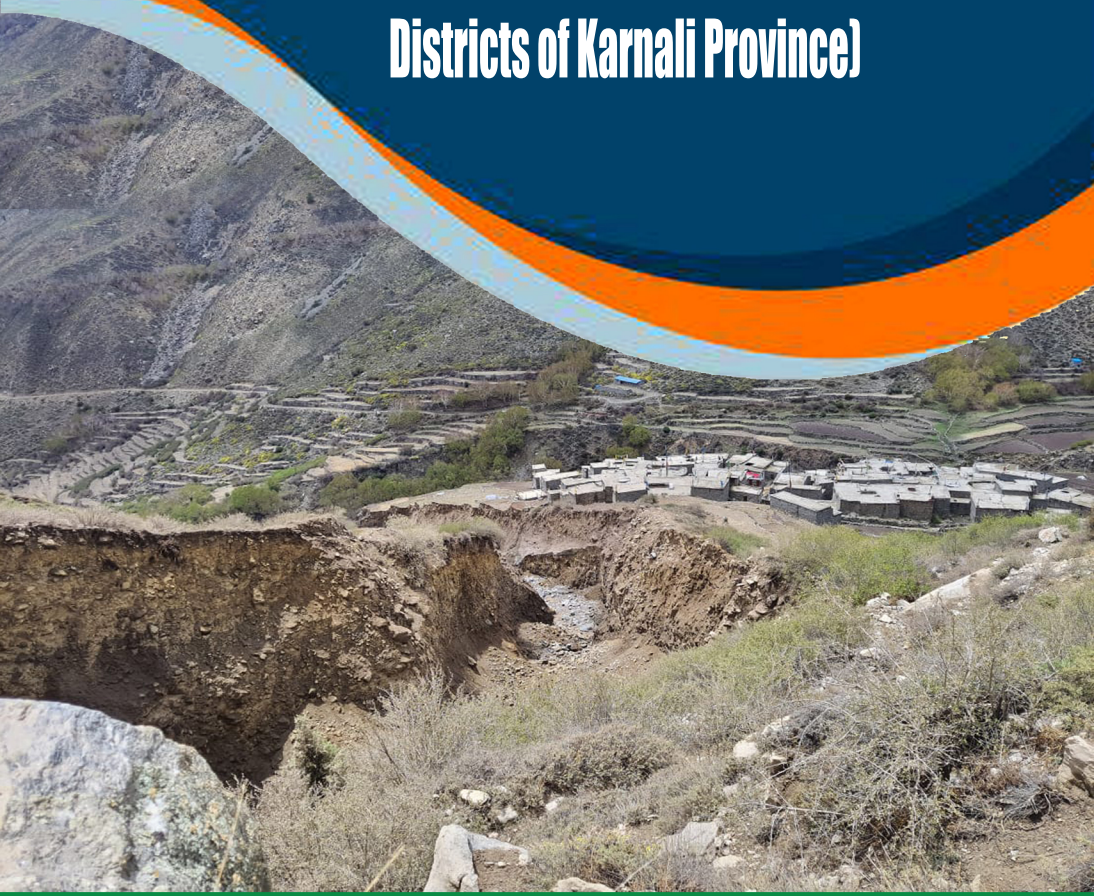
Rapid Assessment of Climate Change Impacts on Farming Communities

(A Brief Study of Jumla, Mugu, and Kalikot Districts of Karnali Province)



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Research Report
Rapid Assessment of Climate Change Impacts on Farming Communities
(A Brief Study of Jumla, Mugu, and Kalikot Districts of Karnali Province)

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This report is a collective effort, and we hope it will contribute to more informed and just climate adaptation strategies for the vulnerable farming communities of Karnali Province.

Research Team
SOLVE Nepal

Abbreviations

Acronym	Full Form
ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Centre
CBA	Community-Based Adaptation
CBS	Central Bureau of Statistics
CC	Climate Change
DHM	Department of Hydrology and Meteorology
DFRS	Department of Forest Research and Survey
DNPWC	Department of National Parks and Wildlife Conservation
DoED	Department of Electricity Development
DoFSC	Department of Forests and Soil Conservation
DoR	Department of Roads
DoTM	Department of Transport Management
DWRI	Department of Water Resources and Irrigation
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FRTC	Forest Research and Training Centre
GoN	Government of Nepal

ICIMOD	International Centre for Integrated Mountain Development
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informant Interview
MoALD	Ministry of Agriculture and Livestock Development
MoEWRI	Ministry of Energy, Water Resources, and Irrigation
MoF	Ministry of Finance
MoFE	Ministry of Forests and Environment
MoHA	Ministry of Home Affairs
MoHP	Ministry of Health and Population
NDRRMA	National Disaster Risk Reduction and Management Authority
NEA	Nepal Electricity Authority
NGO	Non-Governmental Organization
NPC	National Planning Commission
R&D	Research and Development
SDGs	Sustainable Development Goals
UNDROP	United Nations Declaration on the Rights of Peasants
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNFCCC	United Nations Framework Convention on Climate Change

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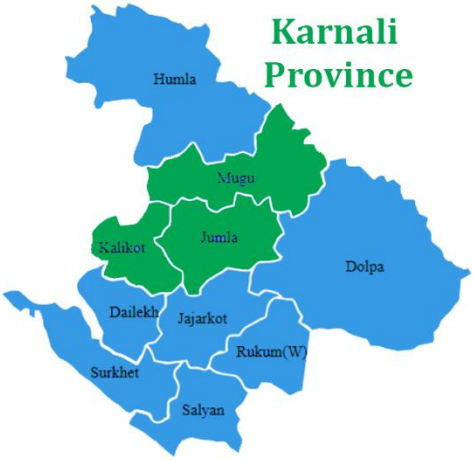
Chapter-I

Introduction

1.1 Background of study



The climatic and environmental crisis at present is a major form of crisis that has emerged as a critical threat to humanity and Mother Earth. Climate change affects every aspect of life on Earth—our ecosystems, weather patterns, food systems, water security, public health, economies, and even geopolitical stability. Global agriculture and farming communities are among the most vulnerable to Climate Change. Despite contributing the least to global greenhouse gas emissions, these communities are mostly affected due to limited capacity to cope with natural disasters and extreme weather events. In underdeveloped countries, where socioeconomic inequalities, feudal structures, and neoliberal policies have already disadvantaged many, climate change further exacerbates their struggles. It has undoubtedly become a great problem for a country like Nepal due to its fragile mountain ecosystem, weak geological conditions, poor economic efficiency, and diverse climate. Major impacts of climate change on agricultural productivity in Nepal include temperature increases, erratic rainfall, unpredictable monsoons, increased frequency of natural disasters, pest outbreaks, soil degradation,

and reduced crop yields threatening food security and livelihoods (Tripathi & Pandey, 2022)

The Karnali Province, one of Nepal's seven provinces, is known for its pristine landscapes, diverse ecosystems, and rich natural resources. However, its difficult terrain, remote location, and mountainous geography make it the least populated and one of the most underdeveloped provinces in Nepal. Over 80% of the rural population of this region relies on agriculture as a primary source of living and climate change has intensified the vulnerabilities of the people in this region, posing severe threats to food security, water availability, and overall agricultural productivity (GoN, 2023). Over the past few decades, rising temperatures, erratic rainfall, prolonged droughts, flash floods, and unseasonal snowfall have significantly disrupted traditional farming practices in Karnali. Due to its high-altitude terrain and dependence on rain-fed agriculture, the region is particularly sensitive to climate-induced disasters, including landslides, glacial lake outbursts, and shifting agroecological zones. These factors have led to declining crop yields, increased soil erosion, pest and disease outbreaks, and water shortages, making it increasingly difficult for farmers to sustain their livelihoods (ibid).

Given these vulnerabilities, a rapid assessment is crucial to gather real-time, region-specific data on the impacts of climate change on farming communities in Karnali. This assessment has provided critical insights into how farmers perceive climate change, the adaptation strategies they are currently employing, and the challenges they face in implementing climate-resilient practices. The findings are an essential foundation for policymakers, researchers, and development agencies to design targeted interventions that enhance climate resilience, sustainable agriculture, and rural development in Karnali.

The population and Agriculture in mountainous districts of Jumla, Mugu, and Kalikot in Nepal's Karnali Province are among the most vulnerable to climate change due to their direct dependence on nature, reliance on subsistence agriculture, and limited adaptive capacity. Situated at high altitudes with rugged terrain, these remote communities depend heavily on rain-fed farming and traditional practices that have sustained livelihoods for generations.

Karnali Province is also one of the most remote and least literate provinces in Nepal. Poverty is highest in Karnali Province and life expectancy is also lowest. Due to lack of infrastructure, compared to the other provinces, the high hills and mountainous regions in Karnali has difficult life especially of farming communities that's why knowledge and capacity to deal in climate change is challenged.

In Karnali Province, Nepal, peasants and farmers are predominantly smallholder and subsistence agricultural workers who rely heavily on traditional farming practices, local knowledge, and seasonal patterns. Feudal practices and castism are significant in Karnali. Similarly, the agriculture is labor intensive. But in the context of distraction from farming, the traditional knowledge and practices is both challenged by conventional farming and climate Change (Pokharel, 2018).

Karnali Province is recently declared as Organic, and it is important to assess the climate change impacts in the context of transitioning towards organic. Agroecological farming is more resilient to climate crisis, but there have been many challenges to agroecological farming in Karnali too (SOLVEN, 2024).

The Agroecological Zone of the research is Mid to high hills above 2,000 m (Generally 2000–3,000 meters above sea level). Mixed farming (crops + livestock) is common in the region.

