BASELINE AGROBIO SURVEY REPORT: MUSTANG DISTRICT

कृषि जैविक विविधता आधार-रेखा सर्वेक्षण प्रतिवेदन: मुस्ताङ जिल्ला

Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal (REGAGRI)

नेपालको पर्वतीय क्षेत्रमा गहन पुनरुत्थानशील कृषि परियोजना (रिगाग्री)

Authors: Pradip Thapa, Arati Khadgi, Sumitra Tamang, Bikas Bhusal, Mukunda Bhattarai, Deepa Singh Shrestha, Mahesh Sapkota, Bhoj Raj Pokhrel, Rubina Karki, Tek Prasad Gotame and Bal Krishna Joshi

With Support From
The Rockefeller Foundation

WWF

BASELINE AGROBIO SURVEY REPORT:
MUSTANG DISTRICT

कृषि जैविक विविधता आधार-रेखा सर्वेक्षण प्रतिवेदन:
मुस्ताङ जिल्ला

Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal
(REGAGRI)
नेपालको पर्वतीय क्षेत्रमा गहन पुनरुत्थानशील कृषि परियोजना
(रिगाग्री)

Author: Pradip Thapa, Arati Khadgi, Sumitra Tamang, Bikas Bhusal, Mukunda Bhattarai, Deepa Singh Shrestha, Mahesh Sapkota, Bhoj Raj Pokhrel, Rubina Karki, Tek Prasad Gotame and Bal Krishna Joshi

With Support From The Rockefeller Foundation

WWF

Kathmandu | 2025
काठमाडौँ, २०८२

NAGRC, NARC; https://genebank.narc.gov.np/
National Agriculture Genetics Resources Center (NAGRC), commonly called Genebank was established in 2010 under the Nepal Agricultural Research Council (NARC) for the conservation and utilization of all agricultural genetic resources (AGRs), including the six components of agrobiodiversity (crop, forage, livestock, aquatic, insect and microorganism) and four subcomponents (domesticated, semi domesticated, wild related species and wild edible species). AGRs are managed through four strategies (ex-situ, on-farm, in-situ and breeding) and by deploying the 101 Good Practices across the country. AGR repositories Include seed banks, tissue banks, DNA banks, field genebanks, community genebanks, livestock farm genebanks, aqua pond genebanks, agro gene sanctuaries, and so on. All AGRs are managed scientifically and made available for research, study and production.

WWF; https://www.wwfnepal.org/
WWF is the world's leading independent conservation organization, established in 1961 and currently operating in more than 100 countries. WWF initiated work in Nepal with a rhino conservation program in 1967, with an office formally operational since 1993. Currently, WWF Nepal works in five thematic areas – Wildlife, Freshwater, Forests, Climate and Energy, and Governance. WWF Nepal's focus has progressed from its localized efforts in conservation of a single species to a new horizon of landscape-level conservation encompassing national, regional and global scales of complexity. WWF Nepal identifies climate change as an active driver of emerging issues in freshwater, forests and wildlife, and it is working with all tiers of government, partners and local communities to address this critical issue through innovative and synergetic actions.

Published by: NAGRC and WWF Nepal

Published date: 2025

NPSN: 134/081/82
NGB-51/2024

Citation: Thapa P, A Khadgi, S Tamang, B Bhusal, M Bhattarai, DS Shrestha, M Sapkota, BR Pokhrel, R Karki, TP Gotame and BK Joshi. 2025. Baseline Agro-bio–Survey Report: Mustang District. Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal. National Agriculture Genetic Resources Center, NARC and WWF Nepal. Kathmandu Nepal.

Copies: 250

Available from (print and e-copies): I. NAGRC, Khumaltar, https://genebank.narc.gov.np/, II. WWF Nepal, https://www.wwfnepal.org/knowledge_hub_/publications2/

Design and layout: Surendra Shrestha

Cover photo: Images of bimbili (wild edible plant), Common bean, Mountain goat and dried apple

Contents

Acknowledgements

The authors would like to extend their sincere gratitude to all the farmers of the Mustang sites for their generous cooperation and willingness to share valuable information on agricultural biodiversity and socio-economic conditions. Their support was indispensable in carrying out the baseline survey and collecting essential data. We would like to thank Dr. Ghana Shyam Gurung, Country Representative-WWF Nepal for guidance and critical inputs, Dr. Kanchan Thapa, Deputy Conservation Director-WWF Nepal for supporting in preliminary assessment of native agrobiodiversity species, Ms. Anita Adhikari, Manager Monitoring, Evaluation & Learning, WWF Nepal for providing support on orientation for baseline survey to enumerators. We are particularly grateful to Mr. Roshan Thakali and Mr. Aita Bahadur Thakali for their insightful contributions regarding the village and its diverse landscape in Mustang district. We also deeply appreciate the enumerators and local leaders for their dedication, valuable information, and time, which were crucial in ensuring the accuracy and comprehensiveness of the survey data. We also acknowledge the significant contributions of Mr. Bhupal Singh oli, Mr. Krishna Rajak, Mr. Bishal Kc and Mr. Rupak during data cleaning and analysis. Last but not least, we extend our heartfelt thanks to all the helping hands who directly or indirectly contributed their valuable time and suggestions for the preparation of this report.

Acronyms

ACAP	Annapurna Conservation Area Project
AGR	Agriculture Genetic Resources
AKC	Agriculture Knowledge Center
ATP	Agro-Trans-Pastoralism
CDO	Chief District Officer
CML	Crops, Medicinal and Livestock
DNA	Deoxyribonucleic acid
FGD	Focus group discussion
GON	Government of Nepal
HDI	Human Development Index
HPI	Human Poverty Index
ICIMOD	International Centre for Integrated Mountain Development
IPR	Intellectual Property Right
ITK	Indigenous and Traditional Knowledge
KII	Key Informant Interviews
LBU	Lumbini Buddhist University
LEC	Landrace Enhancement and Conservation
NAFHA	Nuts and Fruits in Hilly Areas Project
NAGRC	National Agriculture Genetic Resources Center
NARC	Nepal Agricultural Research Council
NGB	National Gene Bank
NGO	Non-Governmental Organization
PMAMP	Prime Minister Agriculture Modernization Project
PTFI	Periodic Table of Food Initiative
REGAGRI	Short form of Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal
SPSS	Statistical Packages for Social Sciences
SQCC	Seed Quality Control Center
THDC	Temperate Horticulture Development Center
WWF	World Wildlife Fund
WWN	Worldwide Nature Conservation Nepal

Executive Summary

The agrobiodiversity baseline survey conducted in Mustang district as part of the "Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal (REGAGRI) project provides critical insights into the status of agricultural biodiversity, traditional knowledge, and cultural practices in this ecologically sensitive region. The survey aims to establish a foundation for promoting agroecological resilience by integrating indigenous wisdom, conserving native agricultural species, and reviving traditional and spiritual agricultural practices. Mustang region' is known for its rich agricultural biodiversity, which is deeply intertwined with food security, nutrition, health, and climate resilience. Despite their immense value, many native crops, livestock breeds, and traditional agricultural practices in this high-altitude region face threats of extinction due to changing socio-economic dynamics, modern agricultural practices, and climate change. This has disrupted the interconnectedness of agrobiodiversity, human life, and the local environment. Recognizing these challenges, the REGAGRI project focuses on documenting the cultural, spiritual, and nutritional significance of local crops and livestock while promoting their use in climate-resilient and regenerative agricultural practices. The baseline survey aimed to explore and document the current state of agrobiodiversity, cultural and spiritual farming traditions, and Indigenous knowledge in the Mustang region. This report provides insights into the local agricultural practices, land use, and the socio-economic dimensions of farming communities, offering a foundation for planning future interventions. The study was conducted in two key locations: Varagung muktikshetra rural municipality in Lower Mustang and Lo-Ghekar Damodar Kunda rural municipality in Upper Mustang, selected for their reliance on agriculture for subsistence and livelihood, accessibility, and community engagement. The project documented the cultivation of crops such as barley, naked barley, buckwheat, and potatoes, and the rearing of livestock like yak, Lulu cattle, and mountain goats, alongside identifying key medicinal plants like sea buckthorn, wild garlic and Himalayan thyme.

The study employed a mixed-methods approach, including household surveys, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs), complemented by secondary data reviews. A pretested semi-structured questionnaire was administered to 100 households, 50 each from the two sites, to gather quantitative and qualitative data. Findings reveal a significant dependency on traditional agricultural practices, with 95% of respondents relying on farming as their primary occupation. However, issues like reduced snowfall, earlier apple ripening, and pest outbreaks attributed to climate change have made agriculture increasingly challenging.

Household demographics show an average size of 6.25 members, with minimal gender disparities. Varagung muktikshetra rural municipality exhibited a higher dependency ratio, implying greater economic pressures on active members. Landholding patterns revealed an average per-household holding 1.14 hectares of land, with variations between cultivated and non-cultivated land use pattern. Livelihood diversification is limited, with most households combining agriculture with livestock farming. Local seed systems dominate, characterized by traditional seed saving and exchange practices. Crops like naked barley and buckwheat are integral to the diet, culture, and economy, while livestock such as Lulu cattle provide essential resources, including milk, meat, and manure.

The findings also highlight the rich biodiversity of the region, including rare medicinal plants, forage species, and a variety of mushrooms and wild edibles. Indigenous practices for crop rotation, intercropping, and seed selection demonstrate a sophisticated understanding of ecological farming. Despite this, soil health degradation and declining livestock populations, particularly yaks, pose significant challenges. The report identifies opportunities to promote climate resilient crops, improve seed systems, and enhance agro-pastoral practices to sustain agricultural productivity.

Key recommendations include adopting regenerative agricultural practices, establishing conservation banks and promoting native landraces through participatory breeding and value addition. Emphasis is placed on integrating spiritual and cultural values into agriculture, preserving Indigenous knowledge, and creating market linkages for local products. The project also advocates capacity building through training, awareness programs, and policy support to incentivize conservation efforts. By fostering collaboration among stakeholders, these initiatives aim to build a resilient, sustainable agricultural system in Mustang, safeguarding its unique biodiversity and cultural heritage for future generations.

1 Introduction

1.1 Background Information

Nepal, a Himalayan country renowned for its towering peaks, is also a hub of agro-biodiversity with traditional farming practices thriving across its diverse mountain ecosystems and encompassing diverse ecosystems from alpine meadows to subtropical forests. Biodiversity is an important source of food, nutrition, clothes, fodder, firewood, medicine, and recreational and comfort materials. However, growing evidence indicates that ongoing ecosystem degradation is likely to trigger negative feedback loops, reducing agricultural yields and increasing the risk of sudden systemic changes (Hossain et al., 2016).

Mustang, a remote district in Nepal's Himalayas, is a treasure trove of traditional knowledge and agrobiodiversity, where ancient farming practices sustain diverse crop varieties adapted to its arid, high-altitude environment. Thakali food, originating from Mustang, is a local cuisine that has gained popularity both in Nepal and around the world. Similarly, traditional practices such as drinking yak blood with religious significance, enjoying tea made with yak milk or Tibetan rock salt, dishes like khole prepared with buckwheat leaves, sadeko or boiled potatoes, makaiko dindo (maize porridge), home-brewed fermented beer, uwa beer, apple brandy, and mustangi chyang are gaining popularity both in Nepal and globally. However, residents, especially the younger generation, migrate to urban areas or abroad for better opportunities, leading to depopulation and loss of traditional knowledge. Similarly, shifts in cropping patterns, decline in indigenous varieties, agricultural shifts, altered feeding habits, seasonal migration, apple plantation relocation due to changing climatic conditions are the major challenging for traditional conservation.

In Mustang buckwheat, wheat, and naked barley, wheat, maize, potato, broadleaf mustard, bean, potato, and apricot have traditionally been major crops in the mountains, while yak, Chyangra (mountain goat), and Lulu cattle have high protein values for these communities and traditional medicinal plants support health and livelihoods. However, climate change affects melting glaciers, changing weather patterns, and reduced snowfall threatening local agriculture and water sources. Similarly, the growing number of visitors to Mustang has increased processed food, waste generation and environmental degradation, affecting its landscape and agriculture.

Agrobiodiversity is a crucial aspect of overall biodiversity, particularly in Nepal, where it encompasses six key components: crops, forages, livestock, aquatic life, insects, and microorganisms. National data from Nepal indicate a slight decline in the share of traditional crops; however, there has been a significant reduction in agrobiodiversity in the country's high-altitude mountain districts (Gautam, 2019). Similarly, a vulnerability assessment conducted by government of Nepal has found this high-altitude mountain region to be especially vulnerable to climate change impacts while having low adaptive capacity (MoFE, 2019). Agrobiodiversity is declining globally, and mountain settlements of Nepal are not an exception.

Climate change is threatening the survival of all the organisms. In particular, the Mustang district proposed as project area, are experiencing a rapid rise in temperatures that disrupt the timing of planting and harvesting of crops (Bajracharya et.al. 2018) To address the issue of increasing rate of agro-biodiversity loss, the National Agriculture Genetic Resources Centre (NAGRC), Gene bank in

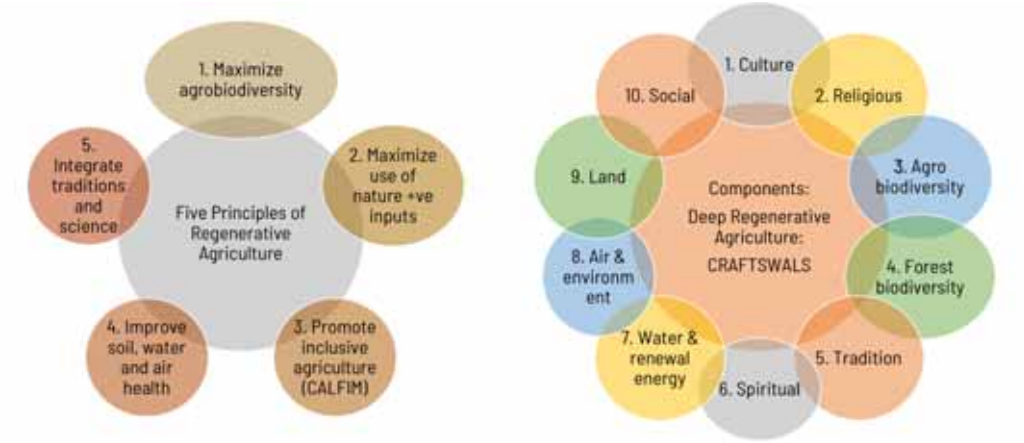
collaboration with WWF has initiated a project titled Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal" (in short REGAGRI).

This project presents an opportunity to promote deep regenerative agriculture across the Eastern Himalayan region, starting with Nepal covering Mustang district. The initiative will document the chemical composition of the targeted 9 crops, 3 livestock species and 3 medicinal plant species, and their cultural importance and contexts, and strategies for adapting their production to climate change. Promoting indigenous, holistic approaches to preserve the cultural and spiritual integrity of mountain communities will be crucial for counteracting industrialized techniques that contribute to environmental degradation and loss of biodiversity. By elevating the indigenous Buddhist practices, knowledge, and values of the high-altitude mountains in Nepal, we can bring this perspective to the agroecology space and other global forums. In addition, this project will aim to contribute data and demonstration site findings to the Periodic Table of Food Initiative (PTFI), of which the Rockefeller Foundation is a leading partner.

This report analyses loss of native agricultural genetic resources and the undervaluation of agrobiodiversity in securing food, nutrition, health, business, and the environment. It explores the deep spiritual and cultural connections with the land and its biodiversity, rooted in traditions that blend indigenous and Buddhist beliefs. Traditional knowledge plays a critical role in addressing society's most pressing challenges, such as climate change, loss of biodiversity, and malnutrition, all of which are exacerbated by the impacts of climate change.

1.2 Deep regenerative agriculture

Deep Regenerative Agriculture is a holistic approach to farming that aims to restore ecosystems by improving soil health, enhancing biodiversity, and strengthening water management. It emphasizes the deep interconnection of ecological systems and seeks to make both living and non-living elements of the environment healthier. Grounded in five core principles and ten components (see figure below), this approach integrates traditional knowledge and cultural practices, honoring ancestral wisdom while promoting innovation. It also embraces a spiritual perspective, recognizing the sacred relationship between humans and nature. A key aspect is conservation through use—encouraging the sustainable use of diverse genetic resources to build resilience against climate change and pests. Deep regenerative agriculture promotes solutions through enhanced genetic diversity and supports nature-positive practices, such as using biodegradable storage and packaging materials like wood, clay, bark, leaves, fiber, and bamboo. Ultimately, it offers a pathway to heal ecosystems, empower communities, and regenerate the land for future generations.



Principles and components of Deep Regenerative Agriculture

1.3 Project Context

The primary goal of this project is to conserve indigenous crops, livestock, and valuable medicinal herbs within the agricultural landscapes of Nepal, specifically targeting the regions of Mustang. The project's focus is on the development, conservation, and promotion of local and indigenous crop varieties while gathering extensive data on traditional agricultural practices and their connections to culture, religion, and the local economy. The project focuses on supporting the use of the rich and unique intra-specific diversity of crops that are of global importance to mountain agricultural environments, in order to buffer against the increasing unpredictability in the amount and occurrence of rainfall, temperature extremes, and the frequency and severity of pest and pathogen occurrence in the mountains of Nepal.

The project targeted species are not only crucial for their adaptability to high-altitude conditions but also play a vital role in maintaining the agro-biodiversity and food security of mountain agricultural systems. The initiative aims to strengthen these traditional varieties to help buffer against the growing uncertainties of climate change, ensuring the sustainable development of agriculture in vulnerable regions. It has been designed through extensive consultations with Nepalese agricultural research scientists and extension experts specializing in conservation, plant breeding, food science, and community empowerment. This project aims to promote deep regenerative agriculture in Nepal's Mustang district as a model for the broader Eastern Himalayan region. It will document the chemical composition, cultural significance, and climate adaptation strategies for nine mandate crops, three livestock species, and three medicinal plants.

2 Objectives of baseline survey

This baseline report summarizes the traditional knowledge held by farmers and the socioeconomic contexts of the farming systems in the project area. The specific objectives of the study are as follows:

- To explore and document the agrobiodiversity status of Mustang district
- To understand and document the cultural, religious, and spiritual context of the farming communities at the project sites
- To document the traditional knowledge on agrobiodiversity management at project sites

- To establish a baseline and provide guidelines for planning future programs at the project sites considering climate change and other existing threats

3 Methodology

The baseline study for the REGAGRI project adopted a mixed-methods approach to ensure a comprehensive understanding of the context, challenges, and opportunities in the study sites. This approach combined quantitative household surveys with qualitative methods, including Focus Group Discussions (FGDs), Key Informant Interviews (KIIs), and secondary information from various organizations/institutions' reports and several academic papers published in journals.

3.1 District selection

Mustang and Manang of Gandaki province are the high-altitude mountain districts of Nepal. The vulnerability and risk assessment of the Government of Nepal (MoFE, 2021) has revealed that these the district is particularly vulnerable to climate change with comparatively lower adaptive capacity. Increasing temperatures in these regions could impact the agriculture dependent mountainous communities by disrupting the seasonal cycles of planting and harvesting, threatening food and nutrition security, thereby affecting livelihoods along with serious health implications. The districts are home to some remaining communities with rich indigenous knowledge, practices and beliefs passed down through generations by ethnic groups such as the Gurung, Thakali and Lopa, who predominantly practice Buddhism. People of Mustang are majorly dependent on animal husbandry for their livelihood while some are also engaged in agriculture and tourism.

3.2 District level inception workshop

The inception workshop was held on 22ndOct,2024 at the seminar hall of District Coordination committee. This program was chaired by Vice Chief District Officer (CDO) and Mrs. Maya Gururng (Chairperson of district coordination committee) was chief guest of this program. There were 26 participants including 20 males and 6 females **(ANNEX 1).** This program was concluded with a collective commitment to supporting these conservation initiatives.

Figure 1: District level inception workshop at Jomson Mustang

3.3 Study site selection

The study focused on Mustang district, regions characterized by high-altitude agro-ecological systems and unique socio-economic conditions. Within Mustang, two rural municipalities were purposively selected to represent the whole district ie. Upper and lower Mustang. The two rural municipalities, namely Varagung muktikshetra RM and Lo-ghekar Damodarkunda RM were selected. The reasons for selection of these two rural municipalities included the prevalence of farming activities based on traditional knowledge, vulnerability to climate impacts, and accessibility for data collection due to topographical structure.

3.4 Targeted agriculture genetic resources

The REGAGRI project targeted 9 agricultural crops (Table 1), 3 livestock species (Table 2) and 3 medicinal plant species (Table 3). The targeted agricultural crops are Barley, Naked Barley, Common Buckwheat, Tartary Buckwheat, Maize, Broadleaf Mustard, Potato, Wheat, and Common Bean. Similarly, Yak, Lulu cow and Mountain goat are 3 livestock species and Sea buckthorn, Wild Garlic and Himalayan Thyme are 3 medicinal plants. These agriculture genetic resources were selected based on reviews, district and community level consultation.

