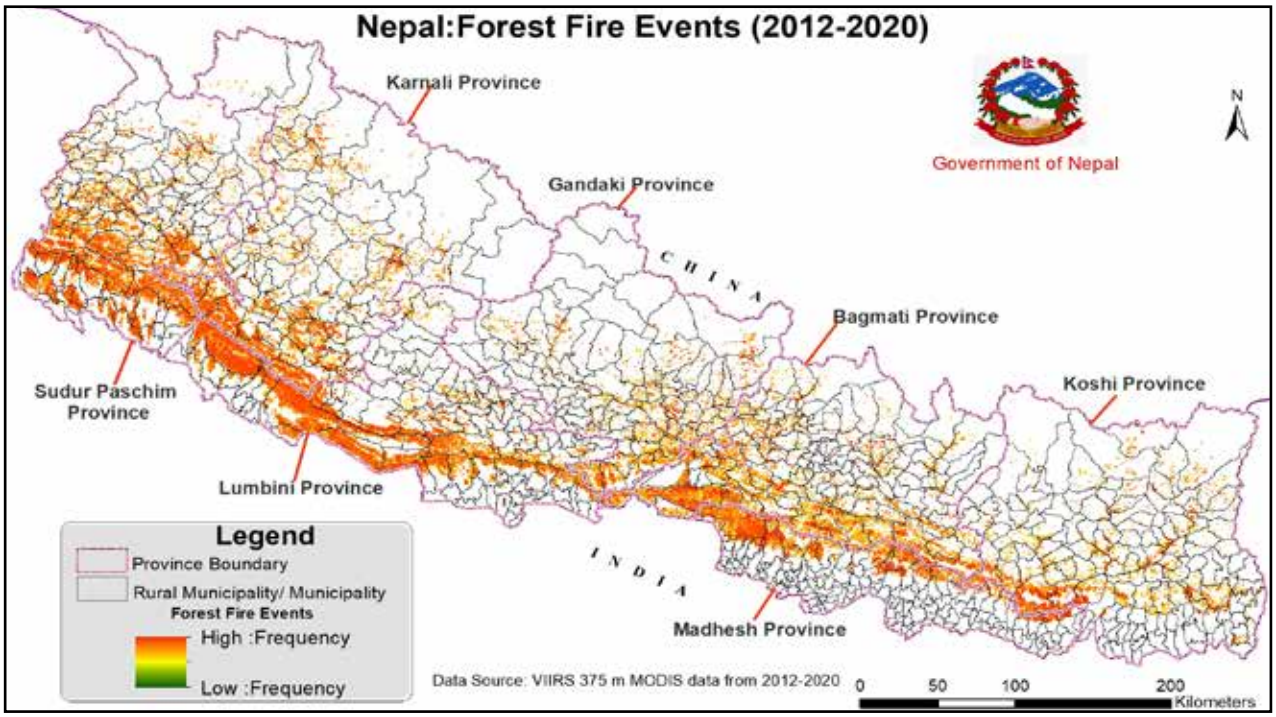


Figure 7: Forest fire events in Nepal at municipal level observed between 2012 and 2021

The 2021 climate vulnerability and risk assessment identified 50 districts that have high to very high vulnerability to climate change, with the majority in hilly or mountainous terrain (MoFE, 2021c). Several vector-borne diseases have been detected in high hill areas in recent years, which were traditionally been prevalent in low land Tarai areas in earlier days (Poudel, 2022). Several of the hill and mountain districts - including Dhading, Dolakha, Khotang, Parsa, Saptari, Solukhumbu, and Taplejung - have not received adequate climate investment (Kunwar, 2021b). The mid and far western hills and mountains are associated with very frequent climate disasters (Mainali & Pricope, 2018), high levels of poverty, and the least climate investment (ADB, 2017). Comparatively, vulnerability is moderate to low in the majority of districts in the Tarai region (MoFE, 2021b).

In Nepal, specific regions (such as high mountain), populations (poor, marginalized communities, women, landless people, indigenous people, disabled people, and people residing in climate-vulnerable geographical areas), and systems (such as food production systems) have a predisposition to be adversely affected by current and projected climate hazards. Rural hill and mountain communities are particularly vulnerable to climate change due to their dependence on climate-sensitive natural resources, chronic poverty, limited livelihood options, and low adaptive capacity to address the adverse changes. These communities have experienced acute shortages of water for drinking and irrigation over the past decade (Gurung et al., 2019). The severity and intensity of disaster events varies at the district level. Floods are common in the southern lowland Tarai districts whereas landslides occur more frequently in the mid-hills districts. Multi-hazard mapping indicates that the Tarai districts experience a greater number of climate hazards (Figure 8).

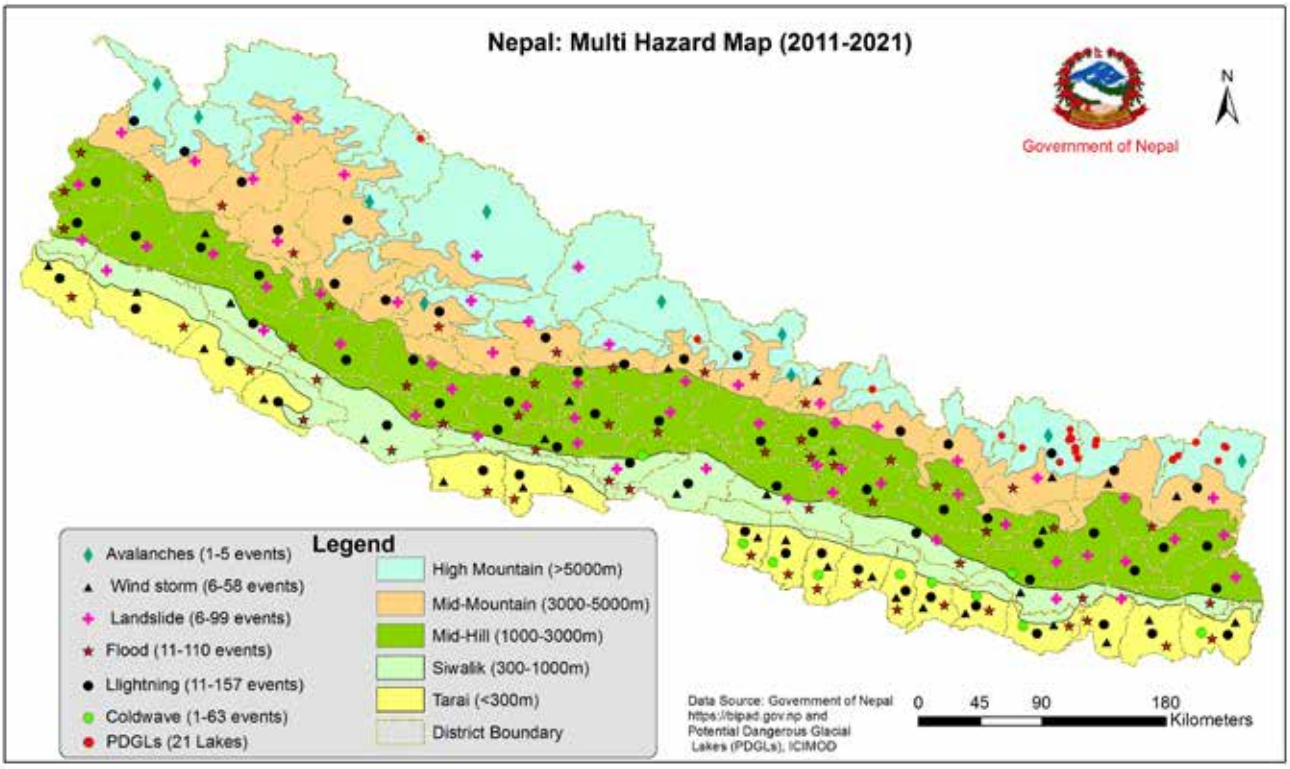


Figure 8: Multihazard map showing climatic hazards at district level observed between 2011 and 2021

Rising temperatures, erratic rainfall, and extreme weather events impact on seasonal and temporal trends of vector, water and food-borne diseases causing respiratory illnesses, nutrition-related diseases, injuries, and mental illnesses. They also affect water availability and timing, prompting water-related disasters (NPC, 2020a). Out of the 445 landslides reported in 2020, 59 occurred along roadsides and 62 occurred on roads, obstructing vehicular flow (NDRRMA, 2020; MoF, 2020). Every year during the monsoon, the impact of climate change on roads grows due to landslides caused by rains and constant toe cutting caused by flooding rivers. High mountains are expected to be more vulnerable to avalanches and GLOFs; hills to landslides and flash floods; and the Tarai lowlands to floods and forest fires (MoFE, 2021c). The consequences of these hazards severely burden rural livelihoods and have negative impacts on the tourism sector.

Agriculture is a main source of incomes and livelihoods in rural areas, and there is a high reliance on small-scale, rain-fed agriculture and dry land farming, where productivity is impacted by climate change (Paudel, 2016). Small landholdings limit crop diversification for small farmers (Panthi et al., 2015). Poverty, food insecurity, and malnutrition plague farming communities; almost 50% of households in the country are food insecure, nearly 25% are poor, and 14% are undernourished (MoALD, 2019a). Women from poor and marginalized households spend more time and energy on collecting fuel for their livelihood (MoFSC, 2018). As a result women are time poor and unable to pursue job opportunities, gain new knowledge and skills, and engage in community activities (UN Women, 2021).

Significant development gap existing between rural and urban areas have been attributed to "persistent discrepancies in income and education between urban and rural areas" (International Fund for Agricultural Development, 2014). These gaps contribute to rural-urban migration, which is a factor in the proliferation of informal settlements in the Kathmandu valley, many of which are located on the floodplains of rivers. Rural out-migration has left behind empty ghost villages in the Manang, Mustang, Ramechhap, and Nuwakot districts (Khatri, 2013). Households with fewer years of schooling and lower wealth levels are considerably more likely to be affected, experience casualties, and incur livelihood losses as a result of floods and landslides (Shrestha et al., 2016). Poverty has affected the ability of mountain communities to recover from landslides (Devkota & Lal, 2017). Marginalized and indigenous groups - particularly Majhi, Raute, Chepang, and Satar - experience high levels of poverty, which increases their vulnerability to climate change (GoN, 2021).

Gendered vulnerability to climate change is related to the inequitable gender divisions of labour, women being the primary caretakers of water and natural resources management, and inequitable incomes complicated by women's control over income being more limited than men (GoN, 2021). Gender vulnerability is also affected by their intersecting identities defined by their age, class, caste, sex, ability- disability, religion, education, migration status and location. Male outmigration (women comprise only 12% of migrant workers (GoN, 2021), which is often a response of the most marginal cultivators hit hard by climate impacts on agricultural productivity (Nellemann et al., 2014; Koirala, 2014). Women and girls are more likely to die as a result of flooding. Flood-related fatalities in 1993 were 13.3 per 1,000 girls aged 2–9 years, 9.4 per 1,000 boys aged 2–9 years, 6.1 per 1,000 adult women, and 4.1 per 1,000 adult men (Pradhan et al., 2007). Poor, marginalized, disadvantaged and female-headed households are more vulnerable than medium, well-off, and male-headed households (Poudel et al., 2020). Compared to men, women have higher perception of risk of climate variability and associated impacts on food security. In terms of adaptation practices, women usually adopted short-term coping mechanisms whereas men adopted long-term options (Bastakoti & Doneys, 2020). Social barriers, including low social status, and discrimination are factors that hinder the access of women to climate adaptation (Gurung & Bisht, 2014), predominantly impacts the gendered vulnerability.

4.2 Future Climate Hazards, Risks and Impacts

Nepal's climate vulnerability and risk assessment (MoFE, 2021c) determined that future climate change is expected to lead to more extreme climate events (precipitation and temperature) by 2045 and 2065. Most of the districts of Koshi Province, Madhesh Province, Bagmati Province, and Gandaki Province are highly likely to experience high/very high incidences of climate extreme events in 2030. In the future, all the Tarai districts are expected to experience increased extreme events, and the eastern districts of Koshi Province will experience a very high incidence of extreme events. These changes in climate are expected to result in climate hazards (Table 5) that are frequent, widespread, long lasting, and intense under future climate change (MoFE, 2021c).

Table 5: Descriptive scenarios of climatic hazards under future climate change

Climate hazards	Impact	Medium-term scenario	Long-term scenario
Heat waves	Increase	Likely	Very likely
Cold waves	Decrease	Likely	Very likely
Heavy rainfall	Increase	Likely	Very likely
Snowstorms	Decrease	Likely	Likely
Thunderbolts	Increase	Likely	Likely
Windstorms	Increase	Likely	Likely
Hailstorms	Increase	About as likely as not	About as likely as not
Floods	Increase	Likely	Likely
Landslides	Increase	Likely	Likely
GLOFs	Increase	Likely	Likely
Droughts	Increase	About as likely as not	About as likely as not
Forest fires	Increase	Likely	Likely
Fires	Increase	Likely	Likely
Avalanches	Increase	Likely	Likely
Epidemics	Increase	Likely	Likely

Note: Virtually certain 99-100% probability, very likely 90-100 %, likely 66-100%, about as likely as not 33-66%, unlikely 0-33% and very unlikely 0-10%, exceptionally unlikely (0-1%). Source: MoFE (2021c).

As temperatures rise in Nepal, acute climate hazards such as extreme weather events (including heavy rainfall, snowstorms, high winds, hailstorms, and increased lightning), heat waves, cold waves, floods, landslides, and wildfires are expected to increase in frequency and severity; and chronic or slow onset hazards such as drought, changes in precipitation patterns, snow cover changes, glacier retreat, and GLOFs, are expected to intensify. Multiple events may occur simultaneously across regions, which could be catastrophic (MoFE, 2021a). The climate hazards will interact with and cause harm to vulnerable systems, leading to climate risks that are expected to impact critical systems and human well-being, including natural ecosystems, food production, livelihoods, human health, communities and settlements, and infrastructure in Nepal. These risks will impact Nepal's efforts to achieve the United Nations Sustainable Development Goals (SDGs) and national development goals, such as economic development and poverty alleviation. This will entrench reliance on development aid and increase the need for donor support to deliver basic services. The future economic costs of climate change in Nepal could be very large, equivalent to an additional 2 to 3% of GDP per year by 2050 (MoSTE, 2014).

4.3 Summary of Climate Hazards, Vulnerabilities, Risks and Impacts

An overview of Nepal's climate hazards, key sources of vulnerability, and climate impacts in the nine priority thematic areas, and particularly vulnerable groups and regions are summarized in Table 6. The climate vulnerabilities and risks for each thematic priority are discussed in Section 7 to provide context for the identification of priority adaptation actions.

Table 6: Summary of climate hazards, climate vulnerability and climate risks in Nepal

Climate hazards	Key factors of vulnerability
Acute Increased frequency and severity of: ▪ Extreme weather events ▪ Heat waves ▪ Floods ▪ Landslides ▪ Avalanches ▪ Forest fires **Chronic / Slow onset** ▪ Drought ▪ Precipitation pattern ▪ Snow cover changes ▪ Glacier retreat	▪ 28.6% of the population is multidimensionally poor; 18.7% live in absolute poverty ▪ Significant disparities between rural and urban areas ▪ Significant disparities along lines of caste and ethnicity ▪ Low levels of gender equality ▪ Reliance on ecosystem services for subsistence livelihoods ▪ Largely natural resource-dependant agrarian economy ▪ High reliance on natural rainfall and insufficient irrigation systems ▪ Small, fragmented landholdings in rural areas ▪ Poor urban and land use planning - rapid and haphazard urbanization ▪ Large number of informal settlements due to rural-urban migration ▪ Poor health infrastructure ▪ Inadequate access to improved technologies ▪ Inadequate evidence and knowledge base ▪ Illiteracy (in 2018, 32% of the population was not literate) ▪ Inadequate, but improving, governance structures ▪ High dependence on international finance to address adaptation priorities **Particularly vulnerable regions** ▪ High mountain landscapes and ecosystems, Tarai region
▪ Glacial lake outburst floods (GLOFs)	**Particularly vulnerable groups** ▪ Women, indigenous people, Madheshi, Tharu, Muslim, oppressed groups, backward classes, minorities, landless, marginalized farmers, labourers, youth, children, senior citizens, persons with all forms of disability, pregnant women, incapacitated and disadvantaged persons or groups. People in remote communities with small landholdings and/or livelihoods dependent on natural resources ▪ Communities in the mid and far western hills and mountain communities that have attracted the least climate investment and experience the highest levels of poverty

Sectors	Vulnerable regions / regions with very high climate risk in the sector	Climate impacts
1. Agriculture and Food Security (AFS)	**Highly vulnerable regions:** ▪ Mid- and high-hill districts ▪ Karnali Province and Sudurpaschim Province Regions with very high risk of climate impacts in the sector in 2050: ▪ Lumbini Province ▪ Gandaki Province ▪ Koshi Province ▪ Madhesh Province	▪ Declining crop, livestock and fisheries production ▪ Shifts in agro-ecological regions ▪ Increase in disease and pests ▪ Declining water availability ▪ Land degradation, soil erosion and low soil quality ▪ Deterioration in food availability ▪ Major losses in subsistence farm production leading to increased risk of food insecurity and a decrease in incomes ▪ Changing dates of sowing, transplanting, flowering and fruiting time of horticultural crops ▪ Shorter recovery time between droughts ▪ Higher weather uncertainties
2. Forests, Biodiversity, and Watershed Conservation (FBWC)	**Highly vulnerable regions:** ▪ Hills and mountain districts ▪ Mugu, Sankhuwasabha, Dolpa and Kalikot districts *Regions with very high risk of climate impacts in the sector in 2050:* ▪ High and middle mountain regions and districts ▪ Chure and Siwalik regions	▪ Decline in and depletion of ecosystem services such as wetlands, rangelands, and forests ▪ Changes in forest distribution and composition ▪ Decreased production of non-timber forest products ▪ Biodiversity loss - changes in species growth and production, including declines in productivity and extinction ▪ Shifts in the geographical range of many species as they move upward in elevation from current locations ▪ Changes in flowering and fruiting times creating food deficiencies for wild animals and insects ▪ Loss/change of habitat of wildlife ▪ Increased wildlife death, injury, pests and disease ▪ Increase in alien and invasive species ▪ Increase in damage and destruction from forest fires
3. Water Resources and Energy (WRE)	**Highly vulnerable regions:** ▪ Bagmati Province, Gandaki Province, Lumbini Province, Karnali Province and Sudurpaschim Province *Regions with very high risk of climate impacts in the sector in 2050:* ▪ Energy - Bagmati Province and Gandaki Province ▪ Water resources - districts of Bagmati Province, Gandaki Province, Karnali Province, and Koshi Province	▪ Reduced water availability for households, agriculture, and industry ▪ Increased water availability from glacial runoff in short-term; decreased in long-term ▪ Disruptions to springs in middle hills ▪ Low seasonal river flows ▪ Soil erosion and sedimentation causing damage to irrigation canals, hydropower dams and turbines, and reduced life span of reservoirs ▪ Reduced water availability for hydroelectricity generation ▪ Damage to energy infrastructure (generation, transmission and distribution) ▪ Increased electricity demand for heating and cooling ▪ Forest fires and impacts on forests reduce availability of fuelwood

4. Rural and Urban Settlements (RUS)	**Vulnerable urban municipalities** ▪ Concentrated in Karnali and Sudurpaschim Province. **Vulnerable rural municipalities** ▪ Concentrated in Madhesh, Bagmati, Lumbini, Karnali and Sudurpaschim provinces *Regions with very high risk of climate impacts in the sector in 2050:* ▪ Urban - Suryodaya and Biratnagar in Koshi Province, Janakpur in Madhesh Province, Bhanu, Byas, and Pokhara Lekhnath in Gandaki Province, and Sitganga in Lumbini Province ▪ Rural - Dhading, Makawanpur, Sindhupalchok, Gorkha, Tanahu, Kavrepalanchok, Pyuthan, Kailali, Sindhuli, Morang, Chitwan, Dang, Jhapa, Mahottari, Saptari	▪ Building and property damage and destruction ▪ Migration from rural to urban areas leading to overcrowding of informal settlements, often in risk-prone areas ▪ Forced migration or displacement - ghost villages in rural/mountain areas ▪ Heat islands in urban settlements ▪ Constraints on urban water provision ▪ Damage and loss to urban ecology ▪ Shifts in production of food and non-food crops in rural areas
5. Industry, Transport, and Physical Infrastructure (ITPI)	**Highly vulnerable regions:** ▪ Mid-hills and mountain districts ▪ Madhesh Province, Bagmati Province, Gandaki Province, Lumbini Province, and Karnali Provine *Regions with very high risk of climate impacts in the sector in 2050:* ▪ Bagmati Province and Madhesh Province	▪ Damage to and destruction of physical and natural infrastructure ▪ Disruption of transportation networks ▪ Disruption to communication networks ▪ Damage to industrial sites and job losses ▪ Disruptions in the supply/availability of water and other raw materials for industrial processes ▪ Disruptions in industrial value chains
6. Tourism, Natural and Cultural Heritage (TNCH)	**Highly vulnerable regions:** ▪ Mountain districts ▪ Koshi Province, Bagmati Province, Gandaki Province, Karnali Province and Sudurpaschim Province *Regions with very high risk of climate impacts in the sector in 2050:* ▪ Bagmati Province, Gandaki Province, parts of Koshi Province, Sudurpaschim Province ▪ Majority of protected areas	▪ Decreasing snowfall leading to fewer visitors ▪ Restricted access to tourist destinations ▪ Obstruction of trails and passages used by trekkers and mountaineers ▪ Destruction of tourism infrastructure ▪ Damage to archaeological sites ▪ Historical buildings exposed to high levels of humidly leading to decay and pest infestation ▪ Destruction and alteration of flora and fauna habitats that negatively impact nature-based tourism

7. Health, Drinking Water, and Sanitation (HDWS)	**Highly vulnerable regions:** ▪ Health – Hills ▪ Drinking water and sanitation - Karnali Province, Madhesh Province and Sudurpaschim Province *Regions with very high risk of climate impacts in the sector in 2050:* ▪ Health: Sunsari, Dhankuta, Terhathum, Sankhuwasabha, Tanahu, Parbat, Syangja, Morang, Taplejung, Panchthar, Jhapa and Ilam districts ▪ Drinking water and sanitation - Madhesh Province	▪ Greater risks of death and physical and psychological disease and injury ▪ Increased risk of death and illness due to heat stress ▪ Greater risk of vector-borne diseases, such as malaria, dengue, scrub typhus to higher altitudes ▪ Higher incidence of water-borne diseases, such as diarrhoea and cholera after severe precipitation events ▪ Increased incidence of respiratory infections, cardiovascular disease, noncommunicable diseases, malnutrition, food insecurity ▪ Reduced progress in reducing mortality and morbidity from under-nutrition ▪ Reduced labour productivity and work capacity ▪ Scarcity of water for drinking, sanitation, and hygiene; because of depletion of water sources, such as springs in mountains ▪ Decrease in groundwater table ▪ Low water flows lead to higher pollutant concentrations ▪ Failure of water and sanitation infrastructure leading to higher diarrhoea risk ▪ Damage to and destruction of health facilities
8. Disaster Risk Reduction and Management (DRRM)	**Highly vulnerable regions:** ▪ Districts of Dhading, Makawanpur, Sindhupalchok, Gorkha, Kailali, Sindhuli, Morang, and Jhapa *Regions with very high risk of climate impacts in the sector in 2050:* ▪ Almost all districts in the Tarai, mid-hills, and mountains	▪ Negative impact on livelihoods because of increase in and frequency of climate-related disasters ▪ Destruction of physical, social, cultural and financial assets. ▪ Loss of life and property
9. Gender Equality Social Inclusion, Livelihood and Governance (GESILG)	**Highly vulnerable regions:** ▪ Karnali Province, Sudurpaschim Province, and districts in Madhesh and Bagmati Provinces. *Regions with very high risk of climate impacts in 2050* ▪ Morang district in Koshi Province; Saptari, Siraha, Dhanusha, Mahottari, Sarlahi, and Bara districts in Madhesh Province; Dang district in Lumbini Province; Kailali district in Sudurpaschim Province	▪ Destruction of physical assets impacting livelihoods ▪ Drought, pests, and lack of rainfall impact agricultural livelihoods ▪ Flood-related fatalities are higher for girls and women, than boys and men ▪ Due to scarcity of water the most vulnerable and disadvantage group including women, children ethnic minorities and poor communities will be affected more ▪ Increased rural to urban migration, leading to increases in urban poverty ▪ Increase in female-headed households ▪ Short recovery time between droughts, moving toward tipping points in rainfed farming households ▪ Shift from transient to chronic poverty

Source: Patra & Terton (2017); MoPE (2017); GoN (202ob, 2021); MoFE (2021c); World Bank & ADB (2021).

5. THE NATIONAL ADAPTATION PLAN (NAP) PROCESS

5.1 The International Context

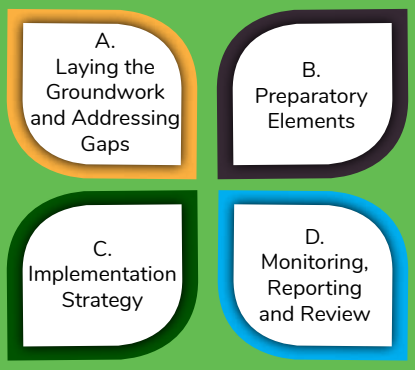
5.1.1 International Framework for Climate Change Adaptation

Climate change is a global problem that requires a long-lasting solution. The international response is framed around the UNFCCC that entered into force in 1994. A total of 196 countries and the European Union (EU) are Parties to the Convention. Nepal signed the UNFCCC in 1992 and ratified the Convention in 1994. The aim of the Convention is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner" (United Nations, 1992). The UNFCCC calls for cooperation to address the impacts of climate change, including assistance for developing countries that are particularly vulnerable to climate impacts and lack the resources to meet the costs of adaptation. The Convention notes that developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change (United Nations, 1992).

While the Convention initially emphasized mitigation, the release of the IPCC's Third Assessment Report in 2001 raised the profile of adaptation (IPCC, 2001). The Least Developed Countries (LDC) work programme was established in 2001 and included, among other things, National Adaptation Programmes of Action (NAPA). The NAP process was formally established in 2010 under the Cancun Adaptation Framework, which was an outcome of the 16th Conference of the Parties (COP 16) to the UNFCCC (Box 4). Article 7(9) of the Paris Agreement noted that countries should engage in adaptation planning processes and the implementation of actions making the NAP process central to the adaptation goal of the Paris Agreement. The 2010 Cancun Adaptation Framework also established the Adaptation Committee, and agreed on a process to address the adverse impacts of climate change and to establish a funding process for adaptation (UNFCCC, 2010). The elements of the LDC work programme were updated in 2018 and included, among other things, "supporting the process to formulate and implement NAPs and relevant adaptation strategies, including national adaptation programmes of action" (UNFCCC, 2018).

Box 4: The NAP process

The NAP process is a strategic process that enables countries to identify and address their medium- and long-term priorities for adapting to climate change. The NAP process helps countries integrate adaptation in development decision-making. This nationally driven process involves analyzing current and future climate change and assessing vulnerability to its impacts, reviewing the gaps, identifying and prioritizing the adaptation options, implementing these options, and tracking progress and results.



Source: UNFCCC (2012)

The NAP process puts in place the systems and capacities needed to make adaptation an integral part of a country's development planning, decision making, and budgeting. There is both a plan and process associated with the endeavour.

The NAP process and NDCs represent important elements of countries' responses to climate change in line with the Paris Agreement. NDCs outline countries' commitments to helping achieve the global goals of the Paris Agreement. A country's NDC communicates the goals and targets that are envisioned for adaptation, while the NAP process elaborates how adaptation will be planned, implemented, and monitored.

Source: Hammil (2020); United Nations (2015).

The Paris Agreement, a legally binding international treaty on climate change under the UNFCCC, was adopted by 196 countries in December 2015 and entered into force in November 2016. Section 2.1(b) of the Agreement includes an adaptation goal of "increasing the ability to adapt to the adverse impact on climate change; and Section 7(1) sets a global adaptation goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring adequate adaptation response in the context of the temperature goal" (UNFCCC, 2015a). The Paris Agreement requires that countries engage in adaptation planning and implementation. Countries set out their national contributions to achieving the global goals of the Paris Agreement in their NDCs; and many countries, including Nepal, have included adaptation in their NDCs. The legally binding aspects of the agreement include the provisions on transparency, reporting, and accountability; meaning that countries have an obligation to prepare NDCs, and to report on their emissions and progress in implementing their NDCs.

5.1.2 Other International Agreements Aligned with Climate Change Adaptation

Many adaptation actions present considerable opportunity to contribute to the goals and objectives of other international agreements. The three Rio conventions - UNFCCC, United Nations Convention on Biological Diversity (CBD), and the United Nations Convention to Combat Desertification (UNCCD) - are intrinsically linked because they address interdependent issues. Adaptation actions can have multiple benefits including combating desertification and preventing biodiversity loss through such initiatives as sustainable land management, ecosystem-based adaptation (EbA), and improving early warning systems (CBD, UNCCD & UNFCCC, 2012).

The Sendai Framework for Disaster Risk Reduction (DRR) (2015-2030) calls for addressing climate change as one of the drivers of disaster risk (Article 13), and shares a foundation of resilience building with the Paris Agreement. The process of developing policies and investing in climate adaption and DRR strategies have similar approaches, common challenges, and complementary advantages for governance, financing, information and data analysis, capacity development, and monitoring (UNDRR, 2021).

Sustainable Development Goals (SDGs) are designed to build on the success of the earlier United Nations Millennium Development Goals (MDGs), which aimed to end all forms of poverty by 2030.

The 17 SDGs go beyond MDGs to focus on the root causes of poverty. Each goal has several associated targets and a set of measurable indicators used to track progress; there are 169 targets and 230 approved indicators in total across the SDGs. Goal 13 is targeted to urgently addressing climate change and its impacts (United Nations, 2015). Leveraging the common objectives of the NAP process and SDG targets 13.1 and 13.2-building adaptive capacity and integrating adaptation considerations into planning processes-can serve as a bridge for linking adaptation efforts under the Paris Agreement and implementation of the SDGs in pursuit of climate-resilient development (Hammill & Price-Kelly, 2019).

Nepal has explored potential entry points for an integrated approach to adaptation, sustainable development, and DRR (GoN, 2020a). Building resilient futures, for example, is a key component of all three agendas, and can contribute to the goals of multiple agendas (UNFCCC Secretariat, 2017). The overarching objective of adaptation, sustainable development, and DRR – to benefit vulnerable people and communities - can aid in identifying highly effective adaptation actions that contribute to all three sets of goals simultaneously (UNFCCC Secretariat, 2017).

Climate change poses risks to the enjoyment of the human rights protected by the International Convention on the Elimination of all Forms of Discrimination Against Women; the International Covenant on Economic, Social and Cultural Rights; the International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families; the Convention on the Rights of the Child, and the International Convention on the Rights of Persons with Disabilities. Climate change impacts affect women and men differently, fall disproportionately on the marginalized and vulnerable, and cause damage to ecosystems that affect the enjoyment of human rights. Complying with human rights provisions and meeting the terms of the Paris Agreement requires that countries reduce GHG emissions and foster climate resilience (United Nations Human Rights Office of the High Commissioner, 2019).

5.2 The National Context

5.2.1 Nepal and the UNFCCC

Nepal, being a party to the UNFCCC, recognizes the importance of preparing to face the impacts of climate change through adaptation actions. The country ratified the UNFCCC in 1994 and the Paris Agreement in 2016. The country's First NDC was submitted in 2016 and Second in 2020; both of which outlined Nepal's planned contributions to the achievement of the goals set out in the Paris Agreement. Both NDCs included adaptation actions. The NDC and NAP process of Nepal are aligned; the NAP setting out actions to achieve the high-level adaptation contributions in the country's NDC.

Nepal reports to the UNFCCC through its National Communications that include a national inventory of GHG emissions and as well as a chapter on vulnerability, impacts, and adaptation assessment. Nepal submitted its First National Communication in 1999, Second National Communication in 2014, and Third National Communication in 2021. This NAP will serve as Nepal's Adaptation Communication, consistent with articles 7(10) and 7(11) of the Paris Agreement. Nepal's inclusive NAP process responds to the UNFCCC's call to consider vulnerable groups, communities, and ecosystems, and to effectively engage a range of stakeholders.

Nepal is an active participant in the international climate change negotiations, and negotiates with the LDC Group and the Group of 77 countries (G77) and China. The country led the LDC Group at COP 19 in Poznan, Poland and COP 20 in Marrakech, Morocco. In addition, Nepal supported the LDC Group in the negotiations of the NAP process. Nepal was elected to the Chair of the Adaptation Fund Board in 2016, after serving as a board member in 2015 (MoFE, 2020b). It has been a member of the LDC Expert Group (LEG) since 2008.

Nepal is one of 40 countries (as of January 2022) that has joined the Adaptation Action Coalition formed in January 2021. Nepal became a member of the Coalition's steering committee in March 2021, and brings its experience in addressing adaptation to inform the building of global resilience. The Coalition aims to accelerate adaptation by delivering sector-specific, action-orientated work streams, initially focused on health, infrastructure, and water (Gov. UK, 2021). This Coalition builds upon the UN Climate Action Summit Call for Action on Adaptation and Resilience. It calls for "equal and increased urgency to adapt to climate impacts and build resilience for the future" and commits to acting to respond to climate impacts, putting climate risk at the centre of decision making, and increasing the availability of adaptation and resilience finance (UN Climate Action Summit, 2019). In addition, Nepal is a member of the Vulnerable 20 Group (2021) that is a high-level dialogue pertaining to action on climate change.

5.2.2 Adaptation in Nepal and Alignment with Other International Agreements

The strategies and actions for climate-resilient development set out in this NAP present considerable opportunity to contribute to the goals and objectives of other international agreements. Nepal's NAP process aligns with the key principles of the 2030 Agenda for Sustainable Development and its 17 SDGs, including the commitment to leave no one behind. The common pathways commit to the development of adaptation plans for local governments, climate-smart agriculture, and the integration of climate change into school curricula (NPC, 2017). The SDG financing strategy highlights that climate-proofing infrastructure is a major intervention requiring investment (NPC, 2018).

Nepal has ratified a series of human rights treaties, including the International Convention on the Elimination of all Forms of Discrimination Against Women (1991); the International Covenant on Economic, Social and Cultural Rights (1991), the Convention on the Rights of the Child (1990), and the International Convention on the Rights of Persons with Disabilities (2010). Addressing the impacts of climate change is necessary to ensure that Nepalese citizens continue to enjoy human rights, and adaptation actions will be guided by these treaties to ensure that the actions appropriately address the needs of children, women, and persons with disabilities.

Nepal adopted the Sendai Framework for Disaster Risk Reduction in 2015 and prepared the National Disaster Risk Reduction Policy and Strategic Plan of Action: 2017-2030. The policy has a vision of a climate-adaptive society; acknowledges the need for an umbrella policy for disaster risk reduction and climate change; and calls for integration of disaster risk reduction and climate change actions, climate adaptive infrastructure, integration of climate adaptation concerns in mega-projects, and development of agriculture and health systems that consider climate adaptation (GoN, 2018b). The strategy calls for a development process that assesses disaster risks and climate risks in an integrated manner, and seeks coherence between DRR and climate adaptation actions in the agriculture, energy, health, and urban and rural development sectors (GoN, 2018a) (Figure 9). Nepal has committed to a range of additional voluntary measures under the Sendai Framework.

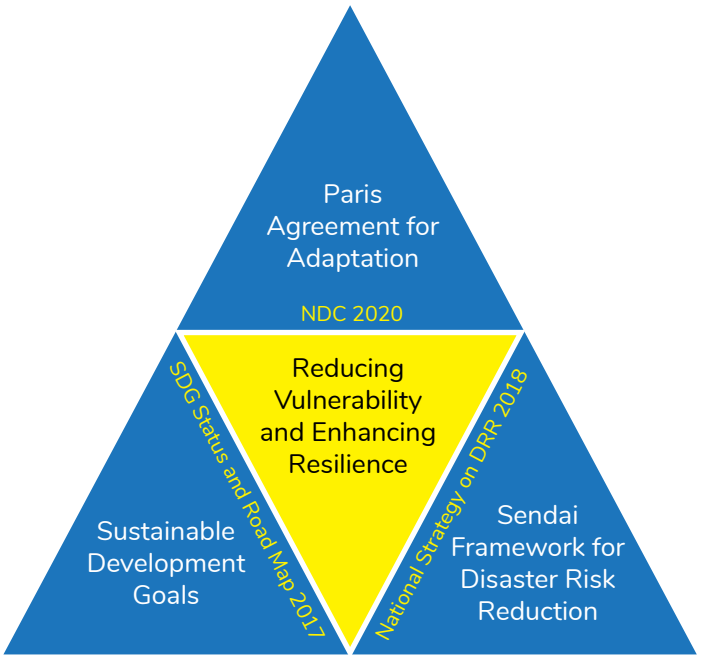


Figure 9: Synergy of adaptation, sustainable development and disaster risk reduction

Nepal is a member of the Regional Consultative Group (RCG) on Humanitarian Civil-Military Coordination for Asia and the Pacific, a regional forum that brings together the humanitarian, civilian and military actors involved in disaster response preparedness planning and disaster response in the region. Nepal served as Chair of the forum in 2020.

Nepal is signatory to the other two Rio conventions, CBD and the UNCCD. The Nepal Biodiversity Strategy and Action Plan (2014-2020) includes a cross-sectoral theme of adaptation and mitigation to address the impacts of climate change. Two identified strategies under this theme are: adaptation to and mitigation of the impacts of climate change on biodiversity, and enhancing the resilience of ecosystems, species and human communities to the climate change impacts (MoFSC, 2014).

5.2.3 NAP Nepal and Associated National Policies, Strategies and Plans

The Nepal NAP document is one major output of the NAP process, and it is informed by a substantive body of research. These technical documents (Annex 1) include the Technology Needs Assessment for Climate Change Adaptation (MoFE, 2021b), the Vulnerability and Risk Assessment and Identifying Adaptation Options: Summary for Policy Makers (MoFE, 2021c), and the adaptation chapter of Nepal's Third National Communication (GoN, 2021). Other government departments have also undertaken adaptation-related research and planning, including the Health-NAP published in 2017 (GoN, 2017a) and substantive adaptation planning in the agriculture sector (FAO, 2021). The NAP process reflects Nepal's commitment to building climate resilience, and is guided by a robust framework of policy, plans, and institutions to address climate change, including climate adaptation. The process is an important element of the overarching institutional and policy framework for climate change and development.

The foundation of the institutional and legal framework for adaptation action is the Constitution of Nepal. Part 1, Article 30 guarantees the fundamental right to live in a clean and healthy environment, which establishes a framework for the country to manage the impacts of climate change (GoN, 2015).

Actions to address adaptation are supportive to the Government of Nepal's 25 Year long-term Vision 2041 for a "Prosperous Nepal, Happy Nepali". Adaptation actions will contribute to the goal of graduation to a middle-income country by 2026 by achieving the SDGs, and to the long-term national strategy "to conserve and utilize natural resources and improve resilience" (NPC, 2019).

The Fifteenth Plan which sets out actions to be taken within the time period to work toward the 2100 goal, includes strategies for macroeconomic, economic, social, and infrastructure sectors, as well as private sector and cooperatives, and democracy and good governance. Crosscutting sectors include climate change, hydrology and meteorology, disaster risk reduction and management, and environment (GoN, 2020a). Actions in the crosscutting climate change sector aim "to contribute to building a sustainable society by augmenting the capacity to adapt to climate change and minimizing its adverse effects"; and will result in the preparation and implementation of local level adaptation measures, at least five major projects that increase capacity to adapt to the adverse effects of climate change, and the provision of climate change education in approximately 90% of schools (NPC, 2019).

Nepal's legal framework guiding adaptation action includes the Environmental Protection Act, 2019, which is a national law that sets out actions to help Nepal, inter alia, "face the challenges posed by climate change" (GoN, 2019a). Chapter 4, "Provisions Relating to Climate Change" mandates that the relevant Ministry will periodically provide information to local communities about climate change impacts; that authorities at national, provincial, and local levels will adopt and implement adaptation plans; and that the government can authorize the adoption of measures, and enact and enforce standards for actions and technologies to address the adverse impacts of climate change (GoN, 2019a).

The National Climate Change Policy, 2019 provides the overarching policy direction for the country and aims "to contribute to the socio-economic prosperity of the nation by building a climate-resilient society" (GoN, 2019c). The policy sets out objectives and priority adaptation actions for each of the eight thematic and four crosscutting areas.

Nepal has submitted 1st and 2nd NDCs to the UNFCCC Secretariat, respectively in 2016 and 2020 (GoN, 2016; GoN, 2020b). Both NDCs included adaptation, and priority thematic and crosscutting areas in the adaptation that are aligned with those in the NCCP 2019. The adaptation section in the 2020 NDC highlights policy priorities out to 2030, including actions and process results to be monitored and tracked. It also notes that Nepal's NAP will outline the country's contribution to meeting the adaptation goals of the Paris Agreement (GoN, 2020b).

Climate adaptation is now mainstreamed in several sectors and components including agriculture, livestock, irrigation, industry, tourism, health, forests, biodiversity, wildlife conservation, urban development, and disaster management. A review is included in Nepal's Third National Communication to the UNFCCC (GoN, 2021). Nepal has already submitted the country's 1st and 2nd national communications respectively in 1999 and 2014.

5.2.4 Existing Institutional Mechanisms for Climate Change Adaptation

Key institutions engaged in the NAP process are briefly described below. Additional information can be found in NAP technical reports.

Overarching coordination

- **Environmental Protection and Climate Change Management National Council** (EPCCMNC) - established by the Environment Protection Act (GoN, 2019a), is chaired by the Prime Minister, with membership comprised of four Ministers, seven Chief Ministers (of all provinces), a representative from the NPC, two professors (at least one women), three experts (at least one woman), and the MoFE Secretary. The Council directs on "integrating the matters relating to the environment and climate change into the long-term policies, plans and programmes"; provides "policy guidance to the Provincial and Local Levels with regard to environmental protection and climate change"; and manages "economic resources for environmental protection and climate change" (GoN, 2019a).
- **Inter-Ministerial Climate Change Coordination Committee** (IMCCCC) - established by the NCCP (2019), is coordinated by MoFE, and chaired by its Secretary with membership comprised of the Joint Secretaries of 22 federal ministries; NPC; representatives of the Nepal Academy of Science and Technology (NAST), National Agriculture Research Council (NARC) and Alternative Energy Promotion Centre (AEPC); and additional members invited at the discretion of MoFE secretary. The Committee is responsible for effective communication and coordination between government and non-governmental institutions.

Federal level

- **Thematic Working Groups (TWGs) and Crosscutting Working Groups (CWGs)** - led by the respective coordinating ministry (Table 7), are responsible for mainstreaming adaptation into sectoral policies, plans, and programmes.
- **Ministry of Forests and Environment (MoFE)** - is responsible for the NAP process and for policies, laws, and standards for climate change; providing guidance and technical support to provincial and local governments; monitoring and evaluation (M&E) of adaptation actions; reporting on adaptation actions on an annual basis; and approval of adaptation projects funded through international sources.
- **Climate Change Management Division (CCMD)** - is responsible for coordination of the NAP process within MoFE and the mainstreaming of adaptation in sectoral, provincial, and local

policies, plans, and programmes; leads development and implementation of the Nepal NAP; leads studies and research on adaptation; reports annually on climate change; serves as the focal point for the UNFCCC; coordinates all climate change-related projects; and provides coordination across working groups.

- **Ministry of Finance** - has established a climate finance unit and serves as the focal point for the Green Climate Fund (GCF) and Global Environmental Facility (GEF); works to increase access to domestic and international financial resources related to adaptation; and helps to coordinate climate finance.
- **Sector Ministries** – are responsible for establishing climate change units to mainstream the NAP (and NDC) in sectoral policies, planning and activities; relevant ministries are responsible for coordinating TWGs and CWGs.
- **National Planning Commission (NPC)** - leads the federal government's planning process and coordinates efforts to achieve the SDGs and the mainstreaming of climate change in these planning processes; ensures that plans and programmes are climate-resilient; and assists MoFE in the M&E of the climate change policy.
- **National Disaster Risk Reduction and Management Authority** - coordinates actions on disaster risk reduction including policies and planning; operationalize the key mandates of Sendai Framework for Disaster Risk Reduction (SFDRR) provision of technical and financial support to provincial and local governments; studies and research; and works for knowledge management.

Provincial level

- **Provincial Climate Change Coordination Committees (PCCCC)** have been established in each of the seven provinces with responsibility to integrate and mainstream climate change adaptation into policies, plans, strategies, programmes, and projects, including vertical linkages with the federal government, integrated approaches across provinces, and coordination of capacity building for provincial governments.
- **Forest, Environment and Climate Change related Ministries** - the focal ministries for climate change affairs at the provincial level are responsible for implementing and coordinating climate adaptation actions; sharing of adaptation information with sector ministries and local governments; and monitoring the implementation of adaptation planning and budgeting. The ministries' Science, Environment and Climate Change Divisions coordinate and support local governments.

Local level

- **Infrastructure and Environment Management Sections** - the units are responsible for facilitating climate change activities, including adaptation; M&E of adaptation action; raising public awareness on adaptation; implementing adaptation projects in areas under local jurisdiction (such as environmental conservation, biodiversity, agriculture and livestock, hydroelectricity, watershed management, and wildlife) and integrating adaptation into local level services (such as health, sanitation, agricultural extension, and drinking water).

5.2.5 Nepal's NAP process

Nepal launched its NAP process in 2015. The NAP process aims to reduce the country's vulnerability to climate change and facilitate the integration of climate change adaptation measures into government policies, programmes, and activities across multiple sectors and the three levels of government (MoPE, 2017a). The NAP process builds on a body of work that began in 2010, when the Government of Nepal prepared its NAPA and began to develop LAPAs to guide implementation of adaptation programmes at the local level. Since 2010, Nepal has made significant progress on integrating climate adaptation in policy and planning, and implementing climate adaptation and climate resilience projects and programmes. This progress includes expanding the priority themes for focused adaptation action from six sectors and two crosscutting priorities set out in the NAPA in 2010, to eight thematic priorities and four cross-cutting priorities in the 2019 National Climate Change Policy (Table 7).

Table 7: Evolution of priority themes for adaptation in Nepal and their alignment with SDGs

NAPA (2010)	NAP process (2015)	National Climate Change Policy (2019)	Alignment with SDGs	Coordinating Ministry
Thematic Sectors				
1. Agriculture and Food Security	1. Agriculture and Food Security	1. Agriculture and Food Security	Goal 1: End poverty. Goal 2: End hunger, achieve food security and improvised nutrition and promote sustainable agriculture. Goal 12: Ensure sustainable consumption and production patterns.	Agriculture and Livestock Development
2. Climate Induced Disaster	2. Climate Induced Disaster	2. Disaster Risk Reduction and Management	Goal 13: Take urgent action to combat climate change and its impacts.	Home Affairs
3. Urban Settlement and Infrastructure	3. Urban Settlement and Infrastructure	3. Urban and Rural Habitats	Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.	Urban Development
4. Public Health	4. Public Health, Sanitation and Hygiene	4. Health, Drinking Water and Sanitation	Goal 3: Ensure healthy lives and promote well-being. Goal 6: Ensure available and sustainable management of water and sanitation.	Health and Population/ Water Supply
5. Forest and Biodiversity	5. Forest and Biodiversity	5. Forest, Biodiversity and Watershed Conservation	Goal 15: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	Forests and Environment
6. Water Resource and Energy	6. Water Resource and Energy	6. Water Resource and Energy	Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all.	Energy, Water Resources, and Irrigation
-	7. Tourism, Natural and Cultural Heritage	7. Tourism, Natural and Cultural Heritage		Culture, Tourism and Civil Aviation

-	-	8. Industry, Transport and Physical Infrastructure	Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.	Physical Infrastructure and Transport/ Industry, Commerce and Supplies
Cross-cutting Sectors				
7. Livelihood and Governance	8. Livelihood and Governance	9. Gender, Equality and Social Inclusion, Livelihood and Good Governance	Goal 5: Achieve gender equality and empower all women and girls. Goal 16: Promote peace and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels. Goal 10: Reduce inequality within and among countries.	Women, Children, and Senior Citizens
8. Gender and Social Inclusion	9. Gender and Social Inclusion			
-	-	10. Awareness Raising and Capacity Development	Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities.	Education, Science, and Technology
-	-	11. Research, Technology Development and Expansion		Forests and Environment
-	-	12. Climate Finance Management	Goal 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.	Finance

Source: Kunwar (2021b).