Mostly, rainfed agriculture and use of traditional irrigation canals (*kuwa, kulo*) also characterize Karnali Farming. Increasing apple orchard cultivation under government and NGO support in Jumla and Mugu is known in Nepal.

Climate change poses an existential threat to agrarian communities in the Global South, and Nepal's northwestern districts of Jumla, Mugu, and Kalikot exemplify this crisis. Characterized by harsh winters, short growing seasons, and limited infrastructure, these regions face compounding challenges from environmental degradation and climatic extremes. Smallholder farmers, who cultivate drought-resistant crops like barley and buckwheat, report unprecedented weather anomalies—unseasonal frosts, prolonged droughts, and unpredictable monsoons—that destabilize yields and amplify food insecurity. Meanwhile, melting snowpack and altered river flows jeopardize irrigation, further straining agricultural productivity. This study highlights the intersection of ecological fragility and socio-economic marginalization, documenting how climate stressors intersect with poverty, gender disparities, and outmigration. By prioritizing local narratives and traditional knowledge, the assessment aims to bridge gaps between grassroots experiences and policymaking, advocating for context-specific interventions to enhance resilience in one of Nepal's most climate-sensitive zones.

As climate impacts intensify—manifesting in crop failures, water scarcity, and shifting growing seasons—the need to understand localized vulnerabilities and resilience strategies becomes urgent. This rapid assessment seeks to evaluate the immediate and projected effects of climate change on farming households in these districts, offering critical insights to inform adaptive policies and safeguard the livelihoods of marginalized

communities already grappling with poverty and geographic isolation.

1.2 Problem Statement

The mountainous districts of Jumla, Mugu, and Kalikot in Nepal's Karnali Province are experiencing escalating threats to agricultural livelihoods and food security due to climate change, yet localized vulnerabilities and adaptive capacities remain critically understudied. These regions, characterized by high altitudes, fragile ecosystems, and subsistence-based agrarian economies, are disproportionately affected by rising temperatures, erratic precipitation, and glacial retreat (IPCC, 2022). Climate models project intensified warming in the Himalayas, with Nepal facing temperature increases up to 1.5 times the global average (MoFE, 2019), exacerbating risks of crop failure, soil degradation, and water scarcity. Farmers in these districts, reliant on rain-fed systems and traditional crops like barley, buckwheat, and millet, report declining yields due to unseasonal frosts, prolonged droughts, and disrupted monsoon cycles (Paudel et al., 2021). Such shifts threaten not only food production but also deepen socio-economic inequities, as marginalized households lack resources to adopt adaptive measures or diversify livelihoods (UNDP, 2021).

Compounding these challenges are systemic issues of poverty, geographic isolation, and inadequate infrastructure, which limit access to climate information, technology, and institutional support (FAO, 2020). For instance, declining snowpack and altered river flows have reduced irrigation reliability, forcing farmers to abandon fertile lands (Shrestha et al., 2019). Women, who constitute the majority of agricultural laborers, face heightened burdens due to gendered roles in water collection and crop management, yet their voices remain underrepresented in

climate adaptation planning (Aryal et al., 2020). Despite Nepal's National Climate Change Policy (2019) emphasizing community-based adaptation, implementation in remote regions like Jumla, Mugu, and Kalikot lags, reflecting a disconnect between national frameworks and local realities (Gentle & Maraseni, 2012). This study addresses these gaps by investigating how climate stressors intersect with socio-economic vulnerabilities in the region, providing evidence to inform equitable, context-specific resilience strategies for at-risk farming communities.

While some studies have examined the impact of climate change on agriculture in Nepal, there remains a substantial research gap in understanding the specific vulnerabilities and adaptation strategies of communities in the mid-hill and mountain regions (Subedi et al., 2023). Existing policies and adaptation programs are often based on national-level climate models that fail to capture the unique challenges faced by smallholder farmers in this remote region. As a result, climate adaptation efforts remain inadequate, leaving communities with limited access to resources, climate-resilient technologies, and early warning systems. Additionally, the disconnect between policymakers, researchers, and local farmers has hindered the development of effective adaptation strategies.

To bridge this gap, a rapid assessment is essential to document the immediate effects of climate change on agriculture, analyze farmers' adaptive responses, and identify gaps in existing support systems. By conducting field visits, interviews, case studies and data analysis in farming communities, this study identifies the most pressing climate-related challenges, assess current adaptation measures, and provide evidence-based recommendations for policymakers, agricultural organizations, and development agencies. Karnali serves as a representative location for assessing the vulnerability of small rural

communities to climate change that serves as a foundation for designing targeted interventions that enhance climate resilience, sustainable agriculture, and food security in vulnerable farming communities.

1.3 Objectives

- *Conduct a rapid assessment* in the upper Karnali region to assess peasants' understanding of climate change and local adaptation strategies
- *Document the* impact of climate change on various aspects of farming, including agro-ecology, bio inputs, and seeds and farming practices.
- *To come out with* recommendations based on the assessment to prepare, reduce risk and successful adaptation strategies and practices among local farmers.

1.4 Significance of the study

This study holds significant value at multiple levels—local, national, and global—particularly as climate change intensifies vulnerabilities within subsistence-based, high-altitude farming systems. In the context of Karnali Province, which is one of the most geographically isolated and economically marginalized regions of Nepal, understanding the lived experiences of climate-affected peasants is not only a research imperative but also a matter of justice and sustainability.

Firstly, the research provides grounded, empirical insights into how smallholder farmers in Jumla, Mugu, and Kalikot are experiencing and responding to climate change. While national-level studies often generalize rural vulnerability, this study disaggregates data at the micro level, capturing local narratives and experiences, local agroecological disruptions, and context-dependent coping strategies. This localized evidence base is crucial for designing tailored adaptation strategies that resonate with the ecological and cultural realities of high-mountain communities.

Secondly, the study enriches the academic discourse on agroecology and climate resilience, by linking traditional farming knowledge with emerging climatic stressors. It critically examines how agroecological practices—such as seed saving, organic composting, and seasonal farming—are being undermined, and how local innovation persists in the face of minimal institutional support. These insights contribute to broader debates around sustainable agriculture, indigenous knowledge systems, and food sovereignty.

Thirdly, from a policy and development planning perspective, the findings offer actionable recommendations for strengthening the resilience of mountain agriculture. The study identifies specific gaps in agricultural extension, input access, and local governance, thereby informing future programming by government agencies, NGOs, and donor communities. By highlighting the voices of women, Dalits, and marginalized peasants, it also aligns with Nepal's commitment to inclusive development and climate justice.

Finally, the study complements Nepal's obligations under international frameworks such as the UNFCCC, UNDROP, and the Sendai Framework for Disaster Risk Reduction, by providing evidence necessary to localize climate adaptation policies. It also advances the global understanding of how climate change is affecting fragile ecosystems and vulnerable populations in the Himalayan region, which is a critical climate hotspot.

In sum, this study is not only an research contribution but also a strategic tool for advocacy, planning, and resilience-building, rooted in the lived realities of those at the frontline of climate change.

1.5 Limitation and Scope of the study

This is a rapid assessment of climate change impacts. Therefore, this study is not intended to collect vast range of climate data and

document its impact on farming communities. Rather this study is the initial assessment of the scenario to carry out further work. It is more qualitative research and also lacks long field experience and immersion in the culture.

Despite all that, a good team of experts and careful planning of field visits, tools and methods of data collection and rapid data collection provides insightful information on what is happening in the field and how this has been understood by the local farming community.

1.6 Organization of the report

This report has five chapters. The first chapter is an introduction, second chapter is literature review, the third chapter is research methodology, the fourth chapter is findings and data presentation, and the final chapter presents the summary, conclusions and recommendations.

Chapter I presents background of the study, statement of the problem, research questions and objectives, conceptual framework and organization of the study. Chapter II discusses the review of literatures both theoretical and empirical such as theories, data published on books, journal articles, research papers, reports and various other records in order to explore the issues regarding the topic. Chapter III focuses on the methodologies used for the study. It explains the research design, research area, technique of data collection. Chapter IV focus on the data presentation and analysis. It has explained about cases and observation. And chapter five is the summary and conclusion.

Chapter II

Literature Review

2.1 Theoretical Review

There are various theories used to analyze the impacts of climate change on communities, especially farming communities. In this study, three important theories are used to assess the impacts. These three theories, at least for the study seem very much interrelated and supplementary to each other.

2.1.1 Vulnerability Theory

Vulnerability theory offers a framework to understand how and why certain populations are disproportionately affected by climate change. According to Adger (2006), vulnerability is determined not only by exposure to hazards but also by sensitivity and adaptive capacity. Farming communities in Karnali are highly exposed to climate-related hazards such as erratic rainfall, prolonged droughts, glacial lake outburst floods (GLOFs), and landslides (Gentle & Maraseni, 2012). These events directly threaten crop yields, livestock, and food security.

In Karnali, sensitivity is exacerbated by ecological fragility and reliance on rain-fed agriculture. Adaptive capacity is often constrained by poverty, limited infrastructure, weak institutional support, and low literacy rates (Paudel, 2021). As such, vulnerability in this region is not only a function of environmental exposure but also of deeply rooted socio-economic structures.

Therefore, to assess the exposure and sensitivity of the communities, this theory is used.

2.1.2 Political Ecology

Political ecology investigates the power relations and structural inequalities that shape environmental access and resource distribution. It critiques how marginalization, governance failures, and external policy interventions influence local capacities to respond to climate change (Robbins, 2012). In Karnali, political ecology reveals how state neglect and centralized planning have historically marginalized remote mountain communities, limiting their voice in climate-related decision-making.

Climate finance and adaptation programs often struggle to reach the most vulnerable due to bureaucratic inefficiencies and limited local ownership (Ojha et al., 2016). Additionally, political ecology draws attention to how external development interventions, though well-intentioned, may disrupt traditional knowledge systems and reinforce dependency on external aid rather than fostering resilience from within.