Table 1: Targeted crop species

S.N.	Crop name	Nepali name/local name	Scientific name
1.	Potato	Aalu	*Solanum tuberosum* L.
2.	Common buckwheat	Mithey Phapar	*Fagopyrum esculentum* Moench
3.	Tartary buckwheat	Titey phapar	*Fagopyrum tataricum* Gaertn
4.	Barley	Jaun	*Hordeum vulgare* L
5.	Naked barley	Uwa/karu	*Hordeum vulgare* L. var. nudum Hook. f.
6.	Common bean	Simi/kolo	*Phaseolus vulgaris* L.
7.	Wheat	Gahun	*Triticum aestivum* L.
8.	Broad leaf mustard	Raayo	*Brassica juncea* L.
9.	Maize	Makai	*Zea mays* L.

Table 2: Targeted livestock species

S.N.	Livestock name	Nepali name	Scientific name
1.	Yak	Yak	*Bos grunniens*
2.	Lulu cow	Lulu Gai	*Bos taurus*
3.	Mountain goat	Chyangra	*Capra hircus*

Table 3: Targeted medicinal crop species

S.N.	Medicinal plants	Nepali name/local name	Scientific name
1.	Seabuck thorn	Daale chuk/tora/chichi	*Hippophae rhamnoides*
2.	Wild garlic	Ban lasun	*Allium ursinum*
3.	Himalayan thyme	Jimbu	*Allium hypsistum*

3.5 Sampling design and sample Size

Due to time constraints and complex topographical structure of Mustang district, sample households were selected for gathering primary data. Collecting information from the sample is considered a more appropriate method to minimize the costs, and it also provides acceptable

results (Casley & Kumar, 1988). As per the population census 2021, there were 723 households in aragung muktikshetra and 451 households in Lo-ghekar damodarkunda rural municipality.A total of 100 samples were selected from the Mustang district for household level data collection. Sample households from each ward were selected using simple random methods. A total of 70 households were selected randomly for Varagung Muktichhetra and 30 households in Lo-Ghekar rural municipality for household level data collection. Two FGDs and five KIIs were conducted at the study sites. The combination of household level surveys with FGDs and KIIs increases the robustness of the findings, even if the sample size is moderate. Studies in rural and remote areas often rely on small sample sizes between 50 and 200 to represent district-level data due to logistical constraints (ICIMOD, 2020). For example, a study on rural livelihoods in Nepal (Shrestha et al., 2018) used a sample of 120 households across multiple districts, arguing that the small populations and relative homogeneity of practices justifies the sample size.

3.6 Method of data collection

3.6.1 Questionnaire preparation

The two days writeshop was conducted at Nagarkot, Bhaktapur to prepare the questionnaire for household survey, KII and FDG. Experts from various fields such as agri-economists, livestock specialist, climate and environmental specialist, traditional medicinal expert and breeders, actively participated in the writeshop. The semi-structured questions which constitute both open and close ended were prepared.The questionnaire was finalized validating with the subject matter specialists in the workshop. The questionnaire was prepared in both English and Nepali language **(ANNEX 2).**

Figure 2: Writeshop on methodologies and baseline questionnaire on deep regenerative agriculture

3.6.2 Pre-testing of questionnaire

The pretesting of the draft questionnaire was done to test the validity of the questionnaire, estimation of cost, travel and interview time. The questionnaire was pretested in chame rural municipality of Manang district with ten Respondents. After pretesting, the necessary modifications were made, and the questionnaire was finalized.

3.6.3 Field survey

The field level survey was carried out in the period from 20-30th Oct 2024. The pretested semi-structured questionnaire was used to collect quantitative data on demographics, agricultural practices, sources of income, resource use and knowledge and perceptions of regenerative agriculture focusing mainly on 15 targeted crops, medicinal and livestock (CML).

3.6.3.1 Enumerator orientation

On October 22, 2024, seven enumerators were selected to assist with data collection for the project. The NAGRC and WWF team provided a comprehensive orientation session by briefing on questionnaire content, sampling, and data collection process to the enumerators. During the orientation, several minor language errors and wording were corrected. The list of enumerators is given in **ANNEX 3.**


Figure 3: Project team and enumerators interaction meeting at Jomsom, Mustang

3.6.3.2 Household level data collection

The household level survey was conducted in Nepali and local languages, with trained enumerators ensuring clarity on the questionnaire. The pretested semi-structured questionnaire was administered to 100 randomly selected households using the face-to-face interview method. Thus, 70 households were interviewed in Varagung Muktichhetra rural municipality and 30 households were interviewed in Lo-Ghekar Damodarkunda rural municipality which totals 100 sampled households **(ANNEX 4)**. We conducted the baseline survey in October 2024 to collect detailed information regarding demographic status, agrobiodiversity status, crop production and seed source of targeted species, soil management practices, crop sufficiency and selling trend of crops.



Figure 4 : Household survey at Mustang

3.6.3.3 Focus group discussions

In general, it is believed that more and reliable information can be collected from the interactions between the participants (Finch & Lewis, 2003). A separate checklist was finalized with the expert team for easing FGD. The total of two FGDs were conducted, one in Varagung Muktikshtra Rural Municipality with 7 female participants and another in Lo-Ghekar Rural Municipality (Charang) with 4 Female participants. FGD provided qualitative insights into local agricultural practices, status production constraints, consumption methods, seed and soil management practices, climate adaptation strategies, and challenges faced by farmers in transitioning to regenerative agriculture. A separate checklist was finalized with the expert team for easing FGD.

Figure 5:Focus group discussions with female farmers at Mustang

3.6.3.4 Key Informant Interviews

In total, five KIIs were conducted in the project sites with key stakeholders such as local agricultural extension officers, rural municipality representatives, and lead farmers. The KII was conducted to understand institutional support mechanisms, policy challenges, and opportunities for scaling regenerative agriculture. A separate checklist was prepared to carry out interviews with key informants. The details of KIIs are presented in **Table 4**.

Table 4: Details of Key Informant Interviews

S.N.	Name	Age/Gender	Organization/designation
1	Kunga Tenzing Gurung	41, Male	Local leader
2	Nima Lokte	55, Male	Aamchi
3	Maya Bista	48, Female	Mukhiya
4	Jhayang Chhes Gurung	55, Male	Ward chairman
5	Dilip Nepali	32, Male	Krishi Gyan Kendra

Figure 6 : Key Informat Interviews with Amchi (Left) and Mukhiya (Right)

3.7 Secondary data collection

A systematic review of secondary data was undertaken to complement and triangulate the primary findings. The sources included:

1. Government publications, such as rural municipalities profiles, annual progress reports, Krishi Gyan Kendra handbook, Forest Division Office annual progress and specific crop wise reports
2. Research studies on high-altitude farming systems in Nepal (e.g., ICIMOD)
3. Project documents from WWF and several publications from NARC

3.8 Data entry and cleaning

The primary household level data were collected from the project sites, systematically coded, and key variables for analysis were prepared in Microsoft Excel, and data were entered. Data entry was completed by the first week of December 2024 at the NAGRC office. To ensure high data quality, the dataset underwent a thorough cleaning process, which involved detecting and rectifying errors and inconsistencies. The necessary data cleaning was carried out by Sumitra Tamang, Bishal KC and Bhupal Singh Oli with the guidance of the project leader. The cleaned data was converted to standard units before analysis through cross-site sharing and experiences of the team members. Any missing data were carefully checked and filled in by making phone calls to the respective household.

3.9 Data analysis

3.9.1 Quantitative data

Quantitative data obtained from household surveys were analyzed by Mahesh Sapkota using Microsoft excel and Statistical Packages for Social Sciences (SPSS) software. The analysis included:

Descriptive statistics (mean, standard deviation, frequency, percentage) to summarize key variables.

Inferential statistics, such as independent sample t-test and chi-square tests, identify relationships between key variables.

3.9.2 Qualitative data

Qualitative data obtained from household surveys, FGDs and KIIs were transcribed and analyzed thematically to identify patterns, trends and insights relevant to the objectives and findings were summarized analytically.

3.9.3 Triangulation

Triangulation was performed by comparing insights from quantitative, qualitative, and secondary data sources. This approach strengthened the validity and reliability of findings (Patton, 2002).

3.10 Ethical considerations

Ethical approval was obtained from the respective local authorities of rural municipalities and Chief District Officer (CDO). Informed consent was obtained from all participants after providing them

with a clear briefing about the study's purpose, the confidentiality of their responses, and their right to withdraw from the study at any time.

4 Site characteristics

4.1 Overview of Mustang District

Mustang is one of two districts where the project is being implemented. It is located in the Gandaki province and covers an area of 3,573 square kilometers. Its district headquarters is Jomsom. Geographically, Mustang lies between 28°45' to 29°20' North latitude and 83°30' to 84°15' East longitude. The elevation ranges from 1,372 meters at the Kaligandaki River to 8,167 meters at Dhaulagiri.

The district comprises 5 rural municipalities, with a population of 14,452 Population (2021) where 7,934 (55%) are male and 6,518 (45%) are female. According to Nepal Human Development Report 2014, the Human Development Index (HDI) and Human Poverty Index (HPI) values of Mustang are 0.508 and 31.2 respectively (NHDR, 2014). Mustang is renowned for its unique trans-Himalayan geography, cultural richness, history, biodiversity and religious value. However, the district is highly vulnerable to climate change, experiencing temperature rise, heavy rainfall causing floods, glacial retreat, and desertification challenges, which pose risks to its ecosystem and livelihoods.

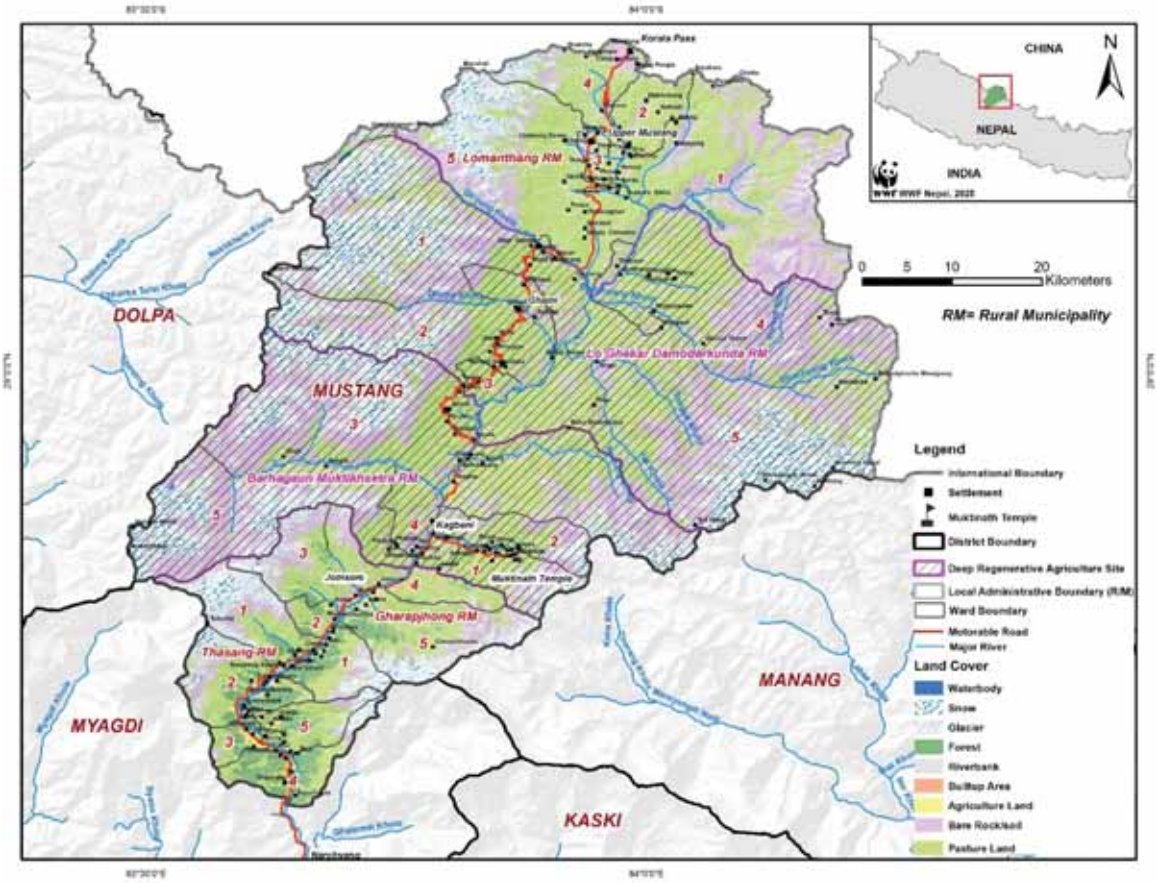


Figure 7 : Map of Mustang

4.2 Overview of Lo-Ghekar Damodarkunda Rural Municipality

Lo-Ghekar Damodar Kunda Rural Municipality lies in the northernmost part of Mustang District, spanning approximately 1,344 square kilometers at an altitude of 3,009 to 6,719 meters above sea level. It is sparsely populated, with 1,292 residents (609 males and 683 females) living in 451 households (Census, 2021). The literacy rate is 45.6%, and the population is predominantly in Gurung (95.98%), with smaller representations of Kami, Rai, Thakuri, and Magar communities. Agriculture and livestock, practiced by 44.03% of the population, are the primary livelihoods, with only 1% of the area being cultivable. Rugged terrain, alpine meadows, and sparse forests cover 85% of the region, while 15% is used for settlements and high-altitude farming.

Significant cultural and religious sites include Damodar Kunda, a sacred pilgrimage destination at 4,800 meters, and Buddhist monasteries like Lo Gekar Monastery (Ghar Gompa) and Luri Gompa, renowned for ancient cave paintings. The area experiences a cool, semi-arid trans-Himalayan climate, with temperatures ranging from -25°C in winter to 33°C in summer. Annual precipitation is 250–400 mm, as the region lies in the rain shadow of the Annapurna and Dhaulagiri ranges.

Traditional agriculture focuses on cereals such as naked barley, buckwheat, and wheat, alongside legumes and vegetables like potatoes, carrots, and radishes. Livestock, including sheep (Bhyanglung breed), mountain goats (Chyangra), yaks, and cows (Lulu breed), are raised using a transhumance system. Ariculture of this area relies on seasonal rainfall supplemented by traditional irrigation systems called kulo, which divert water from streams and rivers such as Charang Khola and Kaligandaki Khola.

4.3 Overview of Varagung Muktichhetra Rural Municipality

Varagung Muktichhetra Rural Municipality, situated in the central part of Mustang District, spans 889.78 sq. km in the high Himalayas (28°45′–29°05′ N, 83°28′–84°07′ E) with altitudes ranging from 2,850 to 5,310 meters. Comprising five wards, it has a population of 2,036 across 723 households, with nearly equal numbers of males (49.85%) and females (49.70%). Predominantly inhabited by Gurungs, the population also includes Magars, Bishwokarmas, Dolpos, and other ethnic groups. The literacy rate is 60.2%, with 69.9% male and 50.5% female literacy (Census, 2021).

Key religious and tourist sites include Muktinath Temple, Kagbeni, Chusang, Jhong, and Thorongla Bhanjyang. The lower region experiences more rainfall than the upper region, where precipitation is minimal. Summers reach up to 26°C, while winters drop to -9°C. Coniferous vegetation thrives near the Himalayas, while the upper areas feature thorny plants. Livelihoods centers on agriculture, livestock farming, tourism, trade, labor, and remittances. Major crops include barley, buckwheat, wheat, peas, beans, and potatoes, alongside vegetables like mustard, carrots, radishes, and cucumbers. Livestock includes sheep, goats, cows, yaks, and jhopas, sustained by a transhumance system.Findings

4.4 Socioeconomic and sociodemographic characteristics

4.4.1 Demographics and household composition

The overall average age of the respondents was found to be 50.42 years, with statistically non-significant difference between Lo-Ghekar (49.27 years) and Varagung (50.91 years) rural municipalities ($p = 0.538$). Similarly, the overall average age of the household head was found to be

55.67 years and the mean difference within the two rural municipalities was found statistically non-significant (p=0.119). The overall average household size was found to be 6.25 members, with negligible variation between the two rural municipalities (p=0.849). On average, household comprised 3.07 male members and 3.18 female members, with statistically no significant differences between the two rural municipalities.

4.4.2 Active and dependent members

During primary data collection, the sampled households were categorized into three different age groups: 0-15, 15-60 and above 60 years. This categorization was made based on the category done in population census by the Government of Nepal (GON). The age group 15-60 years is referred to as economically active members and the rest of the age group members referred as dependent members. The dependency ratio was calculated as the ratio of the total number of dependent members to the total number of active members in the household (CBS, 2014).

The overall dependency ratio was found to be 0.53, whereas a statistically significant difference was observed between two rural municipalities (Lo-Ghekar = 0.33, Varagung = 0.62; p = 0.011) at 5 percent level of significance, indicating a higher dependency in Varagung rural municipalities. This showed that 100 economically active members had to fulfill the basic necessities of 53 dependent members in study sites. Similarly, 100 economically active members had to fulfill the basic necessities of 33 dependent members in Lo-Ghekar and 62 members in Varagung rural municipalities. The overall average economically active member was found to be 4.39, with statistically no significant variation between rural municipalities. The overall average dependent member in household was found to be 1.86, with higher in Varagung (2.03) compared to Lo-Ghekar (1.47), approaching statistical significance (p = 0.074) at 10 percent level.

4.4.3 Landholding patterns

The per household overall average landholding was found to be 1.14 hectares, with Lo-Ghekar households owning slightly more land (1.37 ha) than those in Varagung (1.05 ha), though the difference was not statistically significant (p = 0.118). Among the total landholding, the cultivated land was found to be 0.88 hectares with statistically no significant variation between the two rural municipalities (p = 0.612). The non-cultivated land was found higher in Lo-Ghekar (0.44 ha) compared to Varagung (0.25 ha), and the difference was found statistically significant at 10 percent level of significance (p = 0.084).

4.4.4 Involvement in agriculture and migrated members

On an average, 1.37 household members were found to be involved in agricultural activities, with statistically no significant variation between rural municipalities (p = 0.714). The overall per household average number of migrated members was found to be 0.09, with statistically no significant differences between Lo-Ghekar and Varagung (p = 0.584). The socioeconomic and sociodemographic characteristics of categorical variables of sampled household is described below:

Table 5: Socioeconomic and sociodemographic characteristics of sampled households of Mustang district (Continuous variable)

Variables	Overall (n=100)	Rural municipality		Mean difference	t-value	p-value	Min.	Max.
		Lo-Ghekar (n=30)	Varagung (n=70)					
Age of respondent (year)	50.42 (12.17)	49.27 (11.0)	50.91 (12.69)	-1.65	-0.618	0.538	25.0	83.0
Age of household head (year)	55.67 (12.16)	53.27 (8.36)	56.71 (13.39)	-3.48	-1.316	0.119	30.0	83.0
Household size	6.25 (2.85)	6.33 (2.51)	6.21 (3.0)	0.12	0.191	0.849	1.0	19.0
Male member	3.07 (1.73)	3.17 (1.82)	3.03 (1.70)	0.14	0.364	0.717	0.0	8.0
Female member	3.18 (1.80)	3.17 (1.44)	3.19 (1.94)	-0.02	-0.048	0.962	0.0	12.0
Dependency ratio (n=96)	0.53 (0.52)	0.33 (0.33)	0.62 (0.57)	-0.29	-2.593**	0.011	0.0	3.0
Active member	4.39 (2.34)	4.87 (1.81)	4.19 (2.52)	0.68	1.337	0.184	0.0	13.0
Active male	2.22 (1.44)	2.50 (1.50)	2.10 (1.41)	0.40	1.277	0.204	0.0	7.0
Active female	2.17 (1.45)	2.37 (1.19)	2.09 (1.55)	0.28	0.887	0.377	0.0	8.0
Dependent member	1.86 (1.41)	1.47 (1.43)	2.03 (1.37)	-0.56	-1.821*	0.074	0.0	6.0
Dependent male	0.85 (0.83)	0.67 (0.66)	0.93 (0.89)	-0.26	-1.448	0.151	0.0	4.0
Dependent female	1.01 (0.92)	0.80 (0.96)	1.10 (0.89)	-0.30	-1.511	0.134	0.0	4.0
Total land (ha)	1.14 (0.93)	1.37 (1.15)	1.05 (0.82)	0.32	1.576	0.118	0.01	5.25
Cultivated land (ha)	0.88 (0.62)	0.93 (0.59)	0.86 (0.64)	0.07	0.508	0.612	0.01	3.00
Non-cultivated land (ha)	0.27 (0.66)	0.44 (0.89)	1.90 (0.53)	0.25	1.746*	0.084	0.00	4.25
Member involved in agriculture	3.15 (1.67)	2.97 (1.33)	3.23 (1.80)	-0.26	-0.716	0.476	0.00	9.00
Migrated members	0.11 (0.60)	0.17 (0.75)	0.09 (0.53)	0.08	0.615	0.540	0.00	4.00

Notes: Figures in parentheses indicate standard deviation. p-values are the result of independent sample t-test. **, * indicate significant at 5 and 10 percent level of significance respectively.