5.2.6 Procedure of Nepal NAP Preparation

On September 23, 2018 the Government of Nepal and the UN Environment Programme (UNEP) launched the NAP Project – Building Capacity to Advance the NAP Process in Nepal – to build institutional capacity to deal with the adverse impacts of climate change. This was Asia's first GCF-financed NAP project to support multi-sectoral, medium- to long-term adaptation planning and budgeting across sectors in order to advance the country's adaptation planning process. The formulation of Nepal's NAP was supported through this project.

Nepal's NAP process was redefined, contextualized, and advanced through the project. Building on foundational work and research, the process re-established the thematic and cross-cutting working groups as guided by the NCCP, and set up institutional mechanisms at federal (Inter-ministerial Climate Change Coordination Committee) and provincial (Provincial Climate Change Coordination Committee) levels.

The development process of the Nepal NAP followed the UNFCCC LDC Expert Group guidelines and steps that include: A) Laying the groundwork and addressing gaps; and B) Identifying specific needs, options, and priorities. Moving forward on the NAP process will include: C) Developing implementation strategies for the actions; and D) Reporting, monitoring and review (LDC Expert Group, 2012). Adhering to the leave-no-one-behind (LNOB) principle, Nepal NAP process engages multiple stakeholders (Box 5) in identifying the medium- and long-term adaptation needs in the sectors identified by the NCCP. Total 897 participants including 703 male and 194 female from federal to provincial to local level were directly consulted/engaged representing about 168 institutions while formulating the NAP (Annex 2).

Box 5: Development of the Nepal NAP - Stakeholder consultations

The adaptation actions in this NAP were identified through extensive consultations with stakeholders from:

- Thematic Working Groups and Cross-cutting Working Groups
- National government sectoral ministries
- Provincial governments
- Local councils and wards
- Vulnerable groups
- Civil society organizations
- Academia
- Subject experts
- Private sector entities
- Development partners

The methodology to identify and prioritize climate change adaptation actions, projects, and programmes builds on the review of reports prepared during the NAP formulation process (Annex 1, 2). An adaptation appraisal tool that applied multi-criteria analysis was used to prioritize adaptation actions during the coordinators' conclave and write-shop. The approach was built on the experiences of NAPA formulation, and the comparative strength of multi-criteria analysis over other tools. A long list of adaptation actions was developed through review and consultations, and collected from the provinces (Annex 3). The long list of adaptation actions were scored and ranked to identify priority adaptation actions and programmes. Consideration was given to identify specific needs, options, and priorities on a country-driven basis; utilizing the services of national, provincial, local, and community-based entities, where appropriate; and promoting the principles of ecosystem integrity, participatory processes, gender-responsive and socially inclusive processes, and policy coherence. The methodology promoted eco-friendly and nature-based solutions that align with sustainable development objectives and programmes.

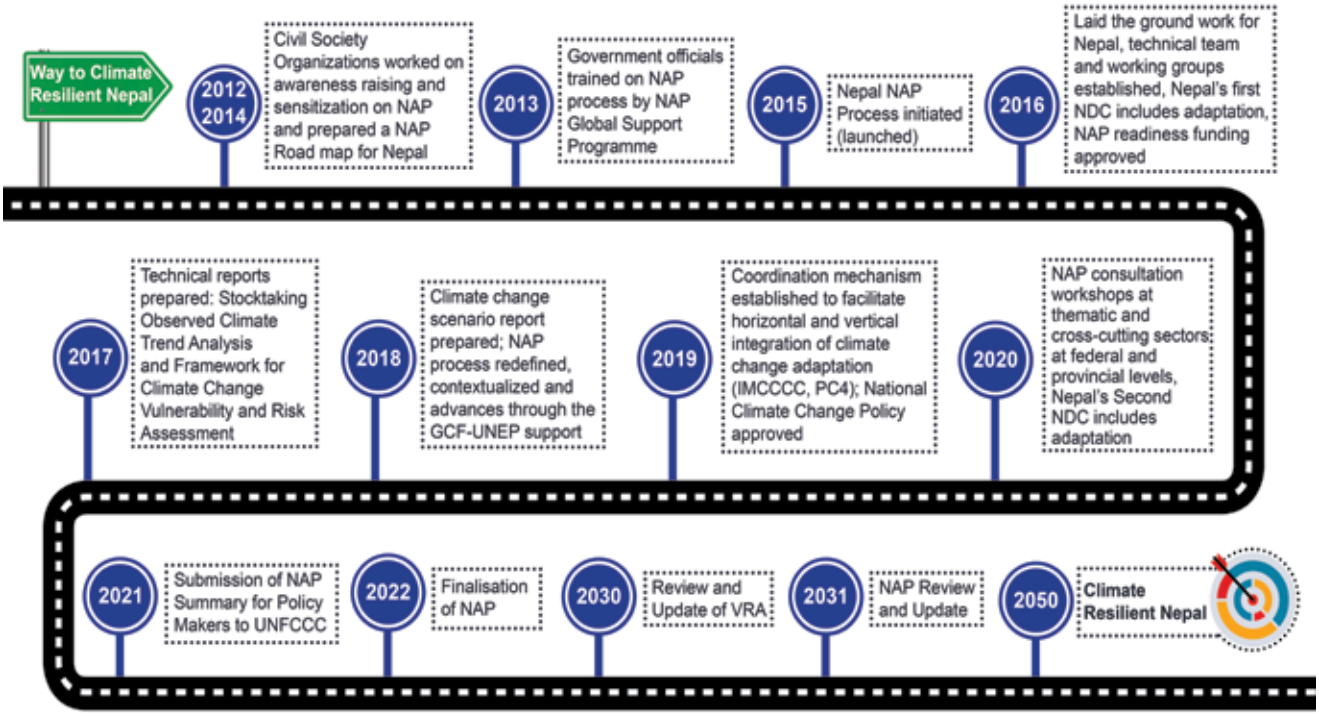


Figure 10: Nepal's NAP process timeline; progress and milestone

The process to formulate the NAP included eight steps, (i) Desk mining and review of literature and documents pertaining to climate change adaptation, (ii) Multi-stakeholder consultations in each province, (iii) Collecting and synthesizing the long list of adaptation actions, (iv) Thematic Working Group coordinators conclave and write-shop with thematic leaders, (v) Roundtable discussion with thematic experts, (vi) Sharing the draft NAP at province-level stakeholders' fora and collecting feedback on the institutional framework and implementation modalities, (vii) Sharing the penultimate draft of the NAP with central level stakeholders for feedback and review, and (viii) NAP finalization and submission (Figure 11).

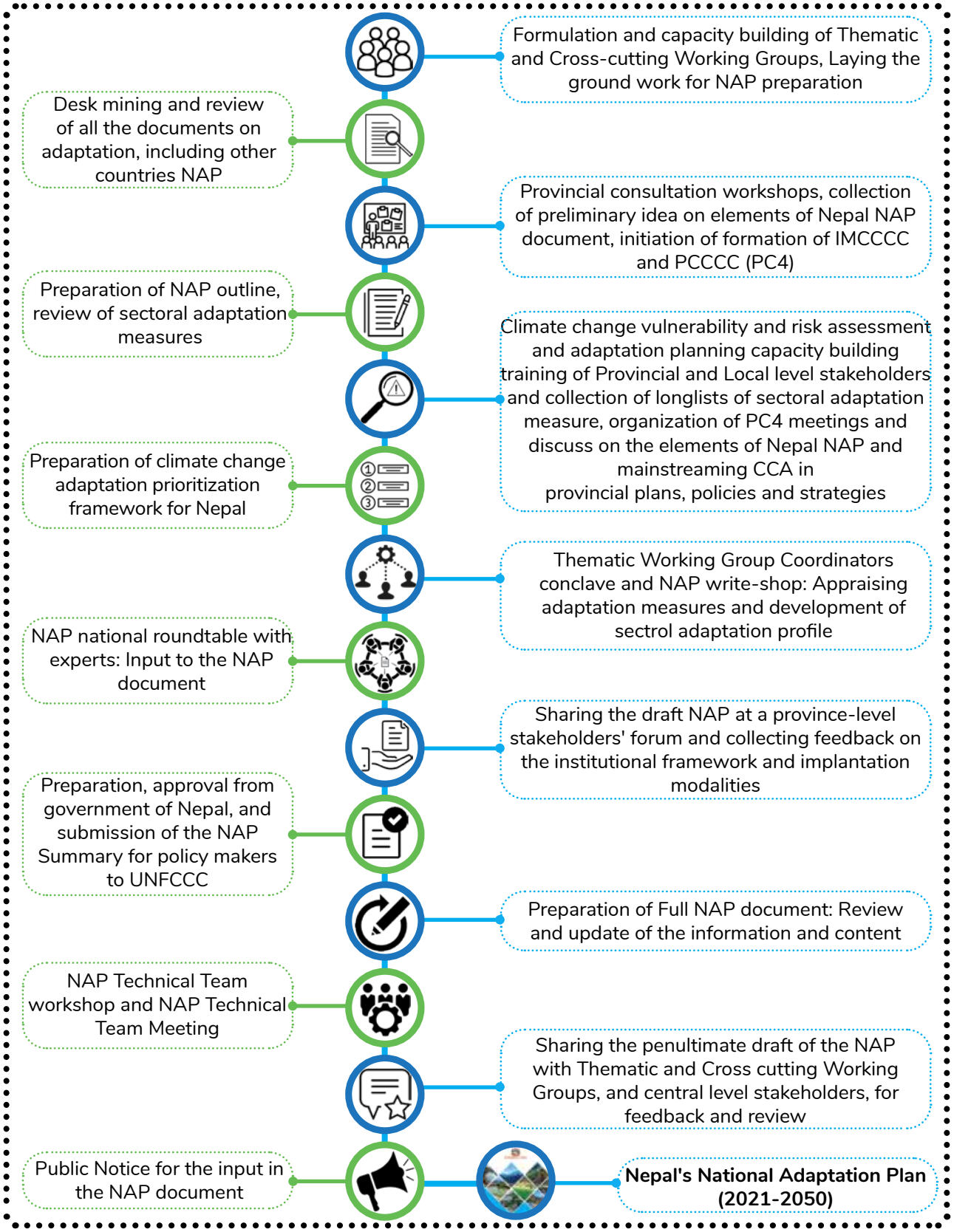


Figure 11: Nepal NAP development process

6. NEPAL NAP: VISION, GOALS, PRINCIPLES AND OUTCOMES

The Nepal NAP aims to achieve the objectives of the NAP process that have been agreed under the UNFCCC. These objectives are:

- To reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience.
- To facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate (UNFCCC, 2012, decision 5/CP.17, paragraph 1).

This NAP has been formulated to adapt to the effects of climate change over the short-term, medium-term, and long-term (until 2050); and will:

- Inform the planning, coordination, and implementation of adaptation actions needed at all levels of government and across society and ecosystems.
- Provide guidance on integrating adaptation considerations into policies, programmes, and activities.

Vision

To contribute to the socio-economic prosperity of the nation by building a climate-resilient society and reducing the risk of climate change impacts on people and ecosystems through the integration of adaptation across sectors and levels of government.

Goals

The over-arching goals are informed by the NCCP (2019), and the Nepal NAP aims to:

- Build the adaptive capacity and resilience of key natural, social, and economic sectors vulnerable to and at risk of climate change, and service providers.
- Integrate climate change issues into policies, strategies, plans, and programmes of all sectors and at local, provincial, and federal levels emphasizing Gender Equality, Social Inclusion, Livelihood and Governance (GESILG) concerns.
- Ensure equitable resource mobilization and distribution of resources for climate change adaptation through national and international financing, research, technology, and extension services related to climate change adaptation.

Principles

The Nepal NAP is guided by the following principles that will help achieve adaptation action that simultaneously advances economic and sustainable development objectives:

- Responsiveness to the actual adaptation needs through the identification of actions that

reduce the adverse impacts of climate change and maximize resilience, informed by a robust body of research and analysis undertaken through the NAP process.

- Policy coherence with:

  -National policies, strategies, plans, development goals, and priorities; and

  -International commitments under the UN conventions including the UNFCCC, Paris Agreement, SDGs, Sendai Framework for Disaster Risk Reduction, UNCCD, and UNCBD.
- Integration of climate change adaptation in the planning, budgeting, and implementation of actions at the three levels of government - federal, provincial, and local.
- Gender responsive and socially inclusive actions to ensure that people of all genders are engaged in all stages of climate adaptation planning, budgeting, implementation, and M&E.
- Multi-stakeholder engagement, coordination, and cooperation to promote transparency, better decision-making, and enhanced implementation of adaptation.
- Ecosystem integrity to maintain naturally biodiverse, healthy, and resilient ecosystems.
- 'Leave-No-One-Behind' through commitment to an inclusive NAP process that prioritizes planning and implementation of adaptation actions by identifying who is left behind, identifying measures to meet their needs, and generating evidence and data to monitor progress.

Implementation Outcomes

The NAP is an overarching strategic instrument that specifies prioritised adaptation programmes in nine themes. Implementation of these priority programmes will support to achieve the goal of the climate change policy of building a climate-resilient society.

Actions to 2030 will lay the foundation for long-term adaptation outcomes, and will result in enhanced adaptation planning capacity and the integration of adaptation across sectors and at all levels of government. Enhanced adaptation planning and implementation of adaptation actions will help to reduce loss and damage due to climate change impacts in key natural, social, and economic sectors.

The establishment and operationalization of early warning systems in the provinces, and climate change data management systems and an adaptation monitoring and review mechanism at the federal level will lay the foundation for implementing the urgent adaptation actions. Improved understanding of climate risk and vulnerability assessments and climate projections will support Nepal's efforts in regard to post-pandemic economic recovery and graduation from LDC status by 2026. Implementation of adaptation actions will support Nepal's efforts to achieve the SDGs and the Sendai Framework for Disaster Risk Reduction.

Building on the outcomes of the short-term adaptation actions, by 2030, Nepal will develop resilient agro-ecosystems for sustainable production, and food sufficiency and nutrition. The actions will help to maintain ecosystem health and functionality; restore critical habitats and protected area networks, implement nature-based solutions, and promote a green and circular economy. The resilience of health, drinking water, and sanitation systems and services will be enhanced for well-being of general public with continuous functionality of water supply and sanitation services. In addition, the resilience of energy systems will be enhanced leading to an uninterrupted supply of electricity that supports the constant operation of industries. Likewise, actions will lead to robust physical infrastructure that can withstand climate change-induced disasters, shocks, and stresses. Implementation of adaptation actions will help to maintain the functionality of key economic sectors including tourism, transport, industry, and agriculture. Climate-sensitive land-use planning and implementation will assist rural and urban settlements to deal with climate impacts. Furthermore, the livelihoods of marginalized and vulnerable people and communities will be diversified and enhanced through GESI-responsive adaptation programmes.

The adaptation actions to 2025 will lay the foundations of a climate-resilient society, while the actions to 2030 will emphasize implementing actions that reduce vulnerability and increase adaptive capacity. A review of the implementation of the NAP will take place in 2031. The results of the review will inform the identification of long-term adaptation programmes that will contribute to the achievement of the national goal of "Prosperous Nepal, Happy Nepali-2043" by building a climate-resilient society and reducing the risk of climate change impacts on people and ecosystems.

7. PRIORITY ADAPTION PROGRAMMES

This section describes the priority programmes in the nine adaptation themes emphasized in Nepal's NCCP (2019) and NDC (2020). The detail methodology of the prioritization of actions is described in Annex 2. A long list of actions (Annex 3) was identified through a review of government documents and stakeholder engagement, including consultations at the provincial level. A prioritization process was undertaken, drawing on the inputs and expertise of the TWGs, to identify the priority actions described in this section. The prioritization process considered actions that are best able to address critical climate vulnerabilities and climate risks in the short-, medium-, and long-term; as well as actions that contribute to the achievement of national economic and development priorities.

7.1 Agriculture and Food Security (AFS)

The existing Constitution of Nepal guarantees the right to food and identifies increasing investment in the agricultural sector as a basic need. The Constitution includes policy statements about the need for agriculture and land reform in order to modernize the sector and increase productivity. The Constitution promotes the development of a sustainable and dependable irrigation system, and increasing investment in the sector to ensure sustainable food productivity that suits soil and climate conditions (GoN, 2015). In line with these national aspirations, the Fifteenth Plan aims to "achieve inclusive and sustainable economic growth through the transformation of the agriculture sector into a competitive, climate-resilient, self-reliant, and export-oriented industry" (GoN, 2020a).

The agriculture sector - including crops, livestock, and fisheries – is a major economic sector in Nepal, being a main source of incomes and livelihoods in rural areas and providing important revenues through agricultural exports. The sector contributed about 27.65% of Nepal's GDP in 2019/20 (Nepal Rastra Bank, 2020), and about 66% of the country's population worked in the agricultural sector in that same year (GoN, 2021). Increasing agricultural productivity in a changing climate is critical to achieving national agriculture and food security goals, including modernizing the sector, increasing smallholder productivity, and ensuring adequate and affordable food.

Climate change has the potential to hinder the achievement of national goals by negatively impacting agricultural production and nutrition security. Rising temperatures, changes in precipitation, and increases in the occurrence of extreme weather events have negatively impacted productivity in the agriculture sector. The sector is vulnerable to climate impacts because of a high reliance on small-scale, rain-fed agriculture and dry land farming (Paudel, 2016). Climate change impacts livestock production. Increased incidence of livestock diseases and pests, depleted grass and feed, heat stress, appetite loss and reduced milk production, and death of animals are some

of the evidenced impacts on livestock production systems (Shrestha & Baral, 2018). Temperature increase has reduced the productivity of freshwater aquaculture, thereby negatively impacting fishing communities (Wagle et al., 2011). The MoFE (2021c) reported that climate change was responsible for 10% to 30% of production losses in the agriculture sector (crops, livestock, and fisheries combined); drought being the most serious hazard responsible for the losses. The direct economic cost of climate vulnerability in the agriculture sector in 2020 was equivalent to 1.5% to 2% of the country's GDP (MoFE, 2021b).

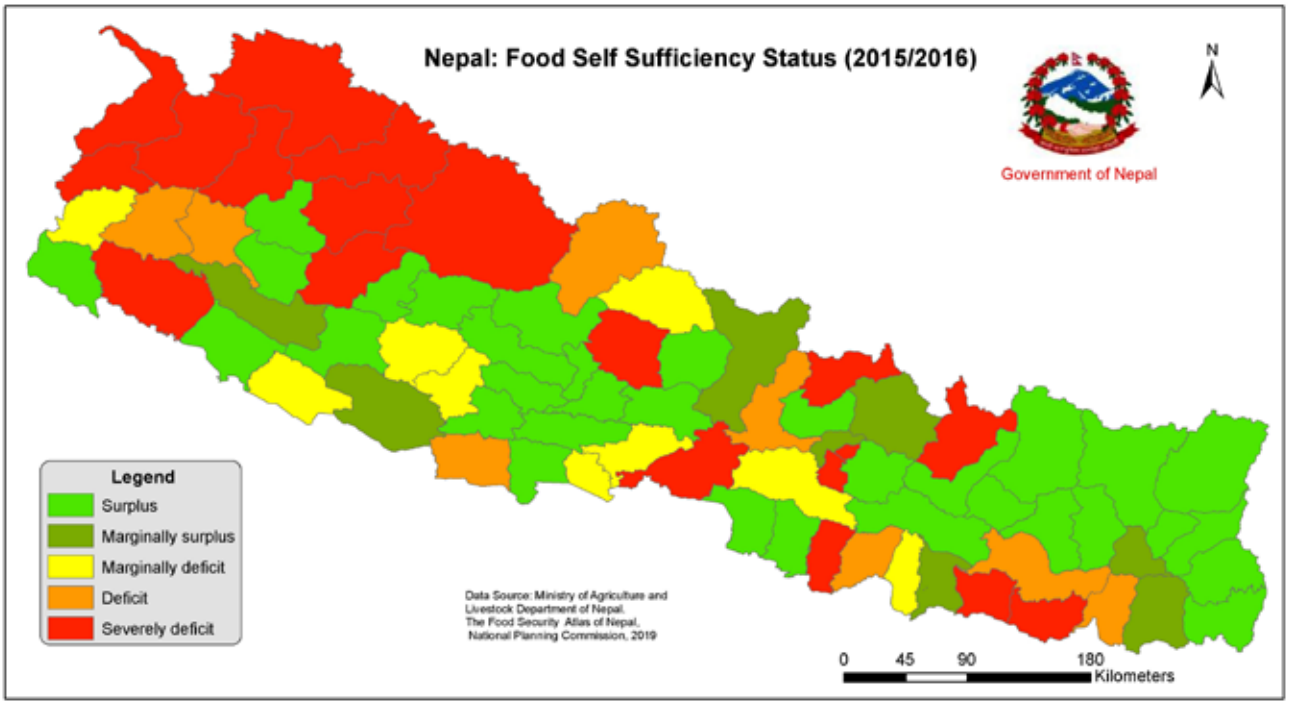


Figure 12: Map showing food insecure areas, 2015/2016

Future climate change is expected to continue to impact agricultural productivity particularly in higher elevation areas (Figure 12). The Ministry of Agriculture and Livestock Development (MoALD, 2019a) identified that the most severe climate impacts on agriculture and food security will be "the loss of already limited arable land from flash floods and landslides, accelerated soil degradation and loss of soil fertility, outbreaks of new pests and diseases, shortages of water for crop production and uncertainty of precipitation that will directly affect rain-fed agriculture, particularly in the mountains."

Climate vulnerability in the sector results from a high reliance on rain-fed agriculture; fragmentation of arable lands; limited access to agricultural extension services; high levels of poverty among farmers; limited resources; and lack of access to markets, loans, insurance, and technology (FAO, 2021). Most farmers are ill equipped to cope with climate change because they have limited technical knowledge of the impacts of climate change and lack knowledge of adaptation measures and practices (MoALD, 2019a). Women-headed households are highly dependent on subsistence level agriculture and remittances from men.

A total of nine priority adaptation programmes with a budget of USD 11.2 billion to 2050 are included in the Agriculture and Food Security sector. Implementation of these programmes will help transform the agriculture sector by building the resilience of agroecological systems through the enhancement of agricultural productivity, preserving genetic resources, building national capacities and information systems, adopting clean energy, and introducing peasant-friendly climate induced risk-sharing models.

1: National Capacity Building of Agriculture and Livestock Institutions on Climate Change Adaptation Research, Planning and Implementation	2030

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Food Safety Policy 2019, Agro-biodiversity Policy 2007, Gender and Social Inclusion Strategy and Action Plan on Climate Change 2020-2030, Agriculture Development Strategy 2015-2035, Sustainable Development Goals: Status and Roadmap 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Reduced crop productivity and production associated with heat and drought stress, extreme precipitation and inundation, flooding and landslides, hailstorms, and snowstorms. Risk of crop failure, risk of limited food access and quality.

Objectives:

1. To enhance the capacity of agriculture and livestock technicians to understand climate and climate change associated risks and vulnerabilities.
2. To strengthen the adaptive capacity of local agriculture-based institutions to address climate risks.

Expected Outcomes:

1. By 2030, at least 70% of 753 local levels institutional capacity on climate adaptation planning, implementation, and M&E increased.
2. By 2030, at least 70% of Agriculture Knowledge Centers and Veterinary Hospital and Livestock Service Expert Centers' institutional capacity on climate change adaptation planning, implementation, and M&E increased.
3. By 2030, increased capacity of agriculture and livestock institutions at federal and provinces on climate adaptation planning, implementation, and M&E.

Impact: Climate risks in the agriculture sector reduced through enhanced institutional capacity.

Summary of Actions:

1. Develop capacity building package on climate vulnerability and risk assessment, and adaptation planning in agriculture and livestock sector.
2. Provide climate change capacity building training to agriculture and livestock technicians at all tiers of governments.
3. Provide technical support on the assessment of climate change vulnerabilities and risks in the agriculture and livestock sector to revitalize Agricultural Cooperatives.
4. Promote Information and Communication Technology (ICT) service on climate change risk to agriculture and livestock service providers, farmers, and other related stakeholders.
5. Introduce and promote Weather Index-based Risk Transfer Services (insurance).
6. Strengthen the service delivery capacity of provincial plant protection, seed, and soil testing laboratories of priority municipalities to improve their ability to consider climate vulnerabilities and risks.
7. Develop a catalogue of low cost, climate-resilient as well as locally adaptive technologies and practices, and promote their adoption through strengthening farmer's field schools.
8. Establish Agriculture Adaptation Learning and Sharing Platforms at municipality level in each ecological zone.
9. Promote knowledge development and transfer across agroecological zones through Agriculture Adaptation Learning Platforms and farmers field schools.
10. Establish agriculture volunteers at the local government level to support agriculture and livestock extension services.

Scope: Capacity Building, Technology Development and ICT

Duration/Timeframe:	**Targeted Community/Beneficiaries:** Service delivery personnel/agriculture and livestock technicians; Farmers and farmer's institutions (cooperatives), Government institutions that provide agriculture and livestock services.
10 years	

Geographic Coverage: National	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Ministry of Land Management, Agriculture and Cooperative (Province), Ministry of Federal Affairs and General Administration, Development Partners, NGO/INGOs

2: Strengthening Climate Services and Agriculture Information System	**2030**
Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Agriculture Development Strategy 2015, National Agriculture Policy 2004, National Climate Change Policy 2019, Second Nationally Determined Contribution 2020	
Climate Risks and Vulnerabilities Addressed by the Actions: • Reduced crop productivity and production associated with heat and drought stress, extreme precipitation and inundation, flooding and landslides, hailstorms and snowstorms. Risk of crop failure, risk of limited food access and quality.	
Objectives: **1.** To establish and operationalize early warning systems and localized weather stations for precise climate services. **2.** To provide a package of climate services (weather information, soil moisture condition, incidence of extreme events, etc.) directly to the farming communities. **3.** To provide timely and accurate information regarding agriculture services.	**Expected Outcomes:** 1. By 2030, 50% additional smallholders received timely and reliable package of climate and agro-advisory services. 2. By 2030, 50% crop production increased through reliable climate services and agriculture information. **Impact:** Livelihoods enhanced thorough ensured food security.
Summary of Actions: 1. Establish agro-meteorological weather station networks at the local government level to address the prevailing weather-related data gap. 2. Establish community-based early warning systems. 3. Develop models and strengthen forecasting systems (floods, drought, dry spells, erratic rainfall). 4. Establish crop growth forecasting mapping and yield prediction through the use of integrated crop modeling – remote sensing – artificial intelligence – statistical tools and technologies and disseminate information to concerned stakeholders and farmers. 5. Capacitate the local communities/farming systems for improved monitoring of localized weather stations, interpretation of climate services, and development of contingency plans. 6. Develop a catalogue and promote gender friendly agriculture tools and techniques. 7. Simulate cropping system under different water and nitrogen regimes.	
Scope: Research and Innovation, Technology Development and Information, Physical Infrastructure, Capacity Building	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Farmers and other agriculture stakeholders
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Ministry of Land Management, Agriculture and Cooperatives, Department of Hydrology and Meteorology, Nepal Agriculture Research Center, Agriculture Cooperatives, Development Partners, NGOs/INGOs

3: Integrated Soil and Nutrient Management for Resilient Agriculture	2030
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, National Land Use Policy 2015, National Land Use Act 2019, National Fertilizer Policy 2009, National Food Safety Policy 2019, Second Nationally Determined Contribution 2020	
Climate Risks and Vulnerabilities Addressed by the Action: Moisture loss, nutrient loss due to different extreme events such as flooding, landslides, dry-spells, drought, and soil erosion.	
Objectives: **1.** To increase productivity by improving soil fertility through adaptive agriculture interventions. **2.** To improve soil nutrient to increase agriculture production by quality and quantity.	**Expected Outcome:** 1. By 2030, Soil Organic Matter increased to 3.95% in reference to that of 2021. **Impact:** Enhanced resilience to climate risks in agriculture sector.
Summary of Actions: 1. Build capacity on and promote composting and farmyard management at local level. 2. Promote Integrated Plant Nutrient Management Systems through field school at municipalities. 3. Promote sloping agriculture land technology (SALT) in hilly areas. 4. Promote conservation agriculture practices: minimum tillage, counter farming, hedgerow promotion, intercropping. Promote legume integration and crop rotation in farming systems. 5. Promote sustainable crop production system through organic agriculture practices and permaculture. 6. Develop a catalogue on Good Agriculture Practices (GAP) and Local Learning's on Soil Nutrient Management in three ecological regions and provide support to implement GAP. 7. Conduct soil nutrient mapping in agroecological zones to support soil nutrient management. 8. Scale up green manure across different physiographic regions. 9. Establish organic and biofertilizers plants in two provinces. 10. Manage biogas slurry to sustain soil fertility. 11. Develop model villages at three ecological zones with all above interventions.	
Scope: Capacity Building, Technology development and Information (ICT), Physical Infrastructure, Research and Innovation	
Geographic Coverage: All ecological regions (300 Municipalities)	**Targeted Community/Beneficiaries:** Farming Communities
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 1,200 million (USD 100,000/Municipality/ year for 10 years) (USD 100,000/plant establishment @two provinces)	**Supporting Agency/Institutions/Groups:** Ministry of Land Management, Agriculture and Cooperative (Province), Development Partners, NGOs/INGOs

<table>
<tr><th colspan="2">4: Enhancing Agriculture Productivity through Building Climate-Resilient Water Management Systems</th><th>2035, 2050</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, Irrigation Policy 2013, Agricultural Development Strategy 2015-2035, National Agriculture Policy 2004</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:
Productivity loss and reduced production due to an increase in extreme events (floods, dry spells, landslides, drought, infestation of pest and diseases).</td></tr>
<tr><td>Objectives:
1. To improve irrigation facilities.
2. To increase the coverage of irrigated area through efficient water use technologies</td><td colspan="2">Expected Outcome:
1. Crop intensity or crop diversity increased by 100% in 2035 and food crop production increased by 20% in 2050 through climate resilient irrigation system.
Impacts:
Food security increased through climate-resilient water management systems.</td></tr>
<tr><td colspan="3">Summary of Actions:
1. Develop and promote efficient water use technology and practices.
2. Promote snow/frost-harvesting, rainwater harvesting initiatives in high hills and mountains.
3. Adopt water saving adaptation technologies in the Tarai: micro irrigation (sprinkler, drip, sub surface, shallow tube-well).
4. Upscale the successful solar powered irrigation systems.
5. Conserve existing and traditional waterspouts, springs, ponds and irrigation measures (Kulesa, Paini maintenance).
6. Increase multiple uses of water systems (drinking, kitchen, gardening, integrated aquaculture and irrigation).
7. Promote water saving crop production technologies: systems of rice intensification, direct seeded rice, and alternate wetting and drying in strategic locations.
8. Adopt and promote stress tolerant and climate resilient crops and varieties.</td></tr>
<tr><td colspan="3">Scope: Technology Development and Information, Physical Infrastructure, Research and Innovation, Capacity Building</td></tr>
<tr><td>Geographic Coverage:
All ecological regions (150 at-risk municipalities by 2035 and 300 at-risk municipalities by 2050).</td><td colspan="2">Targeted Community/Beneficiaries: All rural, marginal, and commercial farmers</td></tr>
<tr><td>Duration/Timeframe:
25 years</td><td colspan="2">Lead Institution: Ministry of Agriculture and Livestock Development</td></tr>
<tr><td>Total Cost:
USD 1,500 million</td><td colspan="2">Supporting Agency/Institutions/Groups: Nepal Agriculture Research Council, Development Partners, I/NGOs</td></tr>
</table>

5: Genetic Resource Conservation and Development Programme for Climate-Resilient Agriculture in Nepal	2030, 2035, 2045

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Agriculture Development Strategy 2015-2035, National Agriculture Policy 2004, Agro-biodiversity Policy 2013, Multisector Nutrition Plan 2018-2022, National Climate Change Policy 2019

Climate Risks and Vulnerabilities Addressed by the Actions:

Genetic loss due to an increase in climate extreme events such as dry spells, floods, cold waves, and pests and diseases.

Objectives:

1. To strengthen the national gene bank to conserve landraces and improved animal breeds.
2. To strengthen biotechnology laboratories to develop climate-resilient crop varieties.
3. To strengthen and establish community seed banks and seed storage facilities.

Expected Outcomes:

1. By 2035, at least five climate-stress crop varieties and animal breeds developed and they will be tested/extended/farmed by 2040.
2. By 2030, seed multiplication centers and animal breed centers strengthened and established in each Province.
3. 30% of farm families provided with seed storage bags/ containers by 2030, 50% by 2035, and 100% by 2045.
4. By 2030, Community Seed Banks established at 40% of local levels.

Impact:

Conservation, expansion, and sustainable utilization of resilient genetic resources for improved food and nutritional security.

Summary of Actions:

1. Collect local and indigenous species and landraces of crops and animals and store them in community seed and gene bank for dissemination and conservation.
2. Develop climate stress tolerant varieties and breeds.
3. Produce and disseminate climate-resilient crops and breeds.
4. Establish seed storage facilities (super grain bags, seed bunker) at municipalities for food security.
5. Establish seed gene store (seed vault) in the high altitude areas.

Scope: Research, Technology Development and Transfer, Food Security and Nutrition

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Farming communities and agriculture stakeholders
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Provincial and local governments, Nepal Agriculture Research Center, I/NGOs, farmers cooperatives, private seed companies, academic institutions

6: Programme on Sustainable Agriculture, Food and Nutrition Security and Climate-Resilient Health and Hygiene	2030, 2040, 2050
Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Agriculture Development Strategy 2015, National Agriculture Policy 2004, Agro-biodiversity Policy 2013, Multisector Nutrition Plan 2018-2022, National Climate Change Policy 2019	
Climate Risks and Vulnerabilities Addressed by the Actions: Compromised health and nutrition due to reduced crop productivity and production associated with heat and drought stress, extreme precipitation and inundation, flooding and landslides, hailstorms and snowstorms.	
Objectives: 1. To promote nutrition security for healthier livelihoods. 2. To increase crop production through identification and adoption of good, climate-resilient, and sustainable agriculture practices. 3. To develop and promote disease/insect/pest management technologies.	**Expected Outcomes:** 1. Food availability and nutrition security ensured in food deficient hill and mountain districts by 2030 and all districts by 2040. 2. By 2035, health status improved through increased food availability, quality and nutrition regime. 3. Increased practices of sustainable and organic agriculture by 50% in 2045, and by 100% in 2050. **Impact:** Improved quantity, quality and availability of food, nutrition and health.
Summary of Actions: 1. Promote suitable climate-resilient agriculture crops across agroecological zones. 2. Cultivate perennial crops in sloped areas. 3. Conduct monitoring and research of fungal, bacterial, viral and nematological diseases of major agricultural commodities. 4. Promote biocontrol agents to address plant and animal diseases and pests. 5. Identify, explore, and promote effective and sustainable disease management technologies. 6. Establish food storage facilities in each of the food deficient districts. 7. Promote healthy consumption and dietary practices in food deficient districts and municipalities.	
Scope: Research, Technology Development and Transfer, Physical Infrastructure	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Farming communities and farmers and agriculture stakeholders
Duration/Timeframe: 30 years	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 2,000 million	**Supporting Agency/Institutions/Groups:** Provincial and local governments, NARC, I/NGOs, farmers cooperatives

<table>
<tr><th colspan="2">7: Commercial Animal Husbandry for Climate-Resilient Rural Livelihoods (753 Model Demonstration Project)</th><th>2030, 2035</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Agriculture Development Strategy 2015, National Agriculture Policy 2004, Agro-biodiversity Policy 2013, National Climate Change Policy 2019</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:
Reduced livestock productivity associated with heat and drought stress, extreme precipitation and inundation, flooding and landslides, hailstorm and snowstorm, pest and diseases</td></tr>
<tr><td colspan="2">Objectives:
1. To develop climate-resilient breeds through exploration of local and indigenous landraces, varieties and cultivars.
2. To diversify rural livelihoods and increase income through commercial and integrated livestock programmes.
3. To promote a circular economy for resilient rural livelihoods.</td><td>Expected Outcome:
1. Commercial/circular economy approach and local/indigenous/wild relatives are promoted to build climate-resilient rural livelihoods at 50% local levels in 2030 and all 753 local levels in 2035.
Impact:
Enhanced local economies through resilient livelihoods.</td></tr>
<tr><td colspan="3">Summary of Actions:
1. Construct climate-resilient sheds for model commercial livestock farming communities in three eco-regions.
2. Develop and promote livestock and agriculture insurance schemes targeting both peasants and large-scale commercial farmers, and extend value chains and market access for rural agri-livestock products.
3. Promote nutritious fodder/grass species and introduce improved animal breeds model demonstration.
4. Promote integrated farming practices (apiculture, sericulture, aquaculture, agriculture, horticulture, piggeries, poultry, goat farming, agroforestry).
5. Explore and conserve local and indigenous species, landraces, varieties, cultivars, breeds and their wild relative for developing climate-resilient types.</td></tr>
<tr><td colspan="3">Scope: Research and Innovation, Technology Development and Transfer, Physical Infrastructure</td></tr>
<tr><td>Geographic Coverage:
National</td><td colspan="2">Targeted Community/Beneficiaries: Farming communities and farmers, livestock rearing communities</td></tr>
<tr><td>Duration/Timeframe:
15 years</td><td colspan="2">Lead Institution: Ministry of Agriculture and Livestock Development</td></tr>
<tr><td>Total Cost:
USD 2,000 million</td><td colspan="2">Supporting Agency/Institutions/Groups: Provincial and local governments, NARC, farmers cooperatives, private seed companies, academic institutions, I/NGOs</td></tr>
</table>

8: Development of Insurance, and Community and Peasant-Friendly Climate Induced Risk Sharing Model and Expansion in both Agriculture and Livestock	2030, 2035, 2040

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Agriculture Development Strategy 2015, National Agriculture Policy 2004, Agro-biodiversity Policy 2013, Multisector Nutrition Plan 2018-2022, National Climate Change Policy 2019, Second Nationally Determined Contribution 2020

Climate Risks and Vulnerabilities Addressed by the Actions:

Loss of production due to climate extreme events: drought, floods, landslides, cold waves, pests and diseases.

Objectives:

1. To build the capacity of local peasants and local governments to cope with climate risks.
2. To create an enabling environment for the promotion and expansion of a climate induced risk-sharing model.

Expected Outcomes:

1. Climate risk sharing model developed and used by 60% farmers of all municipalities by 2030, 80% by 2035 and 100% by 2040.
2. 80% of the local governments and farmers' associations have increased awareness of climate risks and vulnerabilities and adaptation strategies in the agriculture and livestock sector by 2030 and 100% by 2035.
3. Innovative insurance and financing strategies for private sector engagement in the agriculture sector developed and promoted by 50% of local levels in 2030, 80% in 2035 and 100% in 2040.

Impact:

Agriculture production insured against losses due to climate-related risks.

Summary of Actions:

1. Develop and conduct capacity building packages on climate risk and vulnerability and adaptation strategies for local peasants, 753 local governments and private sector entities involved in agriculture.
2. Develop guidelines on climate risk sharing modules for agriculture and livestock.
3. Develop and implement innovative climate financing mechanisms for climate-resilient agriculture practices.

Scope: Capacity Building, Research, Technology Development and Transfer

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Farming communities and farmers, agriculture and livestock private sectors, insurance providers
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Provincial and local governments, NARC, farmer cooperatives, national commercial banks, National Insurance Companies, I/NGOs

9: Climate Smart Collective Agriculture Promotion in Hills and Mountains	2030, 2050

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Agriculture Development Strategy 2015-2035, National Agriculture Policy 2004, Agro-biodiversity Policy 2013, Multisector Nutrition Plan 2018-2022, National Climate Change Policy 2019

Climate Risks and Vulnerabilities addressed by the actions:
Reduced crop production in hills and mountains due to extreme events, increased risk of food insecurity.

Objectives:

1. To explore, assess, and promote climate-smart agriculture technology.
2. To increase crop production and benefits to farmers through collective farming.

Expected Outcomes:

1. 7 collective farming models developed in the hills and mountains by 2030, 300 by 2035, 500 by 2040 and 753 by 2045.
2. By 2030, climate-smart agriculture technology innovation and promotion system established and operationalized.

Impact:

Increased food production and reduced poverty.

Summary of Actions:

1. Establish, promote, and expand agriculture cooperatives.
2. Identify agro-ecological zones and establish collective farming through forming agriculture cooperatives.
3. Delineate pocket areas for agriculture commodities and products and expand collective farming in each of the specialized areas.
4. Establish community agriculture learning centers in each of the local levels.
5. Promote climate-smart agriculture practices (organic agriculture, permaculture, climate smart farm/ village, hydroponics, apiculture, etc.).
6. Use and promote biological pest management approach, biofencing, green manuring.
7. Develop and implement a strategy for reducing land fragmentation of farmlands/agriculture lands.
8. Promote snow harvesting and cloud forest practices in high mountains.
9. Establish and strengthen community seed banks for promoting local, native and indigenous varieties, crops and landraces.

Scope: Research, Technology Development and Transfer

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Farming communities, agriculture stakeholders, agriculture enterprises
Duration/Timeframe: 30 Years	**Lead Institution:** Ministry of Agriculture and Livestock Development
Total Cost: USD 2,000 million	**Supporting Agency/Institutions/Groups:** Provincial and local governments, farmers cooperatives, private seed companies, academic institutions, I/NGOs

7.2 Forests, Biodiversity and Watershed Conservation (FBWC)

Sustainable management of forests, protection of biodiversity, and conservation of watersheds are priorities in Nepal. The Constitution of Nepal directs the State to pursue a policy of sustainable use of biodiversity through the conservation and management of forests, as well as to pursue a policy to keep necessary landmass as forest area (GoN, 2015). The Fifteenth Plan (Fiscal Year 2019/20 - 2023/24) notes that forests, biodiversity, and watersheds are directly linked to livelihoods, and the sustainable management of these areas can make significant contributions to Nepal's prosperity (GoN, 2020a).

The National Forest Policy and the National Agroforestry Policy identify forests and trees as extremely important for adaptation, and the policies place a strong emphasis on local and landscape-scale action to build climate resilience (GoN, 2019b). The Forestry Sector Strategy aims to make forests, biodiversity, plant resources, wildlife, watersheds, and other eco-systems and their communities resilient to climate change (MoFSC, 2016). The National Biodiversity Strategy and Action Plan (2014-2020) promotes climate-resilient approaches for ecosystems and biodiversity management, including assessing the vulnerability of species and ecosystems to the impacts of climate change (MoFSC, 2014).

The forest area in Nepal increased from 39.6% of total area of the country in 1987/88 to 44.74% in 2019/20 (NPC, 2020b). The increase was a result of forest protection programmes, migration from rural areas, and active participation of the community in the protection of forests (NPC, 2020b). Forests offer water catchments, biodiversity, and conservation functions; and are home to forest resource users and provide goods and services that support the livelihoods of communities. Forests provide wood fuel as an energy source, timber for building construction and furnishings, medicinal and aromatic plants, fodder for livestock, and water for multiple purposes. Forests are also a major destination for ecotourism. Forests underpin the livelihoods of rural people in Nepal, with about 80% of rural householders deriving some or their entire livelihoods from the forestry sector (MoFSC, 2015). About 51% of Nepali households use fuelwood as their main source of energy (CBS, 2021). The forestry sector provided average annual revenue of about NPR 550 million (US$ 5.4 million) to the national economy in 2013 (Subedi, 2014).

Climate change has impacted forests and ecosystems in the Himalayas, mountains, hills, lowland Tarai and fragile Chure- Siwalik (MoFE, 2021c). Local livelihood have been negatively impacted by changes in the availability and regeneration pattern of forests and non-timber forest products, which has contributed to a decline in the productivity of some economically viable forest products such as medicinal plants, herbal products, fruits, mushrooms, rattan, and bamboo (GoN, 2021). Climate change has intensified dryness, which has contributed to an increase in the number of forest fires and the area burned.

Future climate change will continue to degrade, damage, and transform forest areas in Nepal, including a large span of mountainous and hilly physiography that is vulnerable to climate change (Chitale et al., 2018). These changes in forest distribution and composition will adversely affect ecosystem services, biodiversity, watersheds and protected areas. Currently, the country has 23.39% of area covered by protected areas that comprise 12 national parks, one wildlife reserve, one hunting reserve, six conservation areas, and 13 buffer zones (Figure 13). Protected areas should be able to maintain a long-term dynamics of biodiversity change (Pressey et al., 2007). Other negative impacts are expected to include reduced access to forest products that include food, household energy (fuelwood), and water (MoPE, 2017b). A decrease in the availability of non-timber forest products will impact the communities that are dependent on these resources for their livelihoods (Kunwar, 2006). In addition, a large proportion of forest species are at increased risk of extinction (IPCC, 2014).

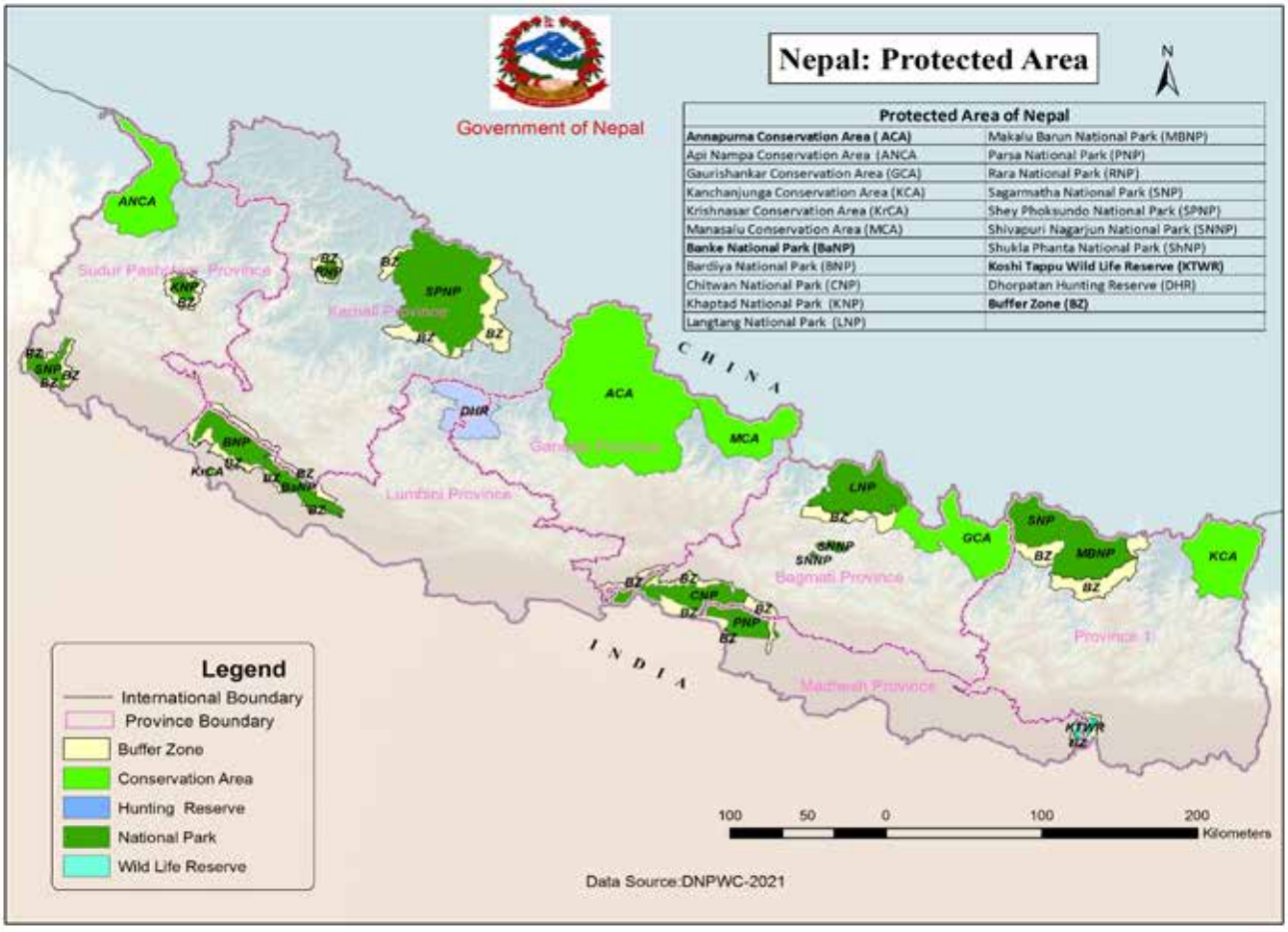


Figure 13: Protected area map of Nepal

Women are particularly vulnerable to the impacts of climate change in the forestry sector because they play a major role in the collection of various forest products and are considered the primary users of forests in Nepal (IUCN, 2020). Poor Dalits, because of poverty and caste-based discrimination are more vulnerable (MoFSC, 2015). Forests under community-based management made up 42.7% of the forest areas in Nepal in 2019 (NPC, 2020b) meaning that these groups have an important role to play in mainstreaming adaptation in forest management plans. Success will require focused interventions that recognize the important role of women as primary land, water, and natural resource managers (IUCN, 2020).