In the context of lowest development comparison to other province, remains of feudal, gender, caste and other forms of hierarchies, this theory is useful to assess the disproportionate impacts of climate on social structure.

2.1.3 Intersectionality and Climate Justice

A growing body of climate change literature emphasizes intersectionality—the idea that vulnerability is shaped by overlapping identities such as gender, caste, and class. In Karnali, women and Dalit farmers often bear the brunt of climate impacts due to limited access to land, credit, and decision-making power (Gurung & Bisht, 2014). Climate justice frameworks call for recognizing these differentiated vulnerabilities and ensuring that adaptation efforts are inclusive and equitable.

Recent policies and programs, including the Green Karnali initiative and Local Adaptation Plans of Action (LAPAs), have attempted to integrate gender and social inclusion. However, their effectiveness remains uneven due to implementation challenges and limited participatory processes (MoFE, 2019).

2.2 Empirical Review

Nepal's agrarian economy, contributing 23% of GDP (World Bank, 2023), is highly vulnerable to climate change due to its reliance on rain-fed subsistence farming. The mountainous Karnali Province—home to Jumla, Mugu, and Kalikot—faces acute risks due to its fragile ecosystems, glacial dependency, and socioeconomic marginalization. There are many literatures which present various types of data and cases on climate trends, agricultural impacts, adaptation strategies, and policy gaps, emphasizing localized vulnerabilities in Karnali's farming communities. For the purpose of this study, we have reviewed articles, government reports (e.g., MoALD, DHM), and datasets (ICIMOD, FAO). Most of the studies review were resent one from 2000–2024.

Climatic Changes is observed in Nepal and various indicators shows the increasing impacts of climate change in various aspects of human and natural world. Rise in temperature is the first and most significant indicator. Nepal's temperature has increased by 0.056°C annually (1981–2010), exceeding global averages (DHM, 2017). Higher temperatures accelerate glacial retreat, affecting water availability (IPCC, 2022). Similarly, precipitation variability and unpredictability are other impacts seen. Monsoon unpredictability and intense rainfall events disrupt cropping cycles. The Terai region faces flooding, while mid-hills experience droughts (MoALD, 2019). Last year in September 2024 there was heavy rainfall which caused flood and landslides

having devastating impacts especially in Bagmati Province of Nepal. Therefore, Extreme Weather Events such as flood and landslides are common. The 2017 Terai floods damaged 70% of rice crops, highlighting vulnerability (Practical Action, 2018). Similarly, Glacial Lake Outburst Floods (GLOFs) pose risks to mountain irrigation systems (ICIMOD, 2021).

Specific to agriculture, literature shows that there are crop-specific impacts of climate change. One example is that delayed monsoons reduce rice yields; a 1°C rise may decrease production by 4–6% (Gentle & Maraseni, 2012). Warming reduces maize yields in mid-hills, while wheat benefits marginally in cooler regions (Tiwari et al., 2020). In the Mountains, Glacial retreat shortens growing seasons, limiting potato and barley cultivation (Sud et al., 2015). There is also socioeconomic and Gender Dimensions of climate change impacts. Smallholders face adaptation barriers due to limited resources (FAO, 2020). Women, responsible for 70% of farm labor, struggle with resource access (Aryal et al., 2020).

The vital factors why the impacts of climate change in Nepal are high are farming communities relying in monsoon agriculture and living in fragile ecosystem. In Nepal, more than 80 % of precipitation occurs in the monsoon during June to September. Since more than 75% of the land is not irrigated round the year and most of them are small and marginal, the agriculture sector in Nepal is highly prone to climate change. The evidence of climate change in the Nepalese agriculture perspective is evident day by day. Traditional rainfalls of Jestha and Ashar (mid-July) have been shifted in Shrawan and Bhadra. It has affected negatively in the paddy production (ANPFa, 2011). Shifts in agro-ecological zones, prolonged dry spells, and higher incidence of pests and diseases are other observed impacts. Increased incidence of fire in recent years affecting thousands of people and loss of large areas of productive forest land is a common

phenomenon. Forest Action Nepal shows that in Nepal, the temporal forest fire incidences and burnt areas were found to vary during the period of 2001 to 2020. On average, 3,098 fire incidences, and burning of 172, 040.65 ha of forest area was found annually (2022). Early Maturity of the crops due to increase in temperature may help to have more crops in the same crop cycle (NARC annual report, 2022). Shifting of climatic zones has been observed in the country. Extinction of natural vegetation: local basmati rice varieties, some local wheat, maize and other agricultural crops are also related to climate change.

But the resilience of Nepalese farmers is also notable and praiseworthy. Nepalese farmers are employing various adaptation strategies and technologies to mitigate the effects of climate change on agriculture including drip irrigation, off-farm employment, adjustments to cropping calendars, the use of biopesticides, soil and water conservation techniques, sharecropping, regulated fertilizer application, the development of climate-resilient crop varieties, and agroforestry (Tripathi & Pandey, 2022). Farmers in rural Nepal are utilizing indigenous low-cost technologies to combat climate-induced water stress and flood disasters. Techniques such as shifting to flood-resilient seeds and constructing local bamboo walls have proven effective. These methods have helped small farmers save approximately 9% of their crops by preventing flood damage at minimal cost (Bista & Shahi, 2024). (Adhikari, 2018) highlights the importance of strategies such as creating climate-resistant cultivars and increasing irrigation and fertilizer use efficiency to ensure food and nutritional security in the face of climate change problems.

Nepal's existing policies to mitigate climate change include the National Climate Change Policy (NCCP), National Adaptation Programme of Action (NAPA), National Biodiversity Strategy

and Action Plan (NBSAP), and the Framework for Sustainable Development (FSS), emphasizing ecosystem-based adaptation measures (Sherpa, 2024).

2. 2.1 Climate Trends and Their Implications

The Karnali Province, encompassing Jumla, Mugu, and Kalikot, is highly vulnerable to climate change due to its rugged topography, fragile ecosystems, and dependence on subsistence agriculture. Recent studies highlight rising temperatures and erratic precipitation patterns as critical drivers of agricultural disruption. Between 1980 and 2020, the average annual temperature in Karnali increased by 0.056°C per year, with a more pronounced warming trend post-2000 (Pandey et al., 2021). Precipitation has become increasingly unpredictable, with monsoon rainfall declining by 15–20% in the last two decades, exacerbating drought risks (Acharya et al., 2022). These shifts disrupt traditional cropping calendars, reduce soil moisture, and threaten rain-fed agriculture, which sustains over 80% of households in the region (MoALD, 2023).

- National Trend: Nepal's annual temperature increased by 0.056°C/yr (1981–2010), exceeding the global average (DHM, 2017).
- Karnali-Specific: Warming intensified post-2000, with Mustang (mountain region) recording +1.2°C versus +0.8°C in Terai (MoFE, 2019). Projections suggest 1.7–3.6°C rise by 2050 under RCP scenarios (NCVST, 2009).

Table 1: Temperature Trends in Nepal (1980–2020)

Region	Avg. Temp. Rise (°C/decade)	Key Impacts
Mountains	0.12	Glacial retreat, shortened seasons
Hills (Karnali)	0.10	Crop heat stress, pest outbreaks
Terai	0.08	Flooding, waterlogging

Source: Pandey et al. (2021), MoALD (2023)

Precipitation Variability

- Monsoon Shifts: Pre-monsoon (March–May) rainfall declined by 15% in western Nepal, critical for wheat planting (DHM, 2017).
- Extreme Events: Heavy rainfall days (>100 mm/day) surged by 26% in Terai (1990–2020), but Karnali faces prolonged droughts (Practical Action, 2020).

2. 2.2 Extreme Weather Events and Agricultural Losses

Farmers in these districts report intensified droughts, unseasonal frosts, and flash floods, damaging crops and infrastructure. A 2022 survey in Kalikot found that 62% of households experienced crop losses due to droughts, while 48% cited hailstorms as a major threat (Thapa et al., 2022). In Mugu, flash floods in 2021 destroyed 35% of arable land along riverbanks, displacing communities and reducing maize yields by 40–50% (ICIMOD, 2023). Such events disproportionately affect marginalized groups, including women and Indigenous

communities, who rely on small-scale farming for food security (FAO, 2023).

2. 2.3. Declining Crop Yields and Food Insecurity

Staple crops like maize, rice, and millet are increasingly vulnerable. In Jumla, maize yields have declined by 25–30% over the past decade due to prolonged dry spells (Dhital et al., 2023). The region's famed Jumli Marshi rice, a cold-tolerant variety, now faces heat stress during critical growth phases, threatening both biodiversity and local diets (Khatri-Chhetri et al., 2021). Food insecurity in Karnali has risen sharply, with 68% of households experiencing moderate to severe food shortages for 3–6 months annually, linked to climate variability (WFP, 2022).

Staple Crop Yields

- Rice:
  - Heat stress during flowering reduces yields by 4–10% per 1°C rise (Gentle & Maraseni, 2012).
  - In Jumla, delayed monsoons disrupted *Jumli Marshi* rice cycles, causing 25–30% yield loss (Dhital et al., 2023).
- Maize: Erratic rainfall in Mugu and Kalikot led to 18–30% declines (Thapa et al., 2022).

Table 2: Crop Yield Changes in Karnali (2010–2020)

District	Crop	Yield Change (%)	Key Driver
Jumla	Rice	-25%	Delayed monsoon
Mugu	Maize	-40%	Flash floods (2021)
Kalikot	Wheat	-32%	2015–2016 drought

Source: ICIMOD (2023), WFP (2022)

Livelihood Shocks

- Food Insecurity: 68% of households in Karnali face 3–6 months of food shortages annually (WFP, 2022).
- Gendered Impacts: Women, responsible for 70% of farm labor, struggle with limited access to climate information (Aryal et al., 2020).