4.4.5 Gender of respondent and household head

The majority of the respondents were male (67%), with a nearly equal distribution in Lo-Ghekar (66.7%) and Varagung (67.1%). The difference was found to be statistically significant at 1 percent level of significance (p = 0.002). Most of the households were found to be headed by males (78%),

with statistically no significant difference between Lo-Ghekar (73.3%) and Varagung (80.0%) (p = 0.461).

4.4.6 Ethnicity

The vast majority of the households belonged to the Janajati ethnic group (95%), consistent across both rural municipalities. A small proportion were Dalit (4%) and Chhetri (1%) and the mean difference between the two rural municipalities was found statistically non-significant (p = 0.302).

4.4.7 Family type

The overall household family type was found nearly evenly split between joint families (51%) and nuclear families (49%). Varagung reported a higher proportion of joint families (54.3%) compared to Lo-Ghekar (43.3%), but this difference was not statistically significant (p = 0.315).

4.4.8 Occupation

The primary occupation of respondents was agriculture (95%) in both rural municipalities, with negligible variation. Other occupations, such as business (3%), service (1%), and another sector (1%), were rare (p = 0.425). Similarly, the primary occupation of household-head was agriculture (92%), with statistically no significant variation between the two rural municipalities. A small percentage were involved in business (4%), remittance (1%), and other sectors (3%) at (p = 0.747).

4.4.9 Decision maker in agricultural related farming activities

The decision-making in agriculture related farming activities was predominantly male led (52%), followed by joint decision-making by both genders (28%). Female-led decision-making was relatively low (20%). No significant differences were observed between the rural municipalities (p

Table 6: Socioeconomic and sociodemographic characteristics of 100 sampled households of Mustang district (Categorical variable)

Variables	Overall (n=100)	Municipality		χ^2-value	p-value
		Lo-Ghekar (n=30)	Varagung (n=70)		
Gender of respondent					
Male	67 (67.0)	20 (66.7)	47 (67.1)	0.963***	0.002
Female	33 (33.0)	10 (33.3)	23 (32.9)		
Gender of household head					
Male	78 (78.0)	22 (73.3)	56 (80.0)	0.544	0.461
Female	22 (22.0)	8 (26.7)	14 (20.0)		
Ethnicity					
Chhetri	1 (53.0)	1 (3.3)	0 (0.0)	2.393	0.302
Janajati	95 (95.0)	28 (93.3)	67 (95.7)		
Dalit	4 (4.0)	1 (3.3)	3 (4.3)		
Family type					
Joint	51 (51.0)	13 (43.3)	38 (54.3)	1.008	0.315
Nuclear	49 (49.0)	16 (56.7)	32 (45.7)		
Occupation of respondent					
Agriculture	95 (95.0)	28 (93.3)	67 (95.7)	2.790	0.425
Business	3 (3.0)	1 (3.3)	2 (2.9)		
Service	1 (1.0)	1 (3.3)	0 (0.0)		
Other	1 (1.0)	0 (0.0)	1 (1.4)		

Occupation of household head					
Agriculture	92 (92.0)	27 (90.0)	65 (92.9)	1.225	0.747
Business	4 (4.0)	2 (6.7)	2 (2.9)		
Remittance	1 (1.0)	0 (0.0)	1 (1.4)		
Other	3 (3.0)	1 (3.3)	2 (2.9)		
Decision maker in agriculture farming					
Male	52 (52.0)	14 (46.7)	38 (54.3)	0.670	0.715
Female	20 (20.0)	6 (20.0)	14 (20.0)		
Both	28 (28.0)	10 (33.3)	18 (25.7)		

Notes: Figures in parentheses represent percentages. p-values are derived from the Pearson Chi-square test. *** denotes significance at the 1% level of significance.

4.4.10 Primary Source of Income

Households in Mustang mainly dependent on agriculture and business for their income source. In Lo-Ghekar, 97% of the households primarily rely on agriculture, while 3% depended on business for their income source.In Varagung, agriculture serves as the main source of income for 96% of households. The remaining 4 % of the total respondents were dependent on business for their income source.

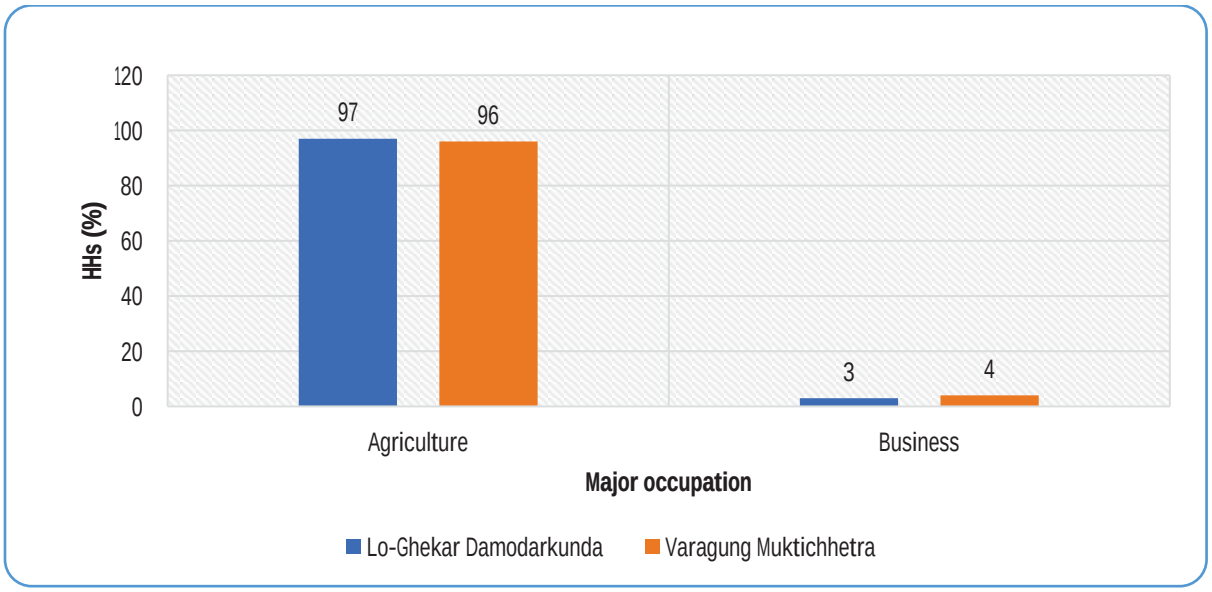


Figure 8:Primary Source of Income

4.5 Agro-transpastoral system in Mustang

Apple, naked barley, buckwheat, potato and vegetables are the important crops in Mustang district. The impact of climate change, including reduced snowfall, earlier apple ripening, and an increase in pests and diseases affecting apples, buckwheat, and other crops. Their pest management relies on traditional methods, such as application of ash, cow urine, and homemade sprays, though they expressed interest in adopting biopesticides with proper training. Changes in climate have also enabled the cultivation of new vegetable crops, like green peas in apple orchards, which improve soil fertility. There is a variation in the crop calendar between lower and upper Mustang. In upper Mustang, only one crop is cultivated per year, while in lower Mustang, two crops can be grown annually. The detailed crop calendar for both regions is presented in **Table 7** and **Table 8.**

Table 7: Crop calendar in Lower Mustang

S.N.	Name of crop	Time for sowing	Time for manuring	Time for harvesting
1	Naked barley	Kartik 15 - Mangsir 15	Asoj	Jestha - Asad
2	Wheat	Mangsir	Kartik	Jestha - Asad
3	Buckwheat	Asad	Jestha	Asoj - Kartik
4	Potato-early variety	Falgun	Magh	Asad last week
5	Potato	Falgun 15 - Chaitra 15	Magh	Bhadra - Asoj
6	Vegetable crops	Chaitra - Baisakh	Falgun - Chaitra	Jestha - Kartik

Table 8: Crop calendar in Upper Mustang

S.N.	Name of crop	Time for sowing	Time for manuring	Time for harvesting
1	Naked barley	Falgun 15 - Falgun 30	Magh	Shrawan 15 - Bhadra 15
2	Wheat	Chaitra 1 - Chaitra 15	Falgun	Shrawan 15 - Bhadra 15
3	Buckwheat	Asad	Jestha	Asoj
4	Potato	Chaitra	Falgun	Asoj
5	Vegetable crops	Chaitra - Baisakh	Falgun - Chaitra	Jestha - Kartik

Source: Agriculture Knowledge Center, Jomsom, Mustang

Livestock, including lulu cow, yak, and mountain goat, play a vital role in their agriculture, providing manure and sustenance, although labor shortages and high costs pose significant challenges. The transhumance system is adopted for yaks and mountain goats. They are shifted from lower to higher altitudes during the warm season and returned to lower belts as winter approaches.

Figure 9: Diversified agricultural field at Lower Mustang (Kagbeni (Left) and Tiri (Right)

4.6 Food sufficiency status

Naked barley, buckwheat and wheat are the major cereals, common bean (black, tateypaatey) is the major legume, and potato is the major vegetable grown in both municipalities of Mustang. Leafy and other vegetables are sufficient only for an average of 4 months for consumption as they are grown seasonally in Mustang. Similarly, common beans and peas are used as pulses. Detailed data on food sufficiency status is presented in **Figure 10**.

In terms of crop sufficiency, 60% of respondents in Lo-Ghekar reported having sufficient crops for 3-6 months, while only 27% in Varagung reported the same. Additionally, 57% of respondents in Varagung reported year-round crop sufficiency compared to only 17% in Lo-Ghekar, highlighting better crop sufficiency in Varagung. A smaller proportion of respondents in both regions have crop

sufficiency for less than 3 months (13% in Lo-Ghekar and 3% in Varagung) and for 6-9 months (10% in Lo-Ghekar and 13% in Varagung).

Lulu cow milk serves as an essential part of the local diet, while jhopa meat and chyangra meat, with an average consumption of two goats per year, provide significant protein intake. Yak meat is also consumed, with some farmers utilizing a whole khur (1/4th part of whole body) per year and others consuming half depending on the season.

Regarding livestock sufficiency, 53% of respondents in Lo-Ghekar have sufficient livestock resources for 3-6 months, compared to 33% in Varagung. Conversely, a significant proportion (30%) of respondents in Varagung reported sufficiency for less than 3 months, while only 20% in Lo-Ghekar reported the same. Regarding year-round sufficiency, Varagung (26%) slightly surpasses Lo-Ghekar (24%). Livestock sufficiency for 6-9 months is relatively low in both regions, with 11% in Lo-Ghekar and 3% in Varagung. Overall, Varagung shows greater crop sufficiency, while Lo-Ghekar exhibits better livestock sufficiency for intermediate periods.

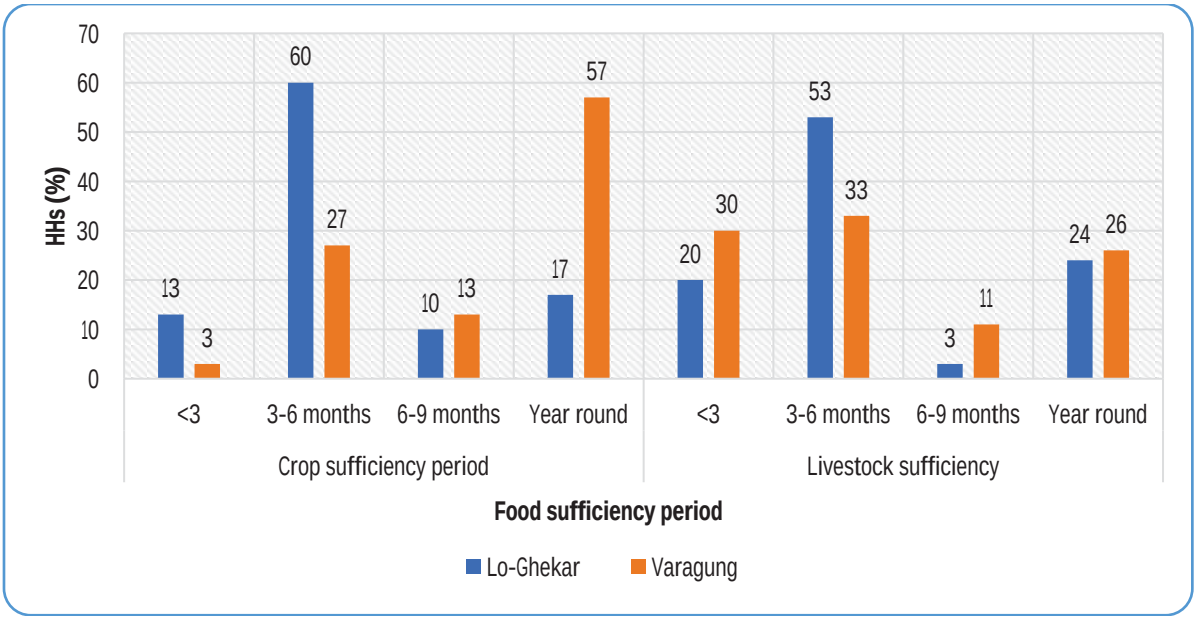


Figure 10: Food and Livestock Sufficiency in Lo-Ghekar and Varagung, Mustang

4.7 Targeted crop diversity and production system

In Lo-Ghekar, all 30 households cultivated naked barley. Among them, 28 households also grew common beans, 23 cultivated common buckwheat and potatoes, 15 cultivated tartary buckwheat, 7 grew rapeseed, broadleaf mustard, and wheat, while only 3 households grew barley. In Varagung, out of 70 households, 66 cultivated naked barley, 61 grew common buckwheat, 60 cultivated potatoes, and 56 grew common beans. Additionally, 44 households cultivated broadleaf mustard, 30 cultivated barley, 18 grew tartary buckwheat, and 6 grew wheat, but no households cultivated rapeseed (**Figure 11**).

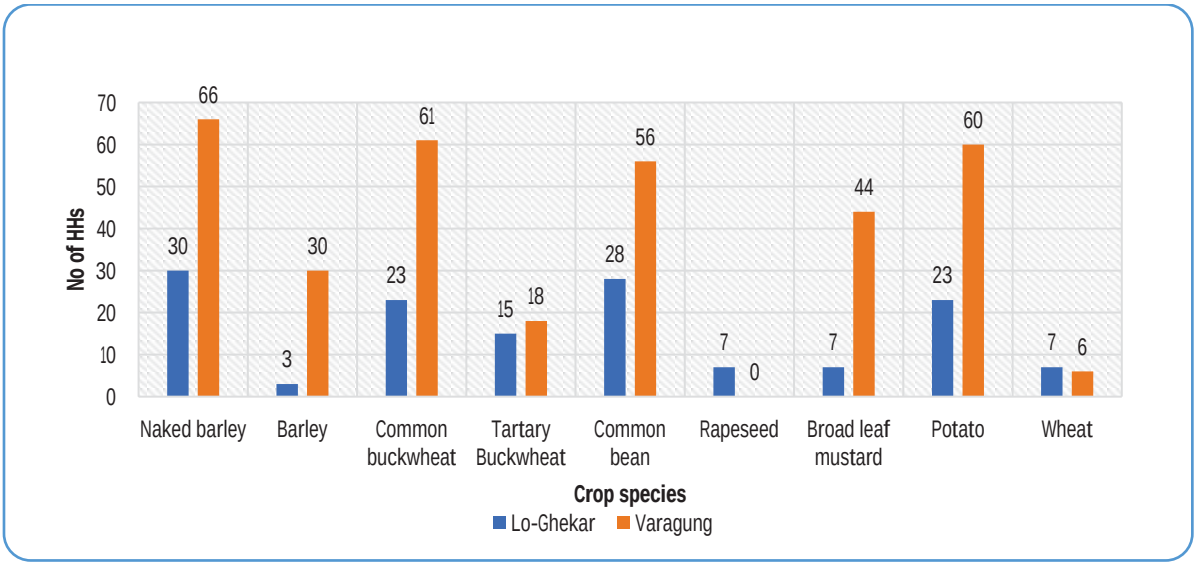


Figure 11: Targeted crop diversity in Lo-Ghekar and Varagung, Mustang

4.7.1 Naked barley (*Hordeum vulgure* var. nudum)

Naked barley, karu, uwa or nye in the local language, holds significant importance as a versatile crop, particularly in high-altitude regions and marginal lands where other grains struggle to grow. It serves as a staple food for human consumption and a vital feed for livestock. At present its cultivation is decreasing as most farmland is left fallow in the winter due to labour shortage. Out of the total households surveyed, 96 were growing naked barley. The farmer estimated the year's yield to be 25 pathi (75kg/ropani). The flour prepared with a mixture of roasted naked barley, soyabean and maize is called saatu and is considered to be a very nutritious and energetic food by the local community by having it with tea, milk and hot water. The flour of naked barley is also used to make roti as a snack and dhido. It is also used in fermentation to make traditional alcoholic beverages called jaand (chyang) and raksi. FGD and household surveys also revealed that naked barley has a religious value in their culture as it is used in puja ceremony. Its ability to thrive under harsh climatic conditions and its low input requirements make it an ideal crop for ensuring food security in vulnerable agricultural systems.

The majority of farmers in Lo-Ghekar (97%) and Varagung (93%) traditionally cultivated naked barley for more than 60 years. However, remaining farmers in these regions had grown naked barley for less than 60 years. Both regions show a consistent decline in cultivation status. In terms of cultivation area, nearly half of the farmers in both Lo-Ghekar (47%) and Varagung (53%) grew naked barley on less than 5 ropani of land. Around one-third of farmers in each region cultivated naked barley on between 5 to 10 ropani of land. Only 20% of households in Lo-Ghekar and 11% in Varagung grew naked barley on more than 10 ropani. Most farmers achieved yields above 500 kg (87%) in Lo-Ghekar and 67% in Varagung. However, only a small percentage managed to produce more than 1000 kg (6%) in Lo-Ghekar and just 3% in Varagung.

A local variety of naked barley was reported during the survey. It grows to a height of approximately 120 cm and features a small stem. Initially, the stalk is green, but as it ripens, it transitions to a yellow color. This variety is known for its high nutritional value and religious value.

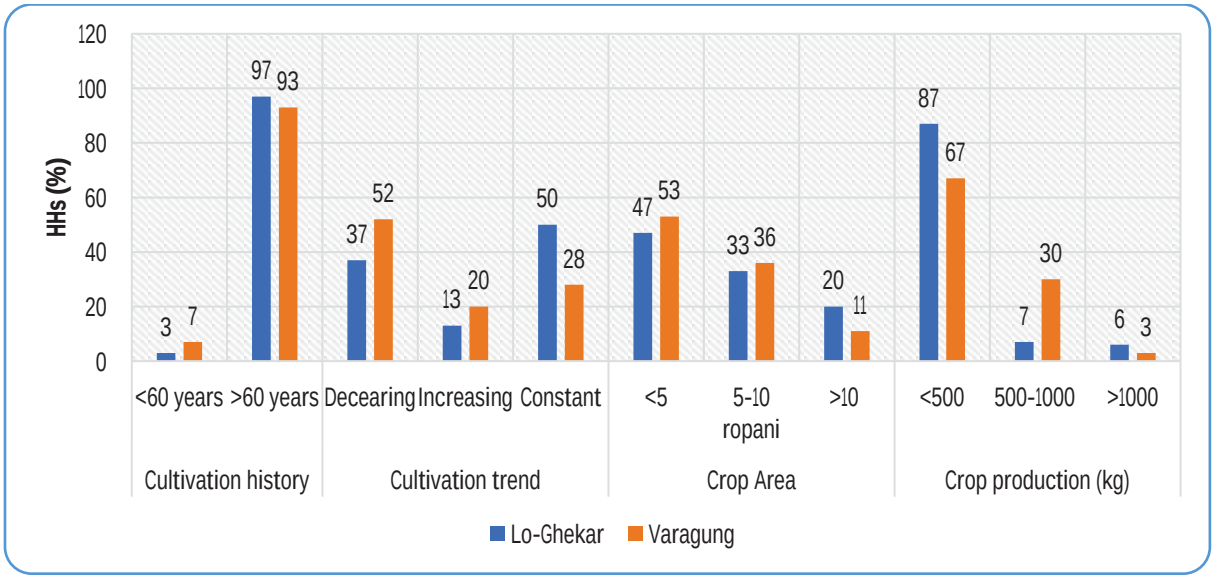


Figure 12: Status of naked barley in Lo-Ghekar and Varagung, Mustang

4.7.2 Common buckwheat (*Fagopyrum esculentum*)

Common buckwheat, phapar/gheprey in a local language, has been cultivated as traditional, winter-season crop. During cultivation, tender buckwheat greens are used as nutritious vegetables. It is used to prepare foods such as saatu, roti, dhido from its flour, traditional fermented alcoholic beverages such as jaand/chyang, raksi (liquor). It is often consumed as saatu. After harvesting, the crop and straw can be used as fodder for cattle, sheep, and goats, as well as for making mats (sukul). Additionally, its husk can be utilized as compost fertilizer, further supporting its role in animal feed and sustainable farming practices. Buckwheat flowers are typically white or pinkish with soft, rounded stalks. The seeds are triangular in shape and come in shades of brown and black. The plant can grow up to 110 cm in height.