The 11 priority adaptation programmes in the forests, biodiversity and watershed conservation sector contribute to the development of climate-resilient ecosystems; the sustainable management and conservation of forests, eco-systems and watersheds; enhanced food and water security; enhanced hydrological ecosystem services such as regulation of rain and storm water; improved livelihoods of forest communities; healthy wildlife populations and viable tourism operations; and improved opportunities for non-timber forest products. The estimated budget for the 11 priority programmes is USD 8.7 billion to 2050.

10: Forests Fire Preparedness, Prevention and Control	2030, 2035
Alignment with/Contribution to National Development Goals: Forest Act 2019, National Forest Policy 2019, 15th Plan (2019/20-2023/24), Second Nationally Determined Contribution 2020, National Climate Change Policy 2019.	
Climate Risks and Vulnerabilities Addressed by the Actions: Increased incidence of forest fires associated with extreme temperatures that lead to dry spells, drought and heat waves	
Objectives: **1.** To prevent and manage forest fires through implementation of an enabling policy. **2.** To capacitate forest-based institutions through technology development and transfer. **3.** To build resilience of forest ecosystems, biodiversity and rural livelihoods.	**Expected Outcomes:** 1. By 2030, 50% of fire incidence is reduced. 2. By 2035, 80% of forest ecosystems and biodiversity loss caused by forest fires is reduced. **Impact:** * Improved health of forest ecosystems. * Increased capability of forest-based institutions and communities to respond to forest fires in the immediate and long-terms.
Summary of Actions: 1. Revise and formulate the forest fire management strategy and action plan for the Federal and Provincial levels. 2. Establish real time forest fire early warning systems throughout the country. 3. Map and assess forest fire climate risk districts. 4. Establish and capacitate Joint Rapid Response Teams that include security forces and communities for districts at high risk of forest fires. 5. Conduct forest fuel management activities (early controlled burning, weeding). 6. Construct and manage forest fire lines in Tarai, Chure foothills, and mid-hills. 7. Develop communication, education, participation and awareness materials for wider outreach and dissemination. 8. Develop insurance packages for forest fire responders. 9. Capacitate Division Forest Offices and other forest-focused institutions with firefighting equipment.	
Scope: Policy Law and Regulation, Capacity Building, Technology Development and Information, Physical Infrastructure, Research and Innovation	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** 50 Forest Division Offices, 2,500 forest dependent communities, protected areas of Tarai and Mid-hills
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Department of Hydrology and Meteorology, Provincial and Local Governments, Division Forest Offices, Forest Users' Committee, I/NGOs, CBOs, User Groups

11: Karnali Watershed Management Programme for Reducing Climate Risks and Vulnerabilities and Promoting Irrigation Facilities in the Downstream	2030, 2035, 2040
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), Second Nationally Determined Contribution 2020, Land Use Policy 2015	
Climate Risks and Vulnerabilities Addressed by the Actions: Flood incidence and riverbank erosion.	
Objectives: 1. To build resilience to climate vulnerabilities and risks of the Karnali watershed community and people. 2. To conserve river- and forest-based watersheds and water resources and enhance the water availability and reliability. 3. To promote upstream- downstream linkages to reduce downstream climate risk. 4. To enhance adaptive capacity of Indigenous Peoples (IPs) and local communities (LCs) and engage them in watershed conservation.	**Expected Outcomes:** 1. By 2030, 50% of IPs and LCs adopt watershed adaptation tools/techniques. 2. By 2035, 60% of the riverbank cutting and flood risk reduced. 3. By 2035, one third of the Karnali downstream areas irrigated. 4. By 2040, the entire Karnil downstream areas irrigated. **Impact:** Secured lives and livelihoods of IP and LCs and vulnerable communities through improved and conserved watershed resources and enhanced adaptive capacity to climate risks.
Summary of Actions: 1. Assess and undertake mapping of river cutting areas, and design appropriate interventions to protect farmland and community land. 2. Identify indigenous people; document their indigenous and traditional knowledge for watershed resources management and support to upscale appropriate interventions for watershed management. 3. Strengthen and diversify livelihood strategies focusing on crop, livestock and agro-forestry for vulnerable livelihood zones and marginalized communities. 4. Strengthen the existing community EWS and promote technology for expansion. 5. Support climate-resilient infrastructure for rural households (high rise toilet, high rise taps) and communities (women-friendly shelter houses). 6. Promote plantations of climate/disaster resilient and native/indigenous plant species in degraded riverbank and soil areas. 7. Develop and strengthen institutions of Karnali for reducing climate vulnerability and building upstream and downstream linkages.	
Scope: Policy Law and Regulation, Capacity Building, Technology Development and Information, Physical Infrastructure, Research and Innovation	
Geographic Coverage: Lumbini Province, Karnali Province, Sudurpaschim Province	**Targeted Community/Beneficiaries:** 2,500 households, IP and LCs (Tharu, Sunar, marginalized communities) and local communities, 2,500 ha degraded area restoration
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, Development Partners, I/NGOs, Community Based Organizations, Forest User Groups

12: Restoration of Habitats and Strengthening Ecological Connectivity for Wildlife and Biodiversity	2030, 2035

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, National Parks and Wildlife Conservation Act (1973), National Forests Policy 2019

Climate Risks and Vulnerabilities Addressed by the Actions:

Flood risk, infestation of new pests and diseases exacerbated by increasing temperatures, emergence of invasive alien species, and loss of biodiversity.

Objectives:

1. To safeguard wild fauna from extreme climate events.
2. To establish climate-resilient safe wildlife passage in selected corridors and connectivity between protected areas.
3. To manage and restore ecological connectivity.

Expected Outcomes:

1. By 2030, habitat and connectivity conserved and maintained.

2. By 2035, 80% reduction of wildlife and road kill incidence on major highways.

3. By 2035, 80% of degraded ecosystems restored and managed to maintain ecological integrity.

Impact:

Enhanced ecological integrity to secure the existence of flagship species through extended landscape connectivity.

Summary of Actions:

1. Construct safe refuge islands and species-specific sites in flood prone area (sites within and outside protected areas).
2. Construct overpasses and underpasses for wildlife crossing in Tarai Arc Landscape areas.
3. Maintain and construct waterholes and ponds in strategic locations.
4. Provide continuous support for management of different ecosystems (forests, grasslands, wetlands) management within landscape to maintain ecological connectivity.
5. Inventory and conserve sacred groves, religious forests and water heritages/holes.
6. Identify and manage climate refuges for threatened wildlife, plants and othe species.
7. Undertake critical habitat management in PAs and outside PAs.
8. Strengthening Rapid Response Teams for rescue and relief operations for wildlife.
9. Strengthen trans-boundary coordination for connectivity.

Scope: Capacity Building, Physical Infrastructure, Research and Innovation

Geographic Coverage: Eastern to Western Nepal (Madhesh, Bagmati, Gandaki, Lumbini, Sudurpaschim and Koshi Provinces)

Targeted Community/Beneficiaries: Local communities residing within buffer zones

Duration/Timeframe:

15 years

Lead Institution: Ministry of Forests and Environment

Total Cost:

USD 200 million

Supporting Agency/Institutions/Groups: Provincial and Local Governments, I/NGOs, Development Partners, Community Based Organizations

13: Integrated Sub-watershed Management for Climate Resilience	2035, 2050

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Parks and Wildlife Conservation Act (1973), National Forests Policy 2019, National Irrigation Policy 2004

Climate Risks and Vulnerabilities Addressed by the Actions:

Loss of agricultural land area due to soil erosion, landslides and increased incidences of flash floods, increase in incidences of extreme temperatures, dry spells and drought leading to drying of water resources and springs, increased incidences of forest fire.

Objectives:

1. To promote watershed management for conservation of soil fertility and enhanced productivity.
2. To support local livelihoods through watershed management.

Expected Outcomes:

1. By 2035, water availability is increased to 50% in sub-watersheds.
2. By 2050, 80% of sub-watersheds are climate-resilient.

Impact:

Increased water availability and agriculture productivity.

Summary of Actions:

1. Assess climate vulnerability and risk at sub-watershed level and develop sub-watersheds health cards for continuous monitoring with respect to climate variables.
2. Map and restore degraded areas within the sub-watersheds and support for management of those vulnerable ecosystems to increase water availability and forest productivity.
3. Support for climate-resilient infrastructure (embankments, dikes) to prevent flooding to secure agriculture land.
4. Promote farmyard/organic manure to maintain soil fertility within sub-watersheds.
5. Map and conserve spring revival through spring-shed approach.
6. Promote soil erosion control techniques in upstream of the sub-watersheds using indigenous and traditional knowledge and local resources.
7. Strengthen and establish Flood EWS in strategic locations of Bagmati and Eastern Rapti River Basin.
8. Install hydro-met stations at strategic location of Bagmati and Eastern Rapti River Basin.

Scope: Capacity Building, Technology Development and Information, Physical Infrastructure, Research and Innovation

Geographic Coverage: Bagmati and Eastern Rapti River Basin	**Targeted Community/Beneficiaries:** Upstream and downstream communities, climate vulnerable communities
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, I/NGOs, Development Partners, Community Based Organizations

14: Improvement of Forest Health and Restoration of Rare, Endangered, Endemic, and Threatened Species for Building Resilient Forest Ecosystem	2030, 2050
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Parks and Wildlife Conservation Act (1973), National Forest Policy 2019, Forests Sector Strategy 2016-2025, National Environment Policy 2019	
Climate Risks and Vulnerabilities Addressed by the Actions: Infestation of new pest and diseases exacerbated by rising temperature, increase in invasive alien species, landslide and flood risks, soil erosion, dry spell and drought	
Objectives: **1.** To control invasive species in forests, wetlands and rangelands. **2.** To conserve, promote and restore Rare, Endangered, Endemic, and Threatened (REET) species. **3.** To improve the overall health of the forests.	**Expected Outcomes:** 1. By 2030, forest health improvement measures identified and implemented through Divisional Forest Offices throughout Nepal primarily in climate-induced disaster prone and hardest hit areas. 2. By 2050, 80% of forest invasive species controlled. 3. By 2050, forest health improved by 80% by controlling degradation. 4. By 2050, 50% REET species are restored. **Impact:** Ecological integrity of forests secured
Summary of Actions: 1. Prepare a database and mapping of REET species throughout the country. 2. Updade VRA of REET species. 3. Strengthen and establish pest and disease control lab across all provinces. 4. Promote massive mechanical uprooting and biological control of forest invasive species on a regular basis. 5. Promote germplasm conservation of major tree species (in-situ and ex-situ). 6. Strengthen and establish Breeding Seed Orchards (BSO) of REET species. 7. Develop innovative actions for the use of forest invasive species. 8. Develop guidelines to conserve and manage REET species for resilient forest ecosystem. 9. Encourage afforestation in degraded forest patches. 10. Develop indicators for resilient forest and actions for enhancing forest health. 11. Explore innovative tools and techniques to improve forest health based on the indicators defined and promote their adoption.	
Scope: Capacity Building, Technology Development and Information, Physical Infrastructure, Research and Innovation	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Forests Users Group members
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, I/NGOs, CBOs

<table>
<tr><th colspan="2">15: Promotion of Multiple Uses of Protected Areas and Natural Heritage and Generation of Climate Adaptation Services</th><th>2035</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Park and Wildlife Conservation Act (1973), National Forests Policy 2019, Forests Sector Strategy 2016-2025</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:
Infestation of new pests and diseases exacerbated by rising temperatures, increases in invasive alien species, increase in occurrence of landslides and floods, soil erosion, dry spells and drought.</td></tr>
<tr><td>Objectives:
1. To assess the multi-functionality of protected areas.
2. To increase the climate adaptation services from the protected area resources.</td><td colspan="2">Expected Outcomes:
1. By 2035, adaptation services increased to 50% in selected PAs.
2. By 2035, protected area benefits maximized to 80%.
Impact:
Adaptive gains in PAs through maximized benefits of climate adaptation services.</td></tr>
<tr><td colspan="3">Summary of Actions:
1. Promote the use of robust climate models that use GIS and remote sensing to make predictions on climate change in PAs.
2. Integrate climate-resilient livelihoods in the management plan of PAs.
3. Explore, design, and implement climate adaptation services in 6 PAs.
4. Explore sustainable financing mechanisms to ensure adaptation services in the PAs.
5. Develop and implement strategies to increase the resilience of natural heritage sites to withstand climatic shocks and climate induced disasters.
6. Scale up Ecosystem-based Adaptation (EbA) approaches in these 6 PAs.</td></tr>
<tr><td colspan="3">Scope: Capacity Building, Technology Development and Information</td></tr>
<tr><td>Geographic Coverage:
6 PAs of Himalayas (Api Nampa, Khaptad, Shey Phoksundo, Rara, Langtang, Makalu Barun, etc.)</td><td colspan="2">Targeted Community/Beneficiaries: Local communities residing in the buffer zone areas</td></tr>
<tr><td>Duration/Timeframe:
15 years</td><td colspan="2">Lead Institution: Ministry of Forests and Environment</td></tr>
<tr><td>Total Cost:
USD 500 million</td><td colspan="2">Supporting Agency/Institutions/Groups: Provincial and Local Governments, Department of National Parks and Wildlife Conservation, I/NGOs, Development Partners, CBOs</td></tr>
</table>

16: Reduce the Impact of Climate Induced Disasters and Extend Forest Networks for Resilient Ecosystems	2030, 2035
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Parks and Wildlife Conservation Act (1973)	
Climate Risks and Vulnerabilities Addressed by the Actions: Infestation of new pest and diseases exacerbated by rising temperatures, increase in invasive alien species, increased occurrence of landslide and flood risks, soil erosion, dry spells and drought.	
Objectives: 1. To strengthen landscape level connectivity and build capacity to respond to climate-induced disasters. 2. To explore, assess, and implement physical and biological means of disaster management in forest ecosystems.	**Expected Outcomes:** 1. By 2030, habitat and connectivity are conserved and maintained. 2. By 2035, 80% of forests habitats are restored applying climate-resilient DRRM. **Impact:** Ecological integrity of forest ecosystems maintained and environmental goods and services increased.
Summary of Actions: 1. Provide continuous support for forest ecosystems to maintain ecological integrity. 2. Prepare a database and mapping of climate-induced hazards in forest areas. 3. Simulation/modeling of climate impacts on highly vulnerable forest area to inform proper management. 4. Support restoration of degraded forest areas to strengthen landscape connectivity 5. Incorporating climate induced disaster management guidelines in all Forests Operational Plans. 6. Build resilient infrastructure (bioengineering, earthen dikes) to control climate-induced disasters.	
Scope: Physical Infrastructure, Research and Innovation, Capacity Building	
Geographic Coverage: All Provinces (strategic locations)	**Targeted Community/Beneficiaries:** Forest dependent communities
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, Division Forest Offices, I/NGOs, CBOs

17: Conserve and Restore Ponds/Lakes in Community-managed Forests for Climate-Resilient Biodiversity (One Community-managed Forest-One Wetland)	2030

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Parks and Wildlife Conservation Act (1973), National Wetland Policy 2012

Climate Risks and Vulnerabilities Addressed by the Actions:

Shrinking of water resources such as springs and ponds due to an increase in incidences of dry spells and prolonged drought, increase in the growth of the invasive alien species, increased incidence of extreme events such as floods, landslides and forest fires causing loss and damage of the wetlands.

Objectives:	Expected Outcome:
1. To conserve and maintain water sources for continuous availability. **2.** To enhance biodiversity through forest health and sustainability regimes.	1. By 2030, 25% ponds/lakes of the National Lake Conservation Development Committee report record restored in community-managed forests. **Impact:** Healthy forest ecosystems and enhanced biodiversity conservation.

Summary of Actions:

1. Undertake mapping of water resources, springs, and wetlands across community forests.
2. Maintain existing wetlands/ponds for water augmentation to withstand the increasing temperature and evapotranspiration.
3. Explore and construct/develop wetlands in new areas of community-managed forests that are hard hit by the changing climate.
4. Encourage plantation campaigns in degraded areas of the community-managed forests.
5. Support the management of wetlands/ponds (silt removal/invasive species removal/water abstraction) in community-managed forests.
6. Facilitate/update the implementation of Community-managed Forest Operational Plans by providing technical capacity.
7. Support the integration of climate-resilient initiatives in the community-managed forest operation plans.
8. Promote the sustainable use of the wetland's goods and resources.
9. Promote traditional and indigenous knowledge, skills and wetland practices inclusive to the wetland dependent community and promote gender equality in planning and management of wetlands.

Scope: Physical Infrastructure, Research and Innovation, Capacity Building

Geographic Coverage: Mid-hills and mountainous areas (all provinces)	**Targeted Community/Beneficiaries:** Community-managed Forest User Group Members
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, I/NGOs, Community Based Organizations

18: Wetland Development and Conservation along the Chure	2030, 2050
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, National Parks and Wildlife Conservation Act (1973), President Chure-Tarai Madhesh Conservation and Management Master Plan 2017, National Wetland Policy 2012, National Ramsar Strategy and Action Plan 2018-2024	
Climate Risks and Vulnerabilities Addressed by the Actions: Drying and shrinkage of wetlands, encroachment of wetlands due to increased invasion of alien species, increased incidences of landslides, soil erosion, and flooding.	
Objectives: 1. To maintain healthy wetlands and conserve biodiversity. 2. To sustain ground recharge in Chure region.	**Expected Outcomes:** 1. By 2030, conservation ponds/wetlands created at the foothills (conserved at least 1,000 ha wetlands in Chure). 2. By 2050, 80% of wetlands at the foothills (Chure) conserved and restored. **Impact:** Increased water availability in the Chure and Bhawar Areas and enhanced wetland services.
Summary of Actions: 1. Undertake mapping of wetlands in Chure region and assess the health of wetlands. 2. Construct wetlands and ponds in strategic locations of the Chure range using small earthen dams, retaining streams, waterholes, ponds and lakes. 3. Conserve wetlands as refuges for REET plants species and wildlife. 4. Support for the protection of springs in the Chure range. 5. Manage/control invasive alien species in wetlands. 6. Develop a network of wetlands along the Chure region to increase buffering capacity.	
Scope: Physical Infrastructure, Research and Innovation, Capacity Building	
Geographic Coverage: Eastern to Western Nepal (All Chure range districts)	**Targeted Community/Beneficiaries:** Local communities, indigenous people, disadvantaged groups/marginalized communities
Duration/Timeframe: 30 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, President Chure-Tarai Madhesh Conservation Development Committee, I/NGOs, Community Based Organizations

19: Integrated Green Economy Promotion through Sustainable Forests Management and Non-Timber Forest Products Management, and Circular Economy in the Hills and Mountains	2030, 2035, 2040, 2045
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Forest Policy 2019, Non-timber Forests Products Policy 2009	
Climate Risks and Vulnerabilities Addressed by the Actions: Loss of forest productivity and biodiversity leading to loss of employment and exacerbated poverty.	
Objectives: 1. To explore, assess, and promote green jobs for forest-based entrepreneurship. 2. To enhance livelihoods of forest dependent communities through diversifying income sources and promoting the circular economy in the forest sector. 3. To build resilience of forest ecosystem through participatory sustainable forest management.	**Expected Outcomes:** 1. By 2030, 20% of hill forest pine monoculture transformed to heterogeneous mixed forest and 40% by 2040. 2. By 2030, 500 CFs produce direct adaptation resources through ecosystem management. The number of CFs producing adaptation resources increased to 5,000 by 2045. 3. By 2035, 40% of green jobs are secured through Sustainable Forest Management. 4. By 2045, 40% of the livelihoods of hill and mountain communities are secured through the circular economy. **Impact:** Resilient livelihoods of hill and mountain forest dependent communities ensured.
Summary of Actions: 1. Undertake mapping of pocket areas of medicinal and aromatic plants species and varieties, non-timber forest products, technology needs, and access to market. 2. Build capacity and facilitate resource mobilization and introduce climate-resilient technologies for upscaling women-led enterprises. 3. Explore and access forest-based green jobs in hills and mountains. 4. Develop guidelines for green jobs based on a public-private partnership model in mountains. 5. Capacitate Community-managed Forests User Group members (climate vulnerable/marginalized/IPs) to uptake green jobs as part of their livelihood support. 6. Strengthen the capacity of community-based forests institutions on gender integration, skill development and technology interventions. 7. Develop elements of a circular economy for the forest sector to diversify incomes of mountain communities. 8. Promote broadleaved mixed forest against pine monoculture in the hills. 9. Support the development of a model of forest-based circular economy in 10 Community-managed forests. 10. Support Forests to implement resilient sustainable forest management practices in hills and mountains.	
Scope: Capacity Building, Technology Development and Information (ICT), Research and Innovation	
Geographic Coverage: Hills and mountains (Koshi, Bagmati, Gandaki, Lumbini, Karnali, Sudurpaschim Provinces)	**Targeted Community/Beneficiaries:** Climate vulnerable mountain communities, Community-managed Forest User Groups
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, Nepal Tourism Board, Development Partners, I/NGOs, Forest-Related Stakeholders

20: Upland Conservation and Climate-Resilient Livelihoods Programme in High Mountains	2030, 2050

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), National Park and Wildlife Conservation Act (1973), National Forests Policy 2019, Forestry Sector Strategy 2016-2025, National Wetland Policy 2012

Climate Risks and Vulnerabilities Addressed by the Actions:

Increase in the incidences of landslides, increase in invasive alien species, landslide and flood risks, soil erosion, dry spells and drought.

Objectives:

1. To conserve, promote, and increase uses of highland high value forest products for climate-resilient livelihoods.
2. To conserve pasture and meadows for high value species through community led control of grazing, animal husbandry and medicinal plant conservation.
3. To promote multiple use of forests in the high mountains.

Expected Outcomes:

1. By 2030, 100 community-managed forests start 'Forest for Food Grain' programme.
2. By 2050, 80% of degraded ecosystems are restored and managed to maintain balanced ecological functioning.
3. By 2050, the quantity of highland high value forest products is increased by 50% through applying rotational harvesting and sustainable harvesting techniques.

Impact:

Climate-resilient livelihoods secured in the high mountains.

Summary of Actions:

1. Research and promote high value forest products for climate-resilient livelihoods.
2. Develop guidelines for private sector engagement for the use of high value forest products for livelihoods.
3. Support capacity building of local communities to conserve, promote, and increase the use of high value forest products.
4. Develop a climate-resilient strategy and action plan for the conservation and management of pastures and meadows and high altitude areas.
5. Support and catalogue ethnobotanical knowledge and practices of upland areas and capacitate local grazers/herders/healers with respect to address climate change, pasture management, and transhumance.
6. Support to ensure community-led pasture management in highlands for resilient livelihoods.
7. Promote livelihood diversification in uplands through pasture/rangeland management, sustainable harvesting of medicinal plants, mountain tourism and commercial animal husbandry.
8. Conserve high altitude wetlands to sustain wetlands-based livelihoods.
9. Develop management practices to rejuvenate highland rocky and barren areas through watershed management approach.

Scope: Physical Infrastructure, Research and Innovation, Capacity Building

Geographic Coverage: Mountain areas (Koshi, Bagmati, Gandaki, Karnali and Sudurpaschim)	**Targeted Community/Beneficiaries:** Vulnerable mountain communities, indigenous people and local communities, community-managed forest user groups
Duration/Timeframe: 30 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Provincial and Local Governments, Nepal Tourism Board, I/NGOs, Development Partners, Community Based Organizations

7.3 Water Resources and Energy (WRE)

The Constitution of Nepal directs the State to pursue a policy of prioritizing national investment in water resources based on people's participation and the multi-utility development of water resources (GoN, 2015). The Constitution promotes the development and production of renewable energy that is cheap, readily available, and dependable and meets the basic needs of citizens (GoN, 2015). In line with these national aspirations, the Fifteenth Plan (Fiscal Year 2019/20 - 2023/24) highlights the proper management of water resources as essential to maintain adequate access to water for drinking, irrigation, and hydropower generation (GoN, 2020a).

The main rivers in Nepal are Mechi, Koshi, Bagmati, Gandaki, Rapti, Mahakali, etc. (Figure 14). The biggest river in Nepal is Koshi, the deepest is Narayani and the longest is Karnali. Most of the rivers in Nepal rise from mountains and avail water round the year. Nepal's annual renewable water availability is 7,173 per capita (m^3/year) (2014 value) (FAO- AQUASTAT, 2019), which is well above the global average. However, a large section of the population and potentially irrigable lands lack adequate access to water, and only about 7% of Nepal's total water potential has been utilized for socio-economic purposes (WECS, 2011) thus, ensuring adequate water resources for hydro-electricity generation is a priority for Nepal where over 90% of total electrical power generated in Nepal in 2019/20 was from hydroelectricity (MoF, 2020).

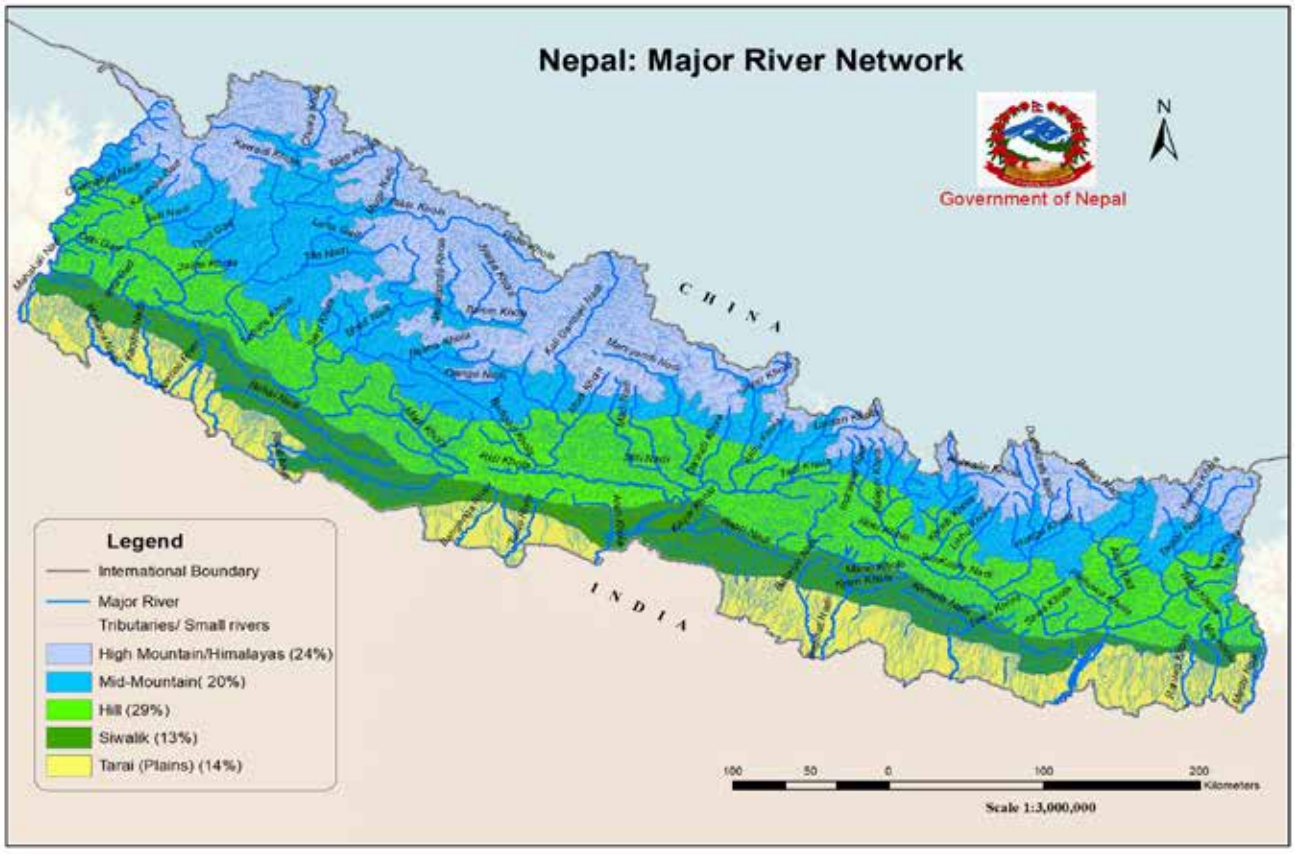


Figure 14: River system in Nepal

The 2019 Irrigation Master Plan reported that water availability, its spatio-temporal distribution, and the hydrological cycle had been altered by climate change and variability (NENCID, 2018). Climate change has accelerated the melting of glaciers, led to the formation of glacial lakes in the mountain valleys, and expanded existing glacial lakes (Salerno et al., 2012). This retreat of glaciers and associated changes in hydrology affects the availability of water resources and has subsequent impacts on energy generation. Substantial areas of different land use and land cover have been reported to be exposed to potential GLOFs. Electricity generated by the Nepal Electricity Authority declined by 6.9% in 2020/21 compared to 2019/20 because of reductions in rainfall that affected river discharge (National Electricity Authority, 2021).

Future climate change is expected to increase annual water availability parameters in most districts, while decreasing in others in the medium-term and long-term; reflecting spatial imbalances and temporal variations in water availability (NENCID, 2018). Future temperature change scenarios and population projections for 2100 indicate that the annual renewable water availability in Nepal will be above the critical line of water stress (Chaulagain, 2015). As per MoFE (2019)'s future climate scenarios for Nepal report, although annual precipitation will increase in the future (2030s and 2050s), the spring season precipitation is likely to decrease, resulting in limited operation of hydropower units. In addition, floods, landslides, sedimentation, snowstorms, and other hazards damage the electricity grids, transmission lines, and powerhouses. The economic costs of the impacts of climate change on hydroelectricity production could be equivalent to 0.1% of GDP per year on average, and 0.3% in extremely dry years (MoSTE, 2014). The main climate risks in the sector are water stress and lower water availability during the winter season; damage to energy infrastructure including dams, hydropower generating stations, and transmission lines; water shortages in rural and urban areas; and GLOFs.

The eight priority adaptation programmes in the WRE sector will lower the risk of GLOFs, improve water availability, promote a clean energy mix system that emphasizes hydroelectricity, and build capacity to improve the enabling environment. These adaptation programmes have an estimated cost of USD 5.35 billion to 2050.

<table>
<tr><th colspan="2">21: Promoting Climate-informed Decision Making, and Developing Climate-Smart Design and Guidelines for Water Resource Infrastructure</th><th>2030, 2035, 2045</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:
Drying up water resources, and decreasing surface water flow and ground water recharge affecting water availability and access.
Reduced water discharge limiting hydropower generation potential due to drying up of water resources and increased siltation in the rivers.
Damage to hydropower plants, solar plants, and their transmission lines due to water induced disaster events such as floods and landslides.
Increased snow retreat, formation of new glacial lakes and probability of Glacial Lake Outburst Floods.</td></tr>
<tr><td colspan="2">Objectives:
To build resilient water resources infrastructure that can withstand extreme climatic events.
To enhance access to climate information for climate informed decision-making.</td><td>Expected Outcomes:
By 2025, National Framework for Climate Services is enforced to enhance the access to climate information.
By 2030, climate-smart designs and guidelines for water resources infrastructure prepared and applied.
By 2030, 200 national meteorological and hydrological professional capacitated in downscaled weather, climate and hydrological scenario forecasting services.
By 2030, total 12,000 MW capacity of hydropower installed.
By 2035, 5 hydropower projects (> 200 MW) implements ecosystem conservation programmes in corresponding watershed. The number of projects increased to 15 by 2045.
By 2040, integrated use of water is promoted.
Impact: Strengthened weather and climate services for better forecasting and early warnings that improve the ability of communities to cope with weather events and climate hazards.</td></tr>
</table>

Summary of Actions:

1. Formulate national meteorological and hydrological act/regulations and policy frameworks regarding hydro-met services including establishment and operation of hydro-met stations and data sharing protocols/mechanisms.
2. Formulate and implement climate-resilient designs and guidelines for water resources infrastructure.
3. Establish/strengthen hydro-met observation stations in the middle and high mountainous regions.
4. Develop hydro-met service decision support system based on impact-based forecasting.
5. Develop sector-specific weather and climate information packages and develop a mechanism for sharing of such information.
6. Establish modern technology and infrastructure for localized weather, climate, and early forecast.
7. Establish monitoring and forecasting and early warning systems for climate-induced hazards (floods, landslides, drought, forest fires, increased crop disease prevalence and its spread, heat waves, cold waves, lightning, storms, etc.).
8. Develop the capacity of the national meteorological and hydrological service, policy makers, users and end-users for integration of climate information in decision making.
9. Develop and implement the national framework on climate services for enhanced weather/climate services.
10. Develop/conduct education and awareness programmes on flooding, landslides, sedimentation, siltation, and adaptation and resilience in water resource and energy sector.
11. Implement ecosystem conservation programmes in the corresponding watersheds of the hydropower projects.

Scope: Policy, law and regulation, Capacity building, Technology development and infrastructure development, Research and innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** All population groups, energy sector stakeholders and producers, private sector, end-users, agri-business companies
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 50 million	**Supporting Agency/Institutions /Groups:** Ministry of Forests and Environment, Department of Water Resources and Irrigation, Department of Hydrology and Meteorology, Nepal Electricity Authority, I/NGOs, Multilateral Development Banks, Private sector

22: Promoting Energy Mix Systems for Industrial Sustainability and Climate-Resilient Livelihoods	2030

Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Drying up of water resources, and decreasing surface water flow and ground water recharge affecting water availability and access.
- Reduced hydropower generation potential due to drying up of water resources and increased siltation in the rivers.
- Reduced water discharge in rivers thus affecting irrigation and energy production.
- Damage to hydropower plants, solar plants, and their transmission lines due to water induced disaster events such as floods and landslides.
- Increased snow retreat, formation of new glacial lakes and probability of GLOFs.

Objectives:

1. To increase renewable energy in the national energy system.

2. To build climate-resilient livelihoods through enhanced energy security.

Expected Outcomes:

1. By 2030, renewable energy contribution in the national energy system increased by 30%.
2. By 2030, energy generation from solar power increased to 20% (aboud 2,000 MWp).

Impact:

Enhanced energy security and resilience through appropriate energy mix and energy diversification.

Summary of Actions:

1. Revise and reform national policy documents to promote decentralized renewable energy sources in the national energy system mix.
2. Identity and assess climate change vulnerability and risk in the electricity generating system.
3. Build the climate resilience of the vulnerable electricity generating power plants.
4. Establish a medium scale solar power plant in each province with exploring potential and economic viability of solar plant with battery system/storage.
5. Promote renewable energy and strengthen energy security in industrial operations.
6. Promote the use of non-conventional energy sources to increase the share of non-conventional energy in the national energy system.
7. Establish biogas plants, distribute improved cooking stoves, and establish solar power mini grids in off-grid areas.
8. Expand rural electrification in off-grid areas to support livelihoods.
9. Reuse and recycle non-functional solar irrigation pumps (SIPs) and explore potential of grid connected large-scale solar irrigation.

Scope: Policy, law and regulation, capacity building, technology development and infrastructure development, research and innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** All population groups, energy sector stakeholders and producers, private sectors
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 2,000 million	**Supporting Agency/Institutions /Groups:** Department of Electricity Development, Nepal Electricity Authority, Ministry of Forests and Environment, I/NGOs, MDBs, Private sector

23: Reduce Glacial Lake Outburst Flood (GLOF) Risks in Gandaki, Koshi and Karnali River Basins	2030

Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

Increased risk of GLOFs due to melting of the snow and ice.

Objectives:

1. To reduce the risk of GLOFs, to save infrastructure, lives and property of peoples/communities living downstream.
2. To build the capacity of the federal, provincial and local level public emergency operations centers.

Expected Outcomes:

1. By 2030, four glacial lakes flow in the Gandaki, Karnali and Koshi river basins regulated and GLOF Early Warning System established and strengthened.
2. By 2030, real time monitoring system of the glacial lakes in Nepal established at the federal level.

Impact:

Life, properties and infrastructure of Gandaki, Karnali and Koshi river basins saved.

Summary of Actions:

1. Study and research to reveal climate change trends and impacts on glaciers and glacial lakes in the Himalayan region and identify vulnerable glacial lakes in Nepal.
2. Assess potentially dangerous glacial lakes based on increasing temperature, lake expansion, moraine dam structure, and geo-morphological structures.
3. Assess hazards and communities in the downstream of glacial lakes that are vulnerable to potential GLOF events.
4. Establish research wings for the study of fresh water and glacial lakes at the federal level.
5. Establish and operate EWS with collaboration and cooperation in emergency response.
6. Quantify the freshwater storage and the impact of climate change on glaciers and snow coverage.
7. Establish and operate adequate hydro-meteorological stations and early warning equipment and systems for continuous monitoring and dissemination of information to the local level.
8. Design and develop environmentally friendly, climate-resilient structures for lowering of water levels in the glaciers and lakes.
9. Build capacity for the operation of the EWS and early actions in community at the federal, provincial and local levels.
10. Develop glacier and snow melting modeling systems to evaluate the freshwater availability in the glacial lakes for its optimum utilization.

Scope: Technology Development and Infrastructure Development, Research and Innovation, Capacity Building

Geographic Coverage: Gandaki, Karnali and Koshi river basins	**Targeted Community/Beneficiaries:** Local communities, farmers, hydropower developers, infrastructure developed downstream of glacial lakes, government and non-government organizations working in the emergency response and rescue activities in glaciated river basins
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 1,000 million	**Supporting Agency/Institutions /Groups:** Department of Hydrology and Meteorology, Ministry of Forests and Environment, I/NGOs, MDBs, Universities, Private sector

24: Promoting Water Pumping Technologies in Water Scarce Areas	2035

Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030, Irrigation Policy

Climate Risks and Vulnerabilities Addressed by the Actions:

Drying up of water resources, and reduced water discharge in rivers thus affecting irrigation and energy production.

Objectives:

1. To enhance climate resilience capacity of rural vulnerable people.
2. To improve access to water for drinking and irrigation.

Expected Outcomes:

1. By 2030, 1,500 solar drinking water and solar irrigation pumping systems established to support rural livelihoods.
2. By 2030, ground water cluster projects commanding more than 95,000 ha developed.
3. By 2030, health, hygiene and water access to rural communities improved in target provinces.
4. By 2030, pumped irrigation system developed to irrigate 25,000 ha.
5. By 2035, additional water cluster projects commanding more than 25,000 ha and by 2040, additional 25,000 ha developed for expansion of irrigation facilities.
6. By 2035, additional pumped irrigation system developed to provide irrigation in 5,000 ha and by 2040, additional system developed to provide in additional 5,000 ha.

Impact:

Enhanced climate resilience and improved socio-economic conditions of rural communities through an improved ability to cope with climate change.

Summary of Actions:

1. Undertake mapping of water scarce areas and feasibility of water pumping technologies and set up ground water monitoring system to evaluate the impact of ground water irrigation.
2. Develop/strengthen prototype of the climate-resilient low carbon water lifting systems and establish in water scarce areas and upscale the successful system.
3. Construct climate-smart irrigation systems to effectively utilize the water available from the water lifting systems and develop the eco-financially feasible business model.
4. Establish multiple water use systems at the local level for easy access to drinking water and irrigation.
5. Develop/conduct education and awareness programmes of climate change and its impact, adaptation, resilience, health and hygiene.
6. Promote solar water pumps to improve access to drinking water and irrigation water requirement.

Scope: Technology Development and Infrastructure Development, Research and Innovation, Capacity Building

Geographic Coverage:

Areas of Koshi, Bagmati, Karnali and Sudurpaschim

Targeted Community/Beneficiaries: All population groups including marginalized groups and communities

Duration/Timeframe:

10 years

Lead Institution: Ministry of Energy, Water Resources and Irrigation

Total Cost:

USD 1,000 million

Supporting Agency/Institutions /Groups: Ministry of Water Supply, Ministry of Education, Science and Technology, Ministry of Forests and Environment, Private Sector, MDBs, User Groups, I/NGOs, Universities

25: Promoting Climate-Resilient Renewable Energy in Rural Vulnerable Settlements and Institutions	2030, 2035

Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

Drying up of water resources, and reduced water discharge in rivers thus affecting irrigation and energy production.

- Reduced hydropower generation potential due to drying up of water resources and increased siltation in the rivers.
- Damage to hydropower plants, solar plants, and their transmission lines due to water induced disaster events such as floods and landslides.
- Increased snow retreat, formation of new glacial lakes and probability of GLOFs.

Objectives:

1. To fulfill energy demand in vulnerable rural settlements.
2. To improve the socioeconomic condition of vulnerable rural communities through diversifying livelihoods options.

Expected Outcomes:

1. By 2030, 300 large scale bio-gas plants and 50,000 domestic bio-gas plants established, 1,000,000 clean cooking stoves distributed, 12 MW solar energy plants with mini-grid in off grid areas installed, and 30 MW institutional solar and rooftop solar power system connected, and 2 MW wind energy installed.
2. By 2035, additional 500 bio-gas plants established, 1,000 clean cooking stoves distributed, 5 MW solar energy plants with mini-grid in off-grid areas installed, and 50 MW grid solar plant connected with the national grid system.

Impact:

Improved energy access and enhanced sustainable socio-economic development of the vulnerable rural settlements.

Summary of Actions:

1. Establish biogas plants, distribute clean cooking stoves, and establish solar power mini-grids in off grid areas with possibility of grid integration.
2. Establish solar power plants in each of the provinces considering the current and future climate change scenarios and impacts in the power plant locations.
3. Build capacity of local technicians, local communities and local governments on climate change risks, adaptation strategies and the use of non-conventional energy sources and their operation and management.
4. Equip and enable rural institutions to meet basic needs (health care and education) through improved access to energy.
5. Promote non-conventional energy (biogas, solar energy, wind energy and hydropower), and fuel-efficient technologies to reduce firewood demand and enhance energy resilience.
6. Promote productive end use of energy to enhance rural livelihoods.

Scope: Technology Development and Infrastructure Development

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Vulnerable rural settlements
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 500 million	**Supporting Agency/Institutions /Groups:** Alternative Energy Promotion Center, Department of Electricity Development, Nepal Electricity Authority, Ministry of Forests and Environment, Solar Power Developers, MDBs, Private sector

26: Climate-Resilient Flood Control to Protect Livelihoods and Assets at Risk from Climate Induced Flooding	2040

Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Drying up of water resources, and reduced water discharge in rivers thus affecting irrigation and energy production.
- Reduced hydropower generation potential due to increased siltation in the rivers damage power plants, and their transmission lines due to water induced disaster events such as floods and landslides.
- Loss of properties, assets caused by flooding.

Objectives:

1. To control soil erosion and reduce flood incidences.
2. To increase efficiency of hydropower plant operation.

Expected Outcomes:

1. By 2025, 20 climate-resilient river check dams constructed in river stretches that are prone to flooding, by 2030, 30 and by 2035, additional 20 climate-resilient river check dams constructed.
2. By 2030, 300 km river embankments constructed.
3. By 2040, vulnerable rivers will be managed with innovative, nature-based and sustainable solution.

Impact:

Vulnerable settlements and assets protected from flooding that are exacerbated by climate change.

Summary of Actions:

1. Identify vulnerable settlements and devise resettlement plan and training activities to safeguard vulnerable cummunities.
2. Promote traditional knowledge, use locally available materials, and incorporate bio-engineering and green belts along the river for blanketing and sustainable management of rivers.
3. Promote small to medium storage for lowering flood peak.
4. Undertake climate and disaster risk assessments to understand the river catchment areas' susceptibility to different hazards such as landslides and soil erosion.
5. Conserve river catchment areas through peoples' participation and building of networks of upstream and downstream communities to forge collaboration.
6. Undertake study and research on river sediment, soil erosion and debris flow to determine the health of the check dams.
7. Extract aggravated riverbed materials to maintain river channels and sustain the life of the check dams.
8. Construct multiple use check dams that enable the various uses of the water, including for irrigation and hydropower generation.

Scope: Infrastructure Development, Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Vulnerable settlements, farmers, hydroelectricity developers
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 200 million	**Supporting Agency/Institutions /Groups:** Department of Electricity Development, Department of Water Resources and Irrigation, Department of Hydrology and Meteorology, Ministry of Urban Development, Ministry of Forests and Environment, Nepal Electricity Authority, Solar Power Developers, National Disaster Risk Reduction and Management Authority, MDBs, Private sector

27: Sustainable Run-of-River Systems at Feasible Locations Supported by Reservoir Systems	2030, 2050

Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Drying up of water resources, and reduced water discharge in rivers thus affecting irrigation and energy production.
- Reduced hydropower generation potential due to drying up of water resources and increased siltation in the rivers.
- Damage to hydropower plants, solar plants, and their transmission lines due to water induced disaster events such as floods and landslides.
- Increased snow retreat, formation of new glacial lakes and probability of GLOFs.

Objective:

1. To increase operability of the run-of-the river based hydropower plants.
2. To diversify the hydropower plants for sustainable supply of energy.

Expected Outcomes:

1. By 2030, climate-resilient hydropower development strategic guidelines operationalized.
2. By 2030, small to medium storage projects expanded for irrigation of 10,000 ha, by 2035, for additional 10,000 ha and by 2040, for additional 10,000 ha.
3. By 2035, additional three reservoir-based hydropower plants developed.
4. By 2050, 10 hydropower projects operate as reservoir-based system.

Impact:

Continuous electricity generated through establishment of climate-resilient run-of-river systems.

Summary of Actions:

1. Undertake climate and disaster risk assessment to understand the operability and energy generation potential of the run-of-river hydropower plants in the business-as-usual and climate extreme situations.
2. Undertake study and research on river sediment, soil erosion and debris flow to determine the health of the reservoirs and hydropower plants.
3. Extract aggravated riverbed materials to maintain river channels and sustain the life of the check dams.
4. Build capacity of the hydropower developers on climate change vulnerability and risks, adaptation, and resilience strategies.
5. Review and develop climate-resilient hydropower development guidelines to run the sustainable supply of power and to integrate climate change adaptation into run-of-river hydropower plant design and operation.
6. Ensure sustainability of the run of river hydropower projects by supporting them with reservoirs.

Scope: Capacity Building, Technology Development and Infrastructure Development, Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Hydroelectricity developers
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 100 million	**Supporting Agency/Institutions/Groups:** Department of Electricity Development, Nepal Electricity Authority, Ministry of Forests and Environment, MDBs, Private sector

28: Clean and Efficient Energy Technology Development, and Build Resilient Systems and Infrastructure	2030
Alignment with/Contribution to National Development Goals: Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Energy Crisis Reduction and Electricity Development Decade 2015, Water and Energy Sector White Paper 2018, Water Resource Policy 2020, Sustainable Development Goals: Status and Road Map 2016-2030	
Climate Risks and Vulnerabilities Addressed by the Actions: • Drying up of water resources, and reduced water discharge in rivers thus affecting irrigation and energy production. • Reduced hydropower generation potential due to drying up of water resources and increased siltation in the rivers. • Damage to hydropower plants, solar plants, and their transmission lines due to water induced disaster events such as floods and landslides. • Increased snow retreat, formation of new glacial lakes and probability of GLOFs.	
Objective: 1. To build resilience of energy systems and infrastructure.	**Expected Outcome:** 1. By 2030, climate-resilient energy production and distribution systems are integrated into the electricity generation sector through research and innovation, and formulation of guidelines and strategies. **Impact:** Improved climate resilience of electricity generating systems and infrastructure.
Summary of Actions: **1.** Catalogue climate-resilient energy efficient technologies pertinent to Nepal's geography and use these technologies in clean and green energy generation and distribution. **2.** Develop guidelines to build climate-resilient energy systems. **3.** Undertake climate and disaster risk integrity assessments of hydropower plants and other energy systems. **4.** Design and develop retrofitting energy system to withstand climate extreme events and promote continuous generation and distribution of energy. **5.** Promote research and innovation for the development and promotion of climate-resilient technology development.	
Scope: Technology Development and Infrastructure Development, Research and Innovation	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Hydroelectricity developers, local communities, research institutions, private sector, industry operators
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Energy, Water Resource and Irrigation
Total Cost: USD 500 million	**Supporting Agency/Institutions /Groups:** Department of Electricity Development, Ministry of Forests and Environment, Nepal Electricity Authority, MDBs, Private sector

7.4 Rural and Urban Settlements (RUS)

The Fifteenth Plan calls for cities and human settlements to be inclusive, safe, sustainable, and resilient; and highlights that losses to disasters need to be reduced (GoN, 2018). The National Urban Development Strategy, 2017 recognized climate change as a major risk factor, particularly in the context of urban poverty and the likelihood of increased numbers of people moving to urban areas due to disasters. The strategy regarded resilience as a guiding principle for achieving balanced and prosperous urban future, and emphasized integration of resilience into urban systems and the preparation of community plans for building disaster resilient cities and communities (MoUD, 2017).