2.2.4. Adaptation Strategies and Barriers

Farmers are adopting drought-resistant crops (e.g., buckwheat, barley) and diversifying livelihoods through apple farming and medicinal herb cultivation (Thapa & Maharjan, 2023). Jumla's apple production, supported by NGOs, has increased by 20% since 2018, offering an alternative income source (UNDP, 2022). However, adaptation is hindered by limited access to climate information, poor infrastructure, and underfunded extension services. Only 12% of farmers in Mugu have received training on climate-smart practices, and 85% lack insurance against crop failures (MoFAGA, 2021).

Traditional Practices

- Agroforestry: Integrating *Alnus nepalensis* trees boosted maize yields by 18% in Kavre (FAO, 2019).
- Water Management: Community-led pond excavation in Kalikot improved irrigation for 45% of households (Pokharel, 2011).

2.2.5. Policy and Institutional Challenges

It is reviewed that there is a huge funding Gaps and out of all funding on climate only 12% of climate funds reach Karnali's

municipalities (GoN, 2023). Another big challenges is Knowledge Barriers. 85% of farmers lack access to climate-smart training (MoFAGA, 2021) in the province.

Despite Nepal's National Adaptation Plan (NAP) and Local Adaptation Plans of Action (LAPA), implementation in Karnali remains weak. Researchers urge decentralized governance, early warning systems, and community-based agroforestry to enhance resilience (Aryal et al., 2022).

Karnali Province, situated in northwestern Nepal, encompasses some of the country's most remote and mountainous districts, including Jumla, Mugu, and Kalikot. These regions are characterized by rugged terrain, limited infrastructure, and a heavy reliance on subsistence agriculture. In recent years, climate change has emerged as a significant threat to the livelihoods of farming communities in these districts, exacerbating existing vulnerabilities and posing new challenges. This literature review synthesizes recent studies and statistical data to assess the multifaceted impacts of climate change on agriculture, food security, health, and adaptive strategies in Jumla, Mugu, and Kalikot.

2.2.6. Agricultural Vulnerability and Food Insecurity

Agriculture is the primary livelihood for over 80% of Karnali's population. However, only 30% of farming households are self-reliant in food production, leaving 70% dependent on external food sources throughout the year (Ratopati, 2023). The province faces an annual food grain deficit of 19,116 metric tonnes, with districts like Jumla, Mugu, and Kalikot among the most affected (Nepal News, 2023).

A recent survey conducted by the World Food Programme, EPI, and FAO revealed that 28% of households in Karnali Province were not consuming the required amount of food, with 8%

consuming extremely low quantities, indicating a hunger situation (Nepal News, 2023). Furthermore, a study by the Nepal Rastra Bank indicated that 77.5% of households in the province have harvests insufficient to feed themselves, highlighting the severity of food insecurity in the region (Republica, 2023).

Rising temperatures and erratic precipitation patterns have led to significant agricultural challenges. In Mugu, reduced snowfall and altered rainfall have disrupted traditional farming calendars, leading to decreased crop yields and water scarcity (Rising Nepal, 2024). Similarly, in Jumla, the decline in cold spells necessary for apple cultivation has resulted in reduced yields, while new pests and diseases have emerged, further compromising crop health (ICIMOD, 2023).

A comparative case study in Kalikot District found that 81% and 91% of respondents in Raskot Municipality and Ramnakot Rural Municipality, respectively, were dependent on rain-fed agriculture. The study also noted an increase in average summer temperatures and abnormal rainfall patterns, with a growing number of days experiencing rainfall of 100 mm or more (Yogi et al., 2024).

The changing climate has also introduced health challenges. Warmer temperatures have facilitated the spread of diseases like dengue fever to higher altitudes, with cases reported in Jumla and Mugu (Republica, 2023). This not only affects human health but also places additional strain on already vulnerable communities.

Communities are adopting various strategies to cope with climate impacts. In Kalikot, the implementation of Climate Smart Village (CSV) approaches has led to increased cropping intensity and improved food security (Yogi et al., 2024). Organic farming initiatives, supported by organizations like FAO Nepal, are promoting sustainable practices and enhancing livelihoods in

districts including Jumla and Mugu (FAO, 2022). Additionally, the adoption of climate-resilient agro-ecological practices, such as drought-resistant crop varieties and natural pest management, is gaining atraction among farmers (GC et al., 2024).

The Local Initiatives for Biodiversity, Research and Development (LI-BIRD) has been instrumental in building the capacity of women farmers in climate-resilient agroecological farming practices in Karnali Province. Their projects focus on empowering women through knowledge and skills development, improving participation in local institutions, and establishing linkages with technical schools and government sectors (LI-BIRD, 2022).

Climate change disproportionately affects women, who bear the brunt of increased labor in agriculture, water collection, and household responsibilities. In Jumla, women report heightened challenges due to shifting climate patterns and resource scarcity (Rising Nepal, 2024). Furthermore, economic hardships have led

to increased labor migration, altering traditional family structures and community dynamics (ICIMOD, 2023).

The farming communities of Jumla, Mugu, and Kalikot are experiencing profound impacts from climate change, affecting agriculture, health, and socioeconomic structures. While adaptive strategies are being implemented, ongoing support and targeted interventions are essential to enhance resilience and ensure sustainable livelihoods in these vulnerable regions.

2.3 Policy Review

This review critically examines the evolution of Nepal's climate change policies, focusing on the National Climate Change Policy 2011, the National Climate Change Policy 2019, the National Adaptation Plan (NAP) 2021–2050, and the Long-Term Strategy for Net Zero Emissions 2021. The analysis highlights the strengths, weaknesses, and areas for improvement in these policies.

2.3.1 National Policies

2.3.1.1 National Climate Change Policy 2011

The National Climate Change Policy (NCCP) 2011 was Nepal's first comprehensive policy addressing climate change. Its primary objective was to promote climate adaptation, mitigation, and sustainable development by integrating climate change considerations into national development processes (Government of Nepal, 2011). The policy emphasized the importance of community-based adaptation, capacity building, and the establishment of institutional mechanisms to coordinate climate change activities.

One of the notable features of the NCCP 2011 was its commitment to allocate at least 80% of the available climate finance to local-level activities, ensuring that vulnerable

communities directly benefit from climate change interventions (WHO, 2013). Additionally, the policy advocated for the establishment of a Climate Change Center to coordinate research and development activities related to climate change (MDPI, 2022).

However, the NCCP 2011 faced several challenges in implementation. The lack of specific targets and timelines made it difficult to monitor progress effectively. Moreover, limited institutional capacity and inadequate coordination among stakeholders hindered the policy's effectiveness (WHO, 2013).

2.3.1.2 National Climate Change Policy 2019

In response to the evolving climate change landscape and the need for more robust policy frameworks, the Government of Nepal revised the NCCP in 2019. The National Climate Change Policy 2019 aimed to build a climate-resilient society by mainstreaming climate change considerations into all levels of governance and development planning (Government of Nepal, 2019). The policy outlined strategies across various sectors, including agriculture, forestry, water resources, energy, health, and urban development.

Key features of the NCCP 2019 include:

- Integration of Mitigation and Adaptation: Unlike its predecessor, the 2019 policy emphasized both mitigation and adaptation measures, promoting a holistic approach to climate change (FAOLEX, 2022).
- Emphasis on Renewable Energy: The policy advocated for the promotion of renewable energy sources and energy-efficient technologies to reduce greenhouse gas emissions (DPNet Nepal, 2019).
- Gender and Social Inclusion: Recognizing the differential impacts of climate change, the policy incorporated

provisions to address gender and social inclusion, ensuring that marginalized groups are considered in climate change interventions (ICIMOD, 2019).

Despite these advancements, the NCCP 2019 has been critiqued for lacking specific emission reduction targets and clear implementation mechanisms. Additionally, while the policy emphasizes mainstreaming climate change, it does not provide detailed guidance on operationalizing this integration across sectors (Spotlight Nepal, 2019).

2.3.1.3 National Adaptation Plan (NAP) 2021–2050

To further strengthen its climate adaptation efforts, Nepal developed the National Adaptation Plan (NAP) 2021–2050. The NAP provides a strategic framework for medium- and long-term adaptation planning, aiming to reduce vulnerability and enhance resilience across sectors and communities (UNFCCC, 2021). The plan emphasizes a participatory approach, involving stakeholders at all levels in the planning and implementation processes.

The NAP identifies priority adaptation actions in sectors such as agriculture, water resources, health, and infrastructure. It also outlines mechanisms for monitoring and evaluating adaptation efforts, ensuring transparency and accountability (UNFCCC, 2021).

One of the strengths of the NAP is its alignment with international frameworks, such as the Paris Agreement, and its emphasis on integrating adaptation into national development planning. However, challenges remain in terms of securing adequate financing and building institutional capacity to implement the identified adaptation measures effectively.

2.3.1.4 Long-Term Strategy for Net Zero Emissions 2021

In October 2021, Nepal released its Long-Term Strategy for Net Zero Emissions, outlining a roadmap to achieve carbon neutrality by 2045 (Climate Action Tracker, 2021). The strategy presents two scenarios: "With Existing Measures" (WEM) and "With Additional Measures" (WAM), detailing pathways for emission reductions across sectors.

Key elements of the strategy include:

- Decarbonization of the Energy Sector: Promoting renewable energy sources and phasing out fossil fuels to reduce emissions.
- Sustainable Land Use: Enhancing forest carbon sequestration and promoting sustainable agricultural practices.
- Transportation Sector Reforms: Encouraging the adoption of electric vehicles and improving public transportation infrastructure.