In terms of cultivation history, 74% of households in Lo-Ghekar reported cultivating for over 60 years, while only 16% had less than 60 years of experience. In Varagung, a higher percentage (90%) of households reported cultivation for more than 60 years, regarding cultivation trends, a decreasing trend was observed among 70% of households in Lo-Ghekar and 46% in Varagung. Conversely, 21% of households in Lo-Ghekar and 33% in Varagung noted a constant cultivation trend, while an increasing trend was reported by 9% and 21% of households, respectively.For crop area, both regions had 43% of households cultivating between 5-10 ropani. However, 43% of Lo-Ghekar households cultivated less than 5 ropani, compared to 34% in Varagung. Larger areas (>10 ropani) were reported by 14% of households in Lo-Ghekar and 23% in Varagung. Crop production also showed variation with 97% of Lo-Ghekar households producing less than 500 kg, compared to 92% in Varagung. Production between 500-1000 kg was slightly higher in Varagung (7%) than in Lo-Ghekar (3%), and only 2% of households in Varagung reported production exceeding 1000 kg, whereas none did in Lo-Ghekar.

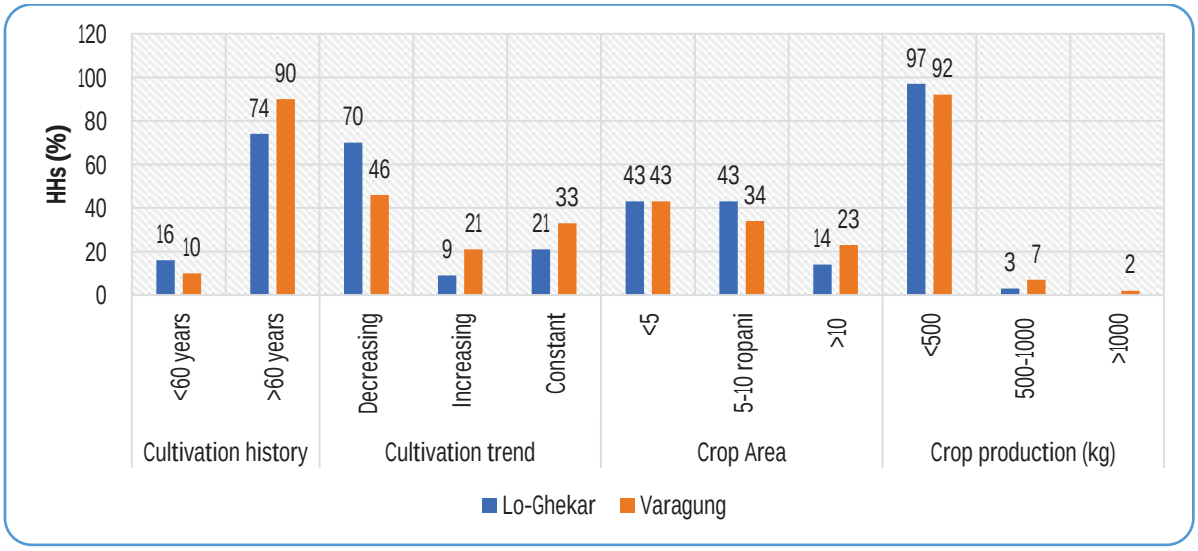


Figure 13: Status of common buckwheat in Lo-Ghekar and Varagung, Mustang

Buckwheat is valued for its unique characteristics, including its highly nutritious, protein-rich, and gluten-free flour, which is both healthy and delicious. Additionally, buckwheat is widely recognized for its significant medicinal properties. Pure buckwheat flour is used to worship deities and drive away ghosts or spirits. People use buckwheat flour to prepare bread for rituals and worship. The use of buckwheat paste can relieve swelling, boils and injuries. During rituals, a thin buckwheat jand (fermented drink) is used. Particularly, during Chaitra Purnima, buckwheat is specially used. Drinking warm water mixed with buckwheat flour helps soothe stomach pain.

Figure 14: Female farmers during harvesting of buckwheat at Upper Mustang

4.7.3 Common bean (*Phaseolus vulgaris*)

Common bean, known as kolo locally, has an important nutritional function in high mountain cold environments. Beans are consumed both as a green vegetable and in its dry form. In the high mountains, consumption of dry beans as simi ko daal (soup made from beans consumed with rice) is common and provides an important source of protein, fibre and energy to the high mountain diet. Simi ko daal remains a recipe for special occasions, however, its popularity is increasing for its taste.

In Lo-Ghekar, 89% of farmers have been cultivating common beans for less than 60 years, while 11% have been doing so for more than 60 years. The current status indicates that cultivation is decreasing for 57% of farmers, constant for 36%, and increasing for only 7%. Regarding crop area,

43% of farmers cultivate beans on less than 5 ropani of land, 39% on 5-10 ropani, and 18% on more than 10 ropani. In terms of production, 93% of farmers produce less than 500 kg of beans, and 7% produce between 500-1,000 kg. In Varagung, 96% of farmers have been cultivating common beans for more than 60 years, while only 4% have less than 60 years of experience. The current status shows a decrease in cultivation for 50% of farmers, constant levels for 27%, and an increase for 23%. Most farmers (54%) cultivate beans on less than 5 ropani of land, 34% on 5-10 ropani, and 12% on more than 10 ropani. In terms of production, 96% of farmers produce less than 500 kg of beans, and 4% produce between 500-1,000 kg.

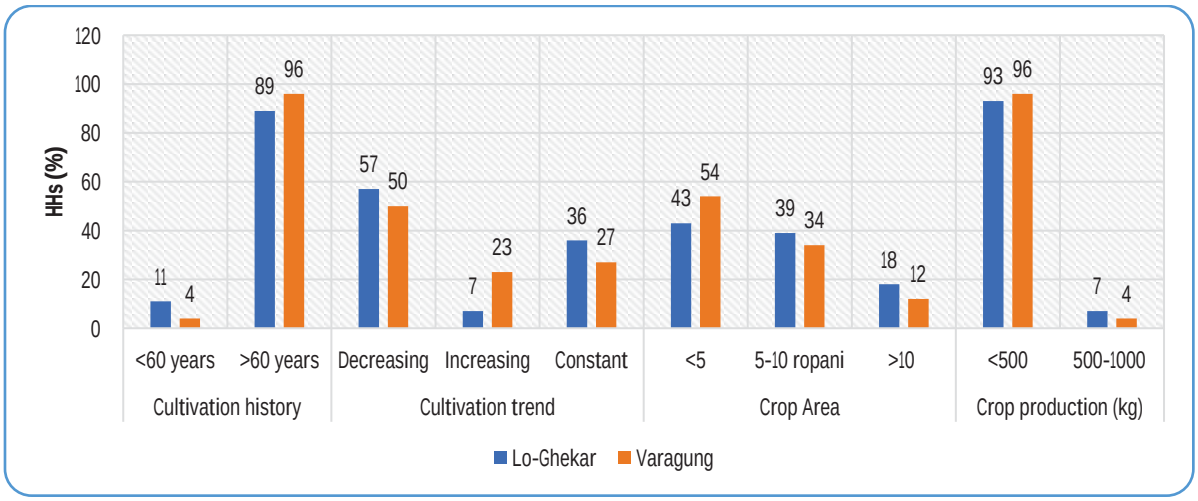


Figure 15: Status of common bean in Lo-Ghekar and Varagung, Mustang

4.7.4 Tartary Buckwheat

Tartary buckwheat, titey phapar in local language, is an important winter crop in the high-altitude regions of Mustang, where it has been cultivated for centuries due to its adaptability to the harsh climatic conditions of the Himalayan region. It is highly resilient to frost, drought, and low-fertility soils, making it well-suited for the challenging conditions in mountainous areas. The plant grows to a height of 60–120 cm, with small (compared to other varieties), triangular seeds that range in color from brown to black. Its flower is typically white. Tartary buckwheat is highly nutritious, making it a valuable food for the local population. It is commonly used to make traditional dishes such as sattu (flour), dhido, roti and even fermented foods like jaand/chyang and also raksi. (Shrestha et al., 2018). Some respondents mentioned that it was mostly preferred by diabetic patients.

The majority of farmers in Lo-Ghekar (93%) and Varagung (83%) had been growing tartary buckwheat for over 60 years. Both regions had experienced a decline in tartary buckwheat cultivation, with 67% of farmers in Lo-Ghekar and 39% in Varagung reporting a decreasing trend. However, 33% of households in Lo-Ghekar and 39% in Varagung maintained steady or constant cultivation practices. In terms of land area, all farmers in Varagung (100%) and a significant number of farmers in Lo-Ghekar (60%) had grown tartary buckwheat on less than 5 ropani. In Lo-Ghekar, 20% of farmers had cultivated it on 5 to 10 ropani, while another 20% had grown it on more than 10 ropani. Regarding yield, all farmers in Varagung had produced less than 500 kg of tartary buckwheat, and 87% of farmers in Lo-Ghekar had the same yield. None of the farmers in either region produced more than 1000 kg. However, 13% of farmers in Lo-Ghekar managed to yield between 500 and 1000 kg.

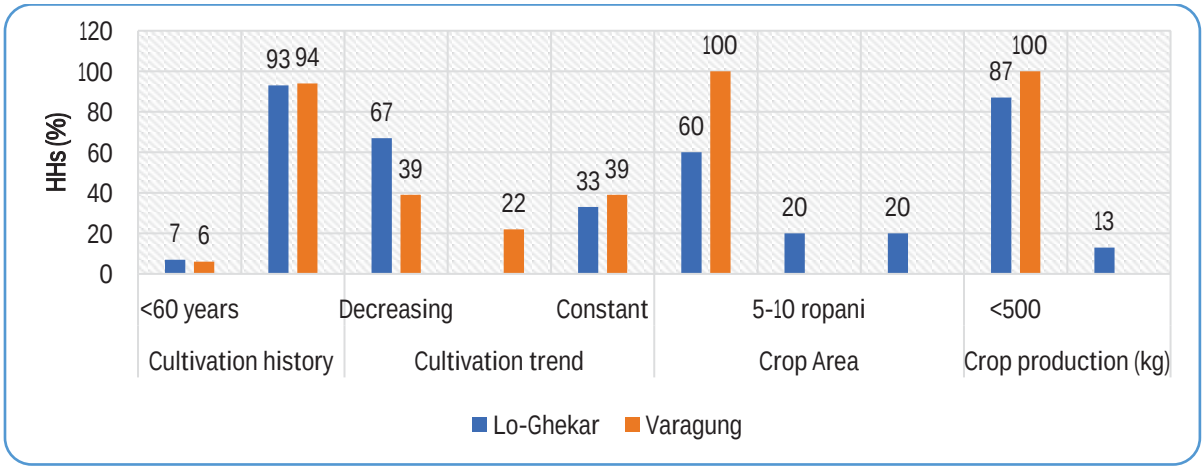


Figure 16: Status of tartary buckwheat in Lo-Ghekar and Varagung, Mustang

4.7.5 Barley (*Hordium vulgaren* L.)

Barley, locally known as Jau, is the primary purposes for growing barley are to save seed for cultural reasons and to produce straw for livestock. Barley is considered an easy crop to farm as they do not need much intercultural activity, but due to tedious post harvesting processing (threshing and de-husking) and labour shortage, cultivation is decreasing. This is especially a problem for barley because of its double husk and awning. Like naked barley, barley is also generally used for making alcoholic beverage jaand (chyang). Most farmers used barley to make animal feed, jaand and raksi. In Lo-Ghekar, all farmers (100%) and most farmers in Varagung (83%) had been growing barley for over 60 years. In Lo-Ghekar, 67% of farmers reported a decreasing cultivation trend for barley farming, while in Varagung, 53% of farmers experienced a similar decline. Despite these reductions, barley is still grown in both regions, but on smaller plots of land. All farmers in Lo-Ghekar (100%) and most farmers in Varagung (80%) grew barley on less than 5 ropani. In Varagung, 20% of farmers cultivated barley on 5 to 10 ropani, but none grew it on more than 10 ropani. In terms of yield, all farmers in Lo-Ghekar produced less than 500 kg of barley, and 97% of farmers in Varagung did the same. None of the farmers in either region produced more than 1000 kg. However, 3% of farmers in Varagung managed to yield between 500 and 1000 kg.

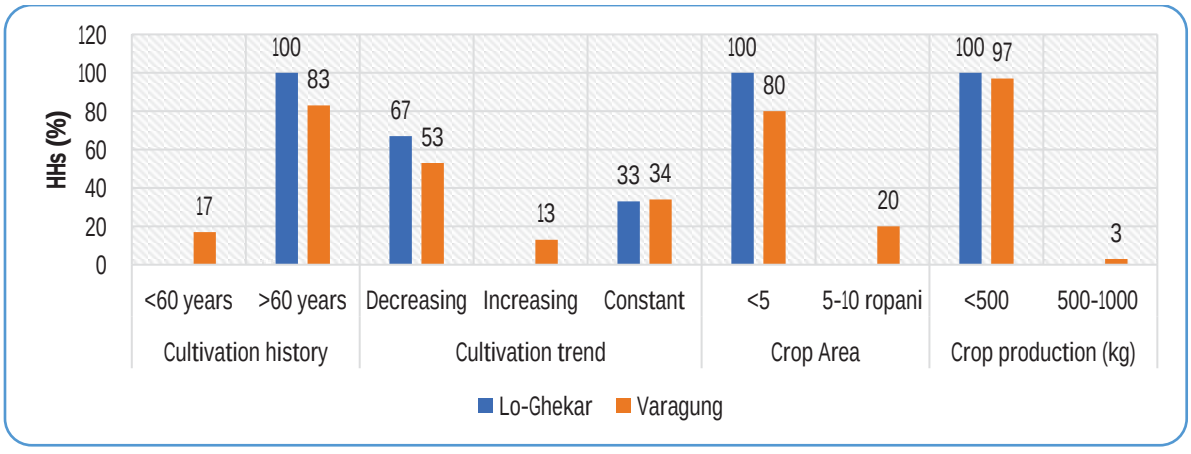


Figure 17: Status of barley in Lo-Ghekar and Varagung, Mustang

4.7.6 Rapeseed (*Brassica napus*)

Rapeseed, locally knwn as tori, is traditionally grown in the high-altitude, cold climate. It is primarily cultivated for its seeds, which are used to produce oil, a staple in the local diet. The oil extracted from rapeseed is commonly used for cooking and as an ingredient in traditional dishes. It is also valued for its role in crop rotation systems. It helps improve soil fertility by providing nitrogen to the soil, which benefits other crops grown in the region. The crop's residues are used as fodder for livestock. Rapeseed has become a rare crop in both Lo-Ghekar and Varagung. No households in Varagung were cultivating rapeseed. In Lo-Ghekar, 57% of households had traditionally cultivated rapeseed for more than 60 years, while the remaining households had grown it for less than 60 years. The cultivation status in both regions had remained constant. It was common to grow rapeseed on less than 5 ropani of land, with yields falling below 500 kg.

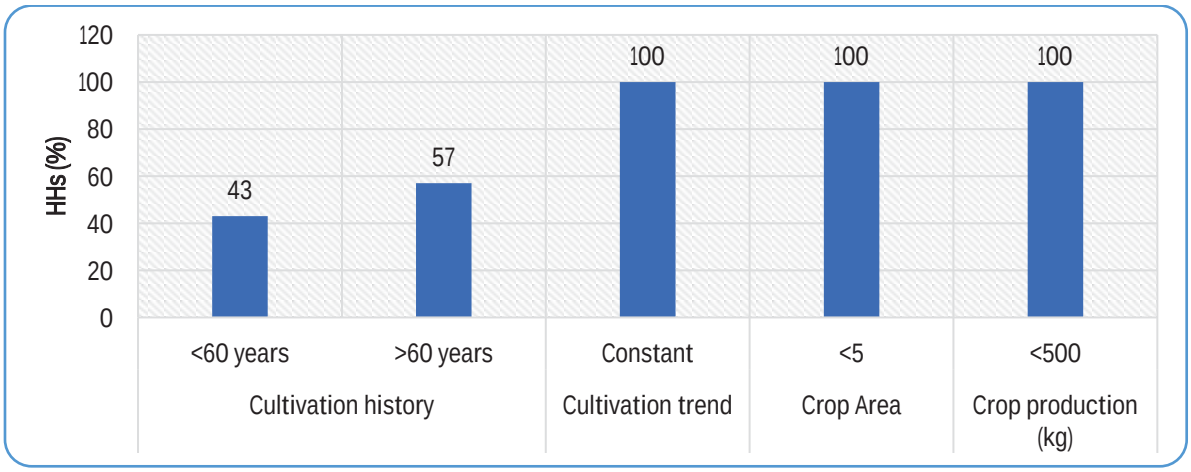


Figure 18: Status of rapeseed in Lo-Ghekar, Mustang

4.7.7 Broad leaf mustard (*Brassica juncea*)

Broadleaf mustard, locally known as raayo, is a seasonal crop, having ability to thrive in the cool, high-altitude region's harsh climatic conditions. It is grown for both its seeds and especially leaves. The seeds are primarily used to produce mustard oil for cooking, while the leaves are used in traditional dishes such as pickles and salads. Most farmers cultivate broadleaf mustard primarily for its use as a vegetable, owing to its high content of vitamins and minerals. The crop is distinguished by its broad leaves, dark green leaf color, and its ability to withstand cold temperatures. Different varieties such as local, agrovet, krishi, marpha, pokhara etc were noted during household survey.

The majority of farmers in Lo-Ghekar (73%) and Varagung (57%) cultivated broadleaf mustard for less than 60 years. The current status shows a huge increment in production in both regions, with 100% of farmers in Lo-Ghekar and 53% in Varagung reporting an increase. 29% of households from Varagung had constant status of production. Regarding the land area, all farmers in Lo-Ghekar (100%) and Varagung (100%) cultivated broadleaf mustard on less than 5 ropani of land. In terms of yield, all farmers on both sites produced less than 500 kg of broadleaf mustard.

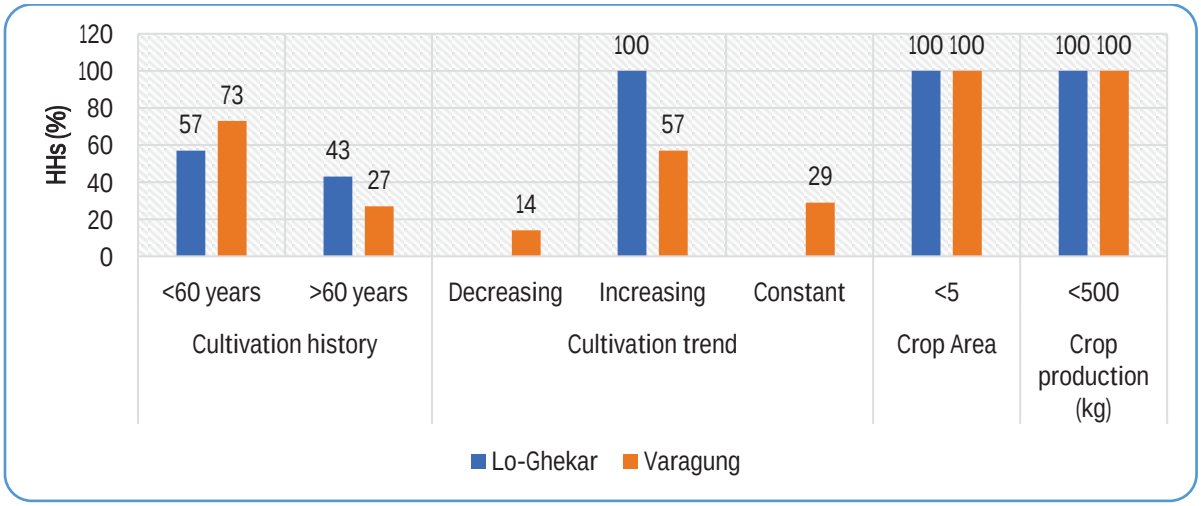


Figure 19: Status of broadleaf mustard in Lo-Ghekar and Varagung, Mustang

4.7.8 Potato (*Solanum tuberosum*)

Potato, locally known as aalu, is an important staple and highly valued crop in the Mustang region. Mustang aalo are prized for their distinctive flavor, firm texture, and ability to retain their shape during cooking. Mustang aalu is contributing significantly to the local diet. The potatoes are used in a variety of traditional dishes such as curries, stews, and local snacks. They are also a key ingredient in making "aloo ko achar" (potato pickle), which is a popular accompaniment in the region's meals. Additionally, the potatoes are often stored for winter use, providing essential food during the colder months. The cultivation of potatoes also provides economic benefits to farmers, as it is a cash crop that can be sold in local markets and beyond.

Household survey reported two varieties of potato- white (elongated tuber) and red (round tuber). The white variety of potato is characterized by its white flowers, elongated, white tubers, small plants, and low height. It cooks quickly and is nutritious and delicious. This variety also has the advantage of not rotting even when stored for long periods, which increases its market demand.The red variety of potato, on the other hand, has round, red-colored tubers. It ripens earlier than the white variety and is particularly suitable for mixing with other vegetables.

The cultivation history of potatoes in Lo-Ghekar reveals that 87% of the farmers have been cultivating potatoes for more than 60 years. Currently, potato cultivation in the area is reported to be increasing by 43% of farmers, decreasing by 39%, and remaining constant by 18% of the households. Regarding crop area, 39% of farmers cultivate potatoes on 5-10 ropani of land, while 18% cultivate on more than 10 ropani. None cultivate on less than 5 ropani. In terms of production, 93% of farmers produce less than 500 kg of potatoes, 7% produce between 500-1,000 kg, and none produce over 1,000 kg.