Nepal's urban population has grown rapidly over the past two decades (MoFALD, 2017); and for the period 2014 to 2050, Nepal is expected to be among the top ten fastest urbanizing countries in the world (UN DESA, 2014). Urbanization in Nepal is primarily fueled by rural-to-urban migration. Cities offer diverse economic opportunities that attract rural migrants including the poor. Cities have been hailed as drivers of economic growth, but urbanization in Nepal has been mostly haphazard (Rimal et al., 2017). There are wide deficits and geographical disparities in the availability of basic urban infrastructure (MoUD, 2017).

Floods, landslides, droughts, epidemics, heat waves, cold waves, and fire events primarily impact rural and urban settlements. Many settlements in Nepal are built in areas such as slopes and riverbanks that are prone to climate risks such as landslides and flooding. The increased occurrence of heavy rainfall has increased the risks of landslides in the high mountains, landslides and floods in the middle mountains, and floods and debris flow in the Tarai. The consequences of climate change include loss of lives; damage to property, physical and social infrastructure, and cultural heritage; impacts on markets; and increased economic burdens. The observed impacts on physical infrastructure include damage to and destruction of buildings, transport systems, communication systems, among others. In urban areas, the urban heat island effect has increased electricity use for cooling purposes and increased heat-related health impacts (MoPE, 2016). Impacts on social infrastructure include disruption to and lack of access to health and education services. These social impacts tend to be higher for children, women, the elderly, expectant mothers, people with chronic health problems, and disadvantaged population groups.

Climate risks and vulnerabilities in this sector include inadequate infrastructure and services for increasing rates of urbanization, including insufficient drainage that contributes to urban flooding; and a failure to integrate climate change in municipal policies and plans, and to adopt sustainable land-use planning. An increase in informal settlements, often located in risk-prone areas, and inadequate and non-compliance with standards, regulations, and building codes during infrastructure construction increases vulnerability to climate hazards.

The priority adaptation programmes in the Rural and Urban Settlements sector will mainstream adaptation in land use planning, integrated settlement planning, and urban and rural development planning; improve the enabling environment to promote climate- resilient building design and construction; and assist vulnerable settlements to cope with climate impacts. The three adaptation programmes for RUS sector have an estimated cost of USD 2.85 billion to 2050.

29: Promoting Circular Economy for Sustainable Urban Development	2030, 2035

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, National Urban Policy 2007, National Urban Development Strategy 2017, Habitat III National Report 2016, Sustainable Development Goals: Status and Roadmap 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Increased climate induced hazards and extreme events lead to increased risk of:
  - damage to rural and urban buildings, but mainly rural buildings that are comparatively less resilient
  - damage to public infrastructure
  - disturbance in the social harmony and fabric
  - damage to human settlements
  - increased risk of injury or death and displacement of population
  - imbalance in migration leading to low populations in rural settings and dense populations in the urban areas with increased urban sprawl
- Disturbance in rural-urban linkages and nexus due to climate extreme events.
- Acute disturbance in the lives and livelihoods of rural and urban populations due to shortages of water supply, drought, increasing temperatures and erratic precipitation.

Objectives:

1. To pilot and promote climate-resilient city planning.
2. To build national capacity on adaptive urban development.
3. To advance circular economy in urban development planning.

Expected Outcomes:

1. By 2030, climate-smart and climate resilience concepts adopted in 7 cities.
2. By 2030, 10 new towns/metro/sub-metropolitan cities that are being developed in Madhya-Pahadi Lok Marge pilot circular economy in climate resilient urban development.
3. By 2035, capacity on adaptive urban planning developed in all cities.

Impact:

Sustainable, prosperous and healthy cities that provide a high quality of urban life.

Summary of Actions:

1. Mapping of the climate and disaster risks at the settlement level in seven cities in each of the seven provinces.
2. Promote non-motorized modes of transportation through construction of climate-resilient infrastructure that is inclusive and safe.
3. Support municipalities to develop and implement green growth strategies and plans.
4. Strengthen institutional capacity for coordination, planning, monitoring, and reporting of concerned agencies.
5. Align urban planning and development of infrastructure to avoid ecological imbalances, increased risk of exposure to new pathogens, and the emergence of new diseases.
6. Promote water retention systems – expanded rainwater harvesting, water storage, and conservation techniques, water reuse, and water use.

7. Enforce land-use planning and provision of subsidies for effective implementation of land-use plans to control the construction in risk-prone areas.
8. Revise building codes so that they integrate climate risk factors.
9. Mechanize an insurance system for populations and livelihood assets that are at risk of climate impacts.
10. Identify and promote social protection measures and alternatives for people living in slum and squatter areas along the banks of the river.
11. Promote urban planning that considers the specific needs of children, women, differently-abled people, and the elderly.
12. Establish a database system to record and monitor the exposure of buildings and their sensitivity to climate extreme events and disasters.
13. Establish accessible multipurpose open spaces and community centers at the settlement level.
14. Promote urban forests and develop urban forest corridors connecting settlements.
15. Promote rooftop farming, aquaponics, hydroponics, roadside plantations, and vertical agriculture in urban centers.
16. Construct new and improve existing drainage systems considering a 100-year return period.
17. Promote, improve, and use local materials and traditional technology for the construction of buildings (bamboo house, mud house, stone etc.), via a municipal tax incentive system.
18. Increase the human resources capacity of the local government by creating compulsory designated posts of urban planners, architects, and engineers.
19. Integrate rainwater harvesting and groundwater recharge systems via recharge pits in the building permit system.
20. Develop regulatory mechanisms on groundwater extraction, and the inclusion of recharge pits and ponds concept before extraction.
21. Design and maintain road infrastructure with side drainage that gives due consideration to the runoff system and flooding.

Scope: Physical Infrastructure, Technology Development and Information, Capacity Building

Geographic Coverage: Cities vulnerable to climate change impacts in each the province	**Targeted Community/Beneficiaries:** Urban population
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Urban Development
Tentative Cost: USD 350 million	**Supporting Agency/Institutions /Groups:** Ministry of Federal Affairs and General Administration, Provincial Ministries of Urban Development and Physical Infrastructure, Local Governments, UN Agencies, MDBs, Private sector

30: Developing Integrated Settlements and Urbanization Models for Climate Risk Reduction and Supplying Climate Adaptation Services through Nature-based Solutions	2030, 2040, 2045

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, National Urban Policy 2007, National Urban Development Strategy 2017, Habitat III National Report 2016, Sustainable Development Goals: Status and Roadmap 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Increased climate induced hazards and extreme events increase the risk of:
  - damage to rural and urban buildings, but mainly rural buildings that are comparatively less resilient
  - damage to public infrastructure
  - disturbance in the social harmony and fabric
  - damage to human settlements
  - increased risk of injury or death and displacement of population
  - imbalanced migration leading to low populations in the rural settings and dense populations in the urban areas with increased urban sprawl
- Disturbance in the rural-urban linkages and nexus due to climate extreme events.
- Acute disturbance of lives and livelihoods of rural and urban populations due to shortage of water supply, drought, increasing temperature and extreme precipitation.

Objectives:

1. To develop integrated safer settlements in rural and urban areas.
2. To ensure climate adaptation services through nature-based solutions for vulnerable populations that are forced to relocate because of climate related disasters.

Expected Outcomes:

1. By 2030, 50 cities, 200 by 2035 and 500 by 2045 have emergency holding centers.
2. By 2040, 300 highly vulnerable settlements relocated to safe areas.
3. By 2040, 300 existing compact settlements upgraded to cope with climate and disaster risks.
4. By 2040, 293 municipalities and 460 rural municipalities develop and implement integrated land-use plans.
5. By 2045, 20 cities are Climate Induced Disease (CiD) proof.

Impact:

Sustainable, safe and climate-resilient integrated settlements across Nepal.

Summary of Actions:

1. Study and identify vulnerable settlements in three ecological zones and seven provinces and undertake mapping of compact settlements.
2. Identify safer locations for resettlement and relocation as part of rural municipal-level strategic spatial plans.
3. Resettle/relocate climate and disaster vulnerable population in safe areas considering people's livelihood, agriculture and their traditional business/economical activities.
4. Prepare Integrated Urban/Rural Development Plans emphasizing low carbon and climate-resilient urban and rural settlements in all municipalities.

5. Identify key potential areas for development of integrated settlements.
6. Establish emergency holding centers in cities.
7. Establish community-based early warnings and disaster information system at local level.
8. Promote cottage and local agro-industrial activities through installation of required technologies and equipment.
9. Build capacity of the local population on income generating activities that help to diversify income sources.
10. Implement climate-resilient physical development plans using GIS and hazards mapping techniques.

Scope: Physical Infrastructure

Geographic Coverage: National (focus on climate and disaster vulnerable areas)	**Targeted Community/Beneficiaries:** Climate and disaster vulnerable groups/ settlement
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Urban Development
Total Cost: USD 2,000 million	**Supporting Agency/Institutions/Groups:** Ministry of Federal Affairs and General Administration, Ministry of Forests and Environment, Ministry of Land Management, Provincial Ministries of Urban Development and Physical Infrastructure, Local Governments, Cooperatives, I/NGOs

31: Upgrading and Promoting Climate-Resilient Building Designs, Codes, Practices and Construction Technologies, and National Capacity Building for Implementation	**2025, 2030**

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, National Urban Policy 2007, National Urban Development Strategy 2017, Habitat III National Report 2016, Sustainable Development Goals: Status and Roadmap 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- High temperatures leading to weakening of the building materials (thermoelastic effect).
- Increased climate-induced hazards and extreme events increase risk of:
  - damage to rural and urban buildings, but mainly rural buildings that are comparatively less resilient
  - loss and damage to public infrastructure and buildings
  - disturbance in the social harmony and fabric
  - damage to human settlements
  - injury or death and displacement of population.

<table>
<tr><td>Objectives:
1. To prepare/revise climate risk-informed urban and rural development plans.
2. To design, pilot and demonstrate climate and disaster-resilient construction technology.
3. To promote climate-resilient building practices.
4. To explore and identify environment friendly building materials and construction technologies.
5. To disseminate information about and raise awareness of climate-resilient building practices.</td><td>Expected Outcomes:
1. By 2025, a catalogue on climate-resilient building design, practices, and construction material technology developed and disseminated.
2. By 2030, 15 new climate-resilient building information and demonstration centers in seven provinces and five physiographic zones (Tarai, Siwalik, Mid-hills, High Mountains and High Himalaya) established and operationalized.
Impact:
Safe, attractive, cost-effective, resilient and environment friendly buildings.</td></tr>
<tr><td colspan="2">Summary of Actions:
1. Explore and prepare local construction materials, responsible sourcing, and preparation of material guide.
2. Conduct a study on climate responsive attributes of local architecture in three ecological regions.
3. Improve and/or enhance the characteristics and use of the building materials and technologies in the context of climate and disaster risk.
4. Explore and identify innovative building technology for climate-resilient buildings.
5. Undertake a study and prepare a catalogue on cost effective, climate friendly and disaster resilient construction materials and technology.
6. Develop climate-resilient design guidelines for critical infrastructure such as roads, bridges, dams, and public buildings such as schools and hospitals.
7. Design a guideline to incorporate child-friendly, disabled-friendly, elder-friendly, and women-friendly factors when upgrading existing infrastructure as well as in new construction.
8. Develop incentive mechanisms for the promotion of improved, climate friendly construction materials and technology.
9. Retrofit existing buildings through the use of climate-resilient building technology (greening of the multistoried building through usage of low carbon and climate-resilient construction materials and building technology).
10. Prepare capacity building packages and promote skill development activities through tailor-made trainings, hands on exercises, and establishment of learning centers in seven provinces.</td></tr>
<tr><td colspan="2">Scope: Policy Laws and Regulation, Capacity building, Physical Infrastructure</td></tr>
<tr><td>Geographic Coverage:
National</td><td>Targeted Community/Beneficiaries: Local communities, public building and private housing developers</td></tr>
<tr><td>Duration/Timeframe:
10 years</td><td>Lead Institution: Ministry of Urban Development</td></tr>
<tr><td>Total Cost:
USD 500 million</td><td>Supporting Agency/Institutions/Groups: Ministry of Federal Affairs and General Administration, Provincial Ministries of Urban Development and Physical Infrastructure, Local Governments, Universities, MDBs, I/NGOs</td></tr>
</table>

7.5 Industry, Transport and Physical Infrastructure (ITPI)

The Constitution of Nepal calls for balanced, environmentally friendly, qualitative, and sustainable physical infrastructure development that prioritizes under-developed regions (GoN, 2015). The NCCP 2019 calls for the use of environmentally friendly and climate friendly technology during the development of industries, transportation systems and infrastructure; and the mainstreaming of climate risks in infrastructure design and construction (GoN, 2019). A total of 8,212 industries were registered in Nepal in 2020, including 1,162 large industries, 1,846 medium industries, and 5,204 small industries (MoF, 2020). The industries, however, were unevenly distributed across physiographic zones and the country's seven provinces. Industry and transport together consumed over 1,500 kilo tons of energy, and the largest energy supply for industries was biomass in 2016 (ADB, 2017b). Transport-related emissions make up the second-largest energy-related carbon emission in Nepal. Hence, the transport sector has become one of the significant contributors to the increase in urban air pollution. To address carbon emissions and air pollution, Nepal needs to move to decarbonize its transport system and electrifying the transport system is the key to transport decarbonization (Maharjan, 2021).

The observed climate change impacts on industry, transport and physical infrastructure vary widely across the geography and location. Floods, landslides, debris flow, rock falls, mudflows, sedimentation, erratic rainfall, windstorms, glacial floods, and groundwater levels are found to damage infrastructure. These climate hazards lead to the collapse of industrial buildings and properties, impact the integrity of infrastructure, increase the instability of land through the weakening of riverbanks and hill toes and land subsidence, damage road drainage structures, breach road embankments, scour bridge foundations, block the flow of traffic, and create washouts and inundation that can submerge infrastructure (UNECE, 2019). In general, the main impacts on infrastructure observed in Nepal's rural and urban areas are damage to houses, buildings, communication systems, bridges and roads, transmission lines, and water. Flooding has damaged water and sewer systems, overwhelmed drainage systems, caused traffic congestion, and polluted water. Drought has contributed to the failure of water and irrigation schemes in rural areas (MoFE, 2021b).

Transport systems are critical for effective disaster response and access to health, education, and agricultural extension services. Heavy monsoon rains in 2019 demonstrated that transport infrastructure is highly vulnerable to flooding and landslides, as major highways were blocked or destroyed, including the Koshi-Kamala section of the East-West Highway in that year (WB, 2020). Out of the 488 landslides reported in 2020, 59 occurred along roadsides and 62 occurred on roads and obstructed vehicular flow (MoF, 2020). Disruptions to road and aviation systems can have negative economic impacts for the industrial sector. The ITPI sector is vulnerable to the impacts of climate change because of the development practices such as rampant construction of buildings, expansion of unplanned settlements, and the rapid development of physical infrastructure and social infrastructure in disaster-prone municipal areas. Sensitivity to climatic hazards is compounded by fragile and feeble road networks, and maladaptive water schemes (MoFE, 2021). Only 46 municipalities have implemented building codes, and these codes were not necessarily developed in a manner that mainstreamed climate risks.

The five priority adaptation programmes in the Industry, Transport and Physical Infrastructure sector will improve the enabling environment to encourage infrastructure and industrial development that accounts for climate risks, diversify the energy supply mix to scale up clean energy to meet industrial demand, and encourage electric modes of transport. The five programmes have an estimated cost of USD 3.05 billion to 2050.

32: Strengthening Institutions, Technologies, Policies and Resources (Databases), and Building Capacity and Awareness for Climate-Resilient Industry, Transport and Physical Infrastructure	2030, 2035

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Environmentally Sustainable Transport Strategy 2014, Second Nationally Determined Contribution 2020, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, Foreign Investment and Technology Transfer Act 2019, Industry Policy 2011, National Mineral Policy 2017, Sustainable Development Goals: Road Map for Nepal, 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

Increased climate-induced hazards and extreme weather events increase the risk of:

- damage to industries and physical infrastructure affecting the operation of the industries.
- disturbances in transport services affecting the supply of materials that in turn impacts industrial production.
- loss of employment due to disturbances in industrial/transport operation.
- reductions in availability of raw materials for industries/transport.

Objectives:

1. To strengthen institutions and upgrade technologies to build climate-resilient industry, transport and physical infrastructure.
2. To develop, update, and provide easier, early and real-time weather and climate information.
3. To build capacity and resources in maintenance and operation of climate-resilient industry and transport infrastructure.

Expected Outcomes:

1. By 2030, real-time weather and climate information systems increased, and information disseminated to encourage climate-resilient industries and infrastructure.

2. By 2035, adaptive capacity of the ITPI sector enhanced through strengthening of institutions and upgrading to new state-of-the-art technologies.

Impact:

Climate and disaster-resilient industries, transportation systems and infrastructure.

Summary of Actions:

1. Develop a nationwide and accessible resource, data and information pool that sopport building capacities of resilient ITPI.
2. Disseminate EWS to industrial facilities that covers industry value and supply chain mechanisms.
3. Amend, plan, and develop climate-resilient infrastructure design, climate friendly guidelines (EIA, SEA and Climate Impact Assessment), proper land-use planning, relocation strategies, green certificates (Leadership in Energy and Environmental Design - LEED), and provision of insurance and subsidy mechanisms.
4. Build capacity and increase awareness on climate-resilient industry and infrastructure operations to ITPI stakeholders and service providers.
5. Conduct periodic monitoring and review as necessitated by standards.

Scope: Policy law and Regulation, Research and Innovation, Capacity Building, Technology development and Information, Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Industries, entrepreneurs, small and medium enterprises, local communities
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Industry, Commerce and Supplies
Total Cost: USD 200 million	**Supporting Agency/Institutions/Groups:** Ministry of Physical Infrastructure and Transport, National Planning Commission, Ministry of Land Management, Cooperatives and Poverty Alleviation, Ministry of Forests and Environment, Provincial Governments, MDBs, I/NGOs, Private Sector

33: Developing and Promoting Resilient, Clean Energy-based Transportation Systems	2030

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Environmentally Sustainable Transport Strategy 2014, Second Nationally Determined Contribution 2020, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, Foreign Investment and Technology Transfer Act 2019, Industry Policy 2011, National Mineral Policy 2017, Sustainable Development Goals: Road Map for Nepal, 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

Increased climate induced hazards and extreme events increase risk of:

- damage to industries and physical infrastructure/transport affecting in the operation of industries.
- damage to water and energy supply systems for transport.
- disturbances in transport services affecting the supply of materials that in turn impacts industrial production.
- loss of employment due to disturbances in industrial/transport operations.
- reductions in availability of raw materials for transport.

Objectives:

1. To reform policies to promote climate-resilient and low carbon transport system.
2. To establish infrastructure for promoting low carbon climate-resilient transport systems.

Expected Outcomes:

1. By 2030, 20% private and public vehicles will run in hybrid fuel system.

2. By 2030, low carbon, climate and disaster resilient and safer transport systems established.

Impact:

People-centric, safe, reliable, resilient and clean transport systems established and operationalized.

Summary of Actions:

1. Undertake climate vulnerability and risk hazard mapping of the road sector.
2. Promote and use climate-resilient and environment friendly tools, technologies, and inclusive measures in roads and transport (e.g., green belts, avenue plantations, bioengineering, bypasses, distance shortening, electric vehicles, waterways, railways, charging stations, etc.).
3. Promote hybrid-fuel systems for transportation vehicles.
4. Develop a Decision Support System for Transportation Systems to enable understanding of the unfolding climate vulnerability and risks in the transport sector.
5. Promote nature-based solutions to building resilience of the road sector.

Scope: Physical Infrastructure

Geographic Coverage: National with a focus on urban centers	**Targeted Community/Beneficiaries:** Urban population (primary), rural population
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Industry, Commerce and Supplies
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Ministry of Physical Infrastructure and Transport, Ministry of Land Management, Cooperatives and Poverty Alleviation, Ministry of Forests and Environment, National Planning Commission, Provincial Governments, MDBs, I/NGOs, Private Sector

34: Developing Climate-Resilient Community Infrastructures to address Climate Risks, Hazards and Pandemics	2030

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Environmentally Sustainable Transport Strategy 2014, Second Nationally Determined Contribution 2020, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, Foreign Investment and Technology Transfer Act 2019, Industry Policy 2011, National Mineral Policy 2017, Sustainable Development Goals: Road Map for Nepal, 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

Increased climate induced hazards and extreme events increase risk of:

- damage to industries and physical infrastructure affecting in the operation of the industries.
- damage to water and energy supply systems for infrastructures.
- disturbances in infrastructures affecting the supply of materials that in turn impacts production.
- loss of employment due to disturbances in infrastructures.
- reductions in availability of raw materials for the infrastructure.

Objectives:	Expected Outcomes:
1. To build community infrastructure that can withstand climate hazards; with a co-benefit of helping communities address disaster risks and pandemics.	**1.** By 2030, 100 climate- and disaster resilient open spaces, community shelters and holding centers strengthened and developed. **2.** By 2030, 100 helipads warehouse developed and strengthened. **Impact:** Communities are equipped to deal with climate and disaster emergencies.

Summary of Actions:

1. Develop guidelines for accessible, safe, and resilient shelters, based on the needs, vulnerabilities, and preferences of vulnerable groups.
2. Assess, develop and strengthen community shelters and holding centers' open spaces, and helipads in each municipality.
3. Develop a climate-resilient and energy efficient multipurpose community infrastructure and technology.

Scope: Physical Infrastructure, Policy Law and Regulation, Capacity Building

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Urban populations most at risk of climate change impacts and disasters including women, children, marginalized groups, senior citizens, persons with disabilities, and youth.
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Physical Infrastructure and Transport
Total Cost: USD 350 million	**Supporting Agency/Institutions /Groups:** Provincial and local governments, MDBs, I/NGOs, CBOs, Private Sector

35: Up-Grading, Maintaining and Relocating Vulnerable Industries and Physical Infrastructures to Increase Resilience to Climate Risks	2035, 2045

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Environmentally Sustainable Transport Strategy 2014, Second Nationally Determined Contribution 2020, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, Foreign Investment and Technology Transfer Act 2019, Industry Policy 2011, National Mineral Policy 2017, Sustainable Development Goals: Road Map for Nepal, 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

Increased climate-induced hazards and extreme weather events increase risk of:

- damage to industries and physical infrastructure affecting the operation of the industries.
- damage to water and energy supply systems for industry/infrastructures.
- disturbances in transport services affecting the supply of materials that in turn impacts industrial production.
- loss of employment due to disturbances in industrial operation.
- reductions in availability of raw materials for the industries/infrastructures.

Objectives:

1. To strengthen, promote and construct climate-smart (resilient) and eco-friendly industries and infrastructure.
2. To relocate the at risk-industries to safer locations.

Expected Outcomes:

1. By 2035, 40% of industries at risk to climate extremes are equipped, strengthened, and relocated.

2. By 2045, industries will have enhanced stock of raw materials.

Impact:

Climate friendly and resilient industries and infrastructure maintained safeguarding the environment and socio-economic development.

Summary of Actions:

1. Map and assess current and potentially climate vulnerable industries.
2. Identify climate-resilient measures for relocation, upgrading, and maintenance of industries and their infrastructure.
3. Provide support to relocate identified vulnerable industries.
4. Incorporate climate- resilient technologies and inclusive measures against climate risk while maintaining and upgrading the industries.

Scope: Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Vulnerable communities and industries
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Industry, Commerce and Supplies, Ministry of Physical Infrastructure and Transport
Total Cost: USD 1,000 million	**Supporting Agency/Institutions /Groups:** Provincial and Local Governments, MDBs, I/NGOs/CBOs, Private Sector

36: Diversifying the Energy Supply for Industrial Districts	2030, 2045

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, Environmentally Sustainable Transport Strategy 2014, Second Nationally Determined Contribution 2020, National Climate Change Policy 2019, Land Use Policy 2015, Land Use Act 2019, Foreign Investment and Technology Transfer Act 2019, Industry Policy 2011, National Mineral Policy 2017, Sustainable Development Goals: Road Map for Nepal, 2016-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Increased climate induced hazards and extreme events increase risk of:
  - damage to industries, physical infrastructure and energy system.
  - damage to water and energy supply systems.
  - Interruption of the electricity supply limiting industrial manufacturing activity.
- Reduced availability of water for energy due to interrupted supply of electricity
- Loss of employment due to no work at the industries caused by limited power supply.

Objectives:

1. To promote diverse, energy smart and climate-resilient energy systems to improve access for industries.

2. To develop and implement an energy mix approach in special economic zones and industrial districts.

Expected Outcomes:

1. By 2030, the proportion of renewable energy in the national system that supplies the industrial sector to be 20%.
2. By 2030, an energy efficient and climate-resilient industrial corridor established and operationalized.
3. By 2045, 50% of the large industries use clean energy.

Impact:

Continuous supply of electricity to industries that is increasingly comprised of renewable energy sources that promote industrial growth and the growth of the country's economy.

Summary of Actions:

1. Undertake mapping and prioritization of climate impacts on industries and develop a list of climate vulnerable industries.
2. Implement provision of insurance and subsidy mechanisms for the small-, medium-, and large-scale industries to absorb and transfer climate and disaster risk.
3. Promote nature-based solutions in the industry and infrastructure sector ensuring circular economy.
4. Establish renewable energy centers and power hubs at seven special economic zones (SEZ) to provide uninterrupted electricity as and when required.
5. Promote One Special Economic Zone at a renewable energy hub.
6. Promote the concept of net-metering to facilitate increase in renewable energy generation.

Scope: Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** SMEs and large industries
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Industries, Commerce and Supplies
Total Cost: USD 1,000 million	**Supporting Agency/Institutions /Groups:** Ministry of Energy, Water Resources and Irrigation, National Planning Commission, Nepal Electricity Authority, Provincial and Local Governments, MDBs, I/NGOs/CBOs, Private Sector, Alternative Energy Promotion Center

7.6 Tourism, Natural and Cultural Heritage (TNCH)

Tourism represents a small but expanding industry in Nepal. The Fifteenth Plan notes that tourism is a foundation of economic prosperity in Nepal and identifies the need to make the tourism climate resilient, which includes identifying climate risks for sensitive tourism destinations and cultural heritage and taking action to protect them from the risks (GoN, 2019). While the number of tourists dropped dramatically in 2020 and 2021 because of COVID-19, the sector has the potential for significant growth and could be a driver of economic and sustainable human development (UNDP, 2020). Tourism accounted for 7.5% of national GDP in 2017 (MoF, 2017a) when 940,218 international tourists visited Nepal, an increase of 25% over the previous year (MoCTCA, 2018). The tourism sector is a key contributor to the national economy as it is a source of foreign exchange in Nepal. However, the sector also poses some threats to wild areas and the natural and cultural heritage (Figure 15).

Figure 15: Tourist and protected areas map of Nepal

Nepal's tourism industry is primarily focused on nature; and most of the nature-based tourism activities are climate sensitive and highly vulnerable to climate change and its impacts. Trekking and mountaineering in Nepal are concentrated in Protected Areas that are at high risk of floods, landslides, glacier melt, avalanches, and GLOFs (ICIMOD, 2021).

Changing monsoon patterns have impacted tourism activities such as trekking, mountaineering, and safari (Nyaupane & Chhetri, 2009). The abrupt changes in climatic variables and extreme events are a major threat to the health and safety of tourists and people directly involved in tourism activities. Climate change and inclement weather have put the lives of trekkers, mountaineers, and associated human resources at threat. Between 2005 and 2014, a total of 235 tourists lost their lives due to inclement weather in the country, including avalanches and snowstorms (MoHA & DPNet-Nepal, 2015).

Other climate impacts on the tourism sector include loss of biodiversity, reduced landscape aesthetics, and infrastructure damage including cultural heritage sites. Many cultural heritage sites are located near rivers and could be destroyed or heavily damaged by rising river waters, flash floods, and landslides (MoSTE, 2014). Flash floods are particularly dangerous for museums and archives. In Mustang, the decrease of snow in winter and the increase in rainfall after the winter months have affected the traditional construction of mud and stone flat-roofed houses (MoFE, 2021c). The main climate risks in the sector are socio-economic losses due to disruptions to tourism businesses; and damage to and destruction of physical property and tourism infrastructure due to landslides, floods, fires, and extreme weather. Women are the de facto managers of many hospitality businesses, including homestays, restaurants, hotels, and teashops; and may experience declines in incomes or increases in workloads (e.g., water scarcity in tourism areas) (Tenzin et al., 2019).

The eight priority adaptation programmes in the Tourism, Cultural and Natural Heritage sector will identify climate sensitive areas, establish emergency preparedness and rescue teams for immediate action in climate-related disasters, establish a digital information center, strengthen sustainable climate-resilient tourism practices, and promote the diversification of tourist products and destinations. The eight adaptation programmes have an estimated cost of USD 1.13 billion to 2050.

<table>
<tr><th colspan="2">37: Climate-Resilient Tourism for Ecological Sustainability and Economic Prosperity</th><th>2030, 2040, 2045</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:

Damage and destruction of cultural heritage and archeological sites due to climate extremes events such as snowstorms, landslides, avalanches, GLOFs, extreme precipitation, hailstorms, windstorms, and extreme temperatures.</td></tr>
<tr><td colspan="2">Objectives:

1. To diversify and promote tourism destinations and products for sustainable tourism.

2. To promote agro-tourism, eco-tourism and tourism value-chains considering payment for ecosystem and climate-resilient practices.

3. To facilitate private and foreign direct investment to improve the climate resilience of tourism infrastructure.</td><td>Expected Outcomes:

1. By 2030, tourism infrastructure of key destinations (trails, bridges, buildings) assessed for climate risk and vulnerability.

2. By 2030, 20% of the key/prioritized tourism destinations enhanced through interventions.

3. By 2030, the contribution of the tourism sector to national GDP attained by 10%.

4. By 2040, revenues for conservation tourism increased by 60% in reference to 2022.

5. By 2045, 100 Agro-based tourism spots developed.

Impact:

Improved resilience and enhanced prosperity through an increase in the contribution of the tourism sector to the national GDP and increased investment in tourism sector.</td></tr>
<tr><td colspan="3">Summary of Actions:

1. Identify and promote new and alternative destinations and tourism products.

2. Promote green trails and nature-based tourism mostly focused on local resources, local products, and sustainable methods of hospitality management.

3. Promote agro-tourism and eco-tourism for resilient livelihoods.

4. Establish, develop, and promote high altitude sports and adventure tourism.</td></tr>
</table>

5. Build capacity of tourism-related stakeholders on climate change vulnerability, risks and adaptation options in tourism sector.
6. Promote and enhance the local and traditional knowledge and skill to diversify tourism products and services.
7. Identify and diversify complementary/alternative employment and income sources, particularly for marginalized groups, women and youth through skills development training (such as bakery, local cuisine, homestay, nature guide, handicrafts, cooking).
8. Develop domestic tourism packages for people irrespective of age including senior citizens, differently abled persons, and students.
9. Undertake a tourism value chain analysis that considers climate-resilient technologies.
10. Promote local customs and traditions to link the local economy to the tourism industry.
11. Develop a climate change adaptation tariff and expenditure framework in tourism sector.
12. Encourage private sector investment/involvement in climate-resilient infrastructure through subsidies and insurance mechanisms.
13. Promote foreign direct investment to enhance climate change resilience in the tourism domain through policy easing, information access, and co-ordination.

Scope: Capacity Building, Physical Infrastructure, Technology Development and Information	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Tourism enterprises, communities involved in the tourism sector, private sectors, foreign investors, domestic and international tourists
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Total Cost: USD 50 million	**Supporting Agency/Institutions /Groups:** Department of Tourism, Nepal Tourism Board, Development Partners, Private Sectors, I/NGOs, MDBs

38: Climate Risk and Tourism Information System for Resilient, Safe and Sustainable Tourism	2030, 2035

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025

Climate Risks and Vulnerabilities Addressed by the Actions:

Losses and damage due to climate extreme events such as snowstorms, landslides, avalanches, GLOFs, extreme precipitation, hailstorms, windstorms and extreme temperatures.

Objectives:

1. To develop and install hi-tech digital forecast information systems.
2. To provide accurate, timely and geo-specific meteorological information.
3. To develop disaster preparedness plans for the high-altitude area destinations by 2030.

Expected Outcomes:

1. By 2030, climate and disaster preparedness strategy and action plan for high altitude destinations developed and implemented.
2. By 2030, a system for forecasting weather and climate information to the tourism sector developed and implemented.
3. By 2030, a decision support system for tourism sector resilience building established and implemented.
4. By 2035, all tourism activities connect with real-time climate information system.

Impact:

Safe and reliable tourism information system that promotes sustainable tourism growth contributing to national GDP.

Summary of Actions:

1. Increase capacity of hydrological and metrological stations, particularly in mountainous regions, to monitor the change in glaciers and patterns of a snowstorm, for example.
2. Establish emergency communication channels (hotlines) for tourists and operators to deal with emergencies during the major disasters.
3. Support a tourism-based real time national weather, cryosphere, and disaster information system and mechanize the access to tourism operators as well as tourists (software based).
4. Establish a national system of weather and disaster information dissemination using relevant scientific tools such as mobile, television, radio, Apps, and web pages for timely alerts (national) that are also accessible and feasible to people from marginalized communities.
5. Develop a rapid respunse cell and climate induced disaster preparedness plan in mountainous districts incorporating the shift in seasons due to climate change and develop an all-season tourism master plan.
6. Establish an integrated tourism facility center in each district that provides information on weather and climate, risk and vulnerable sites, culture, local products, and souvenirs.

Scope: Capacity Building, Technology Development and Information, Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Tourists, communities and private sectors involved in tourism, aviation, and related transport industries; tourism related stakeholders
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Civil Aviation, Culture and Tourism
Total Cost: USD 20 million	**Supporting Agency/Institutions /Groups:** Department of Tourism, Department of Hydrology and Meteorology, Ministry of Home Affairs, MDBs, Nepal Tourism Board, I/NGOs

39: Develop Climate-Resilient Infrastructure, and Explore and Enhance Knowledge and Capacities for Resilient Mountain Tourism	2030, 2035, 2040

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025

Climate Risks and Vulnerabilities Addressed by the Actions:

Loss and damage of cultural heritage and archaeological sites due to an increase in extreme climate events such as hailstorms, windstorms, and snowstorms that disturb tourism operations in mountain regions.

Objectives:

1. To identify, conserve, and restore at-risk cultural, historical, archaeological sites.
2. To promote archaeological and heritage tourism.
3. To catalogue, conserve, and promote indigenous and traditional knowledge contributing to a climate-resilient tourism sector.

Expected Outcomes:

1. By 2030, sustainable and climate-resilient tourism strategy and action plan developed for mountain tourism.
2. By 2030, catalogue of all the cultural, historical, and archaeological sites that are at risk of climate change induced hazards prepared for decision making.
3. By 2035, 20 mountain tourist spots will have all physical facilities. The number of spots with all physical facilities increases to 40 by 2040.

Impact:

Enhanced climate-resilience of mountain tourism.

Summary of Actions:

1. Promote local and indigenous cultures, foods, and products (e.g., handicrafts) that directly benefit local communities.
2. Identify and map at-risk cultural sites for further planning and implementation of cultural site protection and preservation action. Conserve the most vulnerable and at-risk cultural heritage sites through meaningful participation of IPLCs.
3. Conduct regular maintenance of cultural heritage sites and develop mechanisms to allocate resources for repair and maintenance.
4. Develop climate-resilient and environmentally friendly guidelines and standards for the protection of cultural heritage sites.
5. Implement disaster risk reduction measures to protect the cultural heritage sites.
6. Retrofit and reinforce the physical infrastructures in the cultural heritage sites to make them climate resilient without disturbing their original state (2 in each province).
7. Develop and implement climate resilient and disabled, gender, children and senior citizen friendly (extreme temperature, precipitation, windstorm/blizzard proof) infrastructure design and structure guidelines.
8. Establish rescue centers, shed houses, and cooling houses at appropriate locations and on specific trekking routes, climbing routes.
9. Establish centers to collect, archive, share, and promote indigenous and traditional knowledge for building climate resilience in the tourism sector (7 centers as pilot).
10. Increase the number of mountain tourist spots with all physical facilities.

Scope: Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Ethnic, minority, disabled, women, children, senior citizens, tourists, researchers, and tourism entrepreneurs.
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Tentative Cost: USD 60 million	**Supporting Agency/Institutions/Groups:** Department of Archaeology, Department of Tourism, Ministry of Home Affairs, National Disaster Risk Reduction and Management Authority, Nepal Tourism Board, MDBs, I/NGOs, Private Sector

40: Promotion of Community-based Adaptation through Eco-and Cultural Tourism and Indigenous and Traditional Knowledge	2030, 2045

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to cultural and religious sites and heritage due to extreme weather events.
- Reduced number of trekkers and mountaineers due to extreme weather-related events such as windstorms, hailstorms, excessive rain, excessive heat, blizzards, and snowstorms.
- Damage to tourist infrastructure and destinations due to extreme climate events.
- Loss of traditional dress and activities, rituals, and languages due to climate-induced migration and shifting of location.
- Loss in national GDP induced by loss in tourism activity due to extreme climate events.

Objectives:	Expected Outcome:
1. To develop climate-resilient community-based eco-tourism and cultural tourism.	1. Climate-resilient and community-based tourism/livelihoods developed and enhanced in major tourist destinations by 2030 and extend in all tourist destinations by 2045. **Impact:** Increased contribution of the tourism sector to the national economy.

Summary of Actions:

1. Inventory and assess the homestay sites in major tourist destinations and sites.
2. Build capacity and awareness of local communities including women and marginalized populations on the impacts of climate change on tourism services.
3. Promote and enhance local, indigenous and traditional knowledge and skills to diversify tourism products and services.
4. Upgrade existing and build 500 new climate-resilient homestays (nationwide) ensuring their presence in all tourist destinations and trails.
5. Develop, operationalize and link 'One Home Stay Circuit' in each province.
6. Promote GESI inclusive tourism employment at the local level and develop women's leadership.
7. Develop a strategic plan for the establishment of rescue centers at appropriate locations and in specific trekking routes and climbing routes.

Scope: Physical Infrastructure, Capacity building, Technology Development and Information, Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Local level communities, tourists, women, ethnic groups, marginalized communities, and youth.
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Total Cost: USD 100 million	**Supporting Agency/Institutions /Groups:** Department of Tourism, Nepal Tourism Board, MDBs, I/NGOs, Private Sector

41: Diversifying and Promoting Alternative Tourism Destinations and Products for Climate-Resilient Tourism Business	2030, 2035

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to cultural and religious sites and heritage due to extreme weather events.
- Reduced number of trekkers and mountaineers due to extreme weather-related events such as windstorms, hailstorms, excessive rain, excessive heat, blizzards, and snowstorms.
- Damage to tourist infrastructure and destinations due to extreme climate events.
- Loss of traditional dress and activities, rituals, and languages due to climate-induced migration and shifting of locations.
- Loss in national GDP induced by loss in tourism activity due to extreme climate events.

Objectives:

1. To develop climate-smart and diversified tourism products.
2. To promote climate-smart and eco-friendly tourist circuits, routes, and sites.

Expected Outcomes:

1. By 2030, climate-smart and diversified tourism products developed in new tourism destinations.
2. By 2035, climate-resilient circuits, routes, and sites developed.

Impact:

Increased climate-resilient tourism activity.

Summary of Actions:

1. Develop climate-smart and diversified tourism products.
- Identify climate-smart and eco-friendly tourism products.
- Develop diversified tourism products and services so as to minimize the losses from climate hazards particularly in regard to mountaineering and trekking tourism.
- Train/build awareness of personnel in the tourism sector at the local level on climate change impacts and consequences; and adaptation measures.
- Capacitate tourism value chain actors in developing climate-smart tourism schemes.

2. Promote climate-smart tourism circuits and routes.
- Identify climate disaster hotspots in the potential tourist circuits, routes and sites, and delineate the area.
- Establish tourist information centers at strategic places.
- Train trekking guides and other personnel on safety and security including first aid.
- Ensure insurance of guides and porters.
- Collaborate with concerned authorities to establish rescue centers with trained, equipped and dedicated human resource at strategic places.
- Establish emergency communication channels (hotlines) for tourists and operators to deal with emergencies during the major disasters.
- Identify and improve alternative trekking trails so that tourists can use the trails in case of emergency.

3. Promote natural, cultural and eco-friendly tourism and destinations.
- Enforce building codes for the construction of tourism infrastructure along the circuits, routes and at the sites.
- Develop and promote tourism packages integrating local knowledge, traditions, culture, and food.
- Support the development of eco-friendly hotels and homestays.
- Conserve cultural practices, traditions, and sites (water spouts, historical ponds) through community participation.
- Manage solid waste in partnership with the private sectors and collaboration with local communities.

Scope: Physical Infrastructure, Capacity building, Information, Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Local level communities, tourists, tourism entrepreneurs, private sector
Duration/Timeframe: 15 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Tentative Cost: USD 100 million	**Supporting Agency/Institutions /Groups:** Department of Tourism, Nepal Tourism Board, I/NGOs, Tourism Service Providers, MDBs, Private Sector

42: Establishment and Operation of Emergency Relief and Rescue Services in Adventure Tourism	2030

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025, National Disaster Risk Reduction and Management Strategy and Action Plan 2018-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Reduced number of trekkers and mountaineers due to extreme weather-related events such as windstorms, hailstorms, excessive rain, excessive heat, blizzards, and snowstorms.
- Damage to tourist infrastructure and destinations due to extreme climate events.

Objectives:	Expected Outcomes:
1. To develop emergency rescue centers at appropriate strategic locations. 2. To promote insurance that covers climate risks in the tourism sector.	1. By 2030, emergency relief and rescue services in adventure tourism established and operationalized at each of the strategic adventure and tourism strategic locations. **Impact:** Reduced number of casualties resulting from extreme weather through timely and effective emergency relief and rescue service.

Summary of Actions:

1. Assess climate vulnerability and risks in the adventure tourism sub-sector.
2. Explore suitability of the rescue center locations and set them accordingly.
3. Formulate a strategic plan to establish climate-resilient relief and rescue centers at appropriate locations and in specific trekking and climbing routes that are women, child, senior citizen, and differently-abled people friendly.
4. Build accommodation facilities with insulation to address temperature extremes at higher altitudes.
5. Establish a tourism information system that is integrated with weather and climate forecasts, and prepare a dissemination plan.

Scope: Physical Infrastructure, Capacity Building, Technology Development and Information, Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Local level communities, national and international tourists
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Total Cost: USD 500 million	**Supporting Agency/Institutions /Groups:** Department of Tourism, Ministry of Home Affairs, National Disaster Risk Reduction and Management Authority, Nepal Tourism Board, Department of National Parks and Wildlife Conservation, Local Governments, Tourism Service Operators, MDBs, I/NGOs, Private Sector

43: Building Capacity for Resilient Tourism in Nepal	2030

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025, National Disaster Risk Reduction and Management Strategy and Action Plan 2018-2030, Gender Strategy and Action Plan on Climate Change 2020-2030

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to cultural and religious sites and heritage due to extreme weather events.
- Reduced number of trekkers and mountaineers due to extreme weather-related events such as windstorms, hailstorms, excessive rain, excessive heat, blizzards, and snowstorms.
- Damage to tourist infrastructure and destinations due to extreme climate events.
- Loss of traditional dress and activities, rituals, and languages due to climate-induced migration and shifting of location.
- Loss in national GDP induced by loss in tourism activity due to extreme climate events.

Objectives:

1. To build the capacity of tourism entrepreneurs and tourism service providers.
2. To mainstream climate resilience in tourism sector plans, policies, strategies, and programmes.
3. To encourage and support the implementation of climate-resilient programmes and activities by tourism service providers.

Expected Outcomes:

1. By 2030, climate change adaptation is integrated into tourism sector plans, policies, and strategies.
2. By 2030, 1,000 tourism sector stakeholders capacitated on climate change vulnerabilities and risks and adaptation planning in the tourism sector.

Impact:

Increased climate and disaster resilience of the tourism sector.

Summary of Actions:

1. Review and assess the policy framework on tourism considering climate change risks in the tourism sector.
2. Facilitate the integration of climate change adaptation into sectoral plan, policies, and programmes.
3. Develop and deliver tourism stakeholder-based capacity building packages on climate change vulnerability and risk and adaptation strategies in tourism sector.
4. Raise awareness in the local community, including with women and marginalized groups, on the impacts on climate change and its consequences.
5. Build capacity of all government officials, service providers, operators, and private sector entities on climate change risk and vulnerability and adaptation strategies in tourism sector.
6. Develop curricula on climate change vulnerability and risk and adaptation planning and integrate into to school, colleges, and universities.

Scope: Policy, Laws and Regulation, Capacity Building and Awareness

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Tourism industries, tourist, local communities
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Total Cost: USD 200 million	**Supporting Agency/Institutions/Groups:** Department of Tourism, Nepal Tourism Board, Local Governments, Tourism Service Providers, I/NGOs, MDBs, Private Sector

44: Promotion of Climate-Resilient 'One Local Level-One Tourism Destination'	2030
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan 2019/20-2023/24, Sustainable Development Goals: Road map for Nepal 2016-2030, Tourism Strategic Plan 2016-2025, National Disaster Risk Reduction and Management Strategy and Action Plan 2018-2030, Gender Strategy and Action Plan on Climate Change 2020-2030	
Climate Risks and Vulnerabilities Addressed by the Actions: • Damage to tourist infrastructure and destinations due to extreme climate events. • Loss of traditional dress and activities, rituals and languages due to climate-induced migration and shifting of locations. • Loss in national GDP induced by loss in tourism activity due to extreme climate events.	
Objectives: 1. To promote climate-resilient local tourism to improve livelihoods.	**Expected Outcomes:** 1. By 2030, 753 local level tourism destinations identified (one local level – one destination) and promoted. **Impact:** Increased climate-resilient local tourism activity across Nepal.
Summary of Actions: 1. Identity key tourism destinations in each of the local levels and develop plans to make the destinations safe, reliable, and resilient to climate risks. 2. Establish local, regional, and national weather and climate forecasting, as well as an EWS information dissemination platform at local tourism destinations. 3. Build capacity of the local people and local tourism service providers on safe, climate-resilient, and sustainable tourism services and products. 4. Build accommodation facilities with insulation to address climate extremes at higher altitude.	
Scope: Physical Infrastructure, Capacity Building	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Local level communities, national and international tourists
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Culture, Tourism and Civil Aviation
Total Cost: USD 100 million	**Supporting Agency/Institutions /Groups:** Department of Tourism, Nepal Tourism Board, Local Governments, Tourism Service Providers, I/NGOs, MDGs, Private Sector

7.7 Health, Drinking Water and Sanitation (HDWS)

Health, drinking water and sanitation are critical elements of balanced development and the promotion of healthy lifestyles. The Fifteenth Plan highlights the importance of mainstreaming climate change impacts in the design and construction of drinking water and sanitation facilities (GoN, 2019). At COP26, Nepal committed to develop climate-resilient and sustainable low carbon health systems, which included a commitment to conduct climate change and health vulnerability and adaptation assessments, and a commitment to develop Nepal's NAP in Health sector (H-NAP) (World Health Organization, 2021). The Ministry of Health and Population had led the preparation of Nepal's H-NAP for the period 2017-2021 (GoN, 2017a), and this plan requires updating to meet the COP26 health commitment. MoHP launched a climate change and health website in 2019[1].

Rising temperatures, fluctuating precipitation, and extreme weather events have significant impacts on the seasonal and temporal trends of vector-borne diseases, water-borne diseases, respiratory diseases, cardiovascular disease, food-borne and nutrition-related diseases, injuries, and mental illness (NPC, 2020a). The main climate-change health risks include direct mortality from natural hazards (especially landslides and floods) and the expansion of water and vector-borne diseases (IFRC, 2021).

Water availability and quality are impacted by climate change. Springs are the primary source of drinking water in the mid-hill region, and spring discharge has declined by 30% over the last 30 years (Adhikari et al., 2021). The increase in temperature also causes melting and thawing of glaciers, snow, and frozen ground leading to changes in the seasonality of river flows and reduction in water availability in summer (MoFE, 2021c). An increase in precipitation and severe weather has caused flooding, pollution of wells, inaccessibility of water sources, flooding of latrines, damage to infrastructure, landslides around water sources, sedimentation and turbidity, challenges to the sustainability of sanitation and hygiene behaviour, and water-borne diseases (MoFE, 2021a).