While the strategy demonstrates Nepal's commitment to global climate goals, its successful implementation hinges on mobilizing significant financial resources, technological support, and capacity building.

2.3.2 Few policies and program of Karnali Province

2.3.2.1 Local Adaptation to Climate Change (LACC) Project

The LACC Project aims to promote sustainable and inclusive livelihoods and natural resource management in Karnali Province. It supports local communities in adapting to climate change impacts by focusing on climate-resilient livelihoods, inclusive water management, and strengthening governance for sustainable natural resource management. The project emphasizes gender equality, disability, and social inclusion (GEDSI) in its approach.

2.3.2.2 Nepal Climate Change Support Programme – Phase 2 (NCCSP2)

NCCSP2 is a flagship climate change program implemented by the Government of Nepal with support from international partners. It aims to increase the resilience of vulnerable communities to climate-related shocks and future climate change. In Karnali Province, NCCSP2 collaborates with the Ministry of Industry, Tourism, Forests, and Environment to address cross-boundary issues in river basin planning and management. The program supports municipalities in mainstreaming climate resilience within their local development plans.

2.3.2.3 Green Karnali Project

project focuses on building resilient livelihoods for smallholder farmers, especially women and youth, through climate and gender-friendly agroecology-based farming approaches and green enterprises. Implemented in Surkhet, Dailekh, and Achham districts, the project works closely with local and provincial governments to enhance production and establish climate-resilient agriculture and livestock farming systems.

2.3.2.4 Karnali Climate Action Education Program (KCAEP)

The KCAEP, initiated by Wildlife Conservation Nepal (WCN), aims to address climate change through education and awareness among the younger generation. The program focuses on increasing climate literacy by educating students about mitigation and adaptation measures. It has been introduced in schools across various municipalities in Karnali Province, including the development of local curricula and the Green School Program.

2.3.2.5 Karnali Declaration

In response to the province's vulnerability to climate change, the Ministry of Forest and Environment, in collaboration with

various organizations, organized a conclave titled "Bridging Karnali and the Globe: Roadmap to COP 29." The event concluded with the Karnali Declaration, emphasizing the need for climate-related risk management, implementation of climate-friendly activities, and addressing the impacts of climate change on marginalized communities. The declaration calls for international cooperation and climate finance to support climate-resilient programs in Nepal.

2.4 Conceptual framework used in the study

There are many different concepts and framework to assess climate impacts. For this study only few Climate Change Assessment Concepts are considered.

1. Impact Assessment: Identifies how CC (temperature, rainfall, extreme events) affects natural systems, human activities, economies and farming practices. In this regard, following factors will be observed. Especially, analysis of the changes in weather pattern and Climate related Hazards in relation to natural and human resources, food and agriculture etc will be documented.
2. Vulnerability and Risk Assessment: Evaluattion of the extent of CC impacts on farming communities and farming practices based on exposure, sensitivity, and adaptive capacity will be documented.
3. Loss and Damage Assessment: The framework of loss and damage assessment also provides us more clear idea on impact assessment. Estimates for the economic and material losses due to adverse CC impacts will be also analyzed.

   Both economic and non-economic losses will be tried to document. Tangible losses like damage to property, infrastructure, crops, and economic productivity due to extreme weather events like floods, droughts, storms, and

sea level rise as well as intangible losses like loss of cultural heritage, displacement of communities, impacts on mental health, and loss of biodiversity will be analyzed.

4. Adaptive Capacity: The ability of systems and the communities to mitigate and adapt to CC will be analyzed using tools provided by FAO and UNFCCC.
   This includes evaluating factors like:

- Economic resources: Income levels, access to finance, economic diversification.
- Human capital: Education levels, health status, skills and knowledge related to climate change
- Social capital: Community cohesion, social networks, participation in decision-making
- Institutional capacity: Governance structures, legal frameworks, access to information and technology
- Environmental factors: Ecosystem services, land use patterns, natural resource availability

Chapter III

Research Methodology

3.1 Initial Rapid Assessment (IRA)

Initial Rapid Assessment is a new tool mostly used for a preliminary assessment. Initial Rapid Assessment (IRA) is carried out to obtain crucial information about the situation. It seeks to offer a quick overview of the situation, directing subsequent actions for reaction, resource distribution, and intervention tactics. Though it is used mostly after a disaster, even to assess the impacts of climate change induced disaster and climate change impacts, this tool is useful. It is a data gathering methods as well as a quick and efficient method. IRA is not much different from RRA which will be more interdisciplinary and participatory. Rapid Rural Appraisal (RRA) is used to rapidly collect data about rural areas, frequently for research or development projects though different in its objectives.

Similarly, fact finding missions are used to collect precise and trustworthy information on a particular topic, occasion, or circumstance, frequently in regard to human rights, international relations, or humanitarian emergencies. Governments, international organizations, or non-governmental groups usually carry out fact-finding trips to gather information for advocacy, intervention, or decision-making plans. Therefore, in terms of methodology there are not much differences in those tools though the objectives may be slightly different. Since, this study intends to understand the situation more specifically on climate change, IRA is used. But the there is mixed method used learnings from Rapid Rural Appraisal, Fact Finding Mission and also the Participatory Rural Appraisal (PRA). Since the research is more

qualitative the observation, interview, case studies and local narratives are major tools of data collection.

This rapid assessment was designed to capture the perceptions, experiences, and adaptation responses of farming communities to climate change in Jumla, Mugu, and Kalikot districts of Karnali Province. The methodology combined both qualitative and quantitative approaches, ensuring triangulation and representation of diverse voices and ecological zones.

3.2 Study Design

A descriptive and exploratory design was adopted to generate timely insights into the impacts of climate change on farming systems. Given the rapid nature of the assessment, the study focused on capturing prevailing conditions and trends through community engagement, field observation, and existing knowledge systems. The design emphasized participatory tools to ensure the inclusion of peasants' voices and indigenous knowledge.

3.3 Site Selection and Sampling

The districts of **Jumla, Mugu, and Kalikot** were purposefully selected based on their high exposure to climate risks, dependence on subsistence agriculture, and geographical location in the upper Karnali basin.

The main stakeholders involved in the assessment includes:

- Local farming communities: They are the primary beneficiaries and sources of data.
- Local government agencies: This includes district agricultural offices and local disaster management authorities.
- NGOs and civil society organizations: These are groups focused on climate adaptation, agriculture, and rural development.

- Academic institutions and researchers: Experts in climate change, agriculture, and rural development will play a key role.
- Conducting field visit, observation and informal interviews with farmers, local agricultural extension workers, and other stakeholders in the area was a rapid way of getting information. This has helped gather insights into their experiences with climate-related issues, such as changes in crop yields, water availability, and weather patterns. Therefore, being there at the field is important. Field visit will done by a team comprised of Project team including Researcher, Research Assistant and volunteers.

3.4 Data Collection Tools and Techniques

The following tools were used to gather data:

a. Focus Group Discussions (FGDs)

FGDs were conducted in each selected municipality, involving 8–12 participants per group. Separate discussions were held with:

- General farmer groups
- Women farmers
- Dalit and marginalized community representatives

Discussions were facilitated using participatory tools such as seasonal calendars, problem trees, and adaptation mapping.

b. Key Informant Interviews (KIIs)

KIIs were conducted with:

- Agricultural extension officers
- Ward chairpersons
- Local NGOs/CSOs working on agriculture or climate resilience
- Elders and traditional knowledge holders

These interviews helped contextualize survey data and provided expert insights on institutional responses.

c. Field Observations

On-site observations were conducted in farms, irrigation canals, forests, and seed storage facilities to validate claims and gather visual evidence of ecological changes, land degradation, water scarcity, and farming practices.

d. Case Studies:

Individual Cases of people, places and events are documented to have detail story and illustration of the phenomenon.

3.5. Secondary Data Review

Relevant reports, climate vulnerability assessments, district agriculture profiles, and government policies were reviewed to provide context and complement primary findings.

3.6. Data Processing and Analysis

Qualitative data from FGDs and KIIs were transcribed, translated where needed, and analyzed thematically.

Data analysis was guided by the following key themes:

- Climate awareness and perception
- Changes in agro-ecology and seed systems
- Shifts in farming practices
- Local adaptation strategies
- Institutional and systemic gaps

3.7. Ethical Considerations

Informed verbal consent was obtained from all participants. Privacy and confidentiality of responses were ensured, and participants were informed about the purpose and use of the study. Cultural sensitivity was maintained throughout the assessment.

3.8. Concepts/Variables used to assess the CC impacts

3.8.1 FAO, UNFCCC indicators

Many other institutions have developed different frameworks to assess the impacts of Climate Change. The variables used are quite different from climate change vulnerability and risk assessment. Few of the climatic factors used to assess the impacts especially on farming communities are as follows.