In Varagung, 68% of farmers have a cultivation history of more than 60 years. Currently, potato cultivation is reported to be increasing by 42% of farmers, decreasing by 23%, and remaining constant by 35%. Most farmers (93%) cultivate potatoes on less than 5 ropani of land, 5% on 5-10 ropani, and 2% on more than 10 ropani. Regarding production, 57% produce less than 500 kg, 18% produce between 500-1,000 kg, and 25% produce more than 1,000 kg.

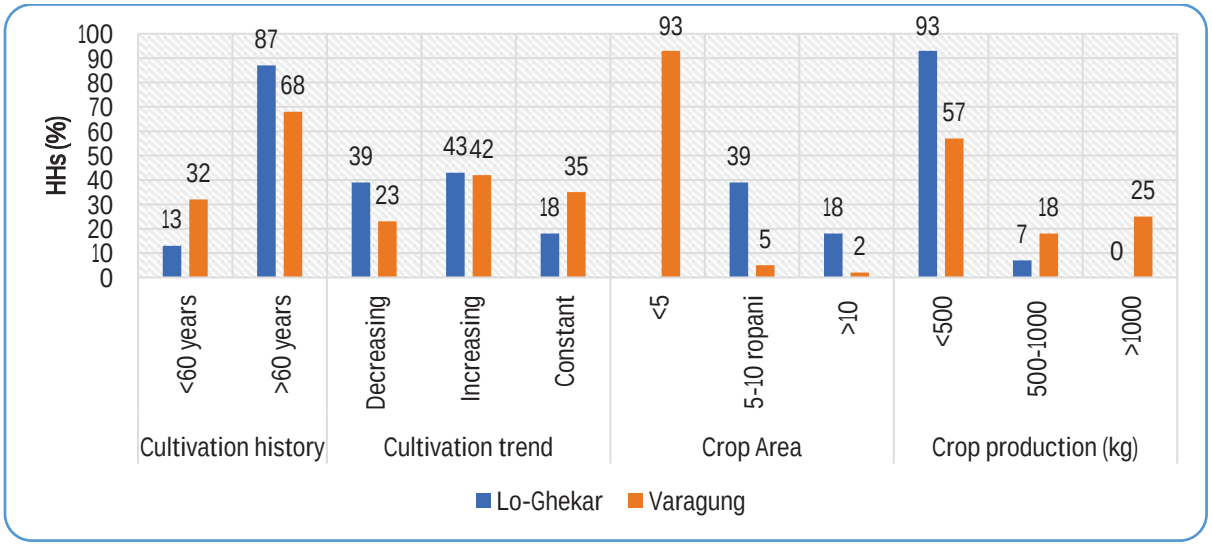


Figure 20: Status of potato crop in Lo-Ghekar and Varagung, Mustang

4.7.9 Wheat (*Triticum aestivum*)

Wheat, locally known as gahun, is a major winter cereal crop in Nepal, which can be grown as a sole crop or mixed with other crops like mustard, peas and lentils. It is nutritious, easy to store and transport and can be used to prepare varieties of foods such as roti, bread, dhido, saatu, fermented drink, beer, raksi. Its straw can be used as cattle feed. Moreover, wheat is considered a good source of protein and minerals. It is often associated with traditional farming methods that prioritize organic and sustainable practices.

In Varagung, all households had traditionally cultivated wheat for over 60 years, while in Lo-Ghekar, 86% of households had a similar history. However, wheat cultivation has shown a significant decline in both regions, with a 71% decrease reported in Lo-Ghekar and an even steeper 84% decline in Varagung. Only 29% of households in Lo-Ghekar maintained constant cultivation levels. Regarding land allocation, all respondents in Varagung cultivated wheat on less than 5 ropani of land. In contrast, in Lo-Ghekar, 57% of households used less than 5 ropani for wheat cultivation, while 43% utilized between 5 and 10 ropani. In terms of productivity, the yield in both regions remained consistently low, with all farmers reporting production levels below 500 kilograms.

In Varagung, all households had traditionally cultivated wheat for over 60 years, while in Lo-Ghekar, 86% of households had a similar history. However, wheat cultivation has shown a significant decline in both regions, with a 71% decrease reported in Lo-Ghekar and an even steeper 84% decline in Varagung. Only 29% of households in Lo-Ghekar maintained constant cultivation levels. Regarding land allocation, all respondents in Varagung cultivated wheat on less than 5 ropani of land. In contrast, in Lo-Ghekar, 57% of households used less than 5 ropani for wheat cultivation, while 43% utilized between 5 and 10 ropani. In terms of productivity, the yield in both regions remained consistently low, with all farmers reporting production levels below 500 kilograms.

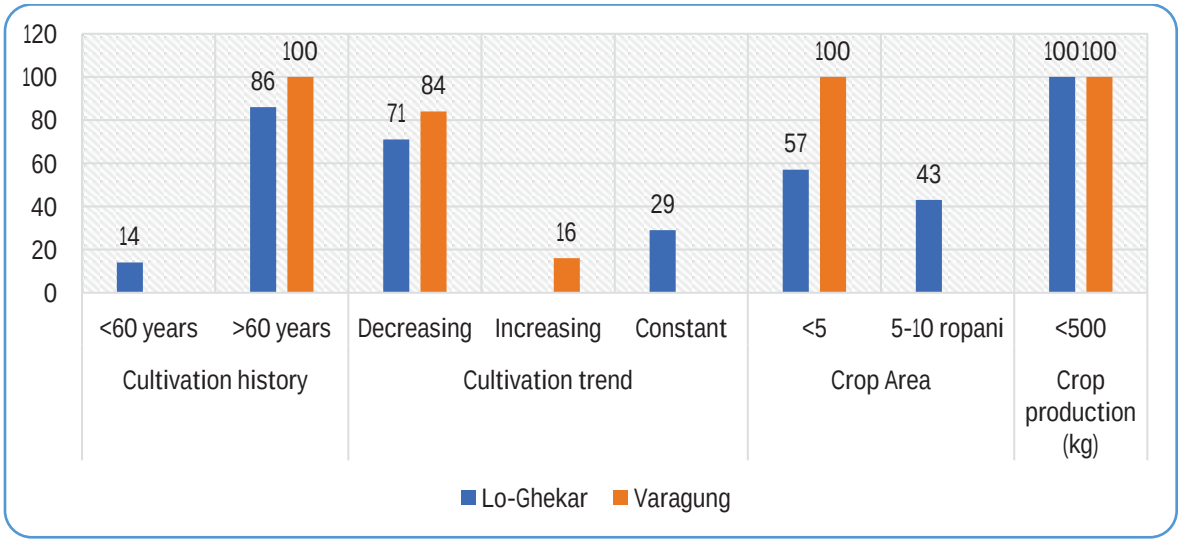


Figure 21: Status of wheat crop in Lo-Ghekar and Varagung, Mustang

4.8 Targeted livestock species and production system

All three targeted livestock—Lulu cattle, Yaks/Chauri, and Himalayan Mountain goat (Chyangra) — are raised in the region. Among these, Lulu cattle dominate in both areas, while Yak/Chauri numbers have been declining day by day. Himalayan goats are also common in both locations (lower and upper mustang). These animals are highly valued for their ability to produce milk, meat, wool, and manure, and for their resilience in cold climates. They also play an important role in the local economy. Beyond these primary livestock, some households raise other animals like Sheep, Jersey and Holstein Friesian cattle, Horses, and Giriraj and other breeds of poultry. This additional diversity enhances the region's agricultural productivity and provides households with supplementary income sources and varied resources, contributing to the resilience and sustainability of the local farming systems.

In terms of livestock, in Lo-Ghekar, 27 households raised lulu cows, 14 households kept chyangra goats, and only 1 household raised yaks. In Varagung, 62 households raised lulu cows, 38 kept chyangra goats, and 6 households reared yaks (**Figure 22**).

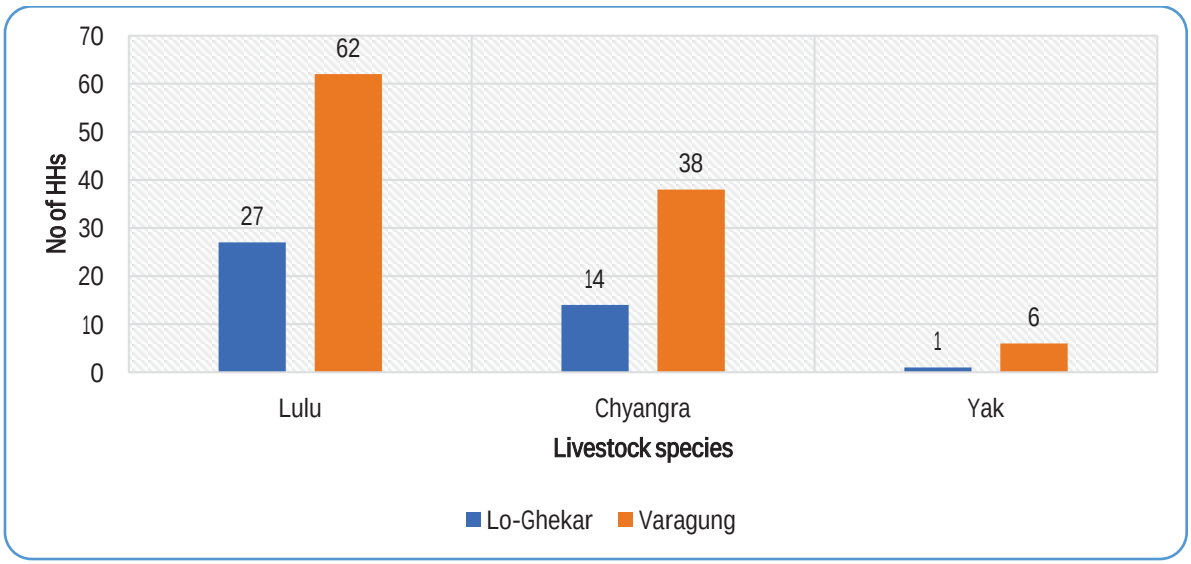


Figure 22: Targeted livestock diversity in Lo-Ghekar and Varagung, Mustang

4.8.1 Yak/Chauri (*Bos grunniens*)

Yaks have been a cornerstone of life in Nepal's trans-Himalayan region for centuries, deeply intertwined with livelihoods, culture, and spirituality. Found at elevations of 3,000 to 6,000 meters. Male yaks weigh approximately 420 kg, while females average 350 kg. Renowned for their resilience in harsh climates and rugged terrains, yaks are vital for milk, meat, wool, transport, and organic fertilizer, and significantly contribute to the local economy. Their milk, rich in fat and protein, is transformed into butter, yogurt, and "chhurpi" (hard cheese), which are consumed locally and traded in regional markets and a globally recognized product that generates foreign exchange. Their wool, prized for warmth and durability, is used to craft traditional clothing, blankets, and tents, including yak-hair tents still employed by some families.

Yaks and their hybrids—Chauries (female) and Jhopkyos (male)—are unique to Nepal but face declining populations, necessitating conservation efforts. Their meat, though consumed less frequently than milk, provides a vital protein source. Beyond practicality, yaks hold deep cultural and spiritual significance, symbolizing prosperity and resilience. They feature prominently in local festivals and rituals and play a role in religious ceremonies. Additionally, they transport goods to remote villages, monasteries, and trekking routes, underscoring their importance in Mustang's high-altitude communities.

4.8.2 Lulu cattle (*Bos taurus*)

The Lulu cattle, Nepal's only hump-less breed, thrive in high-altitude, dry, and cold regions, primarily in Mustang, and parts of Manang and Dolpa. Known for their hardiness, low feed intake, and nutrient-rich (high fat and protein) milk containing A2-type β-casein protein, they are integral to highland communities. Though their numbers are declining due to crossbreeding, they are not endangered but need protection. Conserved by rural farmers for over many years, Lulu cattle resemble Taurine types, with varied coat colors, dense dull hair, and small, curved horns. As Nepal's second smallest indigenous breed after Achhami, their semi-tractable nature ensures ease of management.

Milk production varies across lactation periods. During the early lactation period (up to three months after birth), Lulu cows produce an average of 2 liters of milk per day. This drops to about 1 liter per day during mid-lactation (three to six months after birth) and further declines to less than 1 per day (<2 maana per day) during the late lactation period (after six months). In Varagung, 55% of households collect less than 3 liters of milk daily, while 45% produce 3 liters or more. Conversely, in Lo-Ghekar, 56% of households collect daily milk production of 3 liters or more. These figures highlight regional variations in milk yield and underscore the need for targeted interventions to support lulu cattle farming.

The survey data highlighted Lulu cattle rearing in Lo-Ghekar (27 households) and Varagung (62 households). Most households (85% in Lo-Ghekar, 79% in Varagung) had over 60 years of rearing experience. Decreasing rearing trends is mostly observed (63% in Lo-Ghekar, 47% in Varagung), while increasing trends are minimal (7% and 27%). Regarding rearing numbers, most households rear 5–10 Chayangra (48% in Lo-Ghekar, 35% in Varagung), with fewer rearing over 10 (8% and 18%) or fewer than 5 (44% and 47%).

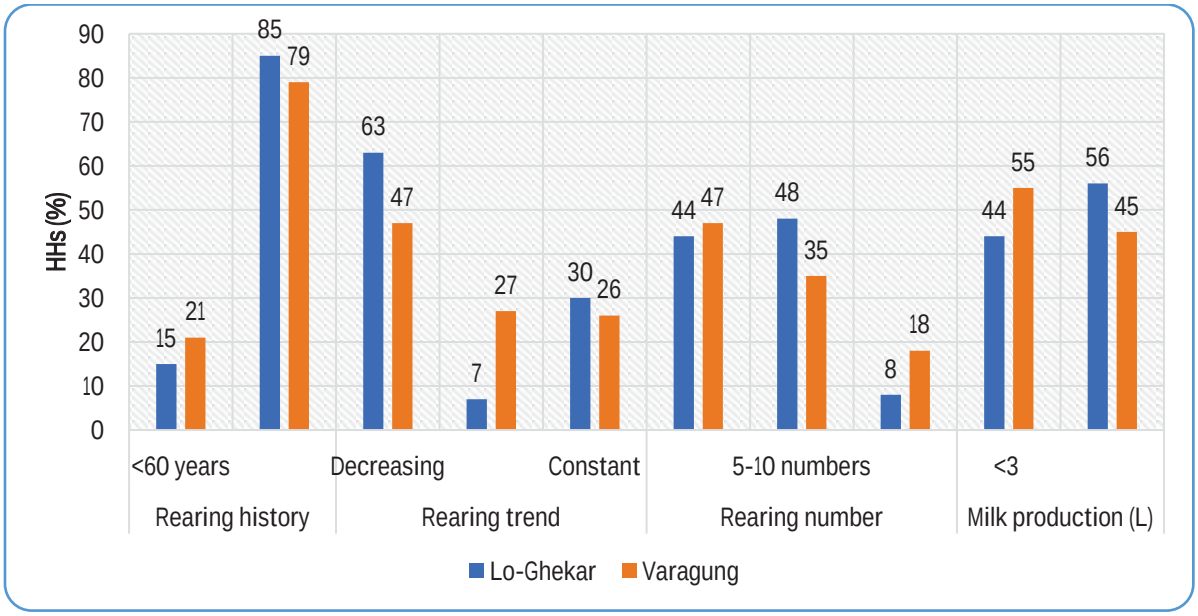


Figure 23: Status of Lulu cattle in Lo-Ghekar and Varagung, Mustang

4.8.3 Mountain goat (*Capra hircus*)

Himalayan mountain goat, locally known as chyangra, is a vital livestock species in Nepal's mountainous regions, particularly Mustang. Indigenous to high-altitude areas, chyangra thrive at elevations of 2,000–6,000 meters due to their fine fiber, woolly coats, which provide excellent insulation against the cool Himalayan climate. Adult males typically weigh 25–40 kg, while female is 29 kg (Gorkhali et al.,2023). These goats are renowned for producing approximately 150-200 grams of cashmere fiber annually, with an average fiber length of 45.97 mm and a diameter of 15.36 µm (Gorkhali et al., 2023). This cashmere fiber, globally recognized as pashmina, is hand-spun into luxurious fabrics, sustaining a centuries-old tradition deeply intertwined with local festivals and crafts.

In addition to fiber, chyangra goats contribute to the local economy and diet through their lean, flavorful meat and milk, which is used to make traditional dairy products like cheese. These goats graze alongside sheep on alpine pastures, helping to prevent the overgrowth of certain plants and supporting biodiversity. However, concerns about overgrazing and its effects on fragile pastureland are growing, particularly as climate change alters grazing patterns. The chyangra's adaptability and socio-economic importance make it a cornerstone of life in Mustang's high-altitude communities.

The survey data highlights the farming history of Chyangra in Lo-Ghekar and Varagung. In both regions, 29% of households have been rearing for under 60 years, while 71% have over 60 years of experience. Rearing trends show 14% and 20% of households in Lo-Ghekar and Varagung, respectively, report declines, while increasing trends are observed in 57% and 60% of the household. For rearing numbers, 29% of Lo-Ghekar and 58% of Varagung households rear fewer than 100 Chyangra, while 71% and 42% rear 100 or more.

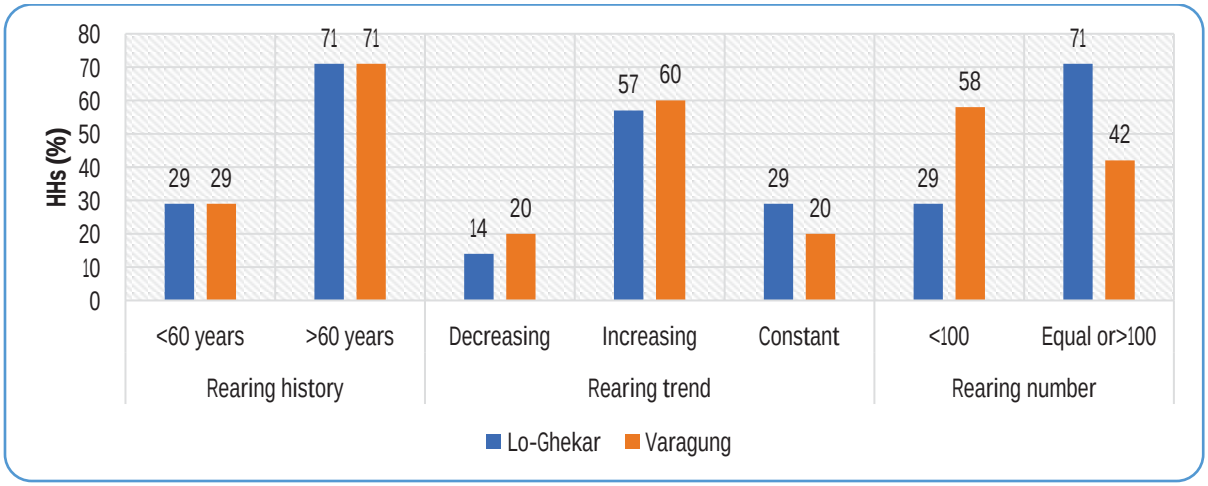


Figure 24: Status of chyangra goat in Lo-Ghekar and Varagung, Mustang

4.9 Targeted medicinal plant species

4.9.1 Seabuck thorn (*Hippophae rhamnoides*)

Sea Buckthorn, chichi, dalechuk, tora in local language, is grown at a height of 3500 meters from sea level. It is mainly grown at Jharkot village and run by the Group of mothers calling Ama Shamuha. It has been around 15 years that Mothrer's Group has been playing a vital role in making Juice, Oil, and souring agent from Sea Buckthorn berries. Sea buckthorn juice is gradually gaining recognition for its nutritional value. Its berries contain 15 times more Vitamin C than oranges and are also rich in carotenoids, Vitamins A and E, amino acids, Omega fatty acids (3, 6, 7, and 9), antioxidants, phytosterols, and tocopherols. These nutrient-dense components make sea buckthorn berries highly beneficial for consumption.

In modern traditional medicine, the Sea Buckthorn is used for treating many ailments. For example, the Sea buckthorn leaves and flowers are used for treating arthritis, gastrointestinal ulcers, gout, and skin rashes caused by infectious diseases. While the Sea Buckthorn berries are used for preventing infections, improving sight, and slowing the aging process.The focus group discussion (FGD) with the Mother's group at Jomsom highlighted concerns regarding the decreasing availability of Sea Buckthorn, emphasizing the need to revitalize its production to meet market demand for Sea Buckthorn juice within the district. The Chief District Officer (CDO) of Gharapjhong Municipality also expressed concern about the preservation of these medicinally valuable herbs.