Nepal's NAP in the health sector (H-NAP) indicated that vulnerability in the health sector is linked to the availability of local resources, institutional good governance, quality of public health infrastructure, and the access to relevant local information regarding extreme weather threats. The spatial distribution of these factors is not uniform, with vulnerable populations being impacted by varying degrees. For example, the mid and far western districts were found to be more exposed to climate risks that increase the incidence of diarrhea, respiratory disease, and malaria.

Climate change can significantly worsen health conditions of poor people and communities that are living below the poverty line (GoN, 2017b). The Tarai region of Nepal is particularly vulnerable because it is prone to flooding and experiences health and hygiene issues during disasters. Floods, drought and landslides damage and disrupt water and sanitation infrastructure and services, resulting in poorer sanitation conditions, contamination of water sources, and limited access to water for hygienic practices that could lead to negative health impacts and potential disease outbreaks. Many health facilities are located near rivers or on steep slopes and are vulnerable to damage during floods and landslides. For example, 30 out of 51 (59%) of health facilities in Ramechhap have suffered damage from landslides (MoFE, 2021c).

The seven priority adaptation programmes for the HDWS sector will enhance the public health system to address critical climate vulnerabilities and risks through improved research and surveillance of diseases linked to climate change; and the establishment of EWS, emergency preparedness, and prompt responses to epidemics and pandemics. The actions will improve the enabling environment for the sector, work to integrate climate risks in all infrastructure projects, and improve the conservation of water sources along with watershed management to ensure sustainable water supply. The proposed programmes have an estimated cost of USD 4.75 billion to 2050.

1 https://climate.mohp.gov.np/

45: 'Health Promoting Cities': Health, Environment and Life (Heal)	2030, 2040, 2050

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, NHSSP, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017, 2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan 2017, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning, Water and sanitation in health facility improvement tool, Nepal Health Sector Support Programme, 15th Plan 2019/20-2023/24

Climate Risks and Vulnerabilities Addressed by the Actions:

- Compromised health care facilities and systems due to extreme events.
- Increase in mental health problems, owing to extreme climatic events such as floods and landslides.
- Greater risk of injury, disease anad death, owing to more intense heat waves, cold waves and fires (forest).
- Increased risk of vector-borne, water-borne, and food-borne diseases, especially in mountain areas, and leading to perennial occurrence in the lowlands.
- Increase in cardiorespiratory diseases, owing to higher ambient air pollution and haze in urban areas, resulting from climate change.
- Increase in morbidity and mortality related to extreme cold waves as well as heat waves in the southern Tarai lowlands.

Objectives:

1. To improve the health and quality of life of all urban and rural dwellers.
2. To ensure adequate open spaces and parks for healthy behaviors.
3. To improve environmental health services (water supply, sanitation, air quality, solid waste management, food safety, and pollution monitoring and control).
4. To increase urban forest coverage and conserve ecosystems those are stable and sustainable.
5. To promote clean, safe physical environment of high-quality including housing.

Expected Outcomes:

1. Environmental/Child/ Nutrition-Friendly Local Governance (E/C/NFLG) is promoted at the local level.
2. By 2030, 100 new green/smart parks established in the major urban centers.
3. By 2040, an additional 100 air quality pollution monitoring system established at strategic locations.
4. By 2050, all urban cities and rural centers adopt the concept of 'Health Promoting Cities': Heal.

Impact:

Healthy urban and rural populations that contribute to a sustainable economy, environment and society.

Summary of Actions:

1. Awareness raising and capacity building on the concept of 'Health Promoting Cities: Heal'.
2. Designate areas for open spaces and parks to promote healthy behaviors.
3. Plant suitable urban tree species and develop urban forestry corridor (e.g., roadside plantation, orchards, arboreta, evergreens, walkways) linking settlements.
4. Increase and implement activities to reduce air pollution in line with WHO interim targets such as promotion of clean cooking solutions, prohibition of open waste burning and healthcare waste management through non-burn technologies.
5. Develop cycling and walking lanes around cities, and install air quality monitoring stations and device controlling measures.
6. Promote waste management with a concept of zero waste and circular economy.
7. Promote renewable energy to power city lights and city centers, public offices and private properties.
8. Improve PES mechanism for control and conservation initiatives.
9. Promote and use climate-resilient and environment friendly tools and techniques in health care facilities.

Scope: Policy, Law and Regulation, Capacity Building, Physical Infrastructure, Research and Innovation, Technology Development	
Geographic Coverage: All urban cities and rural centers	**Targeted Community/Beneficiaries:** Population and assets in all the urban cities and rural centers in all provinces
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Health and Population
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Ministry of Water Supply, Ministry of Urban Development, Ministry of Forests and Environment, Ministry of Federal Affairs and General Administration, Ministry of Home Affairs, Ministry of Energy, Water and Irrigation, Municipalities, MDBs, Universities, I/NGOs, Private Sector

46: Strengthening Climate Sensitive Disease Surveillance Systems with Emergency Preparedness and Response	**2030, 2035, 2045**

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, NHSSP, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017-2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan 2017, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning, Water and sanitation in health facility improvement tool, Nepal Health Sector Support Programme (NHSSP), 15th Plan 2019/20-2023/24, H-NAP 2017-2021

Climate Risks and Vulnerabilities Addressed by the Actions:

- Compromised health care facilities due to damage of infrastructure due to extreme climate events such as floods, landslides, forest fires, hailstorms, and snowstorms.
- Increased risk of injuries, diseases and death, owing to more intense heat waves, cold waves, and prevalence of vector-borne diseases.
- Risk of emergence of new diseases that are sensitive to climate change.
- Risk of VBDs in high hills areas with prevalence in all over Nepal.

Objectives:

1. To operationalize disease surveillance systems through adoption of appropriate technology, tools and early warning reporting system (EWARS).
2. To generate evidence and support for evidence-based decision making for climate sensitive diseases.
3. To integrate climate change related health issues in academic curriculum.
4. To strengthen and equip public health laboratories to considering climate sensitive diseases.
5. To prevent and control life losses and disabilities due to emergency situations (climate induced extreme events).
6. To strengthen multisector collaboration and cooperation in emergency response.
7. To build the capacity of the federal, provincial, and local level public health emergency operations centers.

Expected Outcomes:

1. By 2030, existing public health surveillance system strengthened to reduce morbidity and mortality due to climate sensitive diseases.
2. By 2030, 7 public health laboratories, at least one in each province, equipped and strengthened to consider climate sensitive diseases and health risks.
3. By 2030, all Health Emergency Centers at least in 25 municipalities, by 2035, in at least 100 municipalities and by 2040, in all municipalities capacitated in the functioning in extreme climate emergency situations.
4. By 2030, Federal, provincial and local level governments are capable of preparing for and responding to climate risks and their impacts on public health.
5. By 2035, 50% and by 2045, 70% decrease in the water-borne diseases.

Impact:

Reduce morbidity and mortality through timely Information of prevalence and incidence on climate sensitive disease and climate extremes.

Summary of Actions:

1. Develop an operationalization plan to strengthen federal, provincial and local health emergency operation centers.
2. Strengthen the integrated surveillance system for climate sensitive diseases (vector-borne, water-borne, food-borne, other infectious).
3. Make all surveillance and health information system inter-operable.
4. Strengthen public health laboratories and research centers for climate sensitive diseases and surveillance.
5. Promote and facilitate academia and researchers for evidence-based learning, data depository and research on the public health and climate sensitive health.
6. Develop curricula on climate change vulnerability and risk and adaptation planning and integrate into to school, colleges, and universities
7. Establish, operationalize, and strengthen rapid response teams (health and WASH), emergency teams, trauma centers/services, and hub satellite networks at federal, provincial and local levels.
8. Digitize water and sanitation data and information including different components of climate risks at health emergency centers.
9. Build awareness, community engagement, and capacity of WASH sector stakeholders at federal, provincial and local levels.
10. Update and implement H-NAP as committed in COP26.

Scope: Capacity Building, Physical Infrastructure, Technology Development, Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** General public and health professionals
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Health and Population
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Ministry of Home Affairs, Ministry of Physical Infrastructure and Transport, Ministry of Education, Science and Technology, Ministry of Water Supply, Provincial Governments, Local Governments, DHM, MDBs, Universities, I/NGOs, Private Sector

47: Research, Innovation and Development of Climate Resilient Preventive Measures/ Technologies/Approaches for Water Supply, Sanitation and Health System	**2030, 2035, 2040, 2050**

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, NHSSP, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017-2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan 2017, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning, Water and sanitation in health facility improvement tool, 15th Plan 2019/20-2023/24, H-NAP 2017-2021

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to and destruction of health sector infrastructure and water supply and sanitation systems due to extreme events such as floods, landslides, forest fires, prolonged dry spells, and drought.
- Compromised health care facility systems due to extreme climate events and emergence of new diseases.
- Drying up of water resources, and decreasing surface water flow and ground water recharge affecting water availability and access.
- Compromised access to safe water and sanitation leading to diseases and long-term impacts among the most vulnerable groups, including children, women, disabled persons, and elderly people.
- Increased risk of vector-borne, water-borne, and food-borne diseases, especially in mountain areas, and leading to perennial occurrence in the lowlands.

<table>
<tr>
<td>Objectives:
1. To identify and conserve water recharge areas.
2. To explore, pilot, and implement climate-resilient technologies for supply of safe water and sanitation in line with SDG target.
3. To explore resources and partnerships for scaling up identified climate-resilient WASH technologies and businesses (supply to service) through engagement of the private sector and industries.
4. To develop climate-resilient water supply systems and sanitation services and facilities focusing on gender, youth and overall social inclusion.
5. To design and implement climate proofing of WASH services.
6. To develop a smart WASH MIS system to integrate data, information, technology, resources and management.</td>
<td>Expected Outcomes:
1. Climate-resilient WASH technologies (hybrid, solar, impounding reservoir, catchment protection, structural resilience-additional storage capacity for emergency measures, water and energy efficient technologies, multiple use systems, demand and leakage management) explored and piloted in 3,000 by 2030, 5,000 by 2035 and 10,000 by 2040, vulnerable households, communities and systems at local level.
2. By 2030, more evidence generated on climate sensitive diseases and health risks by data sharing mechanism between Ministry of Health and Population, Ministry of Water Supply and research and academia.
3. By 2030, 40% of the population including women, children and socially marginalized people benefit from safely managed water supply services. By 2035, 80% and by 2040 100% population get benefited.
4. By 2050, early warning system established for the WASH service sector in vulnerable areas.
5. By 2030, 50% of the population including women, children and socially marginalized people benefit from climate-resilient and safely managed sanitation services. By 2035, 70% and by 2040, 100% population get benefitted
Impact:
Climate-resilient water supply systems.</td>
</tr>
<tr>
<td colspan="2">Summary of Actions:
1. Build climate-resilient water supply systems and services focusing on gender, children, youth, and overall social inclusion.
2. Promotion of multiple water use systems focusing on gender and social inclusion.
3. Enhance operationalization of a national WASH/MIS system that integrates hydro-meteorological and land use data.</td>
</tr>
<tr>
<td colspan="2">Scope: Capacity Building, Physical Infrastructure, Information Technology Development, Capacity Development</td>
</tr>
<tr>
<td>Geographic Coverage:
National</td>
<td>Targeted Community/Beneficiaries: Vulnerable communities, water and sanitation service users including women, children, disabled persons and socially marginalized groups.</td>
</tr>
<tr>
<td>Duration/Timeframe:
30 years</td>
<td>Lead Institution: Ministry of Water Supply</td>
</tr>
<tr>
<td>Total Cost:
USD 2,000 million</td>
<td>Supporting Agency/Institutions/Groups: Ministry of Health and Population, Department of Water Supply and Sewage Management, Ministry of Forests and Environment, Provincial Governments, Local Governments, MDBs, I/NGOs, CBOs, Nepal Health Research Council, WHO, Academia</td>
</tr>
</table>

48: Capacity Building of Health and Hygiene Service Providers and Professionals (Institution and Personnel) on Climate-Resilient Health Hygiene Service Planning and Implementation	2030

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, NHSSP, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017-2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan 2017, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning, Water and sanitation in health facility improvement tool, Nepal Health Sector Support Programme, 15th Plan 2019/20-2023/24, H-NAP 2017-2021

Climate Risks and Vulnerabilities Addressed by the Actions:

- Compromised health care facilities due to loss and damage of health sector infrastructure because of extreme climate events such as floods, landslides, forest fires, hailstorms, and snowstorms.
- Increased risk of injury, disease and death owing to more intense heat waves, cold waves, and prevalence of vector-borne diseases.
- Risk of emergence of new diseases that are sensitive to climate change.

Objectives:

1. To empower and inform WASH service providers and professionals to respond to climate risk and vulnerabilities.
2. To ensure sustainable and safe management of water, sanitation, and health care waste services.
3. To ensure use of sustainable renewable energy in health care facilities and services.
4. To develop and promote climate-resilient infrastructure to enable efficient functioning of health care facilities during extreme weather events.

Expected Outcomes:

1. By 2030, 80% of the health care service providers trained and capacitated about climate change risks on health care facilities and services.
2. By 2030, 2,000 health care facilities are resilient to climate risks and maintain their operation during extreme events.
3. By 2030, 2,000 health care facilities improved and environment friendly WASH services integrated into their facilities and operation.

Impact:

Climate-resilient WASH and health care facilities across Nepal.

Summary of Actions:

1. Assess health care facilities and undertake climate change vulnerability risk assessment in the facilities (climate risk screening that essentially covers all disaster and extreme events risk).
2. Explore innovative and climate-resilient technologies and implement (integrate) them in each health care facility.
3. Capacity building of health professionals on climate sensitive diseases and health risks and on climate change health risks research through development of robust training modules.
4. Provide support to improve and develop climate-resilient and environment friendly health care facilities.
5. Explore and develop strategic actions on addressing cardiorespiratory diseases, and other diseases induced through the climate related hazards.

Scope: Capacity Building, Physical Infrastructure, Technology Development, Innovation

Geographic Coverage: Focus on at risk areas (with priority in Sudurpaschim province, Karnali province and Madhesh province)	**Targeted Community/Beneficiaries:** General public (100,000 people per day); health care service providers
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Health and Population
Total Cost: USD 50 million	**Supporting Agency/Institutions/Groups:** Ministry of Water Supply, Provincial Governments, Local Governments, MDBs, WHO, I/NGOs, Private Sector, Universities

49: Development of Climate Resilient and Inclusive WASH Service and Facilities through Building Capacities, Developing Institutions and Systems, Adopting Innovative Technologies and Extending Collaboration	2030, 2035, 2040

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017-2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan-2017, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning, Water and sanitation in health facility improvement tool, Nepal Health Sector Support Programme, 15th Plan 2019/20-2023/24, H-NAP 2017-2021

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to and destruction of health sector infrastructure and water supply and sanitation systems due to extreme events such as floods, landslides, forest fires, prolonged dry-spells, and incidences of drought.
- Compromised health care facility systems due to extreme events and emergence of new diseases.
- Compromised access to safe water and sanitation leading to diseases and long-term impacts among the most vulnerable groups, including children, women, disabled-persons and elderly people.
- Increased risk of vector-borne, water-borne and food-borne diseases, especially in mountain areas, and leading to perennial occurrence in the lowlands.

Objectives:

1. To capacitate and raise awareness of stakeholders on climate-resilient WASH interventions.
2. To build capacities of service providers, WASH practitioners, and local governments in adapting innovative technologies.
3. To promote adaptive water, sanitation and hygiene practices to reduce the impact on the environment.
4. To support local governments to establish and operationalize water-quality monitoring mechanisms.

Expected Outcomes:

1. By 2030, 20%, by 2035, 50% and by 2040, 100% of existing water supply schemes are climate-resilient ensuring the safely managed water supply services.
2. By 2035, 20% of the households in the country have adopted rainwater water harvesting technology.
3. By 2030, partnerships established with academic/research institutions, scholars, private sectors, and industries to develop and promote climate-resilient WASH technologies including human resources at federal level and by 2035, at all provinces.
4. By 2030, system of multisector collaboration strengthened and operationalized at federal, provincial, and local levels.

Impact:

Smart and cost-effective climate-resilient WASH systems built and maintained.

Summary of Actions:

1. Promote climate-resilient and smart WASH technologies (low water use technologies, flood resilient technologies supporting water reuse, automation/pumping, etc.).
2. Establish and strengthen water quality monitoring systems that support climate-resilient water safety planning, and develop and implement wastewater management plans at local levels.
3. Build climate-resilient and inclusive sanitation service facilities focusing on gender, children, youth, and overall social inclusion.
4. Promote water supply and sanitation system insurance schemes, rainwater harvesting innovations technologies and their adoption.

Scope: Research and Innovation

Geographic Coverage: National	**Targeted Community/Beneficiaries:** WASH service providers and users, governments, WASH entrepreneurs etc.
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Water Supply
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Ministry of Health and Population, Ministry of Urban Development, Ministry of Federal Affairs and General Administration, Local Government, Universities, Private Sector, Academia, MDBs, WHO, I/NGOs

50: Promotion and Conservation of Water Sources along with Watershed Management for Sustainable Water Supply Service	2030, 2035, 2040

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, NHSSP, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017-2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan-2017, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning,Water and sanitation in health facility improvement tool, National Drinking Water Quality Standard 2005, National Water Plan, Nepal Health Sector Support Programme, 15th Plan 2019/20-2023/24, H-NAP 2017-2021

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to and destruction of health sector infrastructure and water supply and sanitation systems due to extreme events such as floods, landslides, forest fires, prolonged dry spells, and drought.
- Drying up of water resources, and decreasing surface water flow and ground water recharge affecting water availability and access.
- Depletion of water sources both surface and ground water.
- Compromised health care facility systems due to extreme climate events and emergence of new diseases.
- Compromised access to safe water and sanitation leading to diseases and long-term impacts among the most vulnerable groups, including children, women, disabled persons and elderly people.
- Increased risk of vector-borne, water-borne and food-borne diseases, especially in mountain areas, and leading to perennial occurrence in the lowlands.

Objectives:

1. To conserve and maintain water sources for continuous availability.
2. To promote and support water recharge and retention activities.
3. To promote and support watershed management for sustainable water supply service delivery.
4. To capacitate and equip local government in the conservation of water sources (surface and ground).

Expected Outcomes:

1. By 2030, water sources along the Chure region protected to conserve the ecosystem and to promote recharge.
2. By 2030, water supply services enhanced in at least 300 municipalities by augmenting, protecting and conserving the water sources.
3. By 2030, 30% of villages/settlements have water sources/ponds collecting rainwater and ground recharging. By 2035 70% and by 2040, all of the village settlements have such facilities.
4. By 2030, 15% of households in the country have adopted rainwater water harvesting technology.

Impact:

Ensured water supply through protection of water sources.

Summary of Actions:

1. Identify, map and conserve sources of water with reference to geo-climatic hazards.
2. Conserve and promote existing and traditional water harvesting techniques, and sources.
3. Promote and develop water recharge and flood management/retention systems.
4. Control pollution in and around water sources to control water-borne diseases vectors.
5. Promote and support watershed management system for sustainable supply of water.

Scope: Physical Infrastructure, Technology Development, Capacity building, Land Cover/Land Use Management

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Service providers, vulnerable communities, water users including women, children and social marginalized groups.
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Water Supply
Total Cost: USD 1,000 million	**Supporting Agency/Institutions/Groups:** Ministry of Health and Population, Ministry of Forests and Environment, Ministry of Federal Affairs and General Administration, Provincial and Local Governments, Municipalities, I/NGOs, CBOs, MDBs, Private Sector, Academia

51: Integration and Implementation of Climate Change Adaptation in the Health and WASH sector through Policy Reform, Strategy Development and National Level Awareness	2030, 2040

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, SDG Road Map for Nepal, National Health Policy 2019, Long-term (Water Supply and Sanitation) Sectoral Development Plan 2017-2030, National Health Infrastructure Development Standards 2017, National Disaster Risk Reduction and Management Strategy and Action Plan 2017, Nepal Health Sector Support Programme, Climate Resilient Water Safety Plan, Climate Resilient Sanitation Safety Planning, Water and sanitation in health facility improvement tool, 15th Plan 2019/20-2023/24

Climate Risks and Vulnerabilities Addressed by the Actions:

- Damage to and destruction of health sector infrastructure and water supply and sanitation systems due to extreme events such as floods, landslides, forest fires, prolonged dry spells, and drought.
- Compromised health care facility systems due to extreme climate events and emergence of new diseases.
- Compromised access to safe water and sanitation leading to diseases and long-term impacts among the most vulnerable groups, including children, women, disabled persons and elderly people.
- Increased risk of vector-borne, water-borne and food-borne diseases, especially in mountain areas, and leading to perennial occurrence in the lowlands

Objectives:

1. To reform and formulate policies to promote climate-sensitive WASH and health plans and programmes.
2. To support local governments to integrate and implement climate change adaptation in local WASH and health plans and programmes.
3. To develop national guidelines and strategies to support local governments to integrate multiple uses of water, water quality improvement systems, insurance, and hybrid technologies.
4. To operationalize the National Health and WASH Management Information System that integrates hydro-meteorological and land-use data for climate sensitive planning, implementation and monitoring.

Expected Outcomes:

1. By 2030, 753 local levels integrate climate change adaptation in local WASH and health plans and programmes.
2. By 2030, national guidelines and strategies prepared and implemented to support local governments to integrate multiple uses of water, water quality improvement systems, insurance and hybrid technologies.
3. By 2030, National Health and WASH Management Information System established and operationalized.
4. By 2040, 95% of the WASH services are functional.

Impact:

Improved adaptation-based health care and WASH services.

Summary of Actions:

1. Undertake review of the existing plan, policies, strategies, and guidelines and strengthen integrating climate change adaptation considering the current and future climate risks.
2. Support local governments on the integration and implementation of climate change adaptation.
3. Promote and develop hybrid water supply systems (impounding reservoirs, solar lifting, etc.).

Scope: Policy, Laws and Regulation, Capacity Building

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Vulnerable communities, water and sanitation service users including women, children, disabled persons, and socially marginalized groups
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Water Supply
Total Cost: USD 200 million	**Supporting Agency/Institutions/Groups:** Ministry of Health and Population, Ministry of Forests and Environment, Department of Water Supply and Sewage Management, Provincial Governments, Local Governments, WHO, MDBs, I/NGOs, CBOs, Private Sector

7.8 Disaster Risk Reduction and Management (DRRM)

The Constitution of Nepal has adopted the policy of early warning, preparation, rescue, relief, and rehabilitation to reduce the risk of natural disasters. The Fifteenth Plan notes that climate change is one factor impacting Nepal's high incidence of natural disasters. Nepal has signed the Sendai Framework and has established a national framework including The National Policy for Disaster Risk Reduction; Disaster Risk Reduction National Strategic Plan of Action; National Disaster Risk Financing Strategy; and the establishment of National Disaster Risk Reduction and Management Authority (NDRRMA). From an adaptation perspective, it is important that disaster risk evaluation and plans take account of expected climate risks, vulnerabilities and impacts.

Nepal's diverse topography, complex geology, and highly varying climate indicate that the country is exposed to many natural and human-induced hazards that are impacted by climate change. The hilly areas of Nepal are prone to landslides and the Tarai plains are prone to floods, while the higher Himalaya and middle- mountains experience debris flow and GLOFs (Figure 16).

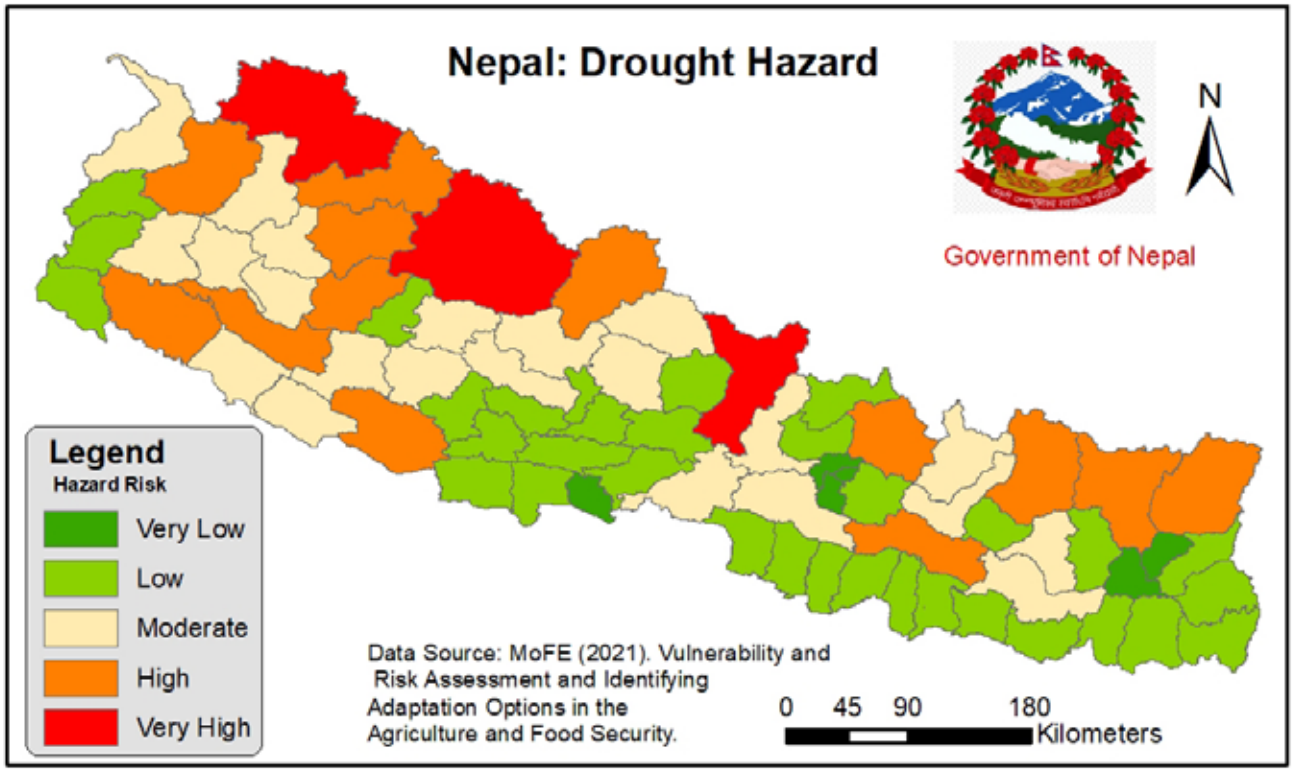


Figure 16: Drought hazard map of Nepal

The middle-mountains and Tarai are affected by forest fires, while the higher mountains by landslides and avalanches. On average, 647 people die from climate- induced disasters in Nepal each year which is about 65% of the total deaths from all disaster events except road accidents (MoHA, 2018). Floods, landslides, epidemics, and fires are the most devastating climate-induced disasters in Nepal in regard to deaths, affected population, and economic losses (MoFE, 2021c). Floods are most damaging, causing over 50% of deaths and 30% of economic losses (UNISDR, 2015). An example is the 2017 flooding that affected 80% of the Tarai region and some surrounding districts and caused USD 584.7 million worth damages (NPC, 2017b). In the future, it is expected that flooding will cause 82.93% of the average annual loss (UNISDR, 2015) as drought changes precipitation patterns; snow cover changes glacier retreat, and GLOFs are expected to be intensified.

The impacts of climate-related disasters are felt at the household level in the form of food insecurity, damage to property, and increased prices of food and fuel; while at the national level in the form of re-allocation of already scarce government resources to address the impacts of disasters at the expense of other programmes. Demographic factors such as rapid population growth, human

encroachment into the vulnerable lands, poverty, and limited awareness about the sustainable use of natural resources increase vulnerability to the impacts of climate-induced disasters and increase the risk of increased damages.

Disaster Risk Reduction and Management (DRRM) is a concurrent function of the federal, provincial, and local governments. The DRRM Act (2017) addresses disaster risk management with a comprehensive approach, focusing on the different stages of the disaster management cycle from preparedness to mitigation response, to rehabilitation. However, collecting and managing disaster- and climate-related data remains inadequate, and it is not accessible to many local level planners and to the private sector. Given that local actors are usually the first responders, the success of immediate rescue often correlates with available data and equipment and their capacity to instigate operations. The priority adaptation actions promote a proactive, rather than reactive, approach to climate-related disasters; and aim to reduce risks to communities and infrastructure resulting from climate-related disasters. The programmes work to ensure that disasters are curtailed, do not result in emergencies, and build the capacity of people to cope with the impacts of climate change.

Six priority adaptation programmes in the DRRM sector will help empower federal, provincial and local governments to assume effective and efficient roles in leading DRRM activities in their respective localities. The enabling environment will be improved through actions to harmonize DRRM and climate adaptation plans, policies, and guidelines; to develop climate risk sensitive land use planning, and to develop actions plans to address climate-induced disasters. The programmes will improve and strengthen early warning systems and multi-hazards monitoring, and integrate adaptation considerations into social protection systems. The adaptation programmes have an estimated cost of USD 8.05 billion to 2050.

<table>
<tr><th colspan="2">52: Building Climate Resilience by Developing and Harmonizing DRRM and Climate Change Adaptation at Federal to Local Levels through Policy Reforms (Integration of DRR in Local Adaptation Plans)</th><th>2030, 2035, 2040</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Disaster Risk Reduction and Management Act 2017, National Disaster Risk Reduction and Management Policy 2018, Disaster Risk Reduction National Strategic Plan of Action, 2018-2030, Land Use Policy 2015, Sustainable Development Goals Status and Road Map: 2016-2030, Local Government Operationalization Act 2017, National Land Policy 2019</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:
Displacement caused by climate-induced hazards.
Loss of lives, property and assets, physical infrastructure, livelihoods, shelter, education, water, sanitation, and food due to climate-induced hazards such as landslides and flooding due to extreme precipitation, forest fires, dry spells and drought incidences due to extreme temperatures, heat waves and cold waves.
Increased vulnerability of women, children, people with disability, senior citizens, poor and marginalized groups as associated with an increase in the magnitude, intensity, and frequency of climate extreme events: landslides, Dam Outburst Floods, GLOFs, emergence of new pests and vector-borne diseases, and pandemics.</td></tr>
<tr><td colspan="2">Objectives:
To formulate integrated guidelines on Disaster Risk Reduction Management (DRRM) and climate change adaptation at the local level.
To harmonize DRR and climate adaptation plans, policies and guidelines at federal, provincial and local level and mainstream into sectoral periodic and annual plans and budgets.</td><td>Expected Outcomes:
By 2030, DRR and climate adaptation plans, policies and guidelines are harmonized at all levels of the government.
By 2030, all 753 local governments have developed GESI responsive local disaster and climate resilient plans, and integrated DRR and climate adaptation in their periodic plans and annual plans and budgets.
By 2030, DRR priorities and goals are incorporated in the existing legal instruments and frameworks, such as child friendly governance, environment friendly local governance, and comprehensive school safety framework.</td></tr>
</table>

3. To develop and implement GESI-responsive local disaster and climate resilience plans. 4. To increase participation and involvement of vulnerable groups in climate and disaster risk governance. 5. To foster an enabling environment for inclusive climate and disaster risk governance.	4. By 2030, meaningful participation of women, children, youth, senior citizens, indigenous groups, persons with disabilities, other marginalized and vulnerable groups in all stages of the planning and implementation process at federal to local level (climate and disaster risk governance) increased by 80% (from a baseline of participation rates in 2020). 5. Age, gender and disability-centric physical infrastructure, early warning, communication, and rescue and relief systems established in 300, 500 and 753 local levels by 2030, 2035 and 2040 respectively. 6. By 2030, 35%, by 2035, 70% and by 2040, 100% of local levels have capacity to develop circular economy based integrated climate adaptation and DRR planning and implementation. **Impact:** Reduced damage and loss from climate-induced disasters in every sector.

Summary of Actions:

1. Harmonize DRR and climate adaptation in the federal, provincial, and local level policy landscape.
2. Support and capacitate all 753 local levels to develop and effectively implement GESI responsive local disaster and climate risk reduction managment plans.
3. Integrate DRR and climate adaptation in federal, provincial and local level development planning guidelines, periodic plans, Medium-term Expenditure Frameworks and local level plans.
4. Formulate and implement guidelines to promote community-based DRR and management, child-centered disaster risk reduction, climate change adaptation and minimum characteristics of resilient communities (including indigenous knowledge and technologies) to promote resilience.
5. Promote mechanisms to ensure meaningful participation of vulnerable people including women, children, youth, persons with disabilities, senior citizens, indigenous people and other marginalized groups in planning, capacity building and implementation processes on DRR and climate adaptation.
6. Strengthen coordination among DRR and climate adaptation institutional actors and other stakeholders.
7. Integrate GESI in DRR plans, policies and programmes emphasizing women, children, youth and senior citizens in adaptation activities.
8. Enhance capacity building on adaptation related GESI issues, solutions, and gaps at all levels of government.
9. Strengthen local levels have capacity to develop circular economy based integrated climate adaptation and DRR planning and implementation.
10. Promote research, knowledge management on GESI, DRR and adaptation.

Scope: Policy Law and Regulation, Capacity Building

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Government institutions at all levels, vulnerable people in general, and women, children, teachers and parents, marginalized groups, senior citizens, disabled persons, people with chronic diseases in particular.
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Home Affairs
Total Cost: USD 1,000 million	**Supporting Agency/Institutions / Groups:** Ministry of Federal Affairs and General Administration, Ministry of Women, Children and Senior Citizen, National Disaster Risk Reduction and Management Authority, Provincial Governments, Local Governments, MDBs, I/NGOs, Private Sector

53: Strengthening Adaptive Social Protection/Shock Responsive Practices for Transferring Climate Risk	2030, 2035, 2040

Alignment with/contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Disaster Risk Reduction and Management Act 2017, National Disaster Risk Reduction and Management Policy 2018, Disaster Risk Reduction National Strategic Plan of Action, 2018-2030, Land Use Policy 2015, Sustainable Development Goals Status and Road Map: 2016-2030, Local Government Operationalization Act 2017, Disaster Financing Strategy 2021.

Climate Risks and Vulnerabilities Addressed by the Actions:

Exacerbated poverty and poverty gap in society associated with an increase in extreme climate events, loss of property and assets, displacement of community, disturbance of the social fabric, and increased risk of loss of development gains.

Objectives:

1. To develop and operationalize adaptive shock responsive social protection frameworks, guidelines, mechanisms, and institutional arrangements at all levels of the government.
2. To develop shock responsive social protection for risk transfer and to implement it at all levels of government.

Expected Outcomes:

1. By 2030, insurance companies adhere to adaptive social protection based on government plans and policies.
2. By 2030, disaster information management system/bipadportal.gov.np established at the federal level and in all 7 provinces.
3. By 2030, rolled out risk transfer mechanism established by governments at all levels.
4. By 2030, increased access to and usage of adaptive social protection schemes by beneficiaries and eligible people, especially those most marginalized and vulnerable.
5. By 2040, adaptive shock responsive social protection framework, guidelines, mechanisms, and institutional arrangements developed and operationalized at all levels of the government.
6. By 2030, 500, by 2035, 1,000 and by 2040, 2,000 Chure-based rivers trained.
7. By 2035, 1,000 and by 2040, 2,000 forest rivers trained.

Impact:

Increased resilience of communities and people, and reduced displacement caused by climate-induced hazards.

Summary of Actions:

1. Develop a centrally managed and accessible disaster management information system that is linked to shock-related indicators and digitalization of data that provides updated information to support shock responsive initiatives.
2. Develop and implement adaptive /shock responsive social protection guidelines, frameworks, mechanisms, and institutional arrangements at all levels of the government.
3. Strengthen risk transfer mechanisms/insurance (PEOC, DEOC, LEOC) for communities displaced by disasters and communities at risk at federal, provincial and local level.
4. Enhance coordination among stakeholders that are part of the social protection and disaster response to ensure equity and coverage to the communities most in need.
5. Enhance involvement of private sector organizations in risk transfer, encourage banking and financial institutions, especially the insurance companies, to adopt climate responsive (insurance) schemes.
6. Generate knowledge products and continuously monitor and evaluate appropriate and accessible banking systems for target groups, especially during disasters causing mobility constraints.
7. Conduct river trainings to manage Chure and forest ecosystem.

Scope: Policy Law and Regulation, Capacity Building, Research and Information

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Corporate sector, financial and insurance companies, cooperatives, women, children, marginalized groups, senior citizen, person with disabilities, youth, and disaster affected and displaced communities.
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Home Affairs
Total Cost: USD 2,000 million	**Supporting Agency/Institutions/Groups:** Ministry of Finance, Ministry of Forests and Environment, National Disaster Risk Reduction and Management Authority, All Provincial Governments, Local Governments, MDBs, I/NGOs, CBOs, Private Sector, Cooperatives, Small and Medium-Sized Enterprises, Insurance Companies

54: Maintaining and Strengthening Early Warning Systems and Multi-Hazard Monitoring Systems to Facilitate Climate Adaptive Function of Key Economic Service Sectors	2030, 2050

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Disaster Risk Reduction and Management Act 2017, National Disaster Risk Reduction and Management Policy 2018, Disaster Risk Reduction National Strategic Plan of Action, 2018-2030, Land Use Policy 2015, Sustainable Development Goals Status and Road Map: 2016-2030, Local Government Operationalization Act 2017, National Early Warning Strategic Action Plan 2013

Climate Risks and Vulnerabilities Addressed by the Actions:

- Loss of lives and property associated with an increase in the intensity, magnitude and frequency of climate induced hazards.
- Damage to physical infrastructure and disturbances in its operations.
- Loss of forest areas and agricultural fields due to an increase in the incidences of flash floods and landslides.

Objectives:

1. To establish timely, effective, appropriate, people-centered and GESI sensitive early warning systems that easily reaches hazard-affected communities including the most vulnerable.

Expected Outcomes:

1. By 2030, national common alert protocols developed and disseminated for effective EWSs and Cell broadcast system established.
2. By 2030, at least 30 new GESI responsive multi-hazard early warning systems established and effectively operationalized in all 7 provinces and major river basins of Nepal.
3. By 2030, now-casting system established and implemented at the federal level.
4. By 2050, 100% of the population covered with real time EWS.
5. By 2050, human loss and damage minimized by 80% through enhanced resilience of communities, including those most vulnerable.

Impact:

Strengthened resilience of people and communities through timely, effective, appropriate, people-centered and GESI-sensitive EWS.

Summary of Actions:

1. Install now-casting system at the federal level.
2. Establish and strengthen real-time/forecast-based early warning systems including monitoring in all 7 provinces (in major river systems), and efficient and people-centric communication channels through appropriate medium (e.g., radio, television, briefing notes, SMS and social media) and use of local language(s).
3. Install at least one radar station and lightning detection system within Nepal's major river basins for the monitoring of precipitation and lightning.
4. Research, pilot and establish landslide EWS in major landslide prone areas of Nepal.
5. Strengthen and promote research on hydro-meteorological modeling, forecasting and future climate risks and GESI-transformative early warning systems.
6. Design and develop early warning system and preparedness action plan, response plans and guidelines taking into account the needs, capabilities, and preferences of vulnerable groups, including women, children, youth, persons with disability, elderly, and indigenous groups.

Scope: Policy, Law and Regulation, Capacity Building, Research and Information, Technology

Geographic Coverage:

Federal, provincial, local and community level

Targeted Community/Beneficiaries: Insurance companies, cooperatives, women, children, marginalized groups, senior citizens, persons with disabilities, youth, chronic patients and disaster-prone areas.

Duration/Timeframe:

25 years

Lead Institution: Ministry of Home Affairs

Tentative Cost:

USD 1,500 million

Supporting Agency/Institutions/Groups: National Disaster Risk Reduction and Management Authority, Department of Hydrology and Meteorology, Provincial Governments, Local Governments, MDBs, I/NGOs, Private Sector, Cooperatives,

55: Developing a Regulatory Framework and Implementation Strategy for Domestic and Industrial Fire Control and Mitigation, and Build National Capacities	2030

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Disaster Risk Reduction and Management Act 2017, National Disaster Risk Reduction and Management Policy 2018, Disaster Risk Reduction National Strategic Plan of Action, 2018-2030, Land Use Policy 2015, Sustainable Development Goals Status and Road Map: 2016-2030, Local Government Operationalization Act 2017

Climate Risks and Vulnerabilities Addressed by the Actions:

- Increase in incidences of fire associated with extreme temperature and heat waves, dry spells, and drought.

Objectives:

1. To reduce and control the magnitude and frequency of domestic and industrial fires.
2. To build capacity of relevant authorities and stakeholders on the use of domestic and industrial fire control tools and technique.

Expected Outcomes:

1. By 2030, established policy, guidelines and institutional mechanisms at federal, provincial and local level for fire prevention and management.
2. By 2030, improved capacities of human resources and equipment for fire risk reduction/mitigation and response management at fire stations at local municipal and household levels.
3. By 2030, training institution for fire control service established to provide services to all seven provinces.

Impact:

Reduced loss and damage lives and assets

Summary of Actions:

1. Develop fire risk management policy and guideline at federal to local level to community level.
2. Enhance the capacity of provincial and local governments, community based organizations (CBOs) (e.g., forest user groups) and other relevant stakeholders through awareness raising, training and human resource mobilization and provision of tools and technologies.
3. Carry out research and monitoring, develop and maintain database on fire management actors and stakeholders.
4. Develop response plans and early warning systems.
5. Set up training institutions and insurance mechanism to fire fighters.

Scope: Policy, Law and Regulation, Capacity Building, Research and Information, Technology Development

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Forest user groups, fire station workers, women, children, marginalized groups, senior citizen, Persons with disabilities, youth, and disaster affected and displaced communities
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Home Affairs
Total Cost: USD 1,000 million	**Supporting Agency/Institutions /Groups:** Ministry of Federal Affairs and General Administration, Ministry of Forests Environment, National Disaster Risk Reduction and Management Authority, All Provincial Governments, Local Governments, MDBs, I/NGOs, CBOs, Private Sector, Insurance Companies, Security Forces (Nepal Army, Armed Police Force, Nepal Police)

56: Promote Culture of Safety and Build Climate Resilience through Climate Risk Sensitive Land Use Plan (RSLUP) Guideline and Standards	2030, 2035, 2040, 2050

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Disaster Risk Reduction and Management Act 2017, National Disaster Risk Reduction and Management Policy 2018, Disaster Risk Reduction National Strategic Plan of Action, 2018-2030, Land Use Policy 2015, Sustainable Development Goals Status and Road Map: 2016-2030, Local Government Operationalization Act 2017

Climate Risks and Vulnerabilities Addressed by the Actions:

- Loss of life and property due to extreme climate events in locations that are highly sensitive and vulnerable to these events.
- Damage to physical infrastructure, agriculture land and settlement areas due to improper land-use planning coupled with increasing extreme climate events.

Objectives:

1. To formulate a climate sensitive land-use plan.
2. To develop and implement a Risk Sensitive Land-Use Plan (RSLUP) guideline and standards at the federal, provincial, and local level covering all the ecological zones.

Expected Outcomes:

1. By 2030, climate risk sensitive areas in major settlements mapped and RSLUP prepared at federal level.
2. By 2035, RSLUP implementation guidelines prepared and implemented at 753 local levels.
3. By 2040, rolled out risk transfer mechanism established by government at all levels, 100% local levels benefitted.
4. By 2050, more than 80% of physical infrastructure and settlements are climate resilient.

Impact:

Reduced loss of human life, and reduced damage to physical assets and the environment due to climate change impacts.

Summary of Actions:

1. Collect, digitalize and manage data at the federal level for infrastructure, land cover and use, demographic data, and hazard risk areas.
2. Develop RSLUP guidelines and standards.
3. Implement RSLUP at the federal level and support the implementation of RSLUPs at the provincial and local levels, including capacity building.
4. Map multi-hazard risk areas in each local level and use hyper spectral images and socio-economic data to develop geo-database.
5. Establish rolled out risk transfer mechanism.
6. Conduct suitability analysis for safer settlements.
7. Enhance capacity from federal to local level on geospatial data management.
8. Establish national standards on natural hazard data collection and management and a data sharing system.

Scope: Policy, Law and Regulation, Capacity Building, Technology Development

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Communities, settlements and population (women, children, marginalized groups, senior citizen, people with disabilities, youth) at risk to climate and disasters.
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Land Management, Cooperatives and Poverty Alleviation
Total Cost: USD 50 million	**Supporting Agency/Institutions/Groups:** Ministry of Federal Affairs, and General Administration, Ministry of Urban Development, Ministry of Forests and Environment, Provincial Governments, Local Governments, MDBs, I/NGOs, Private Sector

57: Developing Federal and Provincial Strategies and Action Plans on Control of Climate Induced (primarily water-borne) Disasters in the Forest Areas of Nepal and Phase-wise Implementation under the Leadership of Forest Authorities	2030, 2050

Alignment with/Contribution to National Development Goals: 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, National Land Use Policy 2015, Sustainable Development Goals Status and Road Map: 2016-2030, Local Government Operationalization Act 2017, Forest Sector Strategy 2016-2025, National Forest Policy 2019, Forest Act 2019

Climate Risks and Vulnerabilities Addressed by the Actions:

- Forest land cutting due to soil erosion, and flooding in plains and landslides in the hills due to intense rainfall.
- Increase in temperature leading to dry spells and drought.

Objectives:

1. To assess and analyze climate induced disasters in forest areas.
2. To implement DRRM schemes in a phase wise manner to control disasters.
3. To build resilience of the forest sector to climate-induced disasters.

Expected Outcomes:

1. By 2030, climate-induced disasters and their impacts on forests assessed and mapped for strengthened resilience of the forests.
2. By 2030, federal and provincial strategies and action plans on climate-induced disasters formulated.
3. By 2030, EbA/ nature-based solutions incorporated in all forest operational plans.
4. By 2050, all FUGs integrated CCA and forest-resilient building interventions in their operational plans.

Impact:

Reduced loss and damage of forests and increased productivity of forests for improved livelihoods and ecosystem sustainability.

Summary of Actions:

1. Assess forest health from the climate-induced hazards perspective and identify the forests with immediate interventions to improve forest health for greater resilience.
2. Develop a catalogue of actions on forest health improvement and climate risk management in forests through review and analysis of Indigenous and traditional knowledge and practices.
3. Build capacity of field forest officers on climate change risks in the forest sector and adaptation planning.
4. Develop forest health improvement and resilience building guidelines at the federal and local levels.
5. Enhance capacity of provincial and local governments, CBOs (e.g., forest user groups), FUGs and other relevant stakeholders through awareness raising, training and human resource mobilization in order to incorporate/address CCA and resilience building in forests.
6. Carry out research and monitoring on climate risks on forest.
7. Develop climate risk management buffer zones within the forest areas such as river flooding channelization, aquifers for storage of flood water, and landslide prevention in the forest areas.

Scope: Capacity Building, Research and Innovation, Physical Infrastructure

Geographic Coverage: National level	**Targeted Community/Beneficiaries:** Forest user groups, forest dependent communities, women, children, marginalized groups, senior citizens, person with disabilities, forest sector government officials in federal, provincial and local governments, private sector, indigenous groups
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 2,500 million	**Supporting Agency/Institutions /Groups:** Ministry of Home Affairs, National Disaster Risk Reduction and Management Authority, Provincial Governments, Local Governments, Forests User Groups, Universities, MDBs, I/NGOs

7.9 Gender Equality and Social Inclusion (GESI), Livelihood and Governance (GESILG)

The Constitution of Nepal, with the commitment to end gender discrimination, has guaranteed the equal right to property, right to safe motherhood and reproductive health rights, right to ensure proportional representation at all concerned levels as well as the right to enjoy fundamental human rights for all women. The constitution guarantees rights to equality, encourages the formulation of gender-friendly acts and laws, encourages the political participation of women in the three tiers of state, and works toward a 50% representation of women at all levels of government. The Fifteenth Plan notes that inclusion of all disadvantaged groups is a means of maximising national development, and calls for inclusive participation in decision-making processes at all levels of government.

Nepal, being a signatory to various international conventions, is legally committed to gender equality, social inclusion, livelihood and governance (GESILG). This is a guiding principle of this NAP, which takes a dual approach of both mainstreaming GESI considerations into policies, and programmes; and targeting excluded and vulnerable groups (MoUD, 2013), where needed, through GESI-specific actions and projects. The NAP formulation process included GESILG analysis across the key sectors, which guided the identification and design of priority adaptation actions that are participatory, transparent, and gender and socially inclusive. This approach provides a solid basis for addressing GESILG in an informed and practical way that supports inclusive economic development and livelihood opportunities.