3.8.2 Agriculture:

- Crop yield variations
- Changes in crop planting seasons
- Impact on livestock productivity
- Crop diversity and Crop quality
- Production losses due to extreme weather events

3.8.3 Water Resources: Assessing the impacts of climate change (CC) on water resources involves monitoring factors such as:

- Water reserves (surface and underground)
- Water quality (chemical, biological, temperature changes)
- Aquatic ecosystems
- Water demand

3.8.4 Farming Practices

Agriculture is highly sensitive to climate factors like temperature, rainfall, and sunny days. CC directly affects crop growth, productivity, livestock, aquatic products, and increases the risk of pests, diseases, and damage to agricultural facilities. Key assessment areas include:

- Plant varieties, crop yield, and arable land for crops
- Livestock varieties, infrastructure, and productivity
- Fisheries species, infrastructure, and productivity
- Resources used, availability and damage
- Practices

3.8.5 Biodiversity:

- Changes in species distribution
- Declining population of sensitive species
- Alterations in ecosystem functions

3.8.6 Socioeconomic impacts:

- Population displacement due to floods and landslides
- Impacts on livelihoods, particularly in rural communities
- Increased vulnerability of marginalized populations

3.8.7 Temperature and Precipitation Changes:

- Average temperature increase
- Changes in precipitation patterns (amount, intensity, distribution)
- Growing season length
- Heat stress on crops
- Drought occurrence and severity

3.8.8 Extreme events, climate induced disasters and diseases

- Landslides, flood
- Pest and disease incidence and severity
- Shift in pest and disease distribution

3.8.9 Land Use and Management:

- Land degradation
- Changes in land use patterns (e.g., cropland to pasture)
- Soil erosion

Chapter IV

Findings

4.1 Climate Perceptions and Awareness

The awareness on climate change, its impacts and adaptation seems challenging for the peasants communities in Karnali. Though they have observed the change in temperature and weather phenomenon, it is yet to understand the trend and cope with change accordingly as these trends are unprecedented. The Ministry of Social Development in Karnali Province has shared statistics that the province has a 34 percent illiteracy rate (2023). This means that 34 percent of people do not have the ability to read and write. People who can understand the climate change issue are not many though they have observed the changes in their own ways.

Farmers across Jumla, Mugu, and Kalikot consistently reported profound shifts in weather patterns over the past 10–15 years. They described delayed monsoon onset, unpredictable rainfall, rising temperatures, shorter winters, and more frequent extreme weather events (Field Visit, 2025). Although most participants lacked familiarity with the scientific term "climate change," their lived experiences reflected a deep, embodied awareness of climate instability.

"We used to plant wheat in Kartik (Oct–Nov), but now the soil remains dry till Mangsir (Dec). Our crops are drying before harvest because the rain doesn't come when needed, and sometimes it comes all at once with hail."

— Ram Kumari Rokaya, Tila Rural Municipality, Jumla

“Rain used to come in the planting season, now it rains when we're supposed to be harvesting. Our crops are ruined.”

— Radhika BK, Sinja, Jumla

“Even the horses are confused by the heat. Short rains, warmer winters — everything feels off.”

— Tsering Lama, Horse Rider, RARA, Mugu

Formal climate education remains rare, with radio and NGO trainings being the few sources of structured information. Despite limited formal education, many farmers are already adjusting practices and in response to these changes based on the community wisdom and traditional knowledge they are having for generations.

4.1.1. Agro-Ecological Changes and Environmental Impacts

Field visit and data collection showed that there are rampants impacts and changes on farming communities. The agrarian ecosystem is actually destroyed by climate change.

Climate variability is driving ecological degradation in the region. Farmers observed:

- Drying water sources, particularly springs, which are critical for both drinking and irrigation.
- Soil erosion and landslides, especially in Kalikot and Mugu, reducing arable land.
- Forest depletion due to erratic rainfall and increased wildfire incidents.

“Two villages depend on the same canal for irrigation. It now dries up by Chaitra (March–April). There have been fights, and one farmer was even injured last year.”

— Community leader, Rara Chhayanath Municipality, Mugu

Traditional ecological calendars based on solar-lunar cycles and natural indicators are increasingly misaligned with actual weather patterns, disrupting planting routines. Indigenous biodiversity—especially crop varieties—is declining, and communal resource-sharing practices like seed exchange are under strain.

"Earlier, we could exchange seeds with neighbors. Now everyone's struggling, and there are no extra seeds to share."

— Radhika Shahi, Women's group, Kalikot

4.1.2. Seed Systems, Bio-Inputs, and Farming Practices

One of the objective of this research was to document the impacts of climate change on farming practices, traditional knowledge and seed system. It is found that the seed system, which is the heart of the farming system is afected.

Traditional seed systems are under pressure. Farmers reported:

- Declining viability of indigenous seeds due to erratic rainfall, frost, and pests.
- Limited access to hybrid seeds due to cost, water needs, and dependency on chemical inputs.
- Decreased production of compost and bio-inputs due to water scarcity and livestock decline.
- Misuse of chemical fertilizers owing to lack of technical training.

"We used to grow foxtail millet, but it no longer grows well. The seeds sprout unevenly, and pests come more frequently. We tried hybrid maize once, but it needed more fertilizer and water, which we don't have."— Laxmi BK, Naraharinath, Kalikot

"Hail hits just when the flowers bloom, the fruits fall before they ripen. Every year we face heavy losses."

— Ramkrishna Chaulagain, Tatopani, Jumla

Some innovation is emerging: In Kalikot, women-led cooperatives have started intercropping legumes with millet to restore fertility and moisture retention.

“By growing green lentils alongside, even without fertilizer, the crops survive. On my father’s dry land, this method is saving us.”
— Lalita Shahi, Kalikot

4.1.3. Changing and Adaptive Farming Practices

Traditional knowledge system, Diversity, resilience and innovation are the key strength of farming communities. The knowledge is especially based on traditions and indigeneity, the diversity in farming and livelihood has increased the resilience and the practice has led to local innovations.

Farmers are shifting practices to cope with new realities:

- Adjusting cropping calendars to better match unpredictable rainfall.
- Abandoning winter crops like wheat and barley at higher altitudes due to poor yields.
- Using mixed cropping and mulching to retain soil moisture.
- Responding to pest outbreaks, such as maize borers, which are becoming more common with warmer winters.

Qualitatively, many farmers estimated **40–60% yield reductions** in key crops over the past decade. Yet adaptive ingenuity is visible:

- Terracing and contour farming to prevent erosion.
- Crop diversification, including potatoes and legumes.
- Local seed preservation, such as Jumla’s community seed banks.

“We test the seeds together, and each family returns double the amount. Now we are more confident that some crops will grow, even when the rains fail.”
— Renu Thapa, Chandannath Municipality, Jumla

“I've grown new saplings that can withstand frost. Now I’m thinking of reaching bigger markets.”
— Ramesh Bohora, Sinja Valley, Jumla

4.1.4. Impacts on Livelihoods and Subsistence Farming

Climate stress has severely impacted subsistence farming, the backbone of life in Karnali. Farmers in Mugu’s Soru Gaunpalika reported:

- Failed potato crops due to snowfall disruption.
- Livestock illness due to heat stress.
- Increasing dependence on remittances and food aid during lean periods.

“The river swallowed everything. I just watched helplessly. The landslide took it all.”
— Deumaya Rokaya, 68, Kalikot

Such incidents underscore the fragility of mountain agrarian livelihoods in the face of accelerating climate risks.

4.1.5. Institutional Support and Gaps

Farmers consistently highlighted gaps in formal support structures:

- Sparse extension services: In Kalikot, only two agricultural officers serve the entire district.
- Lack of infrastructure: Seed banks, irrigation systems, and water storage remain underdeveloped.
- Weak institutional trust: Bureaucratic obstacles hinder access to subsidies and adaptation programs.

“Farmers are adapting on their own because the system is not reaching them.”

— Agricultural Officer, Kalikot

Despite limited institutional backing, farmers are organizing at the community level through cooperatives, seasonal migration planning, rooftop water harvesting, and knowledge-sharing networks.

4.1.6. Local Adaptation Innovations

Despite being on the frontlines of climate vulnerability, communities across Karnali are demonstrating resilience and creativity:

- Community seed banks and traditional seed preservation.
- Legume intercropping, mulching, and mixed cropping.
- Frost-resistant saplings and nursery startups.
- Rooftop rainwater harvesting led by women’s groups.

However, these innovations are **scattered and informal**, risking collapse without policy recognition and long-term investment.

4.1.7. building resilience, reviving agroecology and helping in adaptation

To sustain and scale these efforts, it is found and suggested by the respondent that the following actions are urgently needed:

1. Revive Agroecology: Strengthen seed sovereignty, promote community seed banks, and support organic practices.
2. Localized Extension Services: Train field agents to integrate traditional ecological knowledge with climate science.
3. Invest in Infrastructure: Prioritize irrigation systems, seed storage, water harvesting, and early warning mechanisms.

4. Empower Cooperatives: Strengthen women-led groups, farmer-to-farmer knowledge exchange, and participatory planning.
5. Policy Inclusion: Recognize high-altitude farming communities in national climate adaptation and funding frameworks.

4.2 Impacts felt and experienced by farming communities

4.2.1 Lack of Climate Change Awareness resulting huge loss and damage

The level of awareness is very low. They farming communities have observed and felt the changes in various indicators of climate change, the knowledge about the Climate crisis, its impacts and coping mechanism are still lacking. Direct impacts of lack of knowledge and unprecedented weather are rampant. They are not prepared and they face many accidents and incidents due to lack of inormation.

Every Year there are climate induced disasters. The landslide and flood which were rare has become common every year. This year 2025 in May there was a glacier lake outburst phenomenon resulting flood in the unexpected summer.

In 2023 July, *Floods and landslides damage properties worth millions of rupees in Humla district.* Disasters in Karnali Province have swept away around half a dozen bridges and inundated paddy fields of nearly 100 farmers. According to local residents, floods and landslides swept away bridges and damaged houses which is evident from secondary source too. (https://kathmandupost.com/2023/07/29). Similarly, in the october month of 2022, there was flood and landslide in Karnali. *35 dead, 20 missing in Karnali floods and landslides in 2022. Over 10,500 people rendered homeless by floods and landslides in Karnali.* As many as 10,714 people have been rendered

homeless due to the recent floods and landslides in Karnali Province. The Karnali Province Police Office, Surkhet, stated that the largest number, i.e. 5,282 people have become homeless due to the natural disasters in Mugu, followed by 1,763 in Kalikot district, 1725 in Jumla, 639 in Salyan, 566 in Surkhet, 474 in Humla, 207 in Dailekh, 25 in Dolpa, 18 in Jajarkot and 15 in Rukum West. This was covered by many sources. eg. (https://myrepublica.nagariknetwork.com/news/132550/) .