4.9.2 Wild garlic (*Allium ursinum*)

Wild garlic, also known locally as ban lasun, is a medium-sized bulbous perennial with a distinctive and pungent garlicky smell that pervades woodland in spring. In Mustang, it grows in the shaded areas of the forest, often near streams or wetland environments. The plant is recognized by its broad green leaves and white flowers.It is traditionally used in local dishes, where its fresh leaves and bulbs are added to soups, stews, and pickles, contributing a strong flavor akin to garlic. Medicinally, wild garlic is valued for its antimicrobial properties, making it useful for treating infections and digestive issues. It has been used as a remedy for coughs, colds, and respiratory ailments, as well as a blood purifier and an anti-inflammatory agent.

In Mustang, wild garlic holds cultural significance in the local diet and traditional medicine. Its presence in the wild is celebrated, and locals appreciate its ability to thrive in the harsh, high-altitude conditions of the region. The plant is also an important wild resource for the communities, contributing to local economy through sustainable harvesting. It is also a key element of Mustang's rich natural heritage.

4.9.3 Himalayan Thyme (*Allium przewalskianum*)

Himalayan Thyme, locally known as Jimbu, is a perennial herb native to the highlands of Nepal. It is widely used for both its culinary and medicinal applications. The herb has a distinctive flavor profile, similar to garlic and onions, and is frequently used in Nepali dishes such as dal bhat (lentil soup), aloo tama (a stew made with potatoes and bamboo shoots), and various pickles. Its potent aroma and taste make it a staple seasoning in traditional cuisine, especially in the thakali region.

Jimbu is recognized for its potential health benefits. Its essential oils contribute to its strong flavor and are believed to possess antimicrobial properties. Traditionally, Jimbu has been used in Nepali medicine to treat digestive issues like bloating and indigestion, and it also helps in treating coughs and colds.It was reported that only a few households grew jimbu in their homes, while the majority of households collected it from distant and challenging locations in the mountains.

Figure 25: High value medicinal plant: Himalayan Thyme (Jimbu)

4.10 Soil health management

4.10.1 Soil health awareness

The findings on soil health awareness in Lo-Ghekar and Varagung showed that a significant portion of households in both regions are unaware of the importance of soil health management. In Lo-Ghekar, 43% of households were aware of soil health practices, while 57% lacked this awareness. Similarly, in Varagung, only 31% of households were aware of soil health practices. This highlights a notable gap in knowledge about maintaining soil health across both regions, indicating a potential area for agricultural education and intervention.

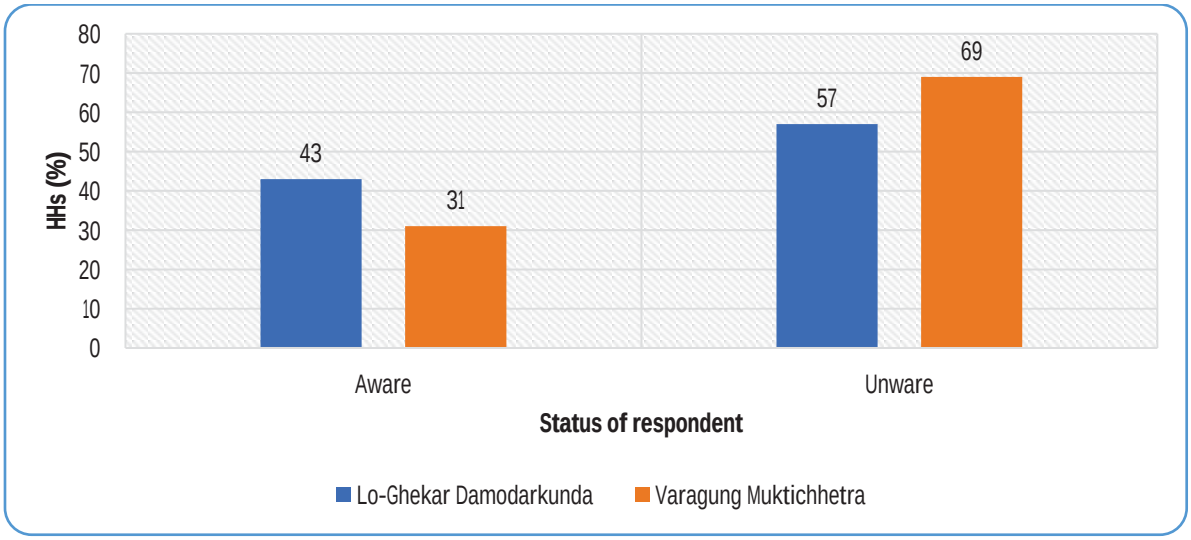


Figure 26: Status of soil health awareness in Lo-Ghekar and Varagung, Mustang

4.10.2 Reasons of soil degradation

The main reasons for soil health degradation in Lo-Ghekar and Varagung were identified as deforestation, overgrazing, floods/landslides, modern agricultural practices, urbanization, and other factors such as climate change, overuse of chemical fertilizers etc. In Lo-Ghekar, 10% of households cited deforestation, and 10% reported overgrazing as contributors to soil degradation. Flooding and landslides were the most common issues, affecting 40% of households, while 7% attributed modern agricultural practices and 23% pointed to urbanization as factors. Other causes, including natural and human-induced factors, accounted for the remaining 23%. In Varagung, the situation was slightly different. Deforestation and overgrazing were less prominent, affecting 3% and 4% of households, respectively. However, flooding and landslides were again the leading cause of soil degradation, affecting 50% of households. Modern agricultural practices (21%) and urbanization (21%) were also significant contributors, while other factors accounted for 5%.

Overall, flooding and landslides were the most significant drivers of soil degradation in both regions, followed by the impact of human activities such as urbanization and agricultural practices.

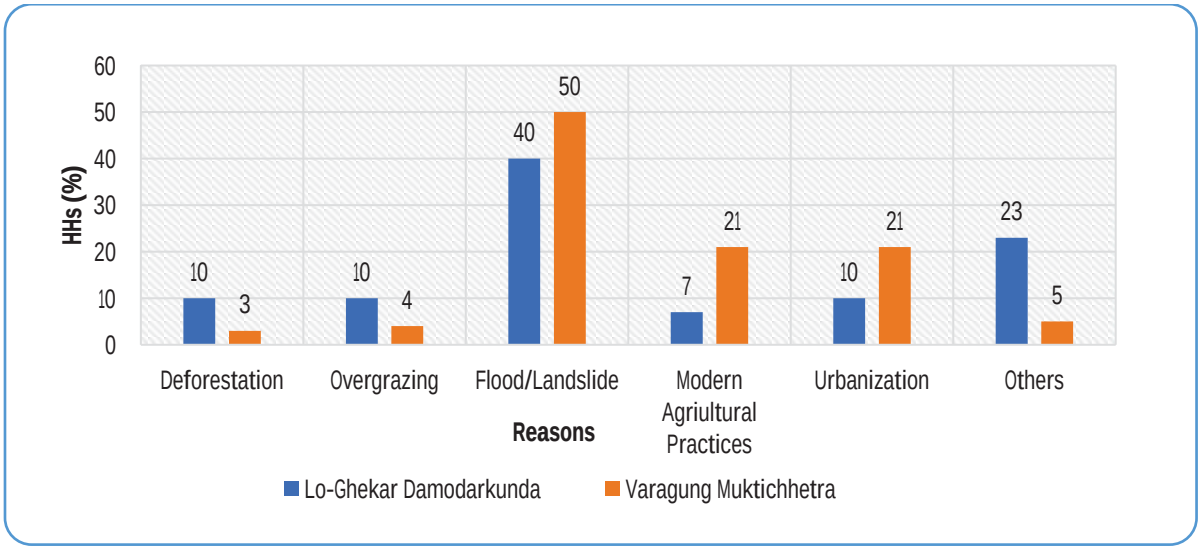


Figure 27: Reason of soil degradation in Lo-Ghekar and Varagung, Mustang

4.10.3 Soil amendment practices

In Lo-Ghekar, soil amendment practices were predominantly a combination of crop rotation and organic amendments, with 67% of households employing both methods. Organic amendments solely were used by 23% of households, while 10% practiced crop rotation only. In contrast, in Varagung, 79% of households applied both crop rotation and organic amendments, while 21% utilized crop rotation exclusively. Interestingly, no households reported the use of organic amendments alone. These findings suggest that integrated soil amendment practices, combining crop rotation with organic amendments, are more widely adopted in both regions, with a particularly high reliance on these practices in Varagung.

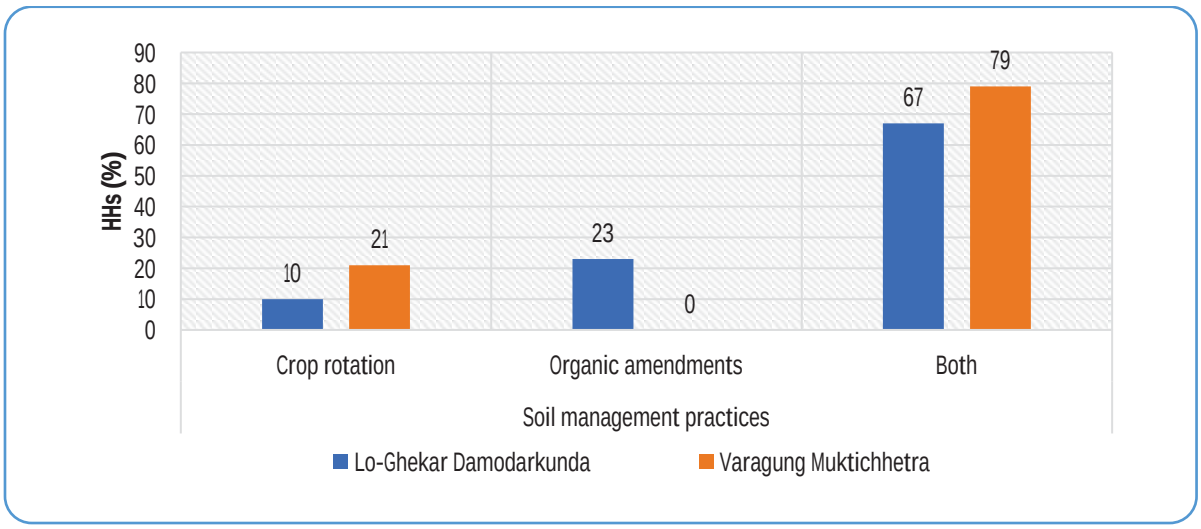


Figure 28: Soil amendment practices in Lo-Ghekar and Varagung, Mustang

In Lo-Ghekar, 81% of households reported that they had never tested their soil, 33% tested rarely, and only 7% testing it occasionally. Similarly, in Varagung muktichhetra, 50% of households had never conducted soil tests, while 40% reported testing their soil rarely and remaining 10 households tested their soil occassionally.

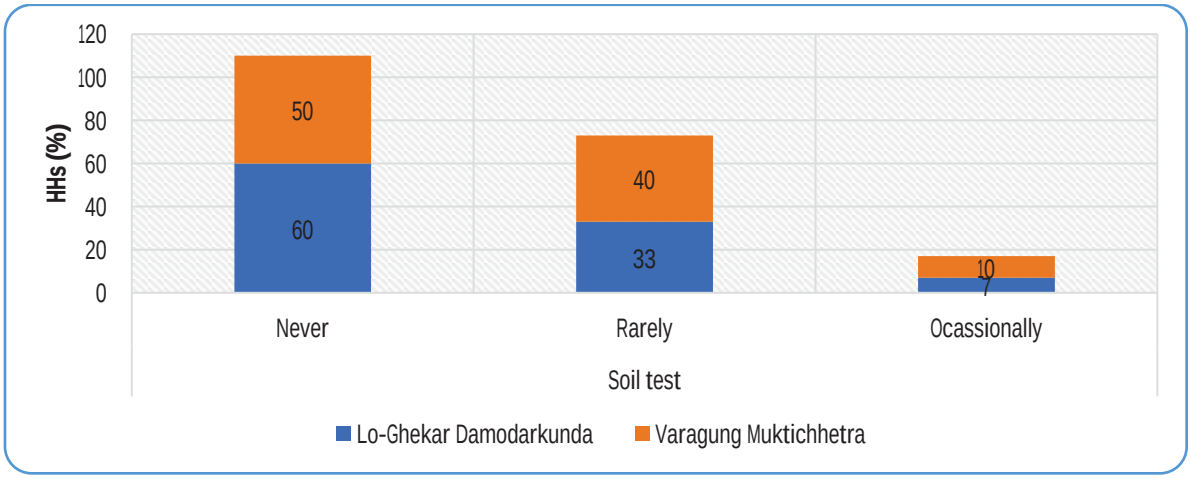


Figure 29: Soil test frequency in Lo-Ghekar and Varagung, Mustang

4.11 Seed source and seed management oractices

4.11.1 Seed source of targeted crop species

Farmers in Mustang primarily rely on informal seed systems to meet their seed needs for targeted crops. These systems include saved seeds from their own farms, seeds purchased from local markets, and seeds provided by rural municipalities, government agencies, and NGOs. The practice of exchanging seeds between communities is also prevalent; for example, Lower Mustang sources seeds from Upper Mustang and vice versa, creating a local seed exchange culture. For most of the targeted crops, including naked barley, barley, common buckwheat, tartary buckwheat, common beans, wheat, rapeseed, broadleaf mustard, and potatoes, farmers mainly use their own saved seeds. However, certain crops like broadleaf mustard and ghiu simi beans receive some contributions from formal sources such as agrovets, rural municipalities, and markets in Pokhara. In Lo-Ghekar, 47% of farmers depended entirely on their own saved seeds for the targeted crops, while 20% used a combination of their own saved seeds and seeds from local markets, and 33% also utilized seeds from government programs and NGOs. In Varagung, most households (57%) relied on a mix of saved seeds, seeds from the local market, and government or NGO contributions. Only 16% of households in Varagung solely depended on their own saved seeds. There are no Community Seed Banks (CSBs) in the region.

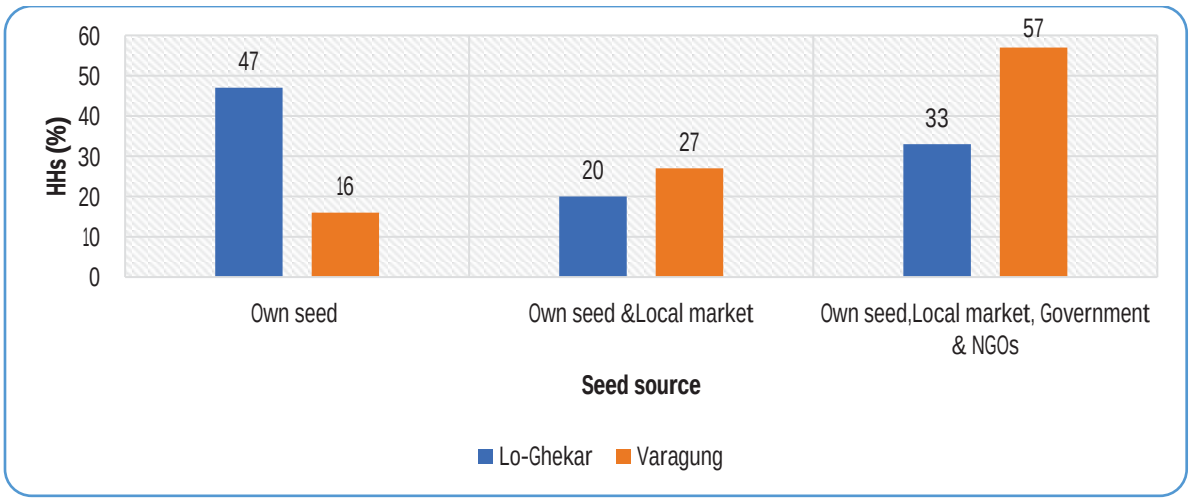


Figure 30: Seed Source of targeted crops in Lo-Ghekar and Varagung, Mustang

4.11.2 Farmer's seed selection method and gender involvement

Seed selection methods in the region largely depend on the type of crop. For example, potato is the most positively selected crop, with farmers favoring tubers that are elongated, disease-free, and have multiple sprouts. On the other hand, buckwheat tends to be selected negatively, possibly due to less favorable growing conditions or concerns about seed quality. For crops like naked barley, barley, wheat, and to some extent, buckwheat, farmers focus on selecting seeds from plants that have been grown in productive fields. They prefer fully ripe, disease-free plants, and ensure that seeds are completely dried before going to storage. The seeds are typically stored in traditional wooden containers called matus, which helps in preserving the seed quality for the next planting season. These practices highlight the importance of choosing healthy, high-yielding crops and the careful handling of seeds to ensure successful future harvests. In Lo-Ghekar, 37% of households reported that male members are responsible for seed selection, while 33% of households mentioned that women take part in this task. Additionally, 30% of households stated that both male

and female members are involved in seed selection. In Varagung, 36% of households reported male involvement in seed selection, while 37% of households indicated that women are primarily responsible. In 27% of households, both male and female members participate in the seed selection process. This data highlights the shared responsibilities in seed selection across both regions, with notable involvement of both genders.

In Lo-Ghekar, 80% of households reported a positive approach to seed selection, while 20% indicated a negative approach. In Varagung, 90% of households expressed a positive stance on seed selection, while only 10% showed a negative approach. These findings suggest that majority of households in both regions are actively engaged in positive seed selection process.

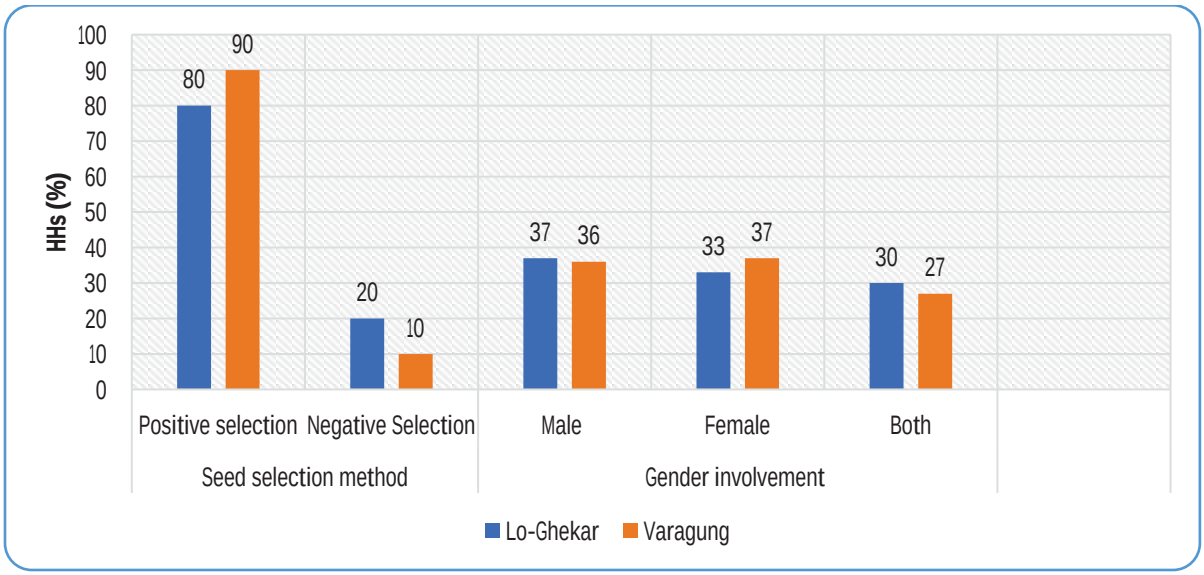


Figure 31: Seed selection method and gender involvement in Lo-Ghekar and Varagung, Mustang

4.12 Buying and selling trend of targeted commodities in Mustang

In both Lo-Ghekar and Varagung, among the targeted crops, naked barley, beans, common buckwheat, and potato are commonly sold. A significant number of households in these regions have shown an increasing trend of purchasing rice, dal, and flour (maida, aata) from nearby markets. Farmers also sell a variety of local products, including large quantities of apples on a leased basis, dried apricots, apple sukuti, local liquor (raksi made from naked barley), and vegetables such as cauliflower, cabbage, and tomatoes in the local markets. The price for a 22kg carton of apples is typically Rs. 2,600, while common beans are sold for Rs. 1,200 per paathi[1] and potatoes for Rs. 200 per paathi . Additionally, mountain goats are sold for Rs. 35,000 each, sheep for Rs. 30,000 each, and yaks for Rs. 1,50,000 each annually. The buyers in both regions are primarily local employees, local people, visitors, as well as local markets and hotels. Households purchase buffalo, fish, pork, and broiler chicken meats from nearby markets. This shift indicates a growing reliance on external markets for staple items, while also emphasizing the significance of local produce for trade and sustenance in these communities.

[1] Paathi is measurement scale used in Nepal for weighting grains. 1 paathi= 152 cubic inch=4.55 litres

4.13 Awareness and training

The findings showed that Mustang hosts several key governments, and local organizations actively involved in promoting agrobiodiversity, playing a significant role in enhancing agricultural practices and community resilience. Still there is a low understanding among farmers in the region about the training and awareness campaigns on agricultural good practices. The household survey discovered that only a few respondents knew about good practices of conservation and utilization techniques. Such unawareness is partly the consequence of restricted access to communication means, for example, radio and television. Likewise, very negligible farmers have even heard of Community Seed Banks, which is a big deficiency regarding both knowledge and outreach activities. Farmers have also benefited from agricultural support services and training programs like apple cutting training. This included distribution of seeds, tools, and equipment such as grass cutters, hand tractors, along with essential infrastructure development like irrigation canals, afforestation programs, and protective fencing. The program also provided plantlets for fruits and vegetables, supported greenhouse construction, and offered financial assistance through grants.