Climate change impacts different groups differently. Children, women and girls, pregnant women, the elderly, and people with disabilities, the Lesbian, Gay, Bisexual, Trans, Intersex and Queer (LGBTIQ+) community, and socially marginalized groups have higher levels of mortality and morbidity due to climate change impacts (MoFE, 2018). Marginalized or indigenous groups, particularly Majhi, Raute, Chepang, Satar, are more vulnerable to food insecurity and are more likely to suffer from disasters like floods, landslides, and fire. Heat and cold waves impact those working outside, including the poor, women, children, and the elderly. Extreme climatic events such as droughts and floods increase the prevalence of water-borne diseases like typhoid, cholera, and other diarrhoeal diseases, which mostly impact children below the age of 5 (Eriksson et al., 2008). Flood-related fatalities are higher for girls and women than boys and men (Bartlett et al., 2008).

Figure 17: Women are particularly vulnerable to climate change impacts

Women are particularly vulnerable to climate change because of lack of income, limited ownership of land and property, limited access to credit and markets, and lack of capacity for diversification of livelihoods. They are particularly vulnerable to the impacts of climate change in the forestry sector because they play a major role in the collection of various forest products and are considered the primary users of forests in Nepal (IUCN, 2020). Women in Nepal make up about 73% of the agricultural work force and the country is experiencing a trend of “feminization of the agricultural sector” because of male out-migration. Women farmers are more vulnerable to climate change as they do not have the same access to land, water, seeds, agricultural extension, training, and credit as men. Only 10% of the farms of Nepal are owned by women or jointly owned by men and women

(IUCN, 2020), and female- headed households are more vulnerable to climate shocks because they grow fewer crop types (MoFE, 2021c).

Nepal's National REDD+ Strategy reported that decisions are made and resources are controlled by male elites, hindering the poor, Dalits, and women from exercising leadership (MoFSC, 2015). There is a strong correlation showing households with fewer years of schooling and lower wealth are considerably more likely to be affected, experience higher casualties, and incur livelihood losses because of floods and landslides (Shrestha et al., 2016).

Climate impacts tend to have a disproportionate effect on the poorest and most vulnerable communities who have limited options or resources to diversify their livelihoods (Goodrich et al., 2017). Addressing these vulnerabilities requires increased access to training and capacity building for women and marginalized groups, the collection of sex-disaggregated climate change data, and the implementation of specific actions to improve the livelihoods of women. Similar to gender equality, a more robust approach to collecting and analyzing data on social inclusion is required to better understand and identify actions (MoFE, 2020b).

The four priority adaptation programmes given below in the GESILG Sector enhance resilience to climate change through GESI-responsive livelihood programmes; integration of GESI and climate foresight in social protection and development interventions; and establishment of climate change aware gender focal desks in all state and non-state institutions. The proposed programmes have an estimated cost of USD 700 million to 2050.

<table>
<tr><th colspan="2">58: Strengthening Gender Equality and Social Inclusion (GESI) Responsive Climate Change Adaptation Planning and Implementation</th><th>2030</th></tr>
<tr><td colspan="3">Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023//24, Gender Strategy and Action Plan on Climate Change 2020-2030, Sustainable Development Goals: Status and Roadmap for Nepal 2016-2030, Framework on Local Adaptation Plans for Actions 2019</td></tr>
<tr><td colspan="3">Climate Risks and Vulnerabilities Addressed by the Actions:
Increase in incidences of extreme climate events leading to impacts on vulnerable groups (people of all genders, children, youth, senior citizens, people living with disability, indigenous people, local communities and other marginalized groups).
Drying of water resources increases the workload and drudgery of vulnerable people and communities.
Loss of access to vital services, such as education, health facilities, medicine, water, sanitation, and hygiene affecting the development and quality of human capital.
Food and nutrition insecurity affecting the development of human capital and the national economy.
Loss of shelter, enhanced displacement, separation of families, forceful migration, discrimination, violence and trafficking during and after climate disasters.
Mental and psychosocial health problems.
Enhanced risk of spreading of vector-borne diseases affecting the well-being of vulnerable groups.</td></tr>
<tr><td colspan="2">Objectives:
To research, catalogue, capacitate and sensitize policy makers, institutions, communities, public, and the private sector on GESI integration in climate change adaptation to compliment sectoral goals through an informed process.
To increase the quality of qualitative and quantitative research on GESI and climate change impacts, risks and adaptation for evidence-based planning and implementation of climate change adaptation projects.</td><td>Expected Outcomes:
By 2030, at least 30% of the communities and public institutions implement GESI responsive adaptation actions.
By 2030, gender responsive climate change adaptation actions are integrated into adaptation plans at 753 local levels.
Impact:
GESI-responsive planning and decision making on climate adaptation interventions</td></tr>
</table>

Summary of Actions:

1. Conduct and promote quantitative and qualitative research involving vulnerable communities on GESI and climate change adaptation.
2. Strengthen, establish, and functionalize climate change sensitized gender focal desks in all state and non-state institutions.
3. Invenrory and promote GESI responsive indigenous skills, practices, knowledge and resources for enhancing adaptive capacity and socio-economic empowerment.
4. Develop GESI-based knowledge products on climate change impacts, risks and adaptation.
5. Develop an accessible knowledge hub for management of research outputs, best practices, information and other knowledge products, and promote its usage in decision-making.
6. Disseminate knowledge and information using inclusive and appropriate language and means of communication, and build knowledge of wider stakeholders including media on the importance of GESI considerations in climate change adaptation actions.
7. Enhance the technical and institutional capacity on GESI and climate change at all levels of the government, for their effective participation in key policy making and implementation processes.
8. Implement federal, provincial and local level programmes/projects through a bottom-up approach with meaningful representation of vulnerable people in CCA plans and processes.
9. Enhance GESI disaggregated data collection, monitoring and evaluation, documentation, and dissemination of information at an institutional level.

Scope: Policy, Laws and Regulation, Capacity Building

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Climate vulnerable groups, including women, children, senior citizens, persons with disability, youth, indigenous groups, people from marginalized communities, government institutions, and researchers.
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Women, Children and Senior Citizen
Total Cost: USD 100 million	**Supporting Agency/Institutions/Groups:** Ministry of Federal Affairs and General Administration, Ministry of Education Science and Technology, Ministry of Forests and Environment, Universities, I/NGOs, Women Groups, Youth Networks, CBOs

59: Building Human Capital for Inclusive Climate and Disaster Resilient Society	2050

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, Second Nationally Determined Contribution 2020, 15th Plan 2019/20-2023//24, Gender Strategy and Action Plan on Climate Change 2020-2030, Sustainable Development Goals: Status and Roadmap for Nepal 2016-2030, Framework on Local Adaptation Plans for Actions 2019

Climate Risks and Vulnerabilities Addressed by the Actions:

- Increase in incidences of extreme climate events leading to impacts on vulnerable groups (people of all genders, children, youth, senior citizens, people living with disability, indigenous peoples, local communities, and other marginalized groups)
- Drying of water resources increases the workload and drudgery of vulnerable people and communities.
- Loss of access to vital services, such as education, health facilities, medicine, water, sanitation, and hygiene affecting in the development and quality of human capital.
- Food and nutrition insecurity affecting the development of human capital and the national economy.
- Loss of shelter, displacement, separation of families, forceful migration, discrimination, violence and trafficking during and after disasters.
- Mental and psychosocial health problems.
- Enhanced risk of spreading of vector-borne diseases affecting the well-being of vulnerable groups.

Objectives:	Expected Outcomes:
1. To promote safe and equitable access to climate and DRR response services. 2. To capacitate the frontline service providers and community networks in providing GESI responsive support during emergency situations.	1. By 2050, GESI is integrated and operationalized in 753 local level plans and actions implemented for climate and DRR preparedness and responses. 2. By 2050, the number of injury, deaths, discrimination and violence during emergency situations reduced by 60%. 3. By 2050, 80% of the community-level frontline service providers and community networks capacitated to respond immediately during climate emergency situations consider GESI aspects. **Impact:** Equitable access to DRR services and decreased incidence of violence during emergency situations.

Summary of Actions:

1. Strengthen current information management systems by enhancing mapping and identification of vulnerable people and communities in disaster prone areas to facilitate effective and equitable preparedness and response interventions.
2. Ensure operationalization of mechanisms supporting collection of GESI disaggregated data of people affected and reached in emergency response interventions to inform preparedness and response interventions, and M&E.
3. Establish and strengthen GESI-responsive early warning systems, preparedness and response at all levels of the government, including meaningful participation of vulnerable people, including children, in the processes with efficient, accessible and inclusive emergency communication channels using appropriate medium (radio, television, SMS, social media, posters) and language(s).
4. Construct and ensure existence of GESI-responsive, safe and accessible spaces for disasters that include WASH facilities and climate-resilient shelters at the local level that are designed to meet the specific needs of women, LGBTIQ+, children, people with disability, elderly and highly marginalized indigenous groups, to ensure their protection and safety (including minimizing risks of discrimination and violence).
5. Ensure prepositioning of and access to emergency kits and supplies for vulnerable groups, including children, during emergencies that are sensitive to the different needs and preferences of various vulnerable groups.
6. Implement gender-based violence and discrimination prevention mechanisms and responses, which include increased leadership of vulnerable groups in the development and implementation process.
7. Ensure equitable access to drinking water, sanitation, hygiene, safe transportation, legal and psychosocial support, and security/police and health services for vulnerable groups.
8. Develop a roster of service providers (community psychosocial workers and counselors, police, health care providers, etc.) and community groups such as woman, indigenous and youth groups, that can be immediately mobilized during disasters, and build their capacity on how to respond during emergency situations from a GESI perspective.

Scope: Policy, Laws and Regulation, Capacity Building, Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** People living in disaster-prone areas, and vulnerable groups including women, children, youth, senior citizens, people living with disability, and other marginalized groups
Duration/Timeframe: 25 years	**Lead Institution:** Ministry of Home Affairs
Total Cost: USD 500 million	**Supporting Agency/Institutions/Groups:** Ministry of Women, Children and Senior Citizen, Ministry of Forests and Environment, Provincial and Local Governments, Development Partners, I/NGOs, CBOs, Service Providers (e.g., WASH, health and security)

60: Economic Empowerment through the Usage of GESI Responsive, Climate-Resilient and Smart Technologies	2030

Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2010, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, Gender Strategy and Action Plan on Climate Change 2021, Sustainable Development Goals Status and Roadmap: 2016-2030, Local Government Operationalization Act 2017, Framework on Local Adaptation Plans for Action 2019

Climate Risks and Vulnerabilities addressed by the Actions:

- Increased workloads that affect the health and well- being of women, children, marginalized populations, and indigenous groups in rural areas due to drying of water resources, extreme weather events, loss of productivity, and loss and damage of livelihoods assets.
- Increase in (likely) social disturbances due to shocks and stress on natural resources due to extreme weather and climate events.
- Imbalanced migration creating more pressure on women, children, marginalized populations, and indigenous groups.
- Loss and damage of developmental infrastructure leading to shrinking access to vital services such as education, health facilities, medicine, water, sanitation and hygiene.

Objectives:

1. To identify and promote GESI-responsive climate-resilient technologies in all thematic sectors.
2. To capacitate and increase access of vulnerable people to the use of climate-resilient technologies for income generation.
3. To involve both the private and public sectors in creating climate-resilient employment opportunities for vulnerable people.

Expected Outcomes:

1. By 2030, GESI-responsive and climate-resilient technologies are up-scaled and out-scaled in vulnerable areas.
2. By 2030, increased productivity and income generation of excluded and vulnerable people by at least 30% through public-private partnerships.

Impact:

Economic empowerment through the usage of GESI-responsive, climate-resilient technologies.

Summary of Actions:

1. Promote GESI-responsive climate-resilient technologies in all eight thematic sectors identified in the National Climate Change Policy (2019) and the GESI and climate change strategy.
2. Build capacity of policymakers and government officials specially tasked to develop plans and formulate budgets, women groups, CSOs, and youth on equitable approaches of adaptation planning.
3. Conduct gap assessments and situational analyses at provincial and local levels on GESI and climate adaptation technology needs, challenges, and opportunities, including policy and institutional gaps. Based on the outcomes and in adherence to existing federal level plans and policies, develop, revise and implement policies and plans to integrate GESI-responsive technologies in sectoral programmes and projects on climate change adaptation.
4. Strengthen information sharing and establish physical information centers on climate-resilient technology options and opportunities at local level, targeting and making accessible to vulnerable and socially excluded groups.
5. Build capacity of vulnerable people to enable them to use those technologies for production, commercialization (e.g., food processing), DRR, water and energy solutions etc., to enhance their livelihoods by working together with value-chain organizations and micro enterprise development organizations.
6. Capacity building on entrepreneurship development through the use of climate-resilient technologies for vulnerable groups.
7. Provide seed money to support vulnerable people to start up climate-resilient business opportunities for livelihood enhancement.

8. Promote public-private partnerships for introducing climate-resilient technologies in both the private and public sectors and create employment opportunities with a focus on vulnerable people. 9. Develop and implement policies and plans to integrate GESI-responsive technologies in sectoral programmes and projects on climate change adaptation.	
Scope: Policy Law and Regulation, Capacity Building, Research and Innovation, Physical Infrastructure	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Vulnerable people and communities
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Women, Children and Senior Citizen
Total Cost: USD 50 million	**Supporting Agency/Institutions/Groups:** Ministry of Federal Affairs and General Administration, Provincial and Local Governments, MDBs, I/NGOs, CSOs, Private Sector, CBOs

61: Enhancing Resilience to Climate Change through GESI-Responsive Livelihood Programmes	**2040**
Alignment with/Contribution to National Development Goals: Second Nationally Determined Contribution 2010, 15th Plan 2019/20-2023/24, National Climate Change Policy 2019, Gender Strategy and Action Plan on Climate Change 2021, Sustainable Development Goals Status and Roadmap: 2016-2030, Local Government Operationalization Act 2017, Framework on Local Adaptation Plans for Action 2019	
Climate Risks and Vulnerabilities Addressed by the Actions: • Increase in incidences of extreme climate events leading to impacts on vulnerable groups (people of all genders, children, youth, senior citizens, people living with disability, indigenous peoples, local communities, and other marginalized groups). • Loss of access to vital services, such as education, health facilities, medicine, water, sanitation, and hygiene affecting the development and quality of human capital. • Food and nutrition insecurity affecting in the development of human capital and thereon to the national economy. • Loss of shelter, displacement, separation of families, forceful migration, discrimination, violence and trafficking, during and after disasters. • Mental and psychosocial health problems. • Enhanced risk of spreading of vector-borne diseases affecting the well-being of vulnerable groups.	
Objectives: 1. To develop, implement, operationalize and monitor GESI- responsive budgetary system at all tiers of government. 2. To promote community level financial safety nets for vulnerable groups to adapt to climate change impacts. 3. To identify and promote climate-resilient alternative businesses for livelihood enhancement especially for vulnerable groups.	**Expected Outcome:** 1. By 2040, GESI-responsive budgetary systems effectively implemented at all tiers of government. 2. By 2040, financial safety nets identified and institutionalized at the community level. **Impact:** Enhanced climate resilience and improved livelihoods of vulnerable people.

Summary of Actions:

1. Promot climate- and GESI-responsive budgets at the federal, provincial and local levels, ensuring effective implementation with meaningful participation of vulnerable people including children, to improve their livelihoods.
2. Promote livelihood diversification (farm/non-farm) for women/youth, IPLCs, and vulnerable people through increased access to skills and formal markets to bridge the gap between production and productivity.
3. Develop and increase access of the marginalized and vulnerable groups to technologies considering the equitable mechanism.
4. Invest, promote, and increase access to social/financial safety nets/social protection such as: cooperatives, savings and credit, grain banks groups with special focus on women and marginalized groups; and ensure that they reach economically and socially vulnerable groups, such as single mothers, children, and persons with disabilities by providing capacity building opportunities.
5. Identify and promote alternative businesses that are less vulnerable to climate change extremes.
6. Integrate GESI and climate foresight in social protection and development interventions.
7. Monitor and review the existing GESI responsive budgeting mechanisms and update as required to meet the commitments.

Scope: Policy Law and Regulation, Capacity Building, Research and Innovation, Physical Infrastructure

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Vulnerable people, communities of climate change affected areas
Duration/Timeframe: 20 years	**Lead Institution:** Ministry of Women, Children and Senior Citizen
Total Cost: USD 50 million	**Supporting Agency/Institutions/Groups:** Ministry of Federal Affairs and General Administration, Ministry of Forests and Environment, Provincial and Local Governments, MDBs, I/NGOs, CSOs, Community Networks

8. ENABLING ACTIONS

The implementation of adaptation programmes will be supported by enabling actions that come across all the sectors. These actions aim to enable and equip governments, stakeholders and communities with the knowledge, skills, technologies, and financing needed to deliver and report on resilience and adaptation actions.

8.1 Programmes to implement enabling actions with their budgets

The tables below present three programmes that will help work on climate change adaptation through the prioritized enabling actions. The first programme will provide the necessary support for research on climate risks and vulnerabilities and capacity building to enhance the implementation of the Nepal NAP. The second programme focuses on building the capabilities across the three levels of government to mainstream adaptation in plans and budgets, including capacitation in the development of LAPAs. The third programme accommodates an adaptation management, monitoring and reporting (MR&R) system that supports the establishment of a system to collect and analyze data and information on adaptation, to meet national and international reporting requirements, and to update the NAP.

62: Implementation of the Nepal NAP including Research on Climate Risks and Vulnerabilities, and Capacity Building of Actors and Stakeholders on Climate Change Issues	**2030**
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24, Sustainable Development Goals: Status and Road Map for Nepal 2016-2030, Second Nationally Determined Contribution 2020	
Climate Risks and Vulnerabilities Addressed by the Actions: Overall risks posed by climate change to the development gains of the country including in the sectors where capacity gaps have prevented an effective response to climate change impacts.	
Objectives: 1. To build capacity of climate change stakeholders to implement the NAP. 2. To undertake research on climate change to support the updating of the Climate Change Vulnerability and Risk Assessment (CCVRA).	**Expected Outcomes:** 1. By 2026, an updated (second) national level climate vulnerability and risk assessment published. 2. By 2030, a pool of researchers and analysts from the key sectors trained on climate risk and vulnerability assessments, and adaptation planning. 3. By 2030, policy makers and stakeholders in each sector informed about climate change vulnerability and risks, which informs their adaptation planning. 4. By 2030, all local level have developed and integrated LAPAs. **Impact:** Climate risks reduced through NAP implementation and adaptation action taken in various sectors.

Summary of Actions: 1. Develop and implement climate change adaptation capacity building packages for different stakeholders and actors. 2. Undertake climate change vulnerability and risk assessment research and capacity building. 3. Develop a system to undertake periodic climate change vulnerability and risk assessments.	
Scope: Capacity Building, Research and Innovation	
Geographic Coverage: All Provinces	**Targeted Community/Beneficiaries:** Federal, provincial and local governments, youth, vulnerable women groups, IPs and marginalized communities, private sectors
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 100 million	**Supporting Agency/Institutions/Groups:** All sectoral line ministries, I/NGOs, MDBs, Private Sector

63: Establish and Operationalize Climate Change Data Management, Monitoring and Reporting Center at the Federal, Provincial and Local Levels	**2030, 2035**
Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24), Sustainable Development Goals: Status and Road Map for Nepal 2016-2030, Second Nationally Determined Contribution 2020	
Climate Risks and Vulnerabilities Addressed by the Actions: Overall risks posed by climate change to the development gains of the country including in the sectors where capacity gaps have prevented an effective response to climate change impacts	
Objectives: 1. To establish a climate change data management and monitoring system at MoFE. 2. To build the capacity of federal and provincial ministries on the adaptation data management and monitoring system. 3. Develop and pilot a prototype management, monitoring, review and reporting (MR&R) system at three tiers of government.	**Expected Outcomes:** 1. By 2030, sectoral level information on NAP implementation maintained at federal level (centralized information for effective reporting to national and international level). 2. By 2030, dedicated human resources developed for the data management and reporting at each of the sectoral ministries, provincial governments and national level. 3. By 2035, NAP updated. **Impact:** Informed decision-making on climate change adaptation planning.
Summary of Actions: 1. Develop a prototype of the Climate Change Data Management, Monitoring and Reporting System (CCDMMRS). 2. Establish a Climate Change Data Management and Monitoring and Reporting System at the Ministry of Forests and Environment. 3. Increase operability of the CCDMMRS through capacity building of government officials involved in the data management process at federal, provincial and local levels.	
Scope: Capacity Building, Research and Innovation, Technology Development	
Geographic Coverage: National	**Targeted Community/Beneficiaries:** Government institutions at federal, provincial and local levels
Duration/timeframe: 15 years	**Lead Institution:** Ministry of Forests and Environment
Total Cost: USD 10 million	**Supporting Agency/Institutions/Groups:** Provincial Governments, Local Level Governments, I/NGOs, MDBs, Private Sector

64: Strengthen Capacities of Federal Thematic Ministries and Provincial and Local Governments on Nepal NAP Implementation	2030

Alignment with/Contribution to National Development Goals: National Climate Change Policy 2019, 15th Plan (2019/20-2023/24, Sustainable Development Goals: Status and Road Map for Nepal 2016-2030, Second Nationally Determined Contribution 2020

Climate Risks and Vulnerabilities Addressed by the Actions:

Overall risks posed by climate change to the development gains of the country including in the sectors where capacity gaps have prevented an effective response to climate change impacts

Objectives:

1. To develop capacities to integrate adaptation in policies, plans, and budgets at provincial and federal governments (thematic ministries) and local level.
2. To build capacity to implement the NAP at all federal, provincial and local levels.
3. To incentivize provincial and local governments to build climate resilient infrastructures and implement adaptation activities.

Expected Outcomes:

1. By 2030, capacity of the thematic ministries and provincial governments enhanced on NAP implementation.
2. By 2030, a pool of climate experts at the sectoral ministries at federal, provincial and local level developed.
3. By 2030, all 753 local government have developed LAPAs and allocated funds to implement LAPAs.

Impact:

Enhanced capacity of the sectoral ministries of federal government as well as provincial and local governments for sectoral adaptation planning and integration.

Summary of Actions:

1. Prepare capacity building packages on sectoral climate change and facilitate mainstreaming of climate change adaptation through the National Capacity Building Programme.
2. Prepare and localize the NAP Implementation Plan by supporting the development of and implementation of LAPAs.
3. Build capacity for effective climate finance management.
4. Adapt Performance Based Climate Resilient Grant system for a part of the inter-governmental fiscal transfers to better track the budget allocated for climate finance and incentivize local governments that are proactively focusing on CC adaptation and mitigation interventions.

Scope: Capacity Building

Geographic Coverage: National	**Targeted Community/Beneficiaries:** Government officials, policy makers and authorities from thematic ministries and provincial and local governments
Duration/Timeframe: 10 years	**Lead Institution:** Ministry of Federal Affairs and General Administration
Total Cost: USD 50 million	**Supporting Agency/Institutions/Groups:** National Natural Resources and Fiscal Commission, Ministry of Forests and Environment, MDBs, I/NGOs, Private Sector

8.2 Policy, Legal and Regulatory Framework and Governance

Enabling actions include establishing the policy, legal and regulatory framework to encourage adaptation action. The process of developing a comprehensive policy and regulatory framework for adaptation is underway in Nepal as demonstrated by the National Climate Change Policy, 2019. A priority is to continue to emphasize mainstreaming climate change in planning and budgeting at the three levels of government.

To facilitate mainstreaming adaptation across all levels of government, work is needed to implement the climate resilient and budgeting guidelines (Karki et al., 2021). Consistent with the NDC, Fifteenth Plan and the National Climate Change Policy, a critical action is the preparation and implementation of LAPAs by all 753 local governments. At the national level, MoFE will need to lead the preparation of a national strategy on loss and damage, and update the climate risk and vulnerability assessment as required in every five years.

Mainstreaming efforts can also build on the work of MoALD that has piloted the integration of climate change in agricultural planning and budgeting at the national and sub-national levels (Kunwar, 2021b). Work is needed to ensure that adaptation is viewed as a core business in the new structures and systems that are being established at the province and local levels. LAPAs are key mechanisms to identify local adaptation priorities and integrate them into development planning.

Table 8: Priority actions and expected results – legal and regulatory framework and governance

Cross-cutting enabling actions – Legal and regulatory framework and governance	Expected results – Timeline and progress indicators
Implement the climate-resilient planning and budgeting guidelines.	By 2025, MoFE and MoALD mainstreamed adaptation in planning and budgeting by applying the guidelines. By 2030, all relevant national sectoral ministries and provincial governments mainstreamed adaptation in planning and budgeting by applying the guidelines.
Prepare and implement local level climate-resilient and gender-responsive adaptation plans.	By 2030, all 753 local governments prepared and implemented gender-sensitive local adaptation plans of action (LAPAs).
National strategy and action plan on loss and damage associated with climate change impacts.	By 2025, national strategy and action plan on loss and damage prepared.
Coordinate adaptation implementation through Thematic Working Groups, Cross-cutting Working Groups and Provincial Climate Change Coordination Committee.	By 2025, TWGs, CWGs and Provincial Climate Change Coordination Committee established and coordinated on a regular basis to guide the NAP implementation.

8.3 Awareness Raising and Capacity Building

Awareness raising and capacity building is required at the national, provincial, and local levels to better understand the impacts of climate change and possible ways to integrate adaptation in planning, budgeting, and implementation. Knowledge and capacities are required to support the implementation of the NAP process and the development of future NAPs and sectoral programmes. Awareness raising is an important part of the NAP process because it helps catalyze and increase support for action, and mobilize local knowledge and resources. Awareness raising of the private sector, communities, and households is required (MoFE, 2020a), to be precise to the youth, women and IPLCs.

Capacity building helps Nepal enhance capabilities to take effective adaptation action at the three levels of government with the involvement of multiple stakeholders. Work is needed to increase the level of awareness and capacities of government agencies at the federal, provincial and local levels including improving their overall understanding of climate change discourse, increasing access to information on climate change variables, and improving cooperation and coordination amongst different stakeholders on the implementation of different climate change adaptation interventions.

MoFE has undertaken assessments of the capacity gaps and needs at the national and provincial levels (MoFE, 2020a and 2020b), and identified key activities to address these needs, that include:

- Strengthen capacities of federal thematic ministries and provincial governments on developing and implementing the NAP process.
- Strengthen institutional support structures by building the capacities of members of the coordination mechanisms to provide oversight to the NAP process, and facilitating the meeting of the oversight and coordination bodies.

Table 9: Priority actions and expected results – awareness raising and capacity building

Cross-cutting enabling actions – Awareness raising and capacity building	Expected results – Timeline and progress indicators
Develop capacities to mainstream adaptation in policies, plans and budgets at both the provincial and federal level (sector ministries).	By 2025, MoFE and MoALD are capacitated and strengthened on CCA in policies, planning and budgeting. By 2030, all relevant national sector ministries and provincial governments are coordinated to work on mainstreaming adaptation in policies, planning and budgeting.
Build capacity to implement the NAP process, including with community associations, youth groups and women's groups.	By 2030, 2,000 persons are trained on climate change adaptation.

8.4 Research and Technology Development

Increasing adaptive capacity and implementing adaptation actions requires research and technology development. A lack of research and technology development constrains Nepal's efforts to adapt to climate change (MoFE, 2021b). Many of the adaptation actions identified in this NAP require enhanced research programmes and appropriate and improved technology. An overall objective of the NAP is to support research and technology development that helps the sectors to develop, identify and disseminate appropriate technologies that deliver adaptation actions. The IPCC (2000) defines technology development and transfer as a broad set of processes covering the flows of know-how, experience, and equipment for adapting to climate change amongst stakeholders, such as governments, private sector entities, financial institutions, civil society, and academia.

Nepal lacks technological innovations to ensure sustainability of adaptation interventions. Scientific climatic information is limited to only a few institutions and is often inadequate, resulting in high uncertainty about climatic events and limited information on scenarios of temperature increase and its implications. The MoFE could work with universities and research institutions to identify an operational research agenda on climate adaptation and promote and coordinate funding for research and study on priority adaptation topics.

The lack of hydro-met stations in high altitude locations means that climate trends and predictions of future climatic conditions cannot be produced. In addition to limited technology, proper dissemination mechanisms are not in place for climate information. Extensive research, sharing of traditional knowledge, building on existing adaptation actions, information dissemination, and science-policy interface are necessary for effective climate adaptation in Nepal (KC, 2018).

Priority research and technology development needs in four critical sectors are:

- Forests, biodiversity and watershed conservation sector - climate change projections, modelling and emissions scenarios to help visualise climate impacts in the long-term.
- Agriculture and food security - improved extension services for agriculture, nutrition, and health can help support small farmers, communities, and households to adapt to climate change.
- Disaster risk reduction and managment - early warning systems and forecast systems are required in each province.
- Health - research and study to better understand the effects and impacts of climate change on people's health.

Priority areas for research and development in hydrology and meteorology sector includes the establishment of reliable weather forecasting and climate predictions and trend analysis through a Climate Information System (GoN, 2019c). Improved climate information services are important for farmers to manage risk, for preparing standards and regulations, and for assessing climate risks in infrastructure projects. Climate information is a critical element of early warning systems that help communities cope with climate hazards like floods and drought. Climate predictions provide critical information for updating climate risk and vulnerability assessments. The establishment of a climate change research centre would encourage continued research on climate change, climate change impacts and addressing vulnerabilities. The centre could lead the updating of Nepal climate change risk and vulnerability assessment in every five years (GoN, 2020b). The actions in the table below will further the aim set out in the National Climate Change Policy, 2019 to encourage climate change-related study, research, and technology development and expansion that help deliver adaptation actions.

Table 10: Priority actions and expected results – research and technology development

Cross-cutting enabling actions – Research and technology development	Expected results – Timeline and progress indicators
Update the national level Climate Vulnerability and Risk Assessment every five years.	By 2026, updated (second) national level climate vulnerability and risk assessment published. By 2031, updated (third) national level climate vulnerability and risk assessment published.
Prepare a strategy and action plan on gender-responsive climate-smart technologies and practices.	By 2025, strategy and action plan prepared on GESI responsive climate smart technology and practices.
Establish a Climate Change Research Centre to facilitate research, technology development and expansion in relation to climate adaptation system.	By 2025, business plan for climate change research centre developed and resources identified. By 2030, climate change research centre established.
Establish and operationalize a Climate Information System	By 2025, plan for a climate information system prepared in 2025 and operationalized in 2030.
Conduct studies and research on hydrology, meteorology, and climate change in collaboration with research institutions. Enhance local capacities to prepare climate change projections.	By 2025, MoFE undertook and published five studies working in collaboration with local research institutions.
Expand the network of weather stations to improve the system of collection, analysis and dissemination of data related to climate change.	By 2030, number of weather stations increased from 69 in 2020 to 75 in 2030, and the number of people accessing weather information increased by double.

8.5 Climate Finance

Nepal has taken steps to mobilize, manage, and monitor climate finance. Recent efforts to mobilize finance for climate change, including adaptation, include the adoption of the Green, Resilient and Inclusive Development (GRID) approach that takes a proactive, coordinated actions to align financial support (including climate finance) to address climate action, COVID-19 recovery, long-term green growth, and sustainable development for all (Shrestha, 2021).

The Government of Nepal has pursued a policy of integrating climate finance into national planning and budgeting processes by adopting the Climate Change Financing Framework (MoF, 2017b). In addition, since 2012, the government has included the climate change code in budget and expenditure tracking. The "highly relevant" climate budget has accounted for about 5% of the total national budget (MoF, 2017a). These efforts have assisted the Government of Nepal to allocate public funds for climate change based on economic development priorities (MoFE, 2020c), which is indicative of the importance placed on adaptation.

The Ministry of Finance (MoF) established the Climate Finance Unit to strengthen national capacity to absorb and manage climate financing. The work of the unit is mainly focused on scaling up funding from the Green Climate Fund (GCF) and Global Environment Facility (GEF). MoF is the National Designated Authority (NDA) to the GCF and had received technical support and capacity building through the GCF readiness project from 2016. MoF, as the NDA, has recommended two national institutions - Alternative Energy Promotion Centre (AEPC) and Nepal Trust for Nature Conservation - for GCF accreditation as National Implementing Entities. AEPC is mandated to promote alternative energy technologies while National Trust for Nature Conservation is working in the field of nature conservation promoting resilient and adaptation measures.

Building on the work to increase finance for adaptation will require actions that help the Government of Nepal mobilize, manage and track finance for adaptation. This includes building the capacity of MoF, NPC and MoFE to track and report on sources, applications and impacts of climate adaptation finance. Tracking of and reporting on climate finance by MoF will need to be aligned with the tracking of adaptation actions and impacts by MoFE and NPC. This alignment can help improve analysis, including the identification of actions that provide value for money, and the amount of climate finance that reaches vulnerable groups and local communities. In addition, sectoral ministries require capacity building to implement the Climate Resilient Planning and Budgeting Guidelines 2020. Work is also needed to develop the adaptation sections of the climate finance strategy considering the ways of mobilizing resources for the priority actions identified in this NAP. The finance strategy for adaptation will need to be part of the GRID approach; and will require a strategic assessment of the best use of climate adaptation-related finance. Nepal will need an over-arching approach that identifies the most strategic use of grant funds from the GCF, bilateral donors, and MDBs, and domestic spending at the national provincial and local levels.

Nepal will also need to identify resources for the coordination and management of the NAP process. The Capacity-building Initiative for Transparency that is managed by the GEF is a potential source of funds for improving MR&R of adaptation. The GCF and GEF provide funding for the development of project proposals, which could be accessed to further the selected sectoral priority short- and medium-term adaptation programmes. Undertaking proper management of climate finance will require increased capacity, including capacity to track climate finance and to assess cost of adaptation actions and benefits of actions, and to develop funding proposals. The actions (Table 11) will further the aim set out in the National Climate Change Policy, 2019 to identify national resources for the implementation of adaptation actions, to mobilize resources in a just manner, and to increase access to bilateral, multilateral, and international financial resources. Importantly, the actions will work toward the goal of 80% of mobilized resources being used to support the implementation of programmes at the local level.

Table 11: Priority actions and expected results – climate finance management

Enabling cross-cutting actions – Climate finance management	Expected results – Timeline and Progress indicators
Build capacity to mobilize, manage and track finance for adaptation, including the development of funding proposals, and implementing the Climate Resilient Planning and Budgeting Guidelines 2020.	By 2025, MoFE and MoALD mainstreamed adaptation in planning and budgeting by applying the guidelines; and capacity building sessions on proposal development held. By 2030, all relevant national sector ministries and provincial governments mainstreamed adaptation in planning and budgeting by applying the guidelines.
Formulate adaptation aspects of Climate Finance Strategy and National Capacity on Climate Finance Management considering mobilization of resources from domestic and international, public and private sources.	By 2025, climate finance strategy prepared that aligned with the priority adaptation actions identified in the NAP.
Establish a web-based tool to track flows of finance for adaptation.	By 2025, climate finance tracking tool established by MoF, working with MoFE and NPC.

8.6 Monitoring, Review and Reporting (MR&R)

Monitoring, Review and Reporting (MR&R) of adaptation is one of the four key elements of the NAP process as defined by the NAP Technical Guidelines (LDC Expert Group, 2012). An MR&R framework stimulates learning and ensures accountability and transparency by setting clearly defined indicators. A robust M&R framework is instrumental for stakeholders to be able to take appropriate decisions on adaptation priorities and actions; overcome any shortcomings observed in relation to the implementation of the NAP with apt solutions; regulate activities effectively and efficiently to achieve anticipated outcomes; and increase the visibility of the NAP throughout the implementation period by sharing its outcomes at different levels. Nepal's MR&R system will be based on the principles of simplicity, having clear aims and objectives, being aligned with existing M&E systems, and using an incremental approach, and being cognizant of human and financial resources constraints (Leiter, 2021).

As an early action, to the extent possible, efforts will be made to incorporate gender-specific indicators and to include data disaggregated by age, gender, and specific groups and indicators to capture the different impacts of adaptation actions on women and men, children, senior citizen and other groups such as persons with disabilities (refer section 9.4 for more details). A Climate Change Data Management Monitoring and Reporting Centre will be established under the purview of MoFE to compile and analyze adaptation data and information. The collection of data will be aligned with M&E processes for Nepal's NDC, SDGs and the GRID strategic plan.

The first phase of the MR&R system will focus on one sector, and then be expanded to gather and analyze data from national sectoral ministries. As learning occurs, the system will be expanded to the provincial level. Actions also include reporting on the NAP and undertaking research to improve measurement and understanding of adaptation outcomes, including how the actions have improved the ability of Nepalese to cope with the impacts of climate change. MoFE will lead the updating of the NAP. The priority actions for MR&R with expected results are elaborated in table 12 below.

Table 12: Priority actions and expected results – MR&R

Enabling cross-cutting actions – MR&R	Expected results – Timeline and progress indicators
Establish the MR&R system for adaptation actions, to include: - Identification of adaptation indicators and data sources for the NAP actions (including collection of baseline data and collection of gender-disaggregated data). - Development of monitoring frameworks for adaptation programmes at the federal, provincial, and local levels. - Establishment and operationalization of a climate change data management monitoring and reporting centre at the federal and provincial levels.	By 2025, pilot MR&R system established. By 2025, two national sector ministries are reporting annually on adaptation actions and outcomes. By 2030, MR&R system is fully functional, with all sector ministries and provincial governments reporting annually.
Review the implementation of the NAP.	By 2026, first review of the implementation of the NAP completed in 2026, second in 2031.
Update the NAP every ten years.	By 2035, updated NAP document published.
Undertake research to improve measurement of adaptation outcomes.	By 2025, research undertaken in the agriculture sector, drawing on international best practices.

9. NAP IMPLEMENTATION MODALITY AND INSTITUTIONAL ARRANGEMENTS

9.1 NAP Implementation

The NAP is designed to complement existing plans. It presents a strategic approach that will help the government achieve national development goals and the SDGs, including poverty alleviation, gender equality, transformation of the agricultural sector, and climate-resilient infrastructure. The short-term actions are aligned with the national development priorities set out in the Fifteenth Plan and the Government of Nepal's COVID-19 recovery plan, including the Green Recovery Inclusive Plan (GRIP). The medium-term plans are aligned with the priority actions of Nepal's NDC and informed by the priorities set out in the SDG roadmap. The strategic vision guiding action to 2050 is aligned with the goals of the National Climate Change Policy, 2019. This NAP promotes actions to mainstream adaptation in the planning and budgeting processes at the provincial and local levels; and in the policies, plans and budgets of the sectoral ministries at the federal level. The NAP has been drawn on and can be an input to strategies on the SDGs, biological diversity, combatting desertification, and Disaster Risk Reduction (DRR). The identification of common adaptation actions across these strategies helps provide consistent messaging to stakeholders and potential funders of adaptation priorities.

9.2 Institutional Arrangements

The effective implementation of the Nepal NAP requires a mix of institutional and behavioral responses, the use of technologies, and the design of climate-resilient plans and climate smart practices. These actions will need to consider a balance between economic development, social development, environmental sustainability, and DRR. The main institutions involved in the implementation of the NAP process range from the Environmental Protection and Climate Change Management National Council (EPCCMNC), chaired by the Rt. Hon. Prime Minister to the Inter-Ministerial Climate Change Coordination Committee (IMCCCC) to the Thematic and Cross-cutting Working Groups (T/CWGs) and MoFE at the federal level.

At provincial level, the institutions responsible for the effective implementation of the NAP include the Provincial Environmental Protection and Climate Change Management Council (PEPCCMC); the Provincial Climate Change Coordination Committee (PCCCC); the Provincial Policy and Planning Commission; the ministries related to forests, environment and climate change; and other sectoral ministries at the province level. The District Climate Change Coordination Committee (DCCCC) provisioned under the chair of the District Coordination Committee (DCC) chief and the Local-level

Executive Board are crucial to implement the strategic adaptation interventions outlined in the NAP document.

The key institutions are briefly described below (please refer to section 5.2.4 for other details).

- The EPCCMNC provides strategic guidance in mainstreaming of the NAP actions into policies, plans and programmes at all levels of government.
- The IMCCCC is responsible for overall coordination of the technical aspects of NAP implementation, and communication of NAP priorities to the three levels of government.
- The MoFE is responsible for the overall NAP process, and for policies, laws, and strategies for climate adaptation; provides guidance and technical support to provincial and local governments; MR&R of adaptation actions; reporting on adaptation actions on an annual basis; and approval of adaptation projects funded through international sources.
- The Climate Change Management Division (CCMD) is responsible for coordinating the NAP process within MoFE; and mainstreaming adaptation in sectoral, provincial, and local policies, plans, and programmes.
- The National Planning Commission assists with the mainstreaming of climate change adaptation in planning processes, ensures that plans and programmes are climate-resilient, and assists MoFE in the MR&R of the NAP.
- The Ministry of Finance works to increase access to domestic and international financial resources related to adaptation and helps to coordinate climate finance through a dedicated climate finance unit within the ministry.
- The ministries related to climate change at the federal level are responsible for establishing climate change units to mainstream the NAP in sectoral policies, planning and activities. Relevant ministries are responsible for coordinating Thematic Working Groups and Cross-cutting Working Groups, and lead the mainstreaming of adaptation into sectoral policies and plans.
- PCCCC established in each of the seven provinces with responsibility to integrate and mainstream climate adaptation into policies, plans, strategies, programmes, and projects. This includes vertical linkages with the federal government, integrated approaches across provinces, and coordination of capacity building for provincial governments.
- District Climate Change Coordination Committee (DCCCC) is to be established at the district level, and will help facilitate implementation of adaptation actions at the district level where the mayor/chairperson remains the member to lead the implementation of the NAP.
- The Executive Board at the local level oversees and provides strategic guidance to coordinate implementation of climate change adaptation actions outlined in the NAP document at the local level.
- A Forest, Environment and Disaster Management Section at the local level is responsible for facilitating climate adaptation activities; MR&R of adaptation action; raising public awareness on adaptation; implementing adaptation projects in areas under local jurisdiction (such as environmental conservation, biodiversity, agriculture and livestock, watershed management, and wildlife) and integrating adaptation into local level services (such as health, sanitation, agricultural extension, and drinking water).
- The role of the development partners and agencies, international and national non-governmental organizations, private sector, academia, networks and associations is crucial in NAP implementation in Nepal. Cross-sectoral learning and experience sharing among all the stakeholders of the NAP will be periodically organized by MoFE, which will utilize the existing and new coordination mechanisms.

Roles and Responsibilities of MoFE

The National Climate Change Policy, 2019 provides guidance on the roles and responsibilities of the MoFE in regard to this NAP and the NAP process. As the convening agency on adaptation, MoFE works through the CCMD to engage with sector ministries at the federal level, and provincial and local governments. This policy commits 80% of mobilized international climate finance for the "implementation of programmes at the local level", meaning MoFE will need to set up planning and reporting channels that enable effective coordination and communication across levels of government. Effective vertical integration requires intentional and strategic linkages between federal, provincial, and local adaptation planning, implementation, and MR&R (Dazé et al., 2016). Moving forward will require identifying which adaptation actions and functions are best undertaken by three levels, as well as adaptation actions that can be undertaken by non-governmental actors such as civil society organizations and the private sector.

MoFE, with the work being led by the CCMD, will:

- Prepare the NAP and oversee the implementation of adaptation actions.
- Update the NAP every ten years.
- Manage the NAP process, including functional coordination and coordination across working groups and levels of government.
- Lead studies and research on adaptation and formulate and implement laws and standards that are required to incentivize adaptation action.
- Provide guidance and technical support to sectoral ministries, provincial governments, and local governments, including for the mainstreaming of adaptation in policies, plans, programmes, and budgets.
- Coordinate adherence to the country's international obligations on adaptation, including vulnerability and adaptation inputs to NDC, National Communications, and Adaptation Communications, and representing Nepal in international negotiations.
- Increase access to international financial resources for adaptation.
- Provide consent for the implementation of adaptation-related projects that are supported with international assistance.
- Develop a transparency and accountability framework to increase the participation of stakeholders in adaptation action and establish easy access to information on adaptation.
- Collect details of adaptation programmes operated by government agencies and the non-governmental sector on an annual basis and publish a report.
- Lead MR&R of the NAP and adaptation actions, working with NPC at the federal level.

The government will work in collaboration with federal sectoral ministries, provincial governments, and local governments to develop strategies and coordinate actions to build resilience to climate change, and to optimise opportunities to increase financing for adaptation actions. The government will establish a Climate Change Data Management, Monitoring and Reporting Centre (CCDMMRC) at the federal level to facilitate regular monitoring of the NAP process that is guided by the NPC, EPCCMNC, IMCCCC, PEPCCMC, PPPC, and DCCCC. This centre will collect and compile all the data related to CCA implementation from sectoral ministries, intra-governmental agencies, development partners, non-governmental organizations, and private sector entities working at all tiers of government through a dedicated system that includes an online portal and a platform for data sharing. Periodic adaptation status reports and monitoring reports will be prepared to improve understanding of the overall implementation of the NAP (Figure 18).

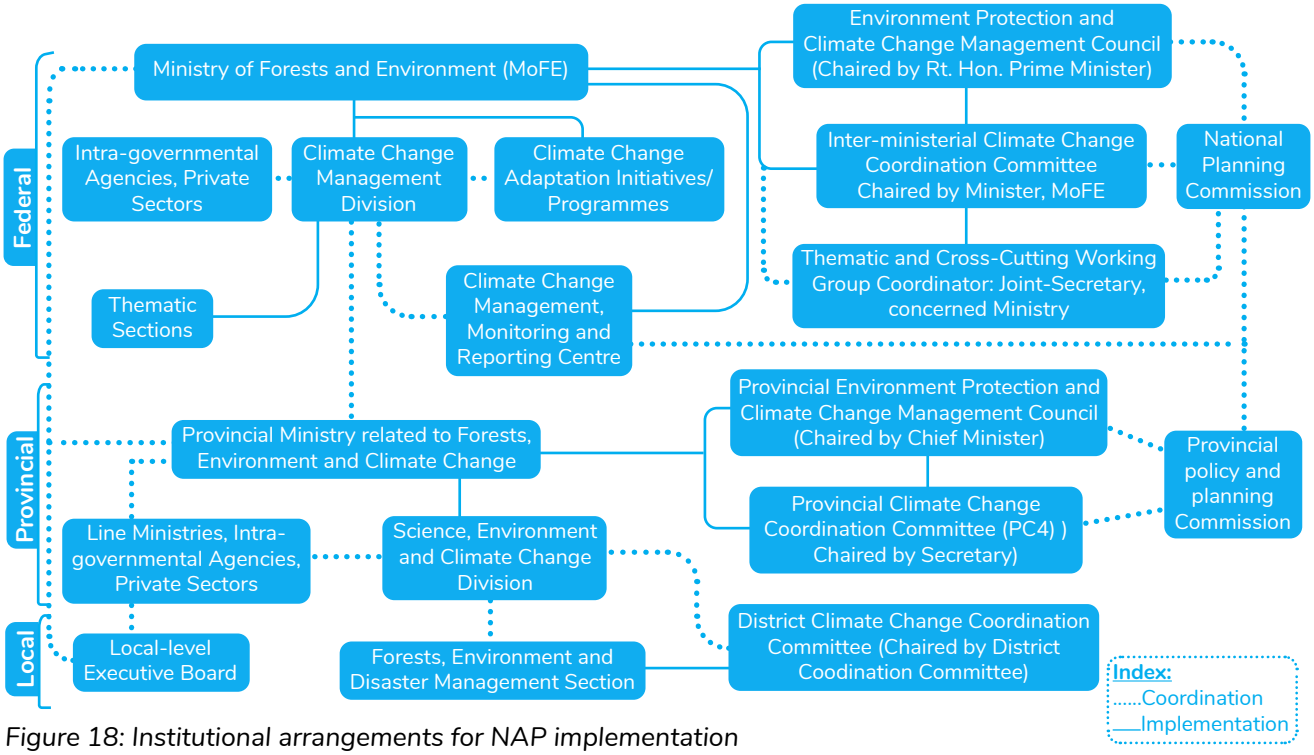


Figure 18: Institutional arrangements for NAP implementation

9.3 Financing the NAP

The National Climate Change Policy (2019) states that 80% of mobilized international climate resources will be used to support the implementation of programmes at the local level. Meeting this goal and financing the NAP process requires the identification of national and international resources for the implementation of adaptation actions, and the establishment of an improved climate change budget code to track climate finance. NAP implementation requires financial resources for stand-alone adaptation programmes and projects, as well as financial resources to climate proof traditional development interventions.

Nepal will mobilize both national and international finance to implement its NAP. The following considerations will guide Nepal's efforts to scale up financial resources for adaptation.