This year 2025 May, eighteen families have been displaced after a flood and landslide struck Tilgaun in ward 6 of Namkha Rural Municipality, Humla district, on Thursday night, according to local authorities. Chief District Officer Narayan Pandey said two houses were damaged in the incident and the affected families had been relocated to a safer site. “The incident occurred around 11pm, but due to the remoteness of the area and delayed access, the news came out late,” Pandey told.

(https://kathmandupost.com/karnali-province/2025/05/19)

4.2.2 Lack of Bio inputs Alternatives and Organic Karnali Mision

One of the big gaps found was that Karnali Government has not made enough effort towards the declaration of Organic mission and its effective implementation. There have been almost no impacts of central, provincial and local level intervention to provide alternatives for the farmers while discouraging them to use Chemicals. In the context of huge loss of indigenous biodiversity and knowledge system, farmers are facing a huge challenge.

Farmers in Karnali reported that they are happy with the move but they need to be supported. If there is no chemicals, what is the options especially for the pests and diseases. They are lacking support and farming has been greatly impacted by this move.

4.2.3 Conservation of local resources, seeds and biodiversity

Karnali is known for the huge biological diversity and indigenous products. Chino, Kaguno, Uwa, Gau, Jau, Phapar, Beans, Brown Rice etc.

But slowly the production for the food security and livelihood has been decreasing and in few cases, it has been commercialized.

4.2.4 Endangering Community wisdom and local knowledge system

Climate change in Karnali has severely impacted the region's community wisdom and local knowledge systems, which are deeply rooted in generations of agricultural practices, weather forecasting, and natural resource management.

Traditional knowledge, such as predicting weather patterns based on local flora, fauna, and celestial observations, is becoming unreliable due to erratic climate conditions. Local crop calendars, seed selection, and indigenous soil management techniques are also losing relevance, as unexpected rainfalls, prolonged droughts, and new pests disrupt established practices. Moreover, the migration of youth seeking alternative livelihoods has further weakened the intergenerational transfer of this knowledge.

4.2.5 Unfitted modern technologies and imported inputs

There seems a huge gap between the imported and imposed development attempts and local needs based on local adaptation. Many of the mechanization attempts are not fitted in the Karnali Context. Power tillers are neither locally suitable in the highly steep sloppy terrace farming nor women friendly. Similarly, in the name of improved seeds, hybrid corn are found in the province. For the commercialization, plastic is distributed haphazardly for the commercialization of vegetables and tunnel farming. The apple seedling, walnut sapling, or any fruits such as dragon and

kiwi are introduced without any studies and scientific recommendations.

4.2.6 Lack of Comprehensive Programs to address each problems

It seems that not a single program can addresses a wide variety of impacts farming communities are facing. An integrated and holistic approach is needed.

The move towards organic seems the best approach towards climate resilience. The multicropping, agroecological and organic farming can reduce the impacts. But the present intervention is very weak and insufficient.

4.2.7 Few Case Studies

a) Ram Laxmi Upadhyaya, Tila Gupha Municipality ward number 9

She had never seen the flood in the river. But recently there was also flood in the river and it has damaged the irrigation canal so badly.

The most important knowledge transmitted through generation was they never made the house in the farmland. But she has seen that there is a motor road, electricity Pole and houses in the farmland.

She complained that Wheat and Barley produced has been reduced largely. This year due to no snowfall at all (there was a little bit monsoon which also came late), both crops couldn't fill grain and the yield and quality was grain was also low.

She also remembered the forefathers anecdotes saying that, *Barsa ma Pani Hiudama Hiu (Rain in the monsoon and Snowfall in the Winter)* were the sources of life, but due to change in both seasons, the farming is very challenging.

b) Ganesh Bitalu, A livestock Keeper/Horse Rider

His raise Horse and his main source of cash income is to horse ride the tourist and tour the RaRa Lake and surroundings. All the family members who are in the village do farming. Interestingly he said that farming is a rural occupation and even those who goes to India for seasonal migration, who goes to cities and other countries, if they have to live in the village for more than a week, it is compulsory that they do farming.

He believes, compared to those childhood days, it has been years since there has been no heavy rain in the area. Both rainfall and snowfall have been erratic and unprecedented.

Child marriage is common in Karnali and people need to settle in their early lives. This is impacted education and migration at early age too.

c) Experience of Senior citizens

In most Karnali, there are no three crops. Only two crops are hardly possible (Though depends on irrigation and altitude). He believes that agriculture is traditional, and agriculture alone was never sufficient to provide food security and livelihood.

Wage labor, livestock keeping, making handmade knitwear, seasonal migration for trade and herbal products have also supplemented the livelihood resources for the people.

Most of the men and women are knitters. It is really great to see all the herders to do knitting while grazing the cattle.

d) Singha Kami-40, Amar Bam-38 and Lokendra Bahadur Bam-40, Chhayanatha Rara

Major Production in the village-Barley, Millet, Beans, Buckwheat, Potators and Maize

Production is not like before. They camplained, No Rain, No Snow how do we sustain lives.

There is almost no Chino (Proso Millet) and Kaguno (Foxtail Millet/Quinao) and people still do not understand the value of these traditional crops. They want to eat rice and other maket products. They also reported many impacts of climate change,

- Impacts on Water is seen. Less rain and snowfall. Drought and Drying water sources
- Farming Practices are Traditional and farmers lack knowledge of climate impacts
- Steep/Sloppy Land to vulnerable to disasters
- Subsidy and grants were promoting chemical fertilizers, hybrid seeds and imported technologies until recently and now chemicals are not there but technologies and seeds are still imported.
- The animals and plants in the surroundings are decreasing except for more monkeys which is also the result of no leopard, snow

4.3 Summary of Findings on the Comprehensive Impacts of Climate Change on Farming Communities in Karnali Province, Nepal

Indicator	Specific Impacts (with Qualitative and Quantitative Evidence)
Agriculture	
Crop yield variations	Decline production reported. The old and recent report varify the data. In wheat (−14.5%) and barley (−17.3%) yields in drought years (e.g., 2009). Similar patterns in Jumla and Kalikot due to reduced winter rainfall.
Changes in crop planting seasons	Monsoon rainfall traditionally expected in Jestha-Ashar now arriving in Shrawan-

Indicator	Specific Impacts (with Qualitative and Quantitative Evidence)
	Bhadra, delaying rice transplantation. Early maturing varieties used as coping mechanisms. In October 2022 there was heavy rainfall and flood.
Impact on livestock productivity	Reduced milk yield and animal weight due to heat stress, fodder scarcity, and disease. Goat herders in upper Mugu report increased mortality during prolonged dry spells.
Crop diversity and quality	Extinction of native basmati rice, local maize, and wheat varieties in many hill districts. Nutritional quality of vegetables and apples declining due to erratic weather.
Production losses due to extreme weather events	Flash floods and hailstorms in highland valleys (e.g., Rara watershed) causing 30–50% production losses. Reports of full crop failures in some rain-fed areas.
Water Resources	
Water reserves (surface & underground)	Springs drying in winter; groundwater recharge slower. Irrigation systems in Jumla and Kalikot unable to cope with unpredictable rainfall.
Water quality	Temperature increases leading to algal blooms; increased sedimentation post-landslides. Contamination of drinking water sources after floods.
Aquatic ecosystems	Traditional cold-water fish species disappearing; invasive species spreading downstream. Wetland degradation around Sinja valley reported.
Water demand	Demand rising for irrigation and domestic use due to long dry spells. Conflicts over water in low-flow seasons among communities.
Farming Practices	

Indicator	Specific Impacts (with Qualitative and Quantitative Evidence)
Plant varieties, yield & arable land	Shift to fast-growing and drought-tolerant varieties; decline in fallow land cultivation due to input and climate stress.
Livestock & infrastructure	Traditional sheds destroyed by floods and heavy snow; lack of storage for fodder. Farmers forced to reduce herd size.
Fisheries	Disruption of local pond aquaculture systems; increase in fish mortality during dry spells.
Resources & damage	Irrigation canals clogged by landslides; grain storage destroyed by floods and rodents due to rising temperatures.
Practices	Farmers abandoning traditional knowledge; switching to plastic tunnels and chemical inputs. Climate-smart practices remain limited due to cost and knowledge barriers.
Biodiversity	
Species distribution	Medicinal herbs like *Yarsagumba* shifting to higher elevations; some previously lowland species encroaching into mid-hills.
Declining populations	Bees, butterflies, and pollinators declining, affecting cross-pollination and crop productivity.
Ecosystem function	Loss of local biodiversity weakening natural pest control, nutrient cycles, and seed dispersal.
Socioeconomic Impacts	
Population displacement	Migration from high-risk landslide and flood zones to road corridors; seasonal migration to India and cities for work increasing.

Indicator	Specific Impacts (with Qualitative and Quantitative Evidence)
Livelihood impacts	Crop failure leads to debt cycles among marginal peasants. Income from agriculture falling; rising reliance on remittances.
Vulnerability of marginalized groups	Dalits and landless more exposed to food insecurity. Women disproportionately burdened by water collection and care during climate shocks.
Temperature & Precipitation Changes	
Temperature increase	Western hills experiencing 0.06–0.08°C annual temperature rise. Higher night-time minima reported by farmers.
Precipitation patterns	Late monsoon, short heavy bursts leading to erosion; decrease in winter rainfall affecting wheat and barley.
Growing season	Early flowering and shorter grain filling periods observed in maize and millet.
Heat stress on crops	Wilting in tomatoes, premature seed drop in mustard and radish. Reduced apple fruit set in Jumla.
Drought severity	Mid-hill zones experience prolonged dry periods—up to 3–4 weeks without rain in monsoon season.
Extreme Events, Disasters & Diseases	
Landslides, floods	Monsoon-triggered landslides cutting off villages, destroying fields. Flash floods more intense in narrow valleys.
Pest and disease severity	Emergence of fall armyworm in maize; rust in barley; increased fungal infections in beans and peas.