4.14 Post harvest practices and techniques of targeted commodities

The communities use traditional tools like "markyang" and "ghesi" for harvesting and following cultural planting rituals, guided by local leaders and celestial observations. The participants shared insights on seed, produce, and product storage methods. Farmers also contributed their indigenous knowledge of post-harvest practices and techniques. Most of Farmer segregate seed and food purpose grain in the field. Fully ripe disease and insect pest free plant with desirable character and high yielding plant were identified in field and chosen for seed. After harvest and before storage, farmers dried cereal crop wheat, naked barley, and buckwheat and leguminous crop bean on the rooftop in direct sunlight. Seed purpose and food purpose grain were stored in sacks separately. The seeds are typically stored in traditional wooden containers called matus, which helps in preserving the seed quality for the next planting season. These practices highlight the importance of choosing healthy, high-yielding crops and the careful handling of seeds to ensure successful future harvests. However, tuber crop potatoes were selected only after harvesting. Oval? shape with disease and insect pest free tuber were selected and dried in the shade. After the shade dried, most of the farmers stored in sacks. Similarly, the primary product from livestock was sukuti (dried meat). After slaughtering, the meat was separated specifically for making sukuti. The selected cuts of meat were hung above the fire oven for fire-drying, allowing them to be preserved and used as needed. They reported no branding initiatives for local products.

4.15 Climate change and other challenges

Farmers face several challenges that hinder their agricultural productivity and livelihoods. Climate change has had a significant impact on both their livelihoods and agricultural practices, further complicating their efforts. Over the past 30 years, they have observed significant changes in climate including reduced snowfall or heavy rainfall on off season, less intense cold, higher rainfall intensity, longer daylight hours, earlier apple ripening, and an increase in pests and diseases affecting apples, buckwheat, and other crops. These changes have led to agricultural challenges, including pest infestations in buckwheat, lodging of crops due to heavy rainfall. Insect pests such as wooly aphid, apple stem borer, tent caterpillar in apple, are problematic now a days in Mustang district. Similarly, late blight disease in problematic for potatoes. However, changes in climate have

also enabled the cultivation of new vegetable varieties, like green peas in apple orchards, which improve soil fertility.

Farmers of the Mustang revealed their traditional agricultural practices, cultural values, and strategies for adapting to climate change. They have developed innovative practices, such as intercropping naked barley, beans, and buckwheat with apple trees and rotating crops like naked barley and buckwheat to maximize production which leads to less crop damaging by insect pest due to increased crop biodiversification. Their pest management relies on traditional methods, such as ash application, cow urine, and homemade sprays, though they expressed interest in adopting biopesticides with proper training. The discussion concluded with a request for technical support in apple cultivation, organic farming, and pest management.

4.16 Traditional knowledge on agrobiodiversity management

Traditional agricultural practices and local knowledge are deeply ingrained in the way of life in Mustang showcasing a harmonious balance between cultural heritage and ecological wisdom. Farmers rely on time-tested methods and tools such as “Markyang” and “Ghesi” for harvesting, and planting rituals guided by local leaders and celestial observations. Storage methods include wooden Matus, sacks for dried crops, and Sukuti preservation through fire-drying and hanging above ovens. For seed and produce storage, potatoes are kept in wooden boxes, wood phlyak, or Nigalo Choya, often shaded before transferring to Madhush, while naked barley is sun-dried for 2–3 days, cleaned, washed, and processed into flour. Beans and buckwheat are typically stored in sacks. Despite limited arable land, farmers maximize productivity through innovative intercropping practices, such as planting naked barley, beans, and buckwheat with apple trees, and rotating crops like naked barley and buckwheat. Potatoes are intercropped with radishes, and maize with beans, which enrich the soil and enhance crop yields. This diversification extends to products, with potatoes being used for chips, pickles, and vegetables, while naked barley flour is central to traditional staples like Sattu, Litto, and Bhote Chiya—a tea made from its flour consumed during labor-intensive activities. Naked barley holds profound cultural and medicinal value, serving in rituals, remedies for altitude sickness, and nutrition. It is consumed as Khole, a dish made by grinding and mixing it with ghee, and is also fermented into Raksi, a traditional beverage. Lulu cow ghee is applied as a Tika during auspicious events, and yak blood is consumed for its nutritional benefits. Locally grown medicinal plants, such as Satuwa consumed to get relief from gastric issues and wild garlic for wound healing, emphasize the community's reliance on natural remedies. Jimbu and fire-drying techniques enhance the nutritional value of food, while Chyaang (a local brew) and Jwano are integral parts of food during pregnancy and childbirth. Altitude adaptation practices include consuming garlic, naked barley flour, garlic soup, and Nepali pepper, while Nirmasi medicine is used to treat colds and coughs. Crops like wheat, naked barley, and buckwheat are dried on rooftops, ensuring preservation for future use. Fertilizers are based on relies on Cow and Chyangra dung, while Guitha made from dung is used as fuel for cooking and heating. Traditional tools such as Ghiluk aid in processing buckwheat. This intricate blend of agricultural innovation, ecological adaptation, and cultural traditions reflects the community’s resilience and resourcefulness, preserving their heritage while ensuring sustainable livelihoods.

Figure 32:Traditional skill and instrument for making cloth and shoes

4.17 Problems and constraints

Farmers face several challenges that hinder their agricultural productivity and livelihoods. One of the primary issues is the shortage of labor, which makes it difficult for farmers to manage their crops and livestock effectively. The lack of experts in specific crops and livestock further complicates the situation, as farmers often lack access to the specialized knowledge required to maximize production.

Pest and disease infestations have become more difficult to manage, posing a growing challenge to crop and livestock health. They also struggle with the unavailability of mechanical tools, which limits their efficiency and scale up their operations. Climate change has had a significant impact on agricultural practices, leading to unpredictable weather patterns, altered growing seasons, and more frequent extreme weather events. The region faces significant agricultural challenges, including difficulty in making hay and silage due to increased rainfall and rising disease and pest issues.

5 Discussion

5.1 Socio-economic and demographic Context

The population of Lo-Ghekar and Vargung muktikshetra is predominantly Janajati followed by Dalit communities. Janajati is indigenous ethnic group of Nepal but are concentrated mainly in the western development region. Dalit is a historically disadvantaged and socially, religiously and culturally discriminated group that live throughout the country (Chaitanya et al., 2014).

Agriculture and livestock are primary sources of livelihood for 63% and 60% of households in Lo-Ghekar and Varagung respectively. Farming in both regions depends on resources available within the household such as land holding and farm labour. Due to lack of mechanization, family labour is critical to agriculture. Hence, the increase in the share of remittance from migrant family members has two fold impacts on agriculture. First of all, the remittance income and access to market means that families are less reliant on growing their own food. Secondly, migration reduces the number of

farm labour available and hence reduces the capacity to farm the existing farmland, leading to increased workload of female members of the household, loss of diversity and fallowing of productive land.

Gender roles in agricultural decision-making and work division also have an impact on agrobiodiversity. The decisions need to be made on what crops and varieties to plant, technologies to adopt and division of work load. Studies have shown that female members tend to maintain more diversity than males, as males are more inclined toward economic benefits while females spend most time being at home and observing things.With male males more likely to migrate than females, women's role in agriculture is going to be even more crucial.In the context of Mustang, Aamchi (locally selected monk) plays a vital role in all agricultural practices.

The analysis of land ownership status across two municipalities in Mustang, Lo-Ghekar Damodarkunda and Varagung Muktichhetra, highlights significant differences in land use and distribution. In Lo-Ghekar Damodarkunda, the mean cultivated land area per household is 18.567 ropani, with a total of 557 ropani, while Varagung Muktichhetra has a slightly lower mean cultivated land of 17.316 ropani but a significantly higher total of 1,212.13 ropani.

Non-cultivated land averages 8.8 ropani in Lo-Ghekar Damodarkunda, amounting to 264 ropani, compared to a mean of 3.8 ropani and a total of 266 ropani in Varagung Muktichhetra. Overall, the total land ownership in Lo-Ghekar Damodarkunda is 821 ropani, with an average of 27.367 ropani per household, while Varagung Muktichhetra has a larger total of 1,468.875 ropani but a lower average of 20.984 ropani.

For upland areas, Lo-Ghekar Damodarkunda reports an average of 12.133 ropani per household (364 ropani in total), while Varagung Muktichhetra averages 10.939 ropani (765.752 ropani total). In terms of lowland, Lo-Ghekar Damodarkunda has a mean of 13.533 ropani (406 ropani in total), exceeding Varagung Muktichhetra's mean of 8.019 ropani (553.305 ropani total). Land leasing is minimal in both municipalities, with Lo-Ghekar Damodarkunda showing a mean lease-in of 0.7 ropani and lease-out of 0.2 ropani, while Varagung Muktichhetra has a higher lease-in mean of 1.18 ropani and no lease-out land reported. With labour migration, lack of mechanization in agriculture and limited marketing infrastructure for farm products the trend of land fallowing will likely continue.

5.2 Targeted crop diversity

Naked barley, barley, common buckwheat, tartary buckwheat, rapeseed, and wheat are commonly cultivated in mustang district. In Lo-Ghekar, the agricultural calendar remains unchanged, with only one-season cropping practiced since ancient times. Intercropping is common, involving naked barley, buckwheat, potatoes and maize cultivated with apples. However, agrobiodiversity is perceived to be declining due to factors such as reduced water resources following the 2072 earthquake, migration, foreign employment, pollution from vehicles and the multiple harvesting of medicinal plants. Certain crop varieties, such as rapeseed, have been lost in areas like Chhusang due to road access and the absence of oil extraction machines.

Two local varieties of potato called Samdo and red potato and mixed bean is usually cultivating in Mustang. Potatoes and beans have a high market demand in Mustang. Potato is commonly consumed as vegetable and common beans are utilized both as a key daal as well as vegetable in

various dishes. Cereal crops such as naked barley, common buckwheat, barley, tartary buckwheat, and wheat are primarily used for preparing saatu, roti, dhido, and traditional alcoholic beverages like chyang and raksi. However, the cultivation of tartary buckwheat, naked barley, wheat, and rapeseed is declining in both project sites. Rapeseed is primarily grown for oil extraction.

Key crops considered nutritious include Tenku (used medicinally), wheat, buckwheat, naked barley, and chuli. Culturally significant crops, livestock, and plants include wheat and naked barley (used to prepare sattu for torma during puja), peas (used in home puja), rapeseed, and local breeds like lulu and bhalang for milk, ghee, and churpi, which is essential for puja.

Mustang faces numerous abiotic stresses, including rising temperatures and floods, as well as biotic stresses such as pest and disease infestations. Farmers select and maintain crop varieties not only based on local environmental conditions but also considering factors such as religious and cultural values, management practices, desirable crop traits (e.g., yield, nutritional content, and taste), post-harvest requirements, and market demand. The choice of crop variety and preferred traits varies among farmers, highlighting the importance of maintaining a wide range of genetic diversity as a valuable resource for the region.

Product diversification and branding are minimal, with most products used domestically. Traditional farming practices include lighting dhup (incense sticks) and singing local songs before planting, along with the use of jhopa, halo, nagi, and kodalo. Irrigation relies on traditional kulo, and insects are manually removed from fields. Commonly grown medicinal plants include kutki (for colds), jimbu, wild garlic, yarsagumba, paanchaaunle, and dalechuk (tora or Sea Buckthorn). Soil fertility management involves organic manure and mixed cropping, but no soil testing has been conducted. Climate change impacts include rising temperatures, erratic and heavy rainfall, reduced snowfall, and increased pests and diseases. Soil erosion from rainfall and landslides has also contributed to declining soil fertility. Challenges in agriculture include irrigation problems, labour shortages, pest infestations, and reduced apple production. Yaldong puja, performed before agricultural activities, reflect the cultural significance of farming. Snowfall typically occurs in Poush and Magh, occasionally extending to Falgun. The major challenges faced with current agricultural techniques include irrigation problems, poor apple farming outcomes, and crop-specific irrigation dependency—red wheat thrives with sufficient irrigation, while the white wheat variety performs better in low-water conditions. Additional challenges include labor shortages, as well as increasing issues with pests and diseases. Some crops and their products are used for remedies for certain problems have been presented in **Table 9**.

Table 9: Crops and their products are used for remedy of certain problems

Condition	Agricultural product
Weakness	Roast naked barley, grind them and consume as khole by adding ghee in it
Pregnancy and delivery	Khole made from titey phapar with addition of pure rapeseed oil
Lactating period	Lulu milk and ghee
Stunting and wasting	Fruits, flour of naked barley and wheat, milk, egg, churpi
Labour intensive work/fatigue	Buckwheat roti, naked barley's saatu/ flour, ghee, churpi
Altitude adaptation	Raksi, garlic, pepper

Major medicinal plants in the area include Yarsagumba (mostly collected by men due to time constraints), Chuk, wild garlic, and Jimbu. Over the past 30 years, they have observed significant climate changes, such as reduced snowfall, less intense cold, higher rainfall intensity, and longer daylight hours. These changes have led to agricultural challenges, including pest infestations in buckwheat (mitigated through religious rituals by monks) and lodging of crops due to heavy rainfall. All locations have road and electricity access. Some government and non-government organizations are involved in agrobiodiversity conservation in Mustang district. Temperate Horticulture Development Centre, Agriculture Knowledge Centre, Annapurna Conservation Area Project, Prime Minister Agriculture Modernization Project, Nuts and Fruits in Hilly Area Project (NAFHA) Division Forest Office and local government are directly involved in conservation of agrobiodiversity in Mustang district.

5.3 Targeted livestock diversity

Lulu cattle, Himalayan goats (Chyangra), and yaks/chauris are commonly raised in Lo-Ghekar and Varagung, where their remarkable adaptability to harsh climates and high-altitude conditions makes them essential to the local livelihood and culture. These animals contribute significantly to the communities, providing not only income and food but also vital resources for daily life.Lulu cattle are primarily reared for their nutritious milk, rich in A2-type β-casein protein, as well as for producing organic manure. Himalayan goats and yaks are mainly raised for meat production being a primary focus and as a source of organic fertilizer. They also hold cultural and religious significance, often playing important roles in local ceremonies.

Yak milk, high in fat and protein, is used to produce butter, cheese, and yogurt, including the renowned "chhurpi" (hard yak cheese). Yak products such as ghee and chhurpi are also integral to religious rituals (puja). Additionally, Chyangra goats are highly valued for their premium cashmere wool, which is used to create high-quality fabrics. Overall, these animals are indispensable to the region, enhancing food security, providing income, and offering critical resources. Their multifaceted contributions make them central to the sustainability of high-altitude communities, blending practical benefits with cultural, spiritual, and economic value.

5.4 Product diversification and marketing opportunities

Mustang's agricultural products offer immense potential for value addition that enables the creation of a wide range of unique and marketable items. Apples can be processed into apple sukuti (dried apple slices), apple wine, jam, candy and apple cider. Similarly, apricots can be turned into dried apricots and apricot oil, which are highly sought after in health food and skincare industries. Dried apricots serve as a natural and nutritious snack, while apricot oil has applications in cosmetics due to its moisturizing properties.

Sea Buckthorn, known for its high nutritional and medicinal value, can be used to produce Sea Buckthorn juice, herbal tea, and even skincare products like Sea Buckthorn oil. These items can be marketed as superfood beverages and natural wellness products. Lulu cow's milk offers opportunities for creating value-added dairy products such as Lulu ghee and churpi (hardened cheese). These traditional products can be positioned as organic, culturally authentic dairy items for premium markets.

Yak meat can be processed into yak dried meat, which appeals to niche markets that value high-protein, preserved, and exotic meat products. Yak wool can be used to produce high-quality pashmina, a luxurious textile with strong demand in international markets. Additionally, Medicinal and Aromatic Plants (MAPs) such as Yarsagumba (caterpillar fungus) can be marketed as high-value medicinal products, while Jimbu can be sold as a unique Himalayan spice for culinary purposes.

These diverse products offer a range of opportunities for market expansion, especially in niche markets focused on organic, sustainable, and culturally distinctive goods. Proper branding, packaging, and marketing strategies could help elevate Mustang's agricultural and handicraft exports, driving economic development in the region.

5.5 Dietary habit

In Mustang, the local diet primarily consists of indigenous crops and traditional food items, reflecting their cultural and agricultural heritage. Naked barley flour and common buckwheat flour are commonly consumed in the form of saatu or used to make snacks like roti and dhido. Broadleaf mustard is a seasonal staple, while potatoes serve as the primary vegetable, often mixed with other vegetable items in daily meals. Common beans are also an integral part of their cuisine, often ground to prepare a special type of daal unique to the region.

Lulu cow's milk is a vital part of their diet, consumed either plain or as milk tea. On average, each person drinks around one glass of Lulu milk per day. Yak meat is consumed seasonally, with households typically eating one khur (50–54 kg) or half a khur (25–27 kg) of yak meat annually. When meat is divided among families, it is oven-dried and preserved for use during seasons when vegetables are scarce. Similarly, mountain goat meat is consumed, with households typically consuming one or two goats a year. Sea Buckthorn juice is another seasonal delicacy, with people consuming about 30–50 ml per week during its availability.

In recent years, people's diets have diversified with the introduction of market-sourced foods. Rice, lentils (daal), and refined flour are now commonly consumed alongside traditional staples. Additionally, meats such as buffalo, pork, and chicken have become more prevalent in the local diet, further expanding the variety of protein sources available to the community. This shift reflects a blending of traditional practices with modern dietary habits.

5.6 Conflict with wildlife in Mustang

The Himalayan region of Mustang, Nepal, is renowned for its unique biodiversity and high-altitude pastoral economy. However, this area also witnesses significant conflicts between livestock farmers and wildlife. The root causes of these tensions lie in resource competition, safety concerns, and divergent priorities between conservationists and local communities.

5.6.1 Predation on livestock

Farmers in Mustang raise yaks, goats, sheep, and Lulu cattle, which are often targeted by predators such as snow leopards, wolves, and jackals. These predators typically prey on young, weak, or sick livestock, resulting in financial losses for farmers. Protective measures like guard dogs, reinforced enclosures, and hired guards are costly and not always effective, further exacerbating the economic strain on farming communities.

5.6.2 Competition for grazing resources

Mustang's limited pastures are shared by livestock and wild herbivores, including blue sheep, Himalayan thar, horses etc. Overgrazing by these wild species reduces forage availability for livestock, intensifying conflicts. Farmers often view conservation efforts as prioritizing wildlife at the expense of their livelihoods.

5.6.3 Scarcity of resources

The harsh terrain of Mustang offers limited water and grazing land. Climate change has further disrupted traditional grazing areas, pushing wildlife into new territories and increasing competition with livestock.

5.6.4 Crop damage

Wild animals such as horses frequently damage staple crops like naked barley by trampling or feeding them. This not only reduces food security but also impacts the income of local farmers who depend heavily on these crops.

5.6.5 Traditional livelihoods vs. Conservation goals

Livestock farming is deeply embedded in Mustang's culture and economy. Conservation policies that restrict grazing lands or prohibit harming protected species are often perceived as threats to traditional practices, creating friction between farmers and conservation authorities.

5.6.6 Few provisions for compensation

There are only a few compensation provisions, and most farmers are unaware of them

5.6.7 ACAP Regulations and Restrictions

ACAP regulations restrict access to traditional grazing lands and prohibit the harming of protected species, significantly impacting livestock farming. Farmers face challenges in protecting crops from wildlife, resulting in recurring losses. Additionally, limited resources such as water and arable land are allocated to conservation efforts, leaving farming communities struggling. Hunting restrictions on predators like snow leopards, wolves, and jackals increase livestock vulnerability, leading to higher losses. Overgrazing by wild herbivores, such as blue sheep and Himalayan thar, exacerbates pasture scarcity. The lack of adequate compensation for wildlife-related losses adds economic strain and frustration, fostering resentment towards conservation policies.

6 Recommended technologies in Manang district

The primary cropping system in Mustang district is cultivation of fruit and nuts, particularly apples, walnuts and cherries due to cold climate and high altitude. Other crops include naked barely, wheat, buckwheat, potatoes, limited varieties of vegetables such as string beans and spinach, garlic, radish, cabbage, broadleaf mustard. Nepal Agricultural Research Council and Seed Quality Control Centre (SQCC) has recommended limited varieties maize, wheat, finger millet, barley, buckwheat, Porso millet, foxtail millet, cabbage, BLM, carrot, turnip, cauliflower, beans and fruits like kiwi fruit, apple, walnut and apricot. Some of the neglected and underutilized (NUS) species of prosomillet foxtail millet, amaranthus, finger millet and common bean are also recommended for cultivation. For example, cv. Bariyo Kaguno of foxtail millet, cv. Khairo Simi and cv. Pahenlo Simi of common

beans can be grown in the district. Fodder and pasture species for livestock feeds are also recommended for cultivation. Similarly, high chilling temperature required varieties of cauliflower, cabbage, carrot, turnip, radish, BLM and onion are recommended. Some of the crop varieties recommended for cultivation in Mustang district is presented in **Table 10**.