- The country's International Development Cooperation Policy (2019), National Climate Change Policy (2019), GRID, and other relevant national financing strategies will guide the prioritization and financing of adaptation actions.
- Nepal will channel most of the externally accessed adaptation finance for NAP implementation through the government system, which will be reflected in the fiscal budget.
- The government of Nepal will use the Climate Change Budget Code (CCBC) at all levels to encourage the allocation of budget for climate change. Updating of the criteria, methods and processes is needed to improve on the practices that have been implemented by the Nepal government since 2012.
- The country will allocate 80% of international climate finance to the local level while implementing NAP-related programmes and projects, as guided by the National Climate Change Policy.
- Adaptation finance will be transparent and promote ownership among the stakeholders, focusing on climate-vulnerable populations.
- Adaptation actions will be gender-responsive and socially inclusive, and will prioritize the engagement of women, minority groups and marginalized sections.

- Adaptation finance will also promote research and development, capacity building and adaptation technology for efficient implementation of the NAP.

Nepal will rely primarily on international financial resources for financing its NAP. The sources include multilateral financial institutions, bilateral development cooperation agencies, the financial mechanism and funds under the UNFCCC, international private sector finance, and other sources of external finance coming from international organisations, foundations, climate dedicated funds, and innovative sources. The total indicative cost of Nepal's NAP is USD 47.4 billion to implement priority programmes up to 2050. Nepal will contribute USD 1.5 billion until 2050; and external support totalling USD 45.9 billion is required to implement the NAP to 2050. The government requires USD 2.1 billion per year to implement the NAP over the medium-term.

Table 13: Climate financing for Nepal NAP

Total Cost of Nepal NAP			
Contributions	Medium-Term (2030)	Long-Term (2030)	Total Costs
External Support	USD 20.5 billion	USD 25.4 billion	USD 45.9 billion
National Contributions	USD 0.5 billion	USD 1 billion	USD 1.5 billion

The cost breakdown for each sector reveals that the highest cost (USD 11.2 billion to 2050) is required to implement the adaptation programmes in the Agriculture and Food Security sector, followed by the Forest, Biodiversity and Watershed Conservation sector (USD 8.7 billion to 2050) and the Disaster Risk Reduction and Management sector (USD 8.05 billion to 2050). The Tourism, Natural and Cultural Heritage sector is a smaller programme with a budget of USD 1.13 billion to 2050. GESILG and the enabling actions have adaptation programmes with an indicative cost of USD 0.86 billion to 2050.

The government of Nepal will transparently track the adaptation finance received from the various sources. A web-based tool will be developed and maintained to record the support received. Similarly, the information will be used to communicate with development partners and to report to the UNFCCC Secretariat as a part of the transparency framework under the Convention and the Paris Agreement. The current criteria and procedures used to allocate the climate change budget in the fiscal budget will be appraised as needed and promoted at all levels. Local Climate Adaptive Living (LoCAL) mechanism of UNFCCC is used to channel climate finance to the local level in the form of Performance Based Climate Resilient Grants. Similarly, the Climate Finance Strategy and Road Map developed by the MoFE will guide the M&E of adaptation finance (Figure 19).

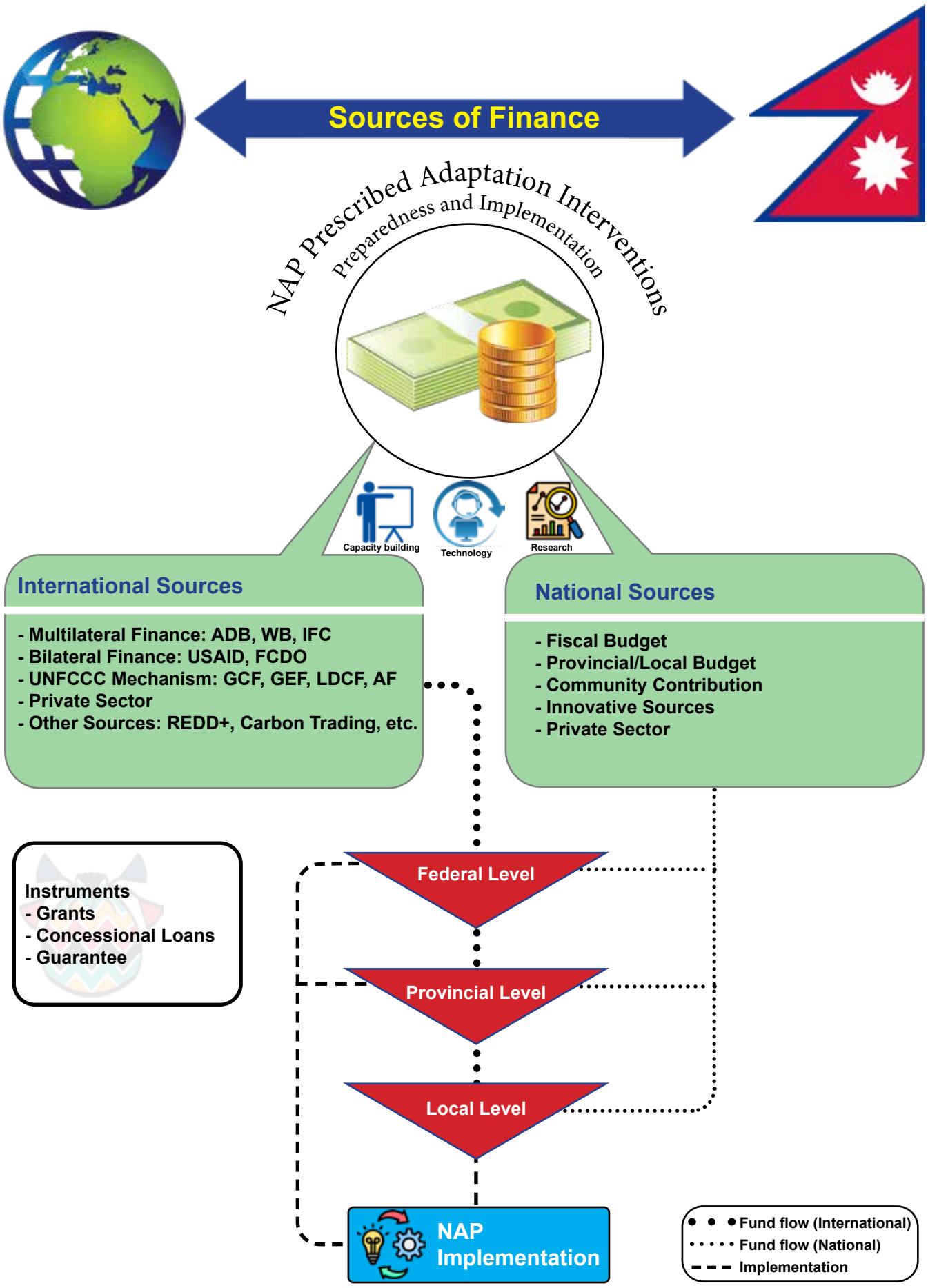


Figure 19: Climate change adaptation financing mechanism in Nepal

9.4 Monitoring, Review and Reporting (MR&R)

The adaptation monitoring, review and reporting (MR&R) system will be developed and implemented to generate information for national and international reporting requirements. MR&R needs to demonstrate how adaptation actions improve the ability of people, communities, and systems to cope with climate change. This system can help the government track the participation of women and vulnerable groups in the NAP process, and identify opportunities to enhance their equitable access to resources and benefits from adaptation interventions.

9.4.1 Monitoring and Review

An MR&R framework stimulates learning and ensures accountability and transparency by setting clearly defined indicators. Nepal's second NDC includes a priority of developing and operationalizing a NAP MR&R Framework by 2022 (GoN, 2020b). The NAP MR&R system is also guided by Nepal's Climate Change Policy (2019) that includes a statement of intent about Monitoring and Evaluation (M&E) and proposes the development of a new 'transparency and accountability framework'.

Ministry of Forests and Environment (MoFE), in its capacity as climate change focal point, is responsible for reviewing and reporting on the implementation of the NAP. A review of the implementation of the NAP will take place every five years; and the NAP will be updated every 10 years (GoN, 2019c). The review will utilize reports from sector ministries, province governments, and local governments, as well as inputs from stakeholders. The review of the NAP will include reporting on progress indicators, but the emphasis will be on measuring the impacts of the adaptation actions - showing how taking action on adaptation leads to development benefits that are linked to the government's national priorities, including poverty alleviation. This will provide the evidence base for planning and implementing future adaptation programmes, for reporting on adaptation at the national and international levels, and for seeking financial support for adaptation programmes. The reporting and review of the NAP will be part of Nepal's adaptation MR&R system, and will be linked to the NPC's national M&E system and SDG reporting, as well as the system established for tracking of climate finance.

The government introduced a climate change budget code in FY 2013-2014 at national level that designated climate change-related financing based on a system using three indicators: "highly relevant," "relevant" and "neutral"[2] and the government is continuing the use of budget code. Ministry of Finance (MoF) has adopted climate change financing framework for integrating climate change and climate finance into national planning and budget processing to ensure that climate finance reaches the vulnerable communities, particularly when climate programmes are directly implemented by line ministries (MoF, 2017). The climate budget code was introduced in the annual budget of fiscal year 2013/14 (NPC, 2013) to track climate public expenditure (NPC, 2013; Shrestha and Gurung, 2020).

On the programmatic front, data gaps, an inadequate legislative framework, not fully functional MR&R mechanisms and limited technical capacity and financial resources for data management are major challenges that impact the development of a national adaptation MR&R system. Nepal will need to address these challenges in order to establish an effective Adaptation MR&R system that monitors and reviews progress on adaptation programmes, on the coordination of the NAP process, and on amounts of financial flows for adaptation.

[2]*Sectoral ministries have to prepare typologies and activities leads to contributing climate change (climate change budget code) as developed by Ministry of Agriculture and Livestock Development.*

9.4.2 MR&R Approach

Nepal's MR&R system will be simple that uses an incremental approach, and considers human and financial resources constraints.

Sectoral frameworks for MR&R - Nepal's approach will include the development of sector-wise monitoring and reporting frameworks that include outcome- and impact-level progress indicators for the NAP priority programmes and data sources to establish baselines and measure progress. The sector monitoring and reporting frameworks will help to, (ii) monitor and review the implementation of adaptation priorities and the NAP process, (i) evaluate the effectiveness of adaptation actions and adjust the course of future interventions that impact gender, age and socio-economic classes of peoples differently, and (iii) track and report on adaptation finance in the sector. Monitoring and reporting plans will be developed for each adaptation programme to assess progress on the implementation of activities, and adaptation results at the outcome and impact levels. These plans will be based on an agreed-upon format and will assess progress and impacts against the indicators that have been identified and agreed based on available data sources (means of verification). Initial work will focus on one or two priority sectors. As experience is gained, additional sector frameworks will be developed.

Indicator development - Process and outcome level indicators will be identified for the adaptation programmes in the NAP to help measure the results. Indicators will align with existing indicators and targets at the national level (NDC and National Development Plan) regardless of whether reporting on national goals or major international mechanisms (e.g., Paris Agreement, UN SDGs, and Sendai Framework on Disaster Risk Reduction).

Data collection - Indicators will be based on available data on climate trends, vulnerabilities, economic and social dimensions, and the status of natural resources and land use from various sources (e.g., meteorological data, and vulnerability assessments) to avoid creating an unnecessary burden of data collection and reporting. Primary and secondary data will be collected, including from the National Planning Commission (NPC) and management information systems (MIS) established in different sectors such as education, health, etc. Data from censuses and surveys produced by the Central Bureau of Statistics will also be used to measure the indicators.

Considering the challenges and gaps in the adaptation M&R system, and in line with indicators and data sources, the M&R team at NPC or MoFE as well as TWG or overarching committee established in the MoFE will decide what data and information to collect in order to measure and assess progress during the planning phase. Quantitative tools such as population censuses, household surveys, and semi-structured questionnaires as well as qualitative tools such as focus group discussions, key informant interviews, participant observation, Strength, Weakness, Opportunities and Threats (SWOT) analysis, case studies, and lessons learnt will be used, where appropriate and relevant.

Roles and responsibilities - The federal, province and local governments have responsibilities for M&E of adaptation. The National Climate Change Policy (2019, Section 10) indicates that provincial and local governments are responsible for carrying out M&E of adaptation programmes within their respective jurisdictions.

The Inter-Ministerial Climate Change Coordination Committee will provide oversight and be responsible for reviewing progress against adaptation targets.

As per Nepal's Government Business Allocation Regulation (2017), at the federal level, MoFE is the designated focal ministry to coordinate affairs related to climate change under the facilitation of the CCMD. As such, MoFE is responsible for the MR&R framework and MR&R of NAP activities at the federal level. This includes establishing, managing and staffing the Climate Change Data Management Monitoring and Reporting Centre (CCDMMRC - described below). All national ministries and agencies (such as CCMD/MoFE, sectoral ministries, intra-government agencies, Department of

Hydrology and Meteorology, and Department of Mines and Geology) will be responsible for MR&R their respective adaptation projects and submitting reports to the MoFE.

At the Provincial level, the Ministries related to forests, environment and climate change will be responsible for MR&R on the implementation of adaptation activities. Sectoral ministries would share the data related to climate change to provincial MoFE for data consolidation. The Science, Environment and Climate Change Division of provincial will compile data and information on adaptation projects/programmes implemented by relevant sectoral ministries, international and national NGOs, the private sector, UN agencies, and bilateral and multilateral agencies. Science, Environment and Climate Change Division will also compile information submitted by local governments, and forward the report to the MoFE.

At the local level, it is proposed that the Forest, Environment and Disaster Management Section[3] be responsible for monitoring of adaptation activities implemented at the local level by local government departments, user's groups (forest, agriculture and water), community-based organizations, the private sector, international and national NGOs, UN agencies, and bilateral and multilateral agencies. A Local Level Climate Change Coordination Committee (chaired by Mayor/ Chairperson) will provide policy guidance to the local government. The District Climate Change Coordination Committee chaired by the District Coordination Committee Chief will compile all data about local level adaptation activities and forward the report to the provincial Science, Environment and Climate Change Division through the specified online platform.

Communication between the levels of government is guided by the Nepal's Government Business Allocation Regulation (2017), and MoFE will work within this regulation. As a regulation guides for coordination and interrelation among the federal, provincial and local level governments (GoN, 2020c), MoFE will form partnerships with relevant ministries to ensure that the sharing of information and data on adaptation can be taken place in a timely manner. MoFE will communicate with provincial ministries through the provincial Office of the Chief Minister and Council of Ministers; and can work through the Ministry of Home Affairs at federal level that has a mandate to communicate directly with district administration offices. In regard to communicating with local government, MoFE may need to work through the Ministry of Federal Affairs and General Administration, which has a mandate to communicate directly with local governments. At the provincial level, district coordination committees can communicate directly with municipalities, meaning that these committees can be a nodal agency to collect and compile information and data on adaptation from the local government level and then forward the information to provincial ministries responsible for forests, environment and climate change.

9.4.3 Climate Change Data Management Monitoring and Reporting Centre

The Climate Change Data Management Monitoring and Reporting Centre (CCDMMRC) will be established at the federal level, and will be responsible for compiling and analyzing adaptation data and information collected across the entire country (Figure 20). This center will collect and manage climate change-related data and information, and ensure the data is publicly accessible using an online platform. The center will be responsible for compiling the monitoring reports on adaptation action submitted by the provincial ministries and technical working groups at the federal level. In addition, development partners will be encouraged to report on financial flows for adaptation, and the private sector will be encouraged to report on their adaptation actions.

[3]*Or the section responsible for overseeing forest and environment related programmes.*

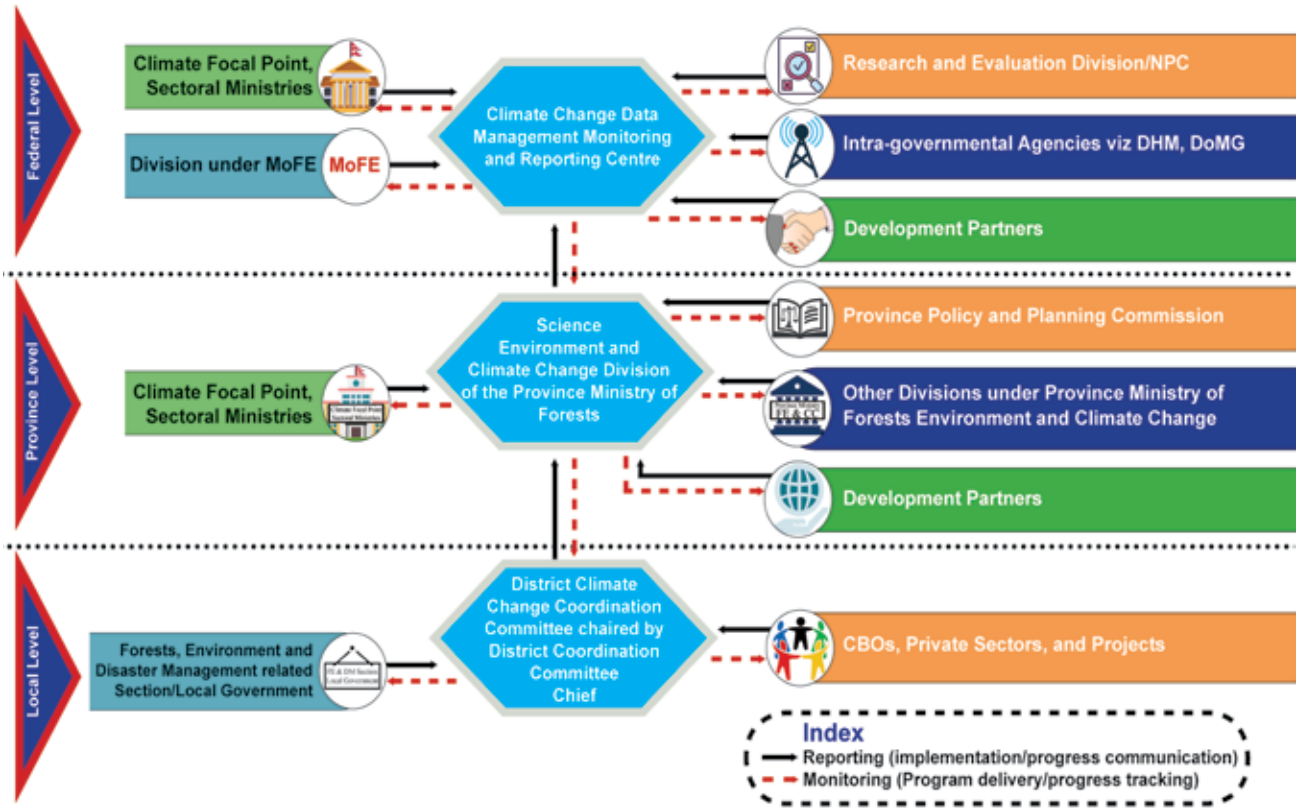


Figure 20: MR&R framework for Nepal's NAP process

Note: The forests and environment ministry at the provincial level is denoted by "MoITFE" (Ministry of Industry, Tourism, Forest and Environment) in the chart. However, the exact name of the ministry varies with province. This applies for all provincial ministries.

Online platform

The climate change data management monitoring and reporting system (CCDMMRS) online platform will be developed in a manner that can accommodate data with different structures and formats and pulled from different sources. It will have a database structure that is scalable to heterogeneous data sets of larger volumes. The database structure will be designed such that the requirements for the data catalog including metadata-based searching, various file formats, and compatibility with the existing data structure are supported. The frontend interfaces will present visualizations with user interactions. It will include elements such as an interactive user dashboard with maps, visualizations, and filters; wide-ranging functionality; offline data retrieval service; layers that allow checking the values of parameters against the specification to detect misuse, and so forth. The entire process of development will also be driven by the quality control process. Unit testing, validation layers, code review, coverage and complexity check, and continuous feedback and fixes will be performed to ensure the product fulfills various functional requirements and is error-free with well-maintained code under the online platform.

9.4.4 Reporting on Adaptation

The data and information collected and compiled for the CCDMMRC will be used to prepare reports on adaptation that meet reporting obligations at the national and international level.

The review will utilize reports from sectoral ministries, provincial governments, and local governments, as well as inputs from stakeholders. Important stakeholders include women, youth, indigenous peoples, and other disadvantaged groups; private sector; and academia. To facilitate this mandated reporting, the following activities will take place:

- Inception phase (end of 2026): This first phase will focus on the identification of indicators and collection of baseline data for selecting priority adaptation programmes in the NAP, with an initial focus on one sector.

- Midterm assessment (end of 2031): The emphasis of the second phase will be monitoring and review of NAP adaptation programmes for the period 2022 to 2026. The report will include an assessment of progress, preliminary analysis of the impacts of adaptation actions with a focus on one sector, and recommendations on the design of the remaining tenure of NAP (2027-2031).
- External review (end of 2033): This phase includes a review of the implementation of the NAP for the first 10-year period that will be undertaken by independent third parties. This report will inform the NDC and international reporting, and help to shape the second-generation NAP to be implemented from 2034 onward.

The collection of data and information on adaptation should be timed to facilitate meeting the reporting requirements of the UNFCCC and the enhanced transparency requirements set out in the Paris Agreement. Nepal, as an LDC, is not required to meet the UNFCCC submission timetables, but will strive to submit its national communications (that include a detailed section on adaptation) every four years, and its Adaptation Communication or a Biennial Transparency Report with an adaptation section every two years beginning in 2024.

9.4.5 Resource Requirements

Human, technical and financial resources are required to operationalize the adaptation MR&R system. CCMD/MoFE will manage the staff of the CCDMMRC and will need to prepare a capacity building plan for staff members that are engaged to implement the MR&R process. In terms of human resources, data officers and information officers working at all levels of governance need to be trained on data collection, data mining, synthesis and analysis of information from an adaptation perspective.

Hardware and software suppors are required; and service providers will be procured to establish and run the MIS and software. Service providers prepare knowledge products, such as an MR&R manual and stepwise guidelines, to assist officers at all levels of government in using the system. To ensure financial security, there needs to be a provision of allocating at least 5% of the cost of each of the operational project under the NAP to prepare robust M&R and reporting systems.

10. NAP ACTION PLAN

Effective implementation of the 64 adaptation programmes is critical in building a climate resilient Nepal. For effective implementation, programmes are grouped into a 5-year period scale. Some of the programmes are scaled for multiple years. Of the 64 adaptation programmes, there are:

- 47% strategic adaptation programmes that are to be implemented immediately and expected to be concluded by 2030, tagged as Short-term.
- 34% adaptation programmes are scheduled for implementation between 2030 and 2040, and tagged as Medium-term.
- 18% adaptation programmes are tagged as Long-term where implementation is expected to begin in 2040 and complete by 2050.

Implementation of the adaptation programmes could be through the development of standalone projects financed by international sources. In addition, it is expected that some of the adaptation programmes will be integrated in the federal and sector development plans and programming, as well as the programmes of the provincial and local level governments. As noted in section 9.3, the majority of financing for the adaptation programmes is expected to come from international sources.

Table 14 presents a tentative timeline of actions to further the implementation of the adaptation programmes.

Table 14: Timeline of Adaptation Action (NAP Implementation) SECTOR: Agriculture and Food Security (AFS)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. At least 70% of 753 local levels' institutional capacity on CCA planning implementation, M&E increased. 2. Seed multiplication center and animal breed center strengthened, and established in each province. 3. At least 70% of Agriculture Knowledge Center and Veterinary Hospital and Livestock Service Expert Centers' institution capacity on climate change adaptation planning implementation, M&E increased. 4. Innovative insurance and financing strategies for private sector engagement in the agriculture sector developed and promoted in 50% of the local levels. 5. 7 collective farming-model developed in hills and mountains. 6. Climate smart agriculture technology innovation and promotion system established and operationalized in a public private model. 7. 50% additional small holders received timely and reliable package of climate and agro-advisory services and 30% of farm families provided with seed storage bags/ container. 8. 50 % crop production increased through reliable climate services and agriculture information and genetic resource conservation. 9. Soil Organic Matter increased to 3.95% in reference to that of 2022. 10. Capacity of agriculture and livestock institutions increased on climate adaptation planning. 11. Community Seed Banks established at 40% of local levels. 12. Food availability and nutrition security ensured in food deficient hill and mountain districts. 13. Circular economy approach is adopted to build climate-resilient rural livelihoods at 50% local levels. 14. Climate risk sharing model developed and used by 60% farmers of all municipalities. 15. 80% of the local governments and farmers associated have increased awareness of climate risks, vulnerabilities and adaptation strategies in agriculture and livestock sector and 50% have promoted commercial approach.	Innovative insurance and financing strategies for private sector engagement in the agriculture sector developed and promoted in 80% of the local levels. 50% of farm families provided with seed storage bags/container. At least five climate-stress crop varieties and animal breed developed. Health status improved through increased food quality and nutrition regime. Crop intensity or crop diversity increased by 100%. Circular economy approach is adopted to build climate-resilient rural livelihoods at all local levels. Climate risk sharing model developed and used by 80% farmers of all municipalities. 100% of the local governments and farmers associated have increased awareness of climate risks, vulnerabilities and adaptation strategies in agriculture and livestock sector. Collective farming model replicated in 300 local levels. Commercial approach and local/indigenous/wild relatives are promoted to build climate-resilient rural livelihoods at all 753 local levels.	Innovative insurance and financing strategies for private sector engagement in the agriculture sector developed and promoted at all local levels. Climate smart agriculture technology innovation and promotion center in a public private model, fully functional. Food availability and nutrition security ensured all over Nepal. Five cereal crops have climate resilient tested varieties. Collective farming model replicated in 500 local levels. Climate risk sharing model developed and used by 100% farmers of all municipalities. 100 wetlands-based irrigation systems established. Collective farming model replicated in 500 local levels.	100% of farm families provided with seed storage bags/ container. Increased practices of sustainable and organic agriculture by 50%. Collective farming model replicated in 753 local levels.	Increased practices of sustainable and organic agriculture by 100%. Food crop production increased by 20%. Increased practices of sustainable and efficient agriculture throughout Nepal by 100%. 500 wetlands-based irrigation systems established.	Built the resilience of agroecological systems through the enhancement of agricultural productivity, preserving genetic resources, building national capacities and information systems, adopting clean energy, and peasant-friendly climate induced risk-sharing models.

SECTOR: Forest Biodiversity and Watershed Conservation (FBWC)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. 50% of forest fire incidence is reduced. 2. 50% of IPs and LCs adopt watershed adaptation tools/technique. 3. Habitat and connectivity are conserved and maintained and the landscape conservation area cover increased by 10%. 4. 25% ponds/lakes of NLCDC report record restored in community-based forests. 5. 20% of hill forest pine monoculture transformed to broadleaved mixed forest. 6. Conservation ponds/wetlands created at the foothills (500 of at least 1,000 ha). 7. 100 CFs/LFs start forest for food grain programme. 8. 500 CFs produces direct adaptation resources through ecosystem management. 9. Forest health improvement measures identified and implemented through Divisional Forest Offices throughout Nepal primarily in climate-induced disaster prone and hardest hit areas. 10. Climate-induced disaster management guideline incorporated in all Community Forests Operational Plans.	80% of forest ecosystem and biodiversity loss caused by forest fires is reduced. 60% of the riverbank cutting and flood risk reduced. One third of the Karnali downstream areas irrigated. 80% reduction of wildlife roadkill incidence on major highways. 80% of degraded ecosystems restored and managed to maintain ecological integrity. Water availability is increased to 50% in sub-watersheds. Adaptation services increased to 50% in selected PAs. PAs benefits maximized to 80%. 80% of forests habitats are restored applying climate-resilient DRRM. 40% green job secured through SFM.	40% of hill forest pine monoculture transformed to broadleaved mixed forest. 5000 CFs produces direct adaptation resources through ecosystem management. Entire Karnali downstream area irrigated.	By 2045, 40% of livelihoods of hill and mountain communities secured through circular economy in forestry and agriculture.	80% of sub-watersheds are climate-resilient. 80% of forest invasive species controlled. Forest health maintained (driver reduced) by 80%. 50% REET species are restored. 80% of wetlands at the foothills of Chure conserved and restored. 80% of degraded ecosystems are restored and managed to maintain balanced ecological functioning. Volume of highland high value forest products is increased by 50% through applying rotational harvesting and sustainable harvesting techniques.	Developed climate resilient ecosystems, ecosystem services and function and biodiversity. Ecosystem restored to maintain balanced ecological functioning.

SECTOR: Water Resource and Energy (WRE)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. National Framework for Climate Services is enforced to enhance the access to climate information. 2. Four glacial lakes flow in the Gandaki, Karnali and Koshi river basins regulated and GLOF Early Warning System (EWS) strengthened and established. 3. Real time monitoring system of the Glacial Lakes in Nepal established at Federal level. 4. Total 12,000 MW capacity of hydropower installed, and 1,500 solar drinking water and solar irrigation pumping systems established. 5. Ground water cluster projects commanding more than 95,000 ha developed. 6. Pumped irrigation system developed to irrigate 25,000 ha. 7. 300 large scale, 50,000 domestic bio-gas plants established, 1,000,000 clean cooking stoves distributed, 12 MW solar energy plants with mini-grid in off grid areas installed, and 30 MW institutional grid solar plant and 2 MW grid connected wind energy installed with the national grid system. 8. 30 climate-resilient river check dams constructed in river stretches that are prone to flooding, and 300 km river embankments constructed. 9. Climate-resilient hydropower development strategic guideline operationalized. Climate-smart designs and guidelines for water resources infrastructure prepared and applied. 10. Small to medium storage project developed for expansion of irrigation of 10,000 ha. 11. 200 national meteorological and hydrological professional capacitated in downscaled weather, climate and hydrological scenario forecasting services. 12. Renewable energy contribution in the national energy system increased by 30%, and solar energy contribution increased to 20%. 13. Climate-resilient energy production and distribution systems are integrated into the electricity generation sector through research and innovation, and formulation of guidelines and strategies.	Additional 20 climate-resilient river check dams constructed. Ground water cluster projects commanding for additional 25,000 ha developed. Small to medium storage project for expansion of irrigation of additional 10,000 ha. Pumped irrigation system managed to irrigate additional 5,000 ha. 5 hydropower projects (> 200 MW) implements ecosystem conservation programmes in corresponding watershed. Additional 3 reservoir based hydropower plants developed. Additional 500 bio-gas plants established, 1,000 clean cooking stoves distributed, 5 MW solar energy plants installed, and 50 MW grid solar plant connected.	Integrated use of water for irrigation, safe drinking and energy use promoted. Additional 500 bio-gas plants established, 1,000 clean cooking stoves distributed, 5 MW solar energy plants with mini-grid in off-grid areas installed, and 50 MW grid solar plant connected with the national grid system. Ground water cluster projects commanding for additional 25,000 ha developed. Small to medium storage project for expansion of irrigation of additional 10,000 ha. Pumped irrigation system developed to irrigate additional 5,000 ha. Vulnerable rivers will be managed by innovative, naturebased and sustainable solutions.	15 hydropower projects (> 200 MW) implements ecosystem conservation programmes in corresponding watershed.	10 hydropower projects operate on reservoir system.	Improved water availability and promoted clean energy mix system through alleviating the water and energy risks and threats, and building enabling environment.

SECTOR: Rural and Urban Settlement (RUS)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. A catalogue on climate-resilient building design, practices, and construction material technology developed and disseminated. 2. Climate smart and climate resilience concept adopted in 7 cities. 3. 15 climate-resilient building information and demonstration center in seven provinces and five physiographic zones established and operationalized. 4. 10 new towns/metro/sub-metropolitan cities that are being developed in Madhya-Pahadi Lok Marge pilot circular economy in climate resilient urban development. 5. 50 cities have emergency holding shelters.	200 cities have emergency holding shelters. Capacity on adaptive urban planning developed in all cities. 50 cities pilot circular economy in climate resilient urban development. 200 cities and rural municipalities have emergency holding shelters. 753 municipalities developed and implemented integrated land use plans.	300 highly vulnerable settlements relocated to safe areas. 300 existing compact settlements upgraded to cope with climate and disaster risk with wide-open spaces.	500 cities have emergency holding centers. 20 Tarai cities are CiD proof.		Mainstreamed climate change adaptation in planning (land use, settlement, rural development) and assisted vulnerable settlements to cope with climate impacts.

SECTOR: Industry Transport and Physical Infrastructure (ITPI)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. Real time weather and climate information systems increased, and information disseminated to encourage climate-resilient industries and infrastructure. 2. 100 climate-resilient safer transport system and 100 climate-resilient open spaces, community/holding shelters strengthened and developed. 3. 100 helipads, warehouse developed and strengthened. 4. Energy mix system in the supply of energy to the industrial sector set up by 20%. 5. Energy efficient and climate resilient industrial corridor established and operationalized (1 by 2030). 6. 20% private and public vehicles will run in hybrid fuel system.	Adaptive capacity of the ITPI sector enhanced through strengthening of institutions and upgrading to new state-of-the-art technologies. 40% of industries at risk to climate extremes are equipped, strengthened and relocated. Low carbon, climate and disaster resilient and safer transport, system established. Energy efficient and climate resilient industrial corridor established and operationalized (additional 2 by 2035).	Energy efficient and climate resilient industrial corridor established and operationalized (additional 2 by 2040).	Industries will have enhanced stock of raw materials. Energy efficient and climate resilient industrial corridor established and operationalized (additional 2). 50% of the large industries use clean energy.	Energy efficient and climate resilient industrial corridor established and operationalized (additional 3 by 2050, total 10 corridors).	Developed resilient ITPI sector and corridors that account for climate risks, run energy-friendly mechanism and scale up clean energy development.

SECTOR: Tourism, Natural and Cultural Heritage) TNCH

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. Tourism infrastructure of key destinations (trails, bridges, buildings) assessed for climate risk and vulnerability. **2.** Contribution of the tourism sector to national GDP attained by 10%. **3.** Climate and disaster preparedness strategy and action plan for high altitude destination developed and implemented. 4. A system for forecasting weather and climate information to tourism sector developed and implemented. 5. A decision support system for tourism sector resilience building established and implemented. 6. Sustainable and climate-resilient tourism strategy and action plan developed for mountain tourism. 7. Catalogue of all the cultural, historical, archaeological sites that are at risk of climate change induced hazards prepared for decision-making. 8. Climate-resilient and community-based tourism livelihood developed and enhanced in major touristic destinations. 9. Climate-smart and diversified tourism products developed in new tourism destinations. 10. Emergency relief and rescue service in adventure tourism established and operationalized at each of the strategic adventure and tourism strategic locations. 11. Climate change adaptation is integrated into tourism sector plans, policies, and strategies. 12. 1,000 tourism sector stakeholders capacitated on climate change vulnerabilities and risks and adaptation planning in the tourism sector. 13. 753 local level tourism destinations identified (one local level – one destination). 14. 20% of the key/prioritized tourism destinations enhanced through interventions.	Climate-resilient circuits, routes and sites developed. All tourism activities are connected with real-time climate info system. 20 mountain tourist spots will have all physical facilities.	Revenue for conservation tourism increased by 60% in reference to 2021. 40 mountain tourist spots will have all physical facilities. Climate-resilient circuits, routes and sites developed.	Climate-resilient and community-based tourism livelihoods developed and enhanced in all tourist destinations. 100 Agro-based tourism spots developed. Climate-resilient circuits, routes and sites developed.	Climate-resilient circuits, routes and sites developed.	Climate sensitive touristic, cultural and heritage areas identified, managed and strengthened in order to build them climate resilient and avail the continued services.

SECTOR: Health Drinking Water and Sanitation (HDWS)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. Environmental/Child/ Nutrition Friendly Local governance (E/C/NFLG) is promoted at the local level. **2.** 100 new smart/green parks established at the major urban centers. **3.** Existing public health surveillance system strengthened to reduce morbidity and mortality due to climate sensitive diseases. **4.** More evidence generated on climate sensitive diseases and health risks by data sharing mechanism between Ministry of Health and Population, Ministry of Water Supply and research and academia. *5.* 7 public health laboratories, at least one in each province, equipped and strengthened to consider climate sensitive diseases and health risks. *6.* All Health Emergency Centers at least in 25 municipalities capacitated in the functioning in extreme climate emergency situations. *7.* System of multisector collaboration and cooperation strengthened and operationalized at the federal, provincial, and local levels. *8.* Federal, provincial and local level governments are capable of preparing for and responding to climate risks and their impacts on public health. *9.* Climate-resilient WASH technologies explored and piloted in 3,000 local level vulnerable households, communities and systems. *10.* Partnership established with academic and research institutions, innovators, scholars, private sectors, industries etc. to develop and promote climate-resilient WASH technologies including human resource at federal level. *11.* Water sources along the Chure region protected to conserve the ecosystem and to promote recharge.	Centers at least in 100 municipalities capacitated in the functioning in extreme climate emergency situations. Additional 100 new parks established at the major urban centers. Climate-resilient WASH technologies explored and piloted for at least 5,000 local level vulnerable households, communities and systems. Partnership established with academic and research institutions, innovators, scholars, private sectors, industries etc. to develop and promote climate-resilient WASH technologies including human resource at all provinces. 70% of villages/ settlements have water sources/ponds collecting rainwater and ground recharging.	Additional 100 air quality pollution monitoring system established at strategic locations. All Health Emergency Centers at least in all municipalities capacitated in the functioning in extreme climate emergency situations. Climate-resilient WASH technologies explored and piloted for at least 10,000 local level vulnerable households, communities and systems.	100% of the population including women, children and socially marginalized benefit from CR and safely managed sanitation services. 70% decrease in water-borne diseases in reference to 2020. Climate-resilient WASH technologies explored and piloted for at least 20,000 local level vulnerable households, communities and systems.	All urban cities and rural centers adopt the concept of 'Health Promoting Cities': Heal. Early warning system established for WASH sector in vulnerable areas. 90% decrease in water-borne diseases in reference to 2020.	Enhanced capacities of public health system to address climate vulnerabilities and risk through improved research and surveillance system, emergency preparedness, and efficient enabling environment.

12. Water supply services enhanced in at least 300 municipalities by augmenting, protecting and conserving the water sources. 13. 30% of villages/settlements have water sources/ponds collecting rainwater and ground recharging. 14. 15% of households in the country have adopted rainwater water harvesting technology. 15. 80% of the health care services providers trained and capacitated on climate change risks on health care facilities and services. 16. 2,000 Health Care Facilities across Nepal are resilient to climate risks and maintained their operation during extreme events. 17. 2,000 Health Care Facilities improved and environment friendly WASH services integrated into their facilities and operation. 18. 20% of existing water supply scheme become climate-resilient ensuring the safely managed water supply services. 19. 40% of the population including women, children and socially marginalized people benefit from safely managed water supply services. 20. 50% of the population including women, children and socially marginalized benefit from CR and safely managed sanitation services. 21. 753 local government integrated climate change adaptation in local WASH and health plans and programmes. 22. National Health and WASH Management Information System established and operationalized. 23. Health, hygiene and water access to rural communities improved in target provinces. 24. 5,000 vulnerable HHs and communities, WASH technologies to be explored and piloted.	20% of households in the country have adopted rainwater water harvesting technology. 50% of existing water supply scheme become climate-resilient ensuring the safely managed water supply services. 80% of the population including women, children and socially marginalized people benefit from safely managed water supply services. 70% of the population including women, children and socially marginalized benefit from CR and safely managed sanitation services. National guidelines and strategies prepared and implemented to support local governments to integrate multiple uses of water, water quality improvement systems, insurance and hybrid technologies. 50% decrease in water-borne disaster in reference to 2020. 10,000 vulnerable HHs and communities, WASH technologies to be explored and piloted.	100% of villages/ settlements have water sources/ponds collecting rainwater and ground recharging. 100% of existing water supply scheme become climate-resilient ensuring the safely managed water supply services. 100% of the population including women, children and socially marginalized people benefit from safely managed water supply services. 95% of the WASH services are functional.			

SECTOR: Disaster Risk Reduction and Management (DRRM)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. DRR and climate adaptation plans, policies and guidelines are harmonized at all levels of the government. **2.** 35% of local levels have capacity to develop circular economy based integrated climate adaptation and DRR planning and implementation. **3.** All 753 local governments have developed GESI responsive LDCRPs, and integrated DRR and climate adaptation in their periodic plans and annual plans and budgets. **4.** Meaningful participation of women, children, youth, senior citizens, indigenous groups, perons with disabilities, other marginalized and vulnerable groups in all stages of the planning and implementation process at federal to local level (climate and disaster risk governance) increased by 80% in comparison to last 10 year's period. **5.** DRR priorities and goals are incorporated in the existing legal instruments and frameworks e.g., child friendly governance, Environment friendly local governance, Comprehensive School Safety Framework, etc. **6.** Age, gender and disability centric physical infrastructure, early warning, communication, and rescue and relief system established in 300 local levels. **7.** 35% of local levels have capacity to develop circular economy based integrated climate adaptation and DRR planning and implementation. **8.** Insurance companies adhere to adaptive social protection based on government plans and policies. **9.** Disaster Information Management System/bipadportal.gov.np established at federal level and in all 7 provinces, integrating existing DIMS and Sutra at local levels.	Age, gender and disability centric physical infrastructure, early warning, communication, and rescue and relief system established in 500 local levels. RSLUP implementation guidelines prepared and implemented at 753 local level. 70% of local levels have capacity to develop circular economy based integrated climate adaptation and DRR planning and implementation. 1,000 forest rivers trained. 1,000 Chure origin river trained.	Developed and operationalized adaptive shock responsive social protection framework, guideline, mechanism, and institutional arrangements at all levels of the government. 100% of local levels have capacity to develop circular economy based integrated climate adaptation and DRR planning and implementation. Age, gender and disability centric physical infrastructure, early warning, communication, and rescue and relief system established in 753 local levels. 2,000 Chure origin river trained. 2,000 forest rivers are trained.	Additional 2,000 rivers trained.	100% of the population covered with real time EWS. Human loss and damage minimized by 80 % and enhanced resilience of communities, including those most vulnerable. More than 80% of physical infrastructure and settlement are climate resilient. All FUGs integrated CCA and forest-resilient interventions in their operational plans.	Empowered governments to effectively respond to DRRM through mainstreaming adaptation action plans and guidelines, land use planning, early warning systems, monitoring, and coordination.

10. Rolled out risk transfer mechanism established by government at all levels, 50% local level benefitted. 11. Increased access and registration to and usage of adaptive social protection schemes of beneficiaries and eligible people, especially those most marginalized and vulnerable. 12. 500 Chure origin river trained. 13. National Common Alert Protocols developed and disseminated for effective Early Warning Systems. 14. Established and effectively operationalized at least 30 new GESI responsive multi-hazard early warning systems in all 7 provinces and major river basins of Nepal. 15. Now-casting system at federal level established and implemented. 16. Established policy, guidelines and institutional mechanisms at federal, provincial and local level for fire prevention and management. 17. Improved capacities of human resources and equipment for fire risk reduction/mitigation and response management at fire stations at local municipal and CFUG levels. 18. Training institution for fire control service established to provide services to all 7 provinces. 19. Climate risk sensitive areas in major settlements mapped and RSLUP prepared at federal level. 20. Climate-induced disasters and their impacts on forests assessed and mapped for strengthened resilience of the forests. 21. Federal and provincial strategy and action plan on climate-induced disasters formulated. 22. Ecosystem-based Adaptation/ nature-based solutions incorporated in all community-based forest operational plans.		Rolled out risk transfer mechanism established by government at all levels, 100% local level benefitted.			

SECTOR: Gender Equality and Social Inclusion, Livelihood and Governance (GESILG)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. At least 30% of the communities and public institutions implement GESI responsive adaptation actions. **2.** Gender responsive climate change adaptation actions are integrated into adaptation plans at 753 local level. **3.** GESI responsive and climate-resilient technologies are up-scaled and out-scaled in vulnerable areas. **4.** Increased productivity and income generation of excluded and vulnerable people by at least 30% through public-private partnerships.		Financial safety nets identified and institutionalized at community level. GESI responsive budgetary system effectively implemented at all tiers of government.		GESI integrated and operationalized in 753 local level plans and actions implemented for climate induced DRR preparedness and responses. Total 80% of the community level frontline service providers and community networks capacitated to respond immediately during climate induced disaster emergency situations considering GESI aspects. Number of cases of injury, deaths, discrimination and violence during emergency situation reduced by 60%.	Enhanced resilience to climate change through GESI-responsive livelihood programmes, gender focal desks, and climate foresight in social protection and development interventions.

SECTOR: Enabling Actions (EA)

By 2025, 2030	By 2035	By 2040	By 2045	By 2050	Cumulative Target
1. Climate vulnerability and risk assessment carried out, reviewed and renewed at each province level. **2.** A roster/pool of trained human resources databased from different sectors. **3.** Sensitized and capacitated policy makers and stakeholders at each of the sectors on climate change vulnerability and risk assessment to further adaptation planning. **4.** Capacity of the thematic ministries and provincial governments enhanced on NAP implementation. **5.** A database/pool of climate experts at the sectoral ministries at federal and provincial level developed. **6.** All 753 local government have developed and integrated LAPAs.	NAP updated. Updated (third) national level climate vulnerability and risk assessment published.				Built data available and access, capacities, capabilities, mechanism and system to integrate adaptation actions in plans and to monitor and share the lessons for broader implications.

7. Sectoral level information on NAP implementation maintained at federal level (centralized information for effective reporting to national and international level). 8. Dedicated human resource developed for data management and reporting at each of the sectoral ministries, provincial government and national level. 9. MoFE and MoALD are capacitated, and all relevant national sector ministries and provincial/local governments mainstreamed adaptation in planning and budgeting by applying the guidelines. 10. All 753 local governments prepared and implemented gender-sensitive local adaptation plans of action (LAPAs). 11. National strategy and action plan on Loss and Damage prepared. 12. Updated (second) national level climate vulnerability and risk assessment published. 13. Climate Change Research/Data Centre established, and its business plan and resources identified. 14. Plan for a Climate Information System prepared in 2025 and operationalized in 2030. 15. MoFE undertook and published five studies working in collaboration with local research institutions. 16. Number of weather stations increased from 69 in 2020 to 75 in 2030, and the access to updated weather information increased by double. 17. Climate finance strategy prepared that aligned with the priority adaptation actions identified in the NAP. 18. Climate finance tracking tool established by MoFE, working with MoFE and NPC. 19. Modalities and implementation framework for a National Climate Fund prepared and by 2030 National Climate Fund established. 20. Pilot MR&R system established. 21. Two national sector ministries are reporting annually on adaptation actions and outcomes. 22. MR&R system is fully functional, with all sector ministries and provincial governments reporting annually. 23. First review of the implementation of the NAP completed in 2026, second in 2030.					

REFERENCES

Adhikari, S., Gurung, A., Chauhan, R., Rijal, D., Dangol, B.S., Aryal, D., & Talchabhadel, R. (2021). Status of springs in mountain watershed of western Nepal. Water Policy 23 (1): 142–156. https://doi.org/10.2166/wp.2020.187

Agrawal, A., Babel, M.S., Maskey, S., Shrestha, S., Kawasaki, A., & Tripathi, N.K. (2015). Analysis of temperature projections in the Koshi River Basin, Nepal. International Journal of Climatology 36: 266-279. https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.4342

Aljazeera. (2021). Nepal battles worst forest fires in years as air quality drops. https://www.aljazeera.com/news/2021/4/9/nepal-battles-worst-forest-fires-in-years-as-air-quality-drops

Anonymous. (2017). Climate change and Nepals food insecurity. https://kathmandutribune.com/climate-change-and-nepals-food-insecurity/

Asian Development Bank (ADB). (2017). Country poverty analysis detailed: Nepal. Manila: ADB. https://www.adb.org/sites/default/files/linked-documents/cps-nep-2013-2017-pa-detailed.pd

Asian Development Bank (ADB). (2021). Key Indicators for Asia and the Pacific 2021: 52nd Edition. Manila: ADB. https://www.adb.org/sites/default/files/publication/720461/ki2021.pdf

ADB. (2022). Nepal and ADB: Economic indicators for Nepal. https://www.adb.org/countries/nepal/economy

Bartlett, R., Bharati, L., Pant, D., Hosterman, H., & McCornick, P. (2010). Climate change impacts and adaptation in Nepal (Working Paper 139). International Water Management Institute. http:// www.iwmi.cgiar.org/Publications/Working_Papers/working/WOR139.pdf

Bhujel, K.B., Sapkota R.P., & Khadka U.R. (2022). Temporal and spatial distribution of forest fires and their environmental and socio-economic implications in Nepal. Journal of Forest and Livelihood 21: 1-13.

Bhushal, R. (2020). Nepal: why are landslides so deadly? The Third Pole. PreventionWeb. https://www.preventionweb.net/news/view/73630

Bishokarma, N.K. (2017). Capacity Gaps and Needs Analysis Report: Livelihoods and governance sector. National Adaptation Plan Formulation Process. Kathmandu: CCMD, Ministry of Forests and Environment.