Indicator	Specific Impacts (with Qualitative and Quantitative Evidence)
Shift in pest/disease zones	Expansion of pests to higher altitudes (e.g., aphids in apples above 2,500m).
Land Use & Management	
Land degradation	Soil fertility declining due to loss of organic matter and erosion. Abandonment of terraced lands in mid-hills.
Changes in land use patterns	Shift from crop farming to livestock rearing in some villages; increase in fallow and shrubland.
Soil erosion	Heavy rains causing gully formation, topsoil loss; landslides undermining terrace stability.

Summary, Conclusion and Recommendations

Summary

This rapid assessment examines the severe and intensifying impacts of climate change on farming communities in the Karnali Province, particularly in Jumla, Mugu, and Kalikot. These districts, characterized by fragile mountain ecosystems, economic marginalization, and high dependence on natural resources, are among the most vulnerable to climatic variability.

Key climate trends include rising temperatures (an average increase of 1.8°C over 32 years), shifting rainfall patterns, increased frequency of floods and droughts, no snowfall to less snowfall, and changes in pest and disease dynamics. The unpredictable rainfall, rising temperatures, shorter winters, prolonged dry spells, and increased incidence of floods, hailstorms, and forest fires have directly impacted the peasantry and farming practices. The further impact of impacts on agriculture and peasantry has resulted the low production, food insecurity, livelihood challenges and aggravated the migration and distraction from farming.

These changes are accelerating the degradation of agro-ecological systems and posing existential threats to subsistence farming.

Key ecological and agricultural impacts include:

- Drying water sources, especially springs, threatening both irrigation and drinking water supplies.
- Soil erosion, landslides, and degradation of forest cover due to erratic weather and unsustainable land use

Decline in indigenous seed viability, increased pest outbreaks, and low adaptive capacity of introduced hybrid varieties

Yield reductions of up to 40–60% in key staples, threatening food security and driving reliance on food aid and remittances.

While climate education is limited, farmers possess strong lived awareness and are adjusting through various adaptive strategies, including:

- Crop calendar adjustments and switching from wheat/barley to potatoes and legumes.
- Community-led seed banks and legume intercropping to restore fertility.
- Mulching, rooftop water harvesting

Conclusions

The study concludes that climate change has emerged as a profound threat to farming livelihoods and food sovereignty in Karnali Province. Poor and marginalized communities—especially women, Dalits, and indigenous groups—bear the brunt due to their socio-economic vulnerability, reliance on natural resources, and limited access to information, education, and institutional support.

Despite the prevalence of effective traditional adaptation practices, current development and policy trends undermine these indigenous systems. The widespread use of chemical inputs, shifting cultivation calendars, and abandonment of traditional crop varieties threaten the sustainability of local food systems. Moreover, the lack of institutional mechanisms and coordination at the local level, alongside the historical absence of local government, has further weakened the implementation of climate change policies like NAPA and LAPA

The rapid impact assessment concludes that climate change is severely disrupting the ecological, agricultural, and socio-economic fabric of farming communities in Karnali Province. The mountainous districts of Jumla, Mugu, and Kalikot are facing increasing climate variability characterized by delayed monsoons, unpredictable rainfall, prolonged droughts, rising temperatures, and more frequent extreme events like hailstorms, floods, and landslides

These climatic changes have undermined traditional farming systems, leading to:

- Shifts in cropping calendars and collapse of agro-ecological rhythms.
- Declining productivity and quality of crops such as wheat, barley, millet, and apples.
- Increasing prevalence of pests and diseases, with limited coping mechanisms.
- Loss of biodiversity, including indigenous seed varieties and local plant species.
- Decline in natural water availability and greater competition for shared resources

The social impacts are especially severe for marginalized groups—including women, Dalits, and indigenous peoples—who face higher exposure due to economic dependence on natural resources, limited land ownership, and exclusion from decision-making and institutional services

The feminization of agriculture, driven by male outmigration, has added additional burdens to women who now shoulder the majority of farm labor with minimal support.

Despite these challenges, local communities have demonstrated resilience by employing traditional knowledge and experimenting with adaptive strategies such as:

- Community seed banks and seed preservation.
- Legume intercropping, mulching, and rooftop rainwater harvesting.
- Crop diversification and cultivation of frost-resistant saplings
- However, these efforts are scattered, under-resourced, and unsupported by formal policies and institutions. Extension services are minimal, adaptation financing is inaccessible, and climate-related plans remain top-down and disconnected from community realities.
- The conclusion is clear: climate change is not only an environmental challenge but a socio-political and economic crisis for Karnali's farming communities. Without inclusive, bottom-up, and sustained interventions that recognize and support local innovation, the region risks ecological collapse, deepening inequality, and large-scale displacement.
-
- In the face of intensifying climate impacts, agroecology and organic farming emerge as vital, locally rooted solutions for building resilience in Karnali's fragile mountain farming systems. As traditional seed varieties decline and chemical inputs prove unsustainable due to cost, water scarcity, and environmental harm, communities across Jumla, Mugu, and Kalikot are rediscovering the value of intercropping, composting, mulching, and seed preservation. Women-led cooperatives and local innovators are experimenting with legume-based soil regeneration and frost-resistant saplings, offering powerful examples of how ecological approaches

can restore degraded land, retain soil moisture, and enhance food security. However, without formal policy support, technical assistance, and investment, these agroecological practices risk remaining isolated innovations. Institutionalizing organic farming within local adaptation frameworks is therefore essential not only for climate resilience but also for food sovereignty and sustainable livelihoods in Karnali.

Recommendations

1. Strengthen Climate Awareness and Education

- Develop community-based climate literacy programs, using radio, local language publications, and interactive workshops.
- Target women, Dalits, and indigenous groups with tailored awareness and training initiatives.
- Integrate climate change education into formal and informal schooling, especially in rural areas.

2. Revitalize Traditional and Agroecological Practices

- Support revival of traditional seed systems, including seed exchanges and preservation of indigenous varieties through community seed banks
- Promote organic farming and agroecology to enhance soil health and reduce reliance on external chemical inputs.
- Document and upscale local innovations like legume intercropping, mixed cropping, and mulching that have proven effective in moisture retention and pest resistance.

3. Improve Localized Extension and Technical Services

- Recruit and train local agricultural extension workers, ensuring at least one trained climate-resilient agriculture facilitator per ward or municipality.

- Create mobile climate advisory services to provide timely weather forecasts and planting advice to farmers.
- Facilitate farmer-to-farmer knowledge exchange, focusing on adaptive practices rooted in local contexts

4. Enhance Infrastructure and Ecosystem Services

- Invest in small-scale irrigation systems, including drip and sprinkler technologies adapted to water-scarce high-altitude areas.
- Construct and maintain embankments, terraces, and water harvesting structures, especially in landslide- and drought-prone zones.
- Rehabilitate degraded lands through community-based afforestation, slope stabilization, and spring conservation projects.

5. Support Institutional and Policy Reforms

- Mainstream high-altitude farming communities into national adaptation plans (e.g., LAPA/NAPA) and climate financing mechanisms

Decentralize planning and budgeting for adaptation, ensuring at least 80% of climate funds reach local levels, as envisioned in Nepal's CC Policy 2011

Address policy gaps by clearly defining district- and ward-level implementation responsibilities, and ensure coordination across ministries.

6. Empower Women, Dalits, and Indigenous Peoples

- Ensure land rights, input access, and financial inclusion for marginalized groups, recognizing their central role in agriculture.

- Support women-led cooperatives and enterprises, particularly those innovating in climate-resilient seed production, nurseries, and alternative income generation.
- Incorporate gender-sensitive adaptation planning that accounts for women's workloads, vulnerabilities, and knowledge systems

7. Promote Livelihood Diversification and Safety Nets

- Expand access to livestock rearing, poultry, small enterprises, and remittance-saving schemes to reduce reliance on climate-sensitive crops.
- Pilot crop and livestock insurance programs targeting climate-vulnerable areas.
- Develop community grain banks and food storage systems to reduce food insecurity during lean seasons.

8. Strengthen Disaster Preparedness and Early Warning Systems

- Establish early warning systems for flash floods, GLOFs, landslides, and droughts, using mobile alerts and community-level sirens.
- Conduct risk mapping and hazard monitoring in vulnerable VDCs and municipalities.
- Train local governments and farmers in emergency response, rescue, and recovery planning.

9. Invest in Climate Research and Monitoring

- Prioritize local climate trend tracking (temperature, rainfall, pests) in coordination with meteorological and agricultural institutions.
- Fund action-research projects to test drought- and frost-resilient varieties and adaptive farming methods across microclimates.

- Promote collaboration between local cooperatives, academic institutions, and international partners for knowledge exchange.

10. Institutionalize Food Sovereignty and Agrarian Reform

- Recognize food sovereignty as a core pillar of Nepal's development strategy, ensuring localized food systems, fair trade, and producer control over agricultural decisions.
- Implement land reform policies to ensure equitable access and ownership of productive land by peasants and landless farmers.
- Discourage dependence on chemical-intensive, export-driven agriculture promoted by global markets and MNCs, and instead promote ecological balance and resilience

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