Boex, J. (2019). A critical year for fiscal federalism in Nepal. Decentralization and Localization. http://decentralization.net/2019/01/a-critical-year-for-fiscal-federalism-in-nepal/

CAIT data: Climate Watch. 2020: GHG Emissions. Washington, DC: World Resources Institute. https://www.climatewatchdata.org/ghg-emissions.

Central Bureau of Statistics. (2011). Third Nepal Living Standards Survey 2010-11. Statistical Report (in two volumes). Kathmandu: CBS, National Planning Commission (NPC) Secretariat, Government of Nepal.

Central Bureau of Statistics. (2014). Population Projection 2011 – 2031. Central Bureau of Statistics, National Population and Housing Census 2011. Volume 08. Ramshahpath, Kathmandu: NPC Secretariat, Government of Nepal.

Central Bureau of Statistics. (2017). National Climate Change Impact Survey 2016: A Statistical Report. Kathmandu: NPC Secretariat, Government of Nepal. https://climate.mohp.gov.np/downloads/National_Climate_Change_Impact_Survey_Report_2016.pdf

Central Bureau of Statistics. (2018). Report on the Nepal Labour Force Survey: 2017/2018. Kathmandu: CBS. https://cbs.gov.np/wp-content/upLoads/2019/05/Nepal-Labour-Force-Survey-2017_18-Report.pdf

Central Bureau of Statistics. (2021). National Population and Housing Census 2011-21. Kathmandu: CBS, National Planning Commission (NPC) Secretariat, Government of Nepal.

Colwell, R.K., Brehm, G., Cardelús, C.L., Gilman, A.C. & Longino, J.T. (2008). Global warming, elevational range shifts, and lowland biotic attrition in the wet tropics. Science 322: 258–261.

Convention on Biological Diversity, United Nations Convention to Combat Desertification & UNFCCC. (2012). The Rio Conventions: Action on Adaptation. https://unfccc.int/resource/docs/publications/rio_20_adaptation_brochure.pdf

Cosic, D., Dahal, S., & Kitzmuller, M. (2017). Climbing higher: toward a middle-income Nepal (English). Washington, D.C.: World Bank Group. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/358501495199225866/climbing-higher-toward-a-middle-income-nepal

Crippa, M., Guizzardi, D., Muntean, M., Schaaf, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J., & Vignati, E. (2020). Fossil CO2 emissions of all world countries - 2020 Report. EUR 30358 EN, Luxembourg: Publications Office of the European Union. https://edgar.jrc.ec.europa.eu/report_2020

Dazé, A., Price-Kelly & Rass, (2016). Vertical Integration in National Adaptation Plan (NAP) Processes: A guidance note for linking national and sub-national adaptation processes. Winnipeg, Canada: International Institute for Sustainable Development. www.napglobalnetwork.org

Department of Forest Research and Survey. (2015). State of Nepal's Forests. Forest Resource Assessment Publication No. 5. Kathmandu: Department of Forest Research and Survey, Government of Nepal. https://www.researchgate.net/publication/337830789_STATE_of_NEPAL'S_FORESTS/link/5dee011b299bf10bc34c6298/download

Department of Hydrology and Meteorology (DHM). (2017). Observed Climate Trend Analysis in the Districts and Physiographic Zones of Nepal (1971-2014). Kathmandu: DHM, Ministry of Population and Environment, Government of Nepal. http://dhm.gov.np/uploads/climatic/1935165359NAP_TrendReport_DHM_2017.pdf

Devkota, D.C., Gosai, K.R., & Devkota, D. (2017). Economic impact analysis of current climate change variability and future impacts in agriculture sector of Nepal. Nepal Journal of Environmental Science 5: 49-56.

Devkota, S. & Lal, A.C. (2017). Local Knowledge for Addressing Climate Change Risks at Local Level: A Case Study from Nepal. In: Sudmeier-Rieux K., Fernández M., Penna I., Jaboyedoff M., & Gaillard J. (eds.) Identifying Emerging Issues in Disaster Risk Reduction, Migration, Climate Change and Sustainable Development. Springer. pp. 211-230. https://doi.org/10.1007/978-3-319-33880-4_13

Eckstein, D., Kunzel, V., & Schafer, L. (2021). Global climate risk index 2021. Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2019 and 2000 to 2019. Bonn: Germanwatch. https://reliefweb.int/sites/reliefweb.int/files/resources/Global%20Climate%2 Risk%20Index%202021_1_0.pdf

FAO. (2021). Integrating Agriculture in National Adaptation Plans (NAP-Ag): Nepal. http://www.fao.org/in-action/naps/partner-countries/nepal/en/

Food and Agricultural Organization of the United Nations (FAO). (2019). FP118: Building a Resilient Churia Region in Nepal. GCF Approved funding proposal. https://www.greenclimate.fund/document/building-resilient-churia-region-nepal-brcrn

Freedom Forum. (2020). Nepal's Citizens Climate Budget: Where is Nepal's money being spent 2018-2019? Kathmandu: Freedom Forum & UNDP's Governance of Climate Change Finance Programme. https://climatefinancenetwork.org/wp-content/uploads/2020/04/Nepal-Climate-Citizen-Budget-English-2019.pdf

Gaire, N.P., Koirala, M., Bhuju, D.R., & Carrer, M. (2017). Site-and species-species treeline response to climate variability in eastern Nepal Himalaya. Dendrochronologia 41: 44–56.

Goodrich, C.G., Udas, P.B. & Larrington-Spencer, H. (2019). Conceptualizing gendered vulnerability to climate Change: Contextual conditions and drivers of Change. In: Goodrich, C.G; Udas, P.B. & Prakash, A. (eds.) Conceptualizing and Contextualizing Gendered Vulnerabilities to Climate Variability in the Hindu Kush Himalayan Region; Special Issue of Environmental Development: 9-18. https://doi.org/10.1016/j.envdev.2018.11.003

Gov.UK. (2021a). Adaptation Action Coalition: an overview. https://www.gov.uk/government/publications/adaptation-action-coalition-an-overview/adaptation-action-coalition-an-overview

Gov.UK. (2021b). COP26 President Alok Sharma welcomes Nepal's positive action on climate change. Press Release. https://www.gov.uk/government/news/cop26-president-alok-sharma-welcomes-nepals-positive-action-on-climate-change

Government of Nepal / United Nations Development Programme (2016). Project Completion Report of Ecosystem based Adaptation in Mountain Ecosystems in Nepal Project. Kathmandu, Nepal: UNDP, IUCN and UNEP. https://www.undp.org/.../UNDP_NP_Project-completion-Report_EBA_Final.pdf

Government of Nepal. (2010). Ministry of Home Affairs, Disaster Preparedness Network, Documentation Center. Kathmandu, Nepal.

Government of Nepal. (2011). National Framework on Local Adaptation Plans for Action. Singh durbar: Ministry of Environment, Government of Nepal. https://climate.mohp.gov.np/downloads/National_Framework_Local_Adaptation_Plan.pdf#:~:text=National%20Framework%20on%20Local%20Adaptation%20Plans%20for%20Action,to%20create%20a%20situation%20for%20climate%20resilient%20development

Government of Nepal. (2015). Nepal's Constitution of 2015. Unofficial translation by Nepal Law society, International IDEA and UNDP. https://www.constituteproject.org/constitution/Nepal_2015.pdf

Government of Nepal. (2016). Nationally Determined Contribution (NDC). Kathmandu: Ministry of Population and Environment. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nepal%20First/Nepal%20First%20NDC.pdf

Government of Nepal. (2017a). Health-National Adaptation Plan (H-NAP): Climate Change Health Adaptation Strategies and Action Plans of Nepal (2017-2021). Kathmandu: Ministry of Health and Population. https://www4.unfccc.int/sites/NAPC/Documents/Parties/Nepal%20HNAP.pdf

Government of Nepal. (2017b). Local Government Operation Act. Kathmandu.

Government of Nepal. (2018a). Disaster Risk Reduction National Strategic Plan of Action. Kathmandu: Ministry of Home Affairs. http://neoc.gov.np/uploads/document/file/DRR%20National%20Strategic%20Plan%20of%20Action%202018-2030_20190531114834.pdf

Government of Nepal. (2018b). National Policy for Disaster Risk Reduction. Kathmandu: Ministry of Home Affairs. http://drrportal.gov.np/uploads/document/1476.pdf

Government of Nepal. (2019a). The Environment Protection Act, 2019. http://blogs2.law.columbia.edu/climate-change-litigation/wp-content/uploads/sites/16/non-us-case-documents/2019/20191018_074-WO-0283_na.pdf

Government of Nepal. (2019b). National Agroforestry Policy, 2019. Kathmandu, Nepal: Ministry of Agriculture and Livestock Development. http://mofe.gov.np/downloadsdetail/8/2018/36366627/

Government of Nepal. (2019c). National Climate Change Policy, 2076 (2019). https://www.mofe.gov.np/downloadfile/climatechange_policy_english_1580984322.pdf

Government of Nepal. (2020a). The Fifteenth Plan (Fiscal Year 2019/20 – 2023/24). Kathmandu: National Planning Commission. https://www.npc.gov.np/images/category/15th_plan_English_Version.pdf

Government of Nepal. (2020b). Second Nationally Determined Contribution. Kathmandu: Government of Nepal. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nepal%20Second/Second%20Nationally%20Determined%20Contribution%20(NDC)%20-%202020.pdf

Government of Nepal. (2020c). Federation, Province and Local Level (Coordination and Inter-relation) Act, 2020 (2077). Kathmandu: Singhadurbar, Nepal.

Government of Nepal. (2021). Third National Communication to the United Nations Framework Convention on Climate Change. Kathmandu: Ministry of Forests and Environment, Nepal. http://mofe.gov.np/downloadfile/Nepal_TNC%20Rep_1627452942.pdf

Gurung, A., Adhikari, A., Chauhan, R., Thakuri, S., Nakarmi, S., Ghalre, S., Dangol, B.S., & Rijal, D. (2019). Water crises in a water-rich country: case studies from rural watersheds of Nepal's mid-hills. Water Policy 21 (4): 826–847. https://doi.org/10.2166/wp.2019.245

Gurung, D. D., and Bisht, S. (2014). Women's empowerment at the frontline of adaptation: emerging issues, adaptive practices, and priorities in Nepal. ICIMOD Working Paper, (2014/3)

Hammill, A. (2020). Resilient recovery: Using climate adaptation plans to build back better. www.iisd.org/blog/climate-adaptation-stimulus

Hammill, A., & Price-Kelly, H. (2019). Using NDCs, NAPs and the SDGs to Advance Climate-Resilient Development. NDC Partnership Expert Perspective. https://ndcpartnership.org/sites/default/files/NDCP_Expert_Perspectives_NDC_NAP-SDG_full.pdf

Hartmann, D.L., Klein Tank, A.M.G., Rusticucci, M., Alexander, L.V., Brönnimann, S., Charabi, Y., Dentener, F.J., Dlugokencky, E.J., Easterling, D.R., Kaplan, A., Soden, B.J., Thorne, P.W., Wild, M., & Zhai, P.M. (2013). Observations: Atmosphere and Surface; in Climate Change 2013: The Physical Science Basis (Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change), (ed.) Stocker, T.F., Qin, D., Plattner, G.K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Xia, Y., Bex, V., & Midgley, P.M. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. pp. 159–254. https://www.ipcc.ch/report/ar5/wg1/observations-atmosphere-and-surface/

Hock, R., Rasul, G., Adler, C., Cáceres, B., Gruber, S., Hirabayashi, Y., Jackson, M., Kääb, A., Kang, S., Kutuzov, S., Milner, A., U. Molau, U., Morin, S., Orlove, B., & Steltzer, H. (2019). High Mountain Areas; in IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, (eds.) Pörtner, H.O., Roberts, D.C., Masson-Delmotte, V., Zhai, P., Tignor, M., Poloczanska, E., Mintenbeck, K., Alegría, A., Nicolai, M., Okem, A., Petzold, J., Rama, B., & Weyer, N.M. Geneva, Switzerland: World Meteorological Organization. https://www.ipcc.ch/srocc/chapter/chapter-2/

ICIMOD. (2020). Forest fire monitoring and detection in Nepal. https://servir.icimod.org/science-applications/forest-fire-detection-and-monitoring-in-nepal/

IFRC (2010). Climate change impacts on health and livelihoods: Nepal assessment. Geneva: International Federation of Red Cross and Red Crescent Societies, Geneva, available at https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Country-assessments-NEPAL-3.pdf

Intergovernmental Panel on Climate Change (IPCC). (2001). TAR Climate Change 2001: Impacts, Adaptation and Vulnerability. in McCarthy, J.J., Canziani, O. F., Leary, N. A., Dokken, D. J., & White, K.S. (eds.), Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press. https://www.ipcc.ch/site/assets/uploads/2018/03/wg2TARfrontmatter.pdf

International Center for Tropical Agriculture (CIAT); The World Bank; CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS); & Local Initiatives for Biodiversity Research and Development (LI-BIRD). (2017). 2017. Climate-Smart Agriculture in Nepal. CSA Country Profiles for Asia Series. Washington, D.C.: CIAT; World Bank; CCAFS and LI-BIRD. https://climateknowledgeportal.worldbank.org/sites/default/files/2019-06/CSA_Profile_Nepal.pdf

International Centre for Integrated Mountain Development (ICIMOD). (2021). HKH Call to Action. https://www.icimod.org/deepening-regional-cooperation-for-climate-action-hkh-high-level-task-force-convenes/

International Fund for Agricultural Development. (2014). President's report - Adaptation for smallholders in hilly areas project. https://www.ifad.org/en/document-detail/asset/41146280

International Union for Conservation of Nature (IUCN). (2018). Nature-based solutions and their application in river basin management: BRIDGE Ganges-Brahmaputra-Meghna River Basin CSO dialogue report. Bangkok, Thailand: IUCN. https://www.iucn.org/sites/dev/files/content/documents/nbs_workshop-bridge_gbm_report_3-june2018.pdf

IPCC. (2012). Summary for Policy Makers; in Managing the Risks of Extreme Events and Disaster to Advance Climate Change Adaptation; in (eds.) Field, C.B., Barros, V.R., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.K., Allen, S.K., Tignor, M., & Midgley, P.M. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. pp. 3-21. https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/

IPCC. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team: R.K. Pachauri & L.A. Meyer (eds.)]. Geneva, Switzerland: IPCC. https://www.ipcc.ch/report/ar5/syr/

IPCC. (2018a). Annex I: Glossary [Matthews, J.B.R. (ed.)]. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, (eds.) Masson-Delmotte, V., Zhai, P., Pörtner, H.O., Roberts, D., Skea, J., Shukla, P.R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J.B.R., Chen, Y., Zhou, X., Gomis, M.I., Lonnoy, E., Maycock, T., Tignor, M., & Waterfield, T. (eds.). Geneva, Switzerland: World Meteorological Organization. https://www.ipcc.ch/sr15/chapter/glossary/

IPCC. (2018b). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, (eds.) Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield. Geneva, Switzerland: World Meteorological Organization. https://www.ipcc.ch/sr15/chapter/spm/

IPCC. (2019). IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, (eds.) H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Geneva, Switzerland: World Meteorological Organization (in press).

IPCC. (2020). The concept of risk in the IPCC Sixth Assessment Report: A summary of cross-working Group discussions. https://www.ipcc.ch/site/assets/uploads/2021/01/The-concept-of-risk-in-the-IPCC-Sixth-Assessment-Report.pdf

IPCC. (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S.L., Péan, C., Berger, S., Caud, N., Chen, Y. , Goldfarb, L., Gomis, M.I., Huang, M., Leitzell, K., Lonnoy, E., Matthews, J.B.R., Maycock, T.K., Waterfield, T., Yelekçi, O., Yu, R., & Zhou, B. (eds.)]. Cambridge University Press.

IUCN. (2020). Gender Assessment: FP131: Improving Climate Resilience of Vulnerable Communities and Ecosystems in the Gandaki River Basin, Nepal. GCF documentation. https://www.greenclimate.fund/sites/default/files/document/fp131-gender-assessment.pdf

Karki, G., Paudel, B. & Uprety B. (2017). Integrating forests and biodiversity in Nepal's National Adaptation Plan: A review and synthesis of knowledge stock on opportunities and way forward. Banko Janakari 27(2): 21-31.

Karki, G., Bhatta, B., Devkota, N.R., Acharya, R., & Kunwar, R. (2022). Climate change adaptation (CCA) research in Nepal: implications for the advancement of adaptation planning. Journal of Mitigation and Adaptation Strategies for Global Change 27(3): 1-13.

Karki, G., Bhatta, B., Devkota, N.R., & Kunwar, R. (2021). Climate change adaptation governance in Nepal: a framework for sustainable generation of adaptation services. Banko Janakari 31 (2): 40-50.

Karki, R., Ul-Hasson, S., Schickhoff, U., Scholten, T. & Bohner, J. (2017). Rising Precipitation Extremes across Nepal. Climate. Retrieved from http://www.dhm.gov.np/uploads/climatic/52837744climate-05-00004.pdf

Khairat, S. (2020). South Asia monsoon: More than 130 people killed in Nepal floods. Aljazeera. https://www.aljazeera.com/videos/2020/7/25/south-asia-monsoon-more-than-130-people-killed-in-nepal-floods

Khanal, B.N. (2019). Nepal: A brief country profile on Disaster Risk Reduction and Management. Available at https://www.adrc.asia/countryreport/NPL/2019/Nepal_CR2019B.pdf

Khatri, N.R. (2013). Climate-Change Refugees in Nepal: The Need for Climate-Smart Capacity Building. In (ed.) Leal-Filho W., Climate Change and Disaster Risk Management. Climate Change Management. Berlin, Germany: Springer. https://doi.org/10.1007/978-3-642-31110-9_22

Koirala, P.K. (2014). Country Profile: Nepal. Disaster Management Institution and System in Nepal. Bangkok: Asian Disaster Reduction Centre.

Krishnan R., Shrestha, A.B., Ren, G., Rajbhandari, R., Sajjad, S., Sanjay, J., Syed, M.S., Vellore, R., Xu, Y., You, Q., & Ren, Y. (2019). Unravelling Climate Change in the Hindu Kush Himalaya: Rapid Warming in the Mountains and Increasing Extremes. In: Wester P., Mishra A., Mukherji A., & Shrestha A. (eds.), The Hindu Kush Himalaya Assessment. Cham, Switzerland: Springer. pp. 57-97. https://link.springer.com/chapter/10.1007/978-3-319-92288-1_3

Kunwar R.M., Subedi, B., Baral, S.R., Maraseni, T., Leboa, C., & Adhikari, Y.P. (2021). Ethnobotany of the Himalayas: The Nepal, Bhutanese, and Tibetan Himalayas. In (eds.) Kunwar R.M., Sher H., & Bussmann R.W., Ethnobotany of the Himalayas-Ethnobotany of Mountain Regions. Cham, Switzerland: Springer. pp. 65-103. https://doi.org/10.1007/978-3-030-45597-2_5-1

Kunwar, R. (2021a). Study and review CCA interventions and researches in Nepal to plan future investments in adaptation across the key economic sectors: Review and synthesize Nepal's past and current adaptation measures and assess their effectiveness for planning and advancing NAP process, Nepal. Component 1 (Final Report). UNEP Nepal GCF-NAP Project.

Kunwar, R. (2021b). Study and review CCA interventions and researches in Nepal to plan future investments in adaptation across the key economic sectors: Assess Nepal's past and CCA adaptation researches, develop a rationale for CCA research programme, and recommend CCA service generation and delivery mechanism - Component 2 (Final Report). Submitted to GCF-UNEP NAP Nepal Project Management Unit.

Kunwar, R.M. (2006). Non-Timber Forest products of Nepal: A Sustainable Management Approach. International Tropical Timber Organization, Japan, 423 p.

LDC Expert Group. (2012). National Adaptation Plans: Technical guidelines for the national adaptation plan process. Bonn: UNFCCC. https://unfccc.int/files/adaptation/cancun_adaptation_framework/application/pdf/naptechguidelines_eng_high__res.pdf

Leiter, T. (2021). Do governments track the implementation of national climate change adaptation plans? An evidence-based global stocktake of monitoring and evaluation systems. Environmental Science & Policy 125: 179-188. https://www.sciencedirect.com/science/article/pii/S1462901121002379?via%3Dihub

Lempert, R. J., Popper, S.W. & Bankes, S.C. (2003). Shaping the Next One Hundred Years: New Methods for Quantitative, Long-term Policy Analysis. RAND Corporation, California, USA.

Liang, E., Wang, Y., Piao, S., Lu, X., Camarero, J.J., Zhu, H., Zhu, L., Ellison, A.M., Ciais, P., & Peñuelas, J. (2016). Species interactions slow warming-induced upward shifts of treelines on the Tibetan Plateau. Proceedings of the National Academy of Sciences of the United States of America 113, pp. 4380–4385.

Lucas, S. (2021). A climate cure for the COVID crisis. Available at https://www.undp.org/nepal/climate-cure-covid-crisis, UNDP Nepal

Lohani, S.N. (2010). Climate change in Nepal – shall we wait until bitter consequences? Journal of Agriculture and Environment 8: 38–45. https://doi.org/10.3126/aej.v8i0.725

Machamasi, A. (2021). Monsoon submerges Kathmandu environs. Nepali Times (9th July). https://www.nepalitimes.com/banner/monsoon-submerges-kathmandu-roads/

Maharjan, A., Kochhar, I., Chitale, V.S., Hussain, A., & Gioli, G. (2020). Understanding rural outmigration and agricultural land use change in Gandaki Basin, Nepal. Applied Geography 124: 102278, https://www.sciencedirect.com/science/article/pii/S0143622818310427

Maharjan, S. (2021). Nepal's Pathways to Decarbonizing the Transport System, available at https://100re-map.net/nepals-pathways-to-decarbonizing-the-transport-system/

Mainali, J. & Pricope, N. (2018). Mapping the need for adaptation: assessing drought vulnerability using the livelihood vulnerability index approach in a mid-hill region of Nepal. Climate and Development 11(7): 607-622. https://doi.org/10.1080/17565529.2018.1521329

Mallapaty, S. (2019). Nepali scientists record country's first tornado. Nature. https://doi.org/10.1038/d41586-019-01159-w

Mandal, C.K. (2021a). A new weed is invading Chitwan National Park. The Kathmandu Post (13th May). https://kathmandupost.com/climate-environment/2021/05/13/a-new-weed-is-invading-chitwan-national-park

Mandal, C.K. (2021b). Wildfires result in loss of forests and pollution, but what about wildlife. The Kathmandu Post (15th April). https://kathmandupost.com/climate-environment/2021/04/15/wildfires-result-in-loss-of-forests-and-pollution-but-what-about-wildlife

Ministry of Agricultural and Livestock Development. (2019a). Integrating Climate Change Adaptation into Agriculture Sector Planning of Nepal; A Handbook. Singhadurbar, Nepal: Government of Nepal. https://www.np.undp.org/content/nepal/en/home/library/crisis_prevention_and_recovery/integrating-climate-change-adaptation-into-agriculture-sector-pl.html

Ministry of Agricultural Development (MoAD). (2017). The State of Nepal's Biodiversity for Food and Agriculture. (Joshi, B.K., Acharya, A.K., Gauchan, D., & Chaudhary, P. (eds). Kathmandu, Nepal: MoAD.

Ministry of Agricultural Development, UNDP & FAO. (2016). NAP-Agriculture Project: Integrating Agriculture in National Adaptation Plans. Inception Report. https://www.adaptation-undp.org/sites/default/files/resources/nap-ag_increport_final_02feb2017.pdf

Ministry of Agriculture and Livestock Development. (2018). Policy brief: SDG Localization through Integration of Climate Change in Agricultural Planning and Budgeting at the National and Sub-national Levels. Kathmandu: MoALD, Government of Nepal. https://www.np.undp.org/content/nepal/en/home/library/crisis_prevention_and_recovery/policy-brief-sdg-localization-through-integration-of-climate-change-in-agricultural-planning-and-budgeting.html

Ministry of Agriculture and Livestock Development. (2019b). Roadmap for Adaptation Planning in Nepal's Agriculture Sectors: Synthesis report of Nepalese adaptation strategies and achievements under the Integrating Agricultural Sectors into NAP Project. Kathmandu: MoALD, Government of Nepal.

Ministry of Environment. (2010). National Adaptation Programme of Action (NAPA) to Climate Change. Kathmandu: MoE, Government of Nepal.

Ministry of Finance (MoF). (2017a). Climate Change Financing Framework: A Road Map to Systematically Strengthen Climate Change Mainstreaming into Planning and Budgeting. Kathmandu: Ministry of Finance, Government of Nepal.

Ministry of Finance. (2017). Climate Change Financing Framework: A roadmap to systematically strengthen climate change mainstreaming into planning and budgeting. Ministry of Finance, Government of Nepal, Kathmandu, Nepal.

Ministry of Finance. (2017b). Green Climate Fund Handbook for Nepal. Kathmandu: Ministry of Finance, International Economic Cooperation Coordination Division.

Ministry of Finance. (2020). Economic Survey - Fiscal Year 2019/20. Kathmandu: Ministry of Finance. Singhadurbar, Nepal. https://www.mof.gov.np/public/site/publication-category/21

Ministry of Forests and Environment (MoFE). (2018a) Nepal's sixth report to the convention on Biological Diversity. Singhadurbar, Nepal.

Ministry of Forests and Environment (MoFE). (2018b). Nepal's National Adaptation Plan (NAP) Process: Reflections on lessons learned and the way forward. Kathmandu: MoFE, Government of Nepal, NAP Global Network, Action on Climate Today (ACT), and Practical Action Nepal. https://napglobalnetwork.org/wp-content/uploads/2018/07/napgn-en-2018-nepal-nap-process.pdf

Ministry of Forests and Environment. (2019). Climate change scenarios for Nepal. National Adaptation Plan, Kathmandu: MoFE, Government of Nepal. https://mofe.gov.np/downloadfile/MOFE_2019_Climate%20change%20scenarios%20for%20Nepal_NAP_1562647620.pdf

Ministry of Forests and Environment. (2020a). Capacity Gap Assessment Report of the Provincial Climate Change Coordination Committee. Kathmandu: MoFE, Government of Nepal. NAP Nepal Technical Paper 15/2020.

Ministry of Forests and Environment. (2020b). Capacity Gap Assessment Report of the Thematic/ Cross-cutting Working Groups. Kathmandu: MoFE, Government of Nepal. NAP Nepal Technical Paper 16/2020.

Ministry of Forests and Environment. (2020c). Mapping of responsibilities of key institutions in the planning, implementation, monitoring and research on climate change adaptation over the medium- and long-term in Nepal. Building Capacity to Advance National Adaptation Plan Process in Nepal. Kathmandu: MoFE, Government of Nepal. NAP Nepal Technical Paper 10/2020.

Ministry of Forests and Environment. (2020d). A Report on Institutionalisation Strategy for the Periodic Review of Cross-cutting and Thematic Area Policies, Strategies and Plans including the Integration. Kathmandu: MoFE, Government of Nepal. NAP Nepal Technical Paper 12/2020.

Ministry of Forests and Environment. (2020e). A Report on Proposed Revisions of the Selected Policies, Strategies and Plans to Integrate Adaptation to Climate Change. Kathmandu: MoFE, Government of Nepal.

Ministry of Forests and Environment. (2021a). Roadmap to Nepal's strategic engagement in the 26th Conference of the Parties (COP26) of the United Nations Framework Convention on Climate Change (UNFCCC COP 26). http://www.mofe.gov.np/noticefile/Strategic%20Roadmap_COP26_1617346258.pdf

Ministry of Forests and Environment. (2021b). Technology Needs Assessment for Climate Change Adaptation. Kathmandu: MoFE, Government of Nepal. http://www.mofe.gov.np/downloadfile/TNA_Adaptation_Nepal_1630828921.pdf

Ministry of Forests and Environment. (2021c). Vulnerability and Risk Assessment and Identifying Adaptation Options: Summary for Policy Makers. Kathmandu: MoFE, Government of Nepal. https://climatenepal.org.np/resources/vulnerability-and-risk-assessment-and-identifying-adaptation-options-summary-policy

Ministry of Forests and Soil Conservation (MoFSC). (2014). Nepal National Biodiversity Strategy and Action Plan, Kathmandu: Ministry of Forests and Soil Conservation, Government of Nepal. http://extwprlegs1.fao.org/docs/pdf/nep163672.pdf

Ministry of Forests and Soil Conservation. (2015). Nepal REDD+ Strategy. Part I: Operational Summary. Kathmandu: Government of Nepal. https://www.forestcarbonpartnership.org/sites/fcp/files/2016/Aug/Annex%201%20-%20Nepal%20draft%20National%20REDD%2B%20Strategy.pdf

Ministry of Forests and Soil Conservation. (2016). Forestry Sector Strategy (2016-25). Kathmandu: Government of Nepal. http://mofe.gov.np/downloadsdetail/8/2018/36366627/

Ministry of Forests and Soil Conservation. (2018). GESI Assessment, Forest Investment Plan (FIP). Supported by World Bank/FCPF, REDD Implementation Centre, Kathmandu: Government of Nepal.

Ministry of Home Affairs (MoHA). (2017). Nepal Disaster Report 2017: Road to Sendai. Kathmandu: Government of Nepal.

Ministry of Home Affairs (MoHA). (2019). Disaster Risk Reduction and Management Act, 2074; and Disaster Risk Reduction and Management Rules, 2076 (2019). Kathmandu: Government of Nepal.

Ministry of Home Affairs. (2018). Disaster Risk Reduction National Strategic Action Plan (2018-2030). Kathmandu: Government of Nepal.

Ministry of Home Affairs. (2019). Nepal Disaster Report. Ministry of Home Affairs, Kathmandu, Nepal.

Ministry of Labour, Employment and Social Security. (2020). Nepal Labour Migration Report 2020. Kathmandu: Government of Nepal. https://moless.gov.np/wp-content/uploads/2020/03/Migration-Report-2020-English.pdf

Ministry of Population and Environment. (2017a). Synthesis of Stocktaking Report for National Adaptation Plan (NAP) Formulation Process in Nepal. Kathmandu: Government of Nepal. https://climate.mohp.gov.np/downloads/Synthesis_of_the_Stocktaking_Report_NAP_2017.pdf

Ministry of Population and Environment. (2017b). Vulnerability and Risk Assessment Framework and Indicators for National Adaptation Plan (NAP) Formulation Process in Nepal. Kathmandu: Government of Nepal. https://floodresilience.net/resources/item/vulnerability-and-risk-assessment-framework-and-indicators-for-national-adaptation-plan-nap-formulation-process-in-nepal

Ministry of Science, Technology and Environment (MoSTE). (2014). Economic Impact Assessment of Climate Change in Key Sectors in Nepal. Kathmandu: IDS Nepal, Global Climate Adaptation Partnership and Practical Action. https://reliefweb.int/sites/reliefweb.int/files/resources/EIA-summary_sharing_final-low-resolution.pdf

Ministry of Urban Development (MoUD). (2013). Gender Equality and Social Inclusion (GESI) Operational Guidelines, 2013. Kathmandu: Government of Nepal. https://www.moud.gov.np/storage/listies/July2019/GESI-Guidelines-en.pdf

Ministry of Urban Development. (2015). National Urban Development Strategy 2015. Kathmandu: Ministry of Urban Development, Government of Nepal. http://www.moud.gov.np/pdf/NUDS-2015-final-draft.pdf

Ministry of Urban Development. (2017). National Urban Development Strategy 2015. Kathmandu: Ministry of Urban Development, Government of Nepal. http://www.moud.gov.np/pdf/NUDS-2015-final-draft.pdf

Murphy, D. & Parry, J.E. (2020). Filling the Gap: A review of Multilateral Development Banks' efforts to scale up financing for climate adaptation. Winnipeg, Canada: International Institute for Sustainable Development (IISD). https://www.iisd.org/system/files/2020-12/filling-gap-financing-climate-adaptation.pdf

NASA Global Climate Change. (2021). 2020 Tied for Warmest Year on Record, NASA Analysis Shows. https://climate.nasa.gov/news/3061/2020-tied-for-warmest-year-on-record-nasa-analysis-shows/

National Planning Commission (NPC). (2018) National M&E Guideline (2018). https://www.npc.gov.np/images/category/ME_GuidelineEng.pdf

National Planning Commission (NPC). (2011a). Climate-Resilient Planning: A Tool for Long-term Climate Adaptation. Kathmandu: Government of Nepal. https://www.npc.gov.np/images/category/climate_resilent_planning.pdf

Nellemann, C., Verma, R., & Hislop, L. (eds). (2014). Women at the frontline of climate change: Gender risks and hopes. A Rapid Response Assessment. UNEP, GRID-Arendal.

Nepal Food Security Monitoring System. (2017). A Report on the Food Security impact of the 2017 Flood in the Tarai. Government of Nepal. https://docs.wfp.org/api/documents/WFP-0000022395/download/?_ga=2.102996102.769984417.1623685355-2041989909.1623685355

Nepal Rastra Bank. (2020). Current Macroeconomic and Financial Situation of Nepal (based on Annual Data of 2019/20) https://www.nrb.org.np/contents/uploads/2020/08/Current-Macroeconomic-and-Financial-Situation.-English.-Based-on-Annual-data-of-2019.20-1.pdf

NENCID. (2018). Proceedings of 8th Asian Regional Conference on Irrigation in Support of Evergreen Revolution. Publisher: Nepal National Committee of ICID (NENCID). May 2-4, Kathmandu, Nepal.

Nepal, S.K. (2016). Tourism and Change in Nepal's Mt Everest Region. In: Richins, H. & Hull, J.S. (Eds.), Mountain tourism: Experiences, communities, environments and sustainable futures. PP 285-294, CAB International.

Nepal's Government Business Allocation Regulation (2017). Government of Nepal. https://asiafoundation.org/wp-content/uploads/2020/10/Assignment-of-Functions-Across-Levels-of-Government-in-Nepal.pdf

National Disaster Risk Reduction and Management Authority (NDRRMA). (2020). NDRRMA Official Twitter Account (December 2020). https://twitter.com/ndrrma_nepal?lang=en

Nills, D., Venegas. G. L., & Richter, L. (2016). Community-based Adaptation (CbA), Ecosystem-based Adaptation (EbA) and the Landscape Approach (LA) - Characteristics and Commonalities. GIZ technical report. https://snrd-asia.org/download/CbA_EbA_Landscape-Approach_version-4_LR_DN_MW_webinar-0B.pdf

Nonoguchi, A. (2012). Gender and Climate Change in Nepal. A PhD dissertation, submitted to the Pennsylvania State University, United States of America.

NPC. (2011b). The Future for Climate Finance in Nepal. Kathmandu: NPC, Government of Nepal. https://www.npc.gov.np/en/category/environment

NPC. (2011c). Nepal: Climate Public Expenditure and Institutional Review (CPEIR). Kathmandu: Government of Nepal. https://www.npc.gov.np/images/category/climate_public_expenditure.pdf

NPC. (2012). Climate Change Budget Code: Documenting the national process of arriving at multi-sectoral consensus. Kathmandu: NPC, Government of Nepal. https://www.npc.gov.np/en/category/environment

NPC. (2013): Climate Change Budget Code, Application Review, Published by Government of Nepal, National Planning Commission with support from UNDP/UNEP in Kathmandu, Nepal in November, 2013

NPC. (2015). Sustainable Development Goals 2016-2030; National (Preliminary) Report. Kathmandu: NPC, Government of Nepal. http://sdg.npc.gov.np/resource/2563/

NPC. (2017). Sustainable Development Goals: Status and Roadmap 2016-2030. Kathmandu: Government of Nepal. https://www.greengrowthknowledge.org/national-documents/nepal-sustainable-development-goals-status-and-roadmap-2016-2030

NPC. (2018). Needs Assessment, Costing and Financing Strategy for Nepal's Sustainable Development Goals. Kathmandu: Government of Nepal. https://www.npc.gov.np/images/category/SDGs_Costing_Final_Version.pdf

NPC. (2019). Fifteenth Plan Approach Paper. National Planning Commission. Government of Nepal https://www.npc.gov.np/images/category/15th_Plan_Approach_Paper2.pdf

NPC. (2020a). Nepal Human Development Report 2020. Beyond Graduation: Productive Transformation and Prosperity. Kathmandu: NPC, Government of Nepal and UNDP. https://npc.gov.np/images/category/NHDR_2020_-_Final_-_TheSquare_compressed_final1.pdf

NPC. (2020b). Nepal: National Review of Sustainable Development Goals. Kathmandu: National Planning Commission. https://sustainabledevelopment.un.org/content documents/26541VNR_2020_Nepal_Report.pdf

NPC. (2020c). Nepal's Sustainable Development Goals: Progress Assessment Report 2016–2019. National Planning Commissions, Government of Nepal, Kathmandu.

Oppenheimer, M., Campos, M., Warren, R., Birkmann, J., Luber, G., O'Neill, B., & Takahashi, K. (2014). Emergent risks and key vulnerabilities. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. pp. 1039-1099.

Panday, P.K., Thibeault, J., & Frey, K.E. (2015). Changing temperature and precipitation extremes in the Hindu Kush-Himalayan region: An analysis of CMIP3 and CMIP5 simulations and projections. International Journal of Climatology 35(10): 3058-3077. DOI:10.1002/joc.4192

Panthi, J., Aryal, S., Dahal, P., Bhandari, P., Krakauer, N.Y., & Pandey, V.P. (2015). Livelihood vulnerability approach to assessing climate change impacts on mixed agro-livestock smallholders around the Gandaki River Basin in Nepal. Regional Environmental Change. Springer. https://nirkrakauer.net/papers/Panthi_et_al_2015_Vulnerability_Assessment_REEC.pdf

Patra, J. & Terton, A. (2017). Review of Current and Planned Adaptation in Nepal. CARIAA Working Paper no. 20. Ottawa, Canada: International Development Research Centre and London, United Kingdom: UK Aid.

Paudel, M.N. (2016). Multiple cropping for raising productivity and farm income of small farmers. Journal of Nepal Agricultural Research Council 2: 37-45. http://dx.doi.org/10.3126/jnarc.v2i0.16120

Poudel, S., Funakawa, S., Shinjo, H., & Mishra B. (2020). Understanding households' livelihood vulnerability to climate change in the Lamjung district of Nepal. Environment, Development and Sustainability 22: 8159-8182. https://doi.org/10.1007/s10668-019-00566-3

Poudel, A. (2022). Diseases climb up mountains as climate warms. Available at https://tkpo.st/346sS4K

Pradhan, E.K., West, K.P., Katz, J., LeClerq, S.C., Khatry, S.K. & Shrestha, S.R. (2007). Risk of flood-related mortality in Nepal. Disasters 31(1): 57-70.

Pressey, R. L. , Cabeza, M. , Watts, M. E. , Cowling, R. M. , & Wilson, K. A. (2007). Conservation planning in a changing world. Trends in Ecology & Evolution 22(11): 583–592.

Sandal, S. (2021). Supporting climate action through gender-responsive budgeting in Nepal. CDKN, https://reliefweb.int/sites/reliefweb.int/files/resources/Mainstreaming-Gender-Responsive-Budgeting_Final.pdf

Sanjay, J., Krishnan, R., Shrestha, A.B., Rajbhandari, R., & Ren, G.-Y. (2017). Downscaled climate change projections for the Hindu Kush Himalayan region using CORDEX South Asia regional climate models. Advances in Climate Change Research 8(3): 185-198. http://dx.doi.org/10.1016/j.accre.2017.08.003

Secretariat of the Convention on Biological Diversity. (2009). Connecting Biodiversity and Climate Change mitigation and Adaptation: Key message from the Report of the Second Ad Hoc Technical Exert Group on Biodiversity and Climate Change. Montreal, Canada: Secretariat of the Convention on Biological Diversity. https://www.cbd.int/doc/publications/ahteg-brochure-en.pdf

Sharma, J., Murthy, I.K., Esteves, T., Negi, P., Sushma, S., Dasgupta, S., Barua, A. Bala, G. & Ravindranath, N.H. (2018). Climate Vulnerability and Risk Assessment: Framework, Methods and Guidelines for the Indian Himalayan Region. India Himalayas Climate Adaptation Programme. Government of India.

Shepherd, A., Mitchell, T., Lewis, K., Lenhardt, A., Jones, L., Scott, L., & Muir-Wood, R. (2013). The geography of poverty, disasters and climate extremes in 2030. London, UK: Overseas Development Institute.

Shrestha, S. & Gurung, D.D. (2020) Gender and Social Inclusion in Climate Change Issues and Opportunities in Federal Nepal. Gender Integration in Forestry Sector National Workshop report: 2020. REDD Implementation Centre, Babarmahal, Kathmandu.

Shrestha, A., & Baral, S. (2018). Impacts of climate change on livestock and livestock products: a case study of Banke District, Nepal. Sarhad Journal of Agriculture 34(4): 760-766. http://researcherslinks.com/current-issues/Impacts%20of%20Climate-Change-on-Livestock-and-Livestock-Produces-A-Case-Study-of-Banke-District-Nepal/14/1/1777/html

Shrestha, S., Bajracharya, A.R. and Babel, M.S. (2016). Assessment of risks due to climate change for the Upper Tamakoshi Hydropower Project in Nepal. Climate Risk Management 14:27–41. https://www.sciencedirect.com/science/article/pii/S2212096316300274

Shrestha, U. B. & Shrestha, B.B. (2019). Climate change amplifies plant invasion hotspots in Nepal. Diversity and Distributions 25 (10): 1599-1612. https://doi.org/10.1111/ddi.12963

Sigdel, M., & Ikeda, M. (2010). Spatial and temporal analysis of drought in Nepal using standardized precipitation index and its relationship with climate indices. Journal of Hydrology and Meteorology 7(1): 59-74.

Subedi, A. (2020). Drought and hunger drive Nepal farmers to India, defying COVID ban. Reuters. https://www.reuters.com/article/us-nepal-drought-farming-climatechange-t-idUSKBN2751G0

Subedi, B. P. (2014). Urbanisation in Nepal: Spatial Pattern, Social Demography and Development. In Population Monograph of Nepal Volume III (Economic Geography) (pp. 95-154). Kathmandu: Central Bureau of Statistics.

Tanner, T., Acharya, S., & Bahadur, A. (2018). Perceptions of climate change: Applying assessments to policy and practice. ACT Learning Paper. https://www.researchgate.net/publication/324246811_Perceptions_of_climate_change_Applying_assessments_to_policy_and_practice

Thakur, S. B. (2017). National Development Vision and Adaptation Pathways Report: Agriculture and Food Security (Nutrition). Report prepared for the Ministry of Population and Environment, Government of Nepal.

The World Bank Group & Asian Development Bank. (2021). Climate Risk Country Profile: Nepal. Washington, D.C.: World Bank Group. https://www.adb.org/sites/default/files/publication/677231/climate-risk-country-profile-nepal.pdf

United Nations. (2015). Sustainable Development Goals communication materials.

UN Children's Fund (2021). The Climate Crisis is a Child Rights Crisis: Introducing the Children's Climate Risk Index. New York: UNICEF. https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf

UN Climate Action Summit. (2019). Call for Action on Adaptation and Resilience. https://www.adaptation-undp.org/sites/default/files/uploaded-images/call_for_action_on_adaptation_and_resilience_v_3_feb_2021.pdf

UN Environment Programme World Conservation Monitoring Centre. (2021). Biodiversity Terms. https://biodiversitya-z.org/themes/terms

UNData. (2021). Nepal: Country profile. http://data.un.org/en/iso/np.html

UNDP. (2009). Country Report on Global Assessment of Risk; ISDR Global Assessment Report on Poverty and Disaster Risk; UNDP: Kathmandu, Nepal.

UNDP. (2020). The Next Frontier: Human Development and the Anthropocene - Human Development report 2020. http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NPL.pdf

UNDP. (2021a). Human Development Index. http://hdr.undp.org/en/content/human-development-index-hdi

UNDP. (2021b). Nepal: Covid-19 Pandemic Responses. https://www.np.undp.org/content/nepal/en/home/coronavirus.html

UNDRR. (2019). Disaster Risk Reduction in Nepal: status report 2019. United Nations Office for Disaster Risk Reduction. https://www.preventionweb.net/files/68257_682306nepaldrmstatusreport.pdf

UNDRR. (2021). Promoting Synergy and Alignment Between Climate Change Adaptation and Disaster Risk Reduction in the Context of National Adaptation Plans: A Supplement to the UNFCCC NAP Technical Guidelines. United Nations Office for Disaster Risk Reduction. https://www.undrr.org/publication/promoting-synergy-and-alignment-between-climate-change-adaptation-and-disaster-risk

UNECE. (2019). Inland transport committee, retrieved april 2022 from http//unece.org/transport/inland-transport-committee.

UNFCCC. (2010). Decisions adopted by the Conference of the Parties: Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010. FCCC/CP/2010/7/Add.1. https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=4

UNFCCC. (2012). LDC Expert Group. (2012). https://www4.unfccc.int/sites/NAPC/Support/Pages/LEG.aspx

UNFCCC. (2015). Paris Agreement. As contained in the report of the Conference of the Parties on its twenty-first session, FCCC/CP/2015/10/Add.1. http://unfccc.int/files/home/application/pdf/paris_agreement.pdf

UNFCCC. (2018). Decision 16/CP.24: Least developed countries work programme. FCCC/CP/2018/10/Add.2. https://unfccc.int/sites/default/files/resource/10a2e.pdf#page=7

United Nations Department of Economic and Social Affairs. (2021). 2021 CDP Plenary - Briefing to Delegates on LDC Issues. https://www.un.org/development/desa/dpad/2021/cdp-concluded-its-2021-plenary-including-the-triennial-review-of-the-ldc-category/

United Nations Human Rights Office of the High Commissioner. (2019). Five UN human rights treaty bodies issue a joint statement on human rights and climate change: Joint Statement on “Human Rights and Climate Change.” https://www.ohchr.org/en/NewsEvents/Pages/DisplayNews.aspx?NewsID=24998&LangID=E

United Nations. (1992). United Nations Framework Convention on Climate Change. https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf

United Nations Women. (2021). State of Gender Equality and Climate Change in Nepal. UN Women, UNEP, ICIMOD, EmPower, https://asiapacific.unwomen.org/sites/default/files/Field%20Office%20ESEAsia/Docs/Publications/2021/12/Full%20report%20Dec2021_Report_State_of_Gender_Equality_andCCinNepal-compress.pdf

University of Notre Dame Global Adaptation Initiative (ND-GAIN). (2021). UN-GAIN country Index. https://gain.nd.edu/our-work/country-index/

Vulnerable 20 Group. (2021). Vulnerable 20 Group. https://www.v-20.org

Wagle, S.K., Gurung, T.B., Pradhan, N., & Raymajhi, A. (2011). Climate change implication for fisheries and aquaculture in Nepal. In Gurung, T.B., Pokharel, P.K., & Wright, I. (eds), Climate change: Livestock and Vulnerability in Nepal. Proceedings of the consultative technical workshop in Kathmandu, Nepal.

Wang, S.Y., Yoon, J.H., Gillies, R.R., & Cho, C. (2013). What caused the winter drought in Western Nepal during recent years? Journal of Climate 26(21): 8241–8256. https://www.researchgate.net/publication/260456501_What_Caused_the_Winter_Drought_in_Western_Nepal_during_Recent_Years

Wester, P., Mishra, A., Mukherji, A., & Shrestha, A.B. (2019). The Hindu Kush Himalaya Assessment—Mountains, Climate Change, Sustainability and People. ICIMOD and Springer Nature Switzerland. https://link.springer.com/book/10.1007/978-3-319-92288-1

World Bank. (2020). COVID-19 impact on Nepal’s economy hits hardest informal sector. Press release 8th October. https://www.worldbank.org/en/news/press-release/2020/10/08/covid-19-impact-on-nepals-economy-hits-hardest-informal-sector

World Bank. (2021). Data: Nepal. https://data.worldbank.org/country/Nepal

World Bank. (2021). Personal remittances received (current US$ and % of GDP) - Nepal. Data: Nepal. https://data.worldbank.org/country/Nepal

World Health Organization. (2021). COP26 Health Programme. https://www.who.int/initiatives/cop26-health-programme/country-commitments

World Meteorological Organization. (2022). 2021 one of the seven warmest years on record, WMO consolidated data shows. https://public.wmo.int/en/media/press-release/2021-one-of-seven-warmest-years-record-wmo-consolidated-data-shows

Government of Nepal
Ministry of Forests and Environment
Singhdurbar, Kathmandu, Nepal
Phone: 01-4211567, Fax: 977-01-4211868
Tol Free Number: 16600101000
Email: info@mofe.gov.np
website: www.mofe.gov.np