Table 10: Crops and varieties recommended for Mustang district

Crops	Varieties	Year of recommendation	Recommendation domain	Present practice
Maize	Ganesh 1	1997	High hills	Cultivated
	Ganesh 3	1989	High hills	Not in practice
	Manakamana 3	2002	1000-1700 m asl	Cultivated
	Manakamana 9	2021	800-1800 m asl	Recently released and cultivated
Wheat	Dhaulagiri	2012	600-2300 m asl	Cultivated
	Munal	2018	600-2300 m asl	Cultivated
	Mudule 1	2021	1700-2300 m asl	Not recorded
	Kautila	2021	1000-2300 m asl	Not recorded
	Tila	2021	1700-2300 m asl	Not recorded
	Surma	2021	1000-2300 m asl	Not recorded
	Himganga	2021	1700-2300 m asl	Not recorded
	Bheriganga	2021		Not recorded
Barley	Muktinath	2024	1300-3000 m asl	Cultivated
Buckwheat	Mide Fapar	2015	High hills	Cultivated
	Tite Faper 1	2021	600-3500 m asl	Cultivated
	Tite Faper 2	2021	600-3500 m asl	Cultivated
Foxtail millet	Bariyo Kaguno	2021	800-1500 m asl	Not recorded
Finger millet	Sailung Kodo -1	2015	1300-2200 m asl	Not recorded
	Kavre Kodo 2	2015	700-1800 m asl	Not recorded
Kidney bean (Rajma)	PDR 14	2019	115-2367 m asl	Not recorded
Potato	Khumal Bikash	2018	1200-3000 m asl	Cultivated
	Khumal Ujwal	2014	Mid to high hills	Cultivated
	Khumal Rato -4	2024	800-2500 m asl	Recently released
	Khumal Seto -1	1999	Mid to high hills	Cultivated
	Cardinal	2019	Terai to high hills	Cultivated
	Rojita	2019	1600 – 3500 m asl	Not in practice
	Disire	1992	Terai to high hills	Cultivated
Sweet potato	Suntale Sakharkhanda -1			Not in practice
	Suntale Sakharkhanda -2			Not in practice
Cauliflower	Dolpa Snowball	1994	Terai, Mid and High Hills	Not in practice
	Kathamndu Local	1990	Terai, Mid and high hills	Cultivated
Broad Leaf Mustard	Marpha Chaudapat	1994	Mid and high hills	Cultivated
Carrot	New Kuroda	2010	Terai, Mid and high hills	Cultivated

Crops	Varieties	Year of recommendation	Recommendation domain	Present practice
Radish	Mino Early	1990	Terai, Mid and high hills	Cultivated
French bean	Chaumase Simi	2022	300-2200 m asl	Cultivated
Onion	Red Creol	1990	Terai, Mid and high hills	Cultivated
Spinach	Patane Palungo	2018	Terai, Mid and high hills upto 2100 m asl	Cultivated
Garden Pea	Sikkime	1994	Terai, Mid and High hills	Cultivated
Kiwifruit	Heyward		1400-2500 m asl	Cultivated
	Abort, Alisson, Bruno	2022	1100-2100 m asl	Not in practice
Apple	Fuji, Golden Delicious, Red Delicious, Royal Delicious, Richa Red	Pipeline (yet to be regiested/released)	2000-3000 m asl	Commonly cultivated and popular
Gladiolus	Lumle Gladiolus-1, Lumle Gladiolus-2 and Lumle Gladiolus-3	2022	800-2200 m asl	Not in practice
Rye Grass	Dhunche Rai	2015	Mid and High hills	Not in practice
Common Vetch	Kutil Kosa 1	2017	Upto 2000 m asl	Not recorded
White Clover	Pyali Seto Clover	2012	Mid to high hills	Not reported in cultivation
Oat	Parbati	2012	Terai, Mid and high hills	Cultivation

Recommended cultural practices and interventions in Mustang district are as follows:

1. Seed production methods of cole crops/crucifers (cauliflower, cabbage), carrot, BLM, turnip, onion, radish. Seed to seed and head to seed methods in cabbage.
2. Grafting technology in apple by using crab apple as rootstock.
3. Top working in walnut on hard shell rootstock to thin shell walnut
4. Training and pruning in deciduous fruit orchards
5. Grape, apple, almond and pecan nut production technology
6. Sexual (using seed) and asexual (grafting) methods of propagation in walnut
7. Application of bordex mixture/paint in deciduous fruits
8. Monthly calendar of operation in apple, almond, apricot, grape and walnut
9. High density planting of apple using spur type varieties

10. Post-harvest handling of apple: solar drying and electrical drying of apple (shyau ko sukuti), packaging, transportation, home brewed fermented apple beer/apple brandy
11. Almond production technology
12. Digital soil mapping
13. Rainbow trout farming
14. Sheep and himalayan goat farming technologies
15. Nechugi, a specialized grafting technique, is recommended for rejuvenating declining apple and pear orchards. For apple trees, this method uses crab apple as the rootstock, while for pear trees, mayal serves as the rootstock.
16. Similarly shuttle breeding of wheat varieties in Mustang has been in practice and a great value in fast-track breeding and varietal development in wheat
17. In case of livestock, cheese and churpi production methods from yak milk are recommended by GoN.

There are 37 apple varieties, and the diversity is maintained at single orchard at government farm, Temperate Horticulture Farm, Marpha.

7 Recommendation and Ways Forward (Nepali + English)

To ensure the enduring availability and competitiveness of native technologies and germplasm on both local and global scales, it is crucial to develop targeted strategies and action plans. Enhancing genetic diversity is a key factor in establishing resilient agricultural systems, which are both climate-adaptive and sustainable. Addressing agricultural challenges should prioritize solutions derived from locally available agricultural biodiversity, leveraging their proven adaptability and relevance. Furthermore, fostering localized seed systems while promoting globalized product systems can create a balanced approach that strengthens community resilience and integrates local strengths into global markets.

Documenting and preserving the cultural and spiritual values, along with indigenous agricultural knowledge and practices of mountain communities, is essential. Identifying climate change impacts and adaptation strategies, as well as studying and promoting high-nutrient, healthy and climate-resilient plant and livestock species through local markets, will help conserve the cultural and spiritual integrity of these communities. This approach will improve livelihoods, enhance community resilience to climate change, and strengthen their deep connection to the land.

7.1 Mountain agriculture

1. **Adopt Regenerative and Ecological Agriculture**: Promote deep regenerative and ecological agricultural practices to enhance soil health, biodiversity, and sustainability. Circular agriculture should be prioritized as it maximizes resource efficiency and profitability.
2. **Evaluate Landraces on Ecological Yields**: Assess the performance of landraces based on their ecological yield rather than focusing solely on single traits. Incorporate the food health index of agricultural products to highlight their nutritional and health benefits.
3. **Strengthen Agro-Trans-Pastoralism (ATP)**: Recognize the uniqueness of agro-trans-pastoralism (distinct from transhumant agro-pastoralism, agro-silvo-pastoralism, and

other systems) as a core practice in mountain agriculture. Implement measures to enhance the performance and sustainability of ATP practices.

4. **Promote Inclusive Agriculture**: Foster an inclusive agricultural approach that integrates crops, forages, livestock, agro-insects, agro-microbes and aquatic genetic resources with food, nutrition, health, business, and environmental objectives to address the diverse needs of mountain communities while ensuring ecological sustainability.

7.2 Conservation

1. **Establish Conservation Banks**: Develop and promote diverse conservation banks, such as Muktinath agro-gene sanctuary, seed gene banks, field gene banks, forage field gene banks, school field gene banks, community gene banks, agro-insect field gene banks, crop-specific parks, agro-microbial field gene banks, livestock farm gene banks, and household gene banks.
2. **Raithane Nurseries and Agro-Plantation**: Establish Raithane (native) nurseries and organize agro-plantation initiatives to restore and conserve native species and strengthen agro-ecosystems.
3. **Document Agricultural Biodiversity**: Compile detailed profiles of all agricultural genetic resources at species, landrace, and genotype levels across households, villages, wards, and districts, alongside food biodiversity and climate change impact documentation for high-altitude areas.
4. **Seed Fairs and Exchange Systems**: Regularly organize seed fairs and promote community-based seed exchange systems to enhance seed security, biodiversity, and community resilience.
5. **Publish Landrace Catalogs**: Develop and distribute comprehensive catalogs and profiles of landraces covering all six components of agrobiodiversity, including their nutritional and health value profiles, to raise awareness and support conservation efforts.
6. **Create a Digital Gene bank**: Establish a digital gene bank or digital map of landraces to document, manage, and facilitate access to valuable genetic resources.
7. **Agro-Friendly Fields**: Promote agricultural practices that create agro-insect, agro-microbe, and agro-bird-friendly fields, fostering biodiversity within agricultural landscapes.
8. **Nature-Positive Practices**: Advocate for nature-positive agro-trans-pastoralism (ATP), including the adoption of nature-positive storage systems, to align conservation with sustainable practices.
9. **Conserve Threatened Species**: Designate agrobiodiversity hotspots or conservation areas for threatened species and protect habitats of wild relatives of agricultural genetic resources (AGRs) and medicinal plants to ensure long-term preservation.

7.3 Utilization

1. **Participatory Landrace Enhancement**: Implement participatory landrace enhancement and conservation (LEC) programs to improve and utilize native genetic resources effectively.
2. **Promote Genetic Diversity**: Introduce evolutionary plant breeding, cultivar mixtures, and practices that enhance genetic diversity in fields, kitchens, and food systems to support resilience and nutrition.
3. **Domesticate Valuable Species**: Identify and domesticate high-value species with potential for agricultural, nutritional, and economic benefits.

4. **Climate-Resilient Crops and Livestock**: Identify and promote climate-resilient crops and livestock, prioritizing ecological yield and Food Health Index parameters for sustainable production systems.
5. **Establish Diversity Blocks**: Create diversity blocks to support selection, natural adaptation, and the evolution of new genotypes suited to changing conditions.
6. **Reintroduce Lost Landraces**: Reintroduce lost landraces and repatriate them from national and global gene pools to restore local agrobiodiversity.
7. **Study Climate Change Impacts**: Conduct studies on the impact of climate change on native agrobiodiversity and monitor the evolution of new genotypes under shifting environmental conditions.
8. **Register Landraces**: Register native landraces as private goods to incentivize their conservation and utilization while ensuring community rights and benefits.
9. **Ecological Pest Management**: Develop and implement ecological pest management strategies to address insect pest challenges in an environmentally sustainable manner.
10. **Value Addition and Market Linkages**: Enhance the value of agrobiodiversity through breeding and non-breeding approaches and establish strong market linkages for these improved products.
11. **Product Diversification**: Diversify agricultural products to cater to various markets and enhance resilience to market fluctuations.
12. **Improve Local Tools and Mechanization**: Upgrade traditional tools and mechanization systems to make local agricultural practices more efficient and productive.
13. **Periodic Table of Foods**: Develop and refine a periodic table of foods tailored for healthy, smart, and resilient diets, integrating agrobiodiversity to promote well-being.

7.4 Cultural and spiritual integrity

1. **Preserve Indigenous Knowledge and Practices**: Document, safeguard, and promote traditional agricultural practices that reflect the cultural and spiritual values of Mustang communities.
2. **Integrate Spiritual Values in Agriculture**: Incorporate the spiritual and cultural significance of agriculture into development strategies to maintain harmony between farming practices and local traditions.
3. **Support Traditional Festivals and Rituals**: Provide resources and support for agricultural festivals, rituals, and ceremonies that celebrate planting, harvesting, and other agrarian activities.
4. **Promote Culturally Significant Crops and Livestock**: Identify and prioritize the conservation and promotion of crops and livestock species with deep cultural or spiritual connections to the local communities.
5. **Community-based Tourism**: Foster cultural tourism, such as agro-tourism and homestays, to highlight the unique agricultural heritage and spiritual values of the region.
6. **Educate Cultural Agrobiodiversity**: Develop community-based education programs to raise awareness about the importance of cultural and spiritual integrity in agricultural practices, particularly for younger generations.
7. **Support IPR for Traditional Practices**: Protect traditional agricultural practices, knowledge, and products under intellectual property rights (IPR), ensuring their continued relevance and contribution to the community's cultural identity.

8. **Create Cultural Heritage Zones**: Designate certain agricultural landscapes or practices as cultural heritage zones to preserve and celebrate the unique agricultural legacy of Mustang .

7.5 Awareness and capacity

1. **Training and Skill Development**: Conduct training programs and action research focused on adding value to native and local genetic diversity, enhancing community skills in utilizing and promoting these resources.
2. **Awareness on Value Addition**: Raise awareness about the importance of adding value to and promoting traditional and native genetic resources to strengthen their role in sustainable agriculture.
3. **Organize Community Events**: Regularly hold diversity field schools, food fairs, diversity fairs, seed exchange programs, exchange visits, traveling seminars, and workshops to engage communities and share knowledge.
4. **Document and Share Indigenous Practices**: Systematically document Indigenous agricultural practices and traditional knowledge, and ensure this information is widely shared to encourage adoption and preservation.
5. **Develop Accessible Materials**: Publish and distribute farmer-friendly materials in local languages and formats to make information on agrobiodiversity accessible and practical for end-users.
6. **Incorporate Agrobiodiversity into Education**: Integrate agrobiodiversity science into school curricula to build early awareness and foster a new generation of advocates for sustainable agricultural practices.

7.6 Policy actions

1. **Provide Incentives for Conservation and utilization**: Implement incentive mechanisms to support the conservation and utilization of native germplasm, ensuring they are aligned with broader strategies to promote sustainable agricultural practices.
2. **Integrate Native Genetic Resources into Formal Systems**: Ensure native genetic resources are automatically included in formal agricultural systems, with applicable incentive mechanisms to encourage their use and preservation.
3. **Increase Genetic Diversity**: Recognize the importance of genetic diversity in agricultural policies. Develop strategies to enhance genetic diversity at all levels, from local to national scales, as a cornerstone of resilient and sustainable agriculture.
4. **Protect Traditional Knowledge and Products**: Safeguard traditional practices, native products, and technologies under intellectual property rights (IPR), including geographical indications, to preserve cultural heritage and add value to local products.
5. **Support Local Packaging and Branding**: Allow and promote the packaging and branding of local products at the community level to improve marketability and economic benefits for producers.
6. **Promote Market Access for Agricultural Items**: Facilitate the marketing of all agricultural items through initiatives such as agro-tourism, homestays, hat-bazar and the establishment of community and household gene banks, which also serve to strengthen community resilience and biodiversity conservation.

सिफारिस र मार्गदर्शन

स्वदेशी प्रविधि र जर्मप्लाजम (कृषि आनुवाशिक स्रोतहरु) लाई स्थानीय र विश्वव्यापी स्तरमा दिगो उपलब्धता र प्रतिस्पर्धात्मकता सुनिश्चित गर्न लक्षित रणनीति र कार्य योजनाहरू विकास गर्न आवश्यक छ। कृषि जैविक विविधताको वृद्धि, जलवायु अनुकूल र दिगो कृषि प्रणाली स्थापना गर्न महत्वपूर्ण छ। कृषि चुनौतीहरूको समाधानमा स्थानीय रूपमा उपलब्ध कृषि जैविक विविधतालाई प्राथमिकता दिनु पर्दछ, जसले आफ्नो अनुकूलन क्षमता र प्रासंगिकता प्रमाणित गरिसकेको छ। साथै, स्थानीय बीउ प्रणालीलाई प्रोत्साहन गर्दै विश्वव्यापी उत्पादन प्रणालीलाई प्रवर्द्धन गर्दा समुदायको सहनशीलता बलियो बनाउनुका साथै स्थानीय बललाई विश्व बजारमा एकीकृत गर्न सकिन्छ।

हिमाली समुदायहरूको सांस्कृतिक र आध्यात्मिक मूल्यहरू साथै आदिवासी कृषि ज्ञान र अभ्यासहरूलाई दस्तावेजीकरण र संरक्षण गर्नु अत्यावश्यक छ। जलवायु परिवर्तनका प्रभावहरू र अनुकूलन रणनीतिहरू पहिचान गर्दै उच्च पोषणयुक्त, स्वस्थ र जलवायु अनुकूल वनस्पति तथा पशु प्रजाति/ भुमि जातहरूको अध्ययन र स्थानीय बजारमार्फत प्रवर्द्धन गर्नु महत्वपूर्ण छ। यसले यी समुदायहरूको सांस्कृतिक र आध्यात्मिक अखण्डता संरक्षण गर्न, जीविकोपार्जन सुधार गर्न, र समुदायको जलवायु परिवर्तनप्रतिको सहनशीलता वृद्धि गर्न मद्दत गर्नेछ।

हिमाली कृषि

१. **पुनरुत्थानात्मक र पारिस्थितिक कृषि अवलम्बन गर्ने:** माटोको स्वास्थ्य, जैविक विविधता, र दिगोपनलाई बढावा दिन पुनरुत्थानात्मक र पारिस्थितिक कृषि अभ्यासहरू प्रवर्द्धन गर्नु पर्छ। स्रोतहरूको अधिकतम उपयोग र लाभका लागि घुम्ती कृषि (Circular Agriculture) लाई प्राथमिकता दिनुपर्छ।

२. **भूमि-जातहरूको मूल्यांकन गर्ने:** भूमि जातहरुको प्रदर्शनलाई एकल लक्षणमा मात्र आधारित नगरी पारिस्थितिक उत्पादन (Ecological Yield) को आधारमा मूल्यांकन गर्नु पर्छ। कृषि उत्पादनहरूको पोषण र स्वास्थ्य लाभहरूलाई उजागर गर्न खाद्य स्वास्थ्य सूचकांकलाई समावेश गर्नु पर्छ।

३. **कृषि-घुम्ती गोठ-चरनवन प्रणाली (ATP) बलियो बनाउने:** हिमाली कृषि प्रणालीको मुख्य अभ्यासको रूपमा मान्यता दिइँदै यसको प्रदर्शन र दिगोपन सुधारका उपायहरू लागू गर्नु पर्छ।

४. **समावेशी कृषि प्रवर्द्धन गर्ने:** खाद्य, पोषण, स्वास्थ्य, व्यापार र वातावरणीय उद्देश्यहरू पूरा गर्न बाली, घाँसे बालि, पशुपन्क्षि, कृषि-कीरा, कृषि-शुक्ष्म जीवाणु र जलीय आनुवंशिक स्रोतहरूलाई समेटेर समावेशी कृषि दृष्टिकोणलाई प्रोत्साहन गर्नु पर्छ। यसले समुदायको विविध आवश्यकतालाई सम्बोधन गर्दै पारिस्थितिक दिगोपना सुनिश्चित गर्नेछ।

संरक्षण मुक्तिनाथ

१. **संरक्षण बैंकहरू स्थापना गर्ने:** विभिन्न प्रकारका संरक्षण बैंकहरू स्थापना र प्रवर्द्धन गर्नु पर्छ, जस्तै मुक्तिनाथ कृषि वंशानु आरक्ष स्थल, बीउ बैंक, फिल्ड जीन बैंक, घाँसे बाली फिल्ड जीनबैंक, स्कूल फिल्ड जीन बैंक, सामुदायिक जीन बैंक, कृषि-कीरा फिल्ड जीन बैंक, बाली-बिशेष पार्क, कृषि-शुक्ष्म जीवाणु फिल्ड जीन बैंक, पशुपन्क्षि फार्म जीन बैंक, र घरायसी जीन बैंक, आदि।

२. **रैथाने नर्सरी र कृषि-वृक्षारोपण कार्यक्रमहरू** : रैथाने (स्थानिय) नर्सरीहरू स्थापना गर्ने र कृषि- **वृक्षारोपण** कार्यक्रमहरू आयोजना गरी स्थानिय प्रजातिहरूको पुनर्स्थापना र संरक्षण गर्दै कृषि-परिस्थिति प्रणालीलाई बलियो बनाउनु पर्छ।

३. **कृषि जैविक विविधता दस्तावेजीकरण**: घरपरिवार, गाउँ, वडा, र जिल्लास्तरमा प्रजाति, भूमि-जात, र आनुवंशिकी स्तरमा सम्पूर्ण कृषि आनुवंशिक स्रोतहरूको विस्तृत विवरण तयार गर्नु पर्छ। उच्च पहाडी क्षेत्रका खाद्य जैविक विविधता र जलवायु परिवर्तन प्रभावहरूको पनि दस्तावेजीकरण गर्नु पर्छ।

४. **बीउ मेला र आदानप्रदान प्रणालीहरू**: नियमित रूपमा बीउ मेला आयोजना गर्ने र सामुदायिक स्तरमा आधारित बीउ आदानप्रदान प्रणालीलाई प्रवर्द्धन गरी बीउ सुरक्षामा वृद्धि, कृषि जैविक विविधता संरक्षण, र समुदायको सहनशीलता बढाउनु पर्छ।

५. **भूमि-जातहरु को क्याटलग प्रकाशन**: कृषि जैविक विविधताको छ वटा मुख्य अंगहरु समेट्दै, भूमि-जातहरूको पोषण र स्वास्थ्य मूल्य विवरणहरू समावेश गरेर विस्तृत क्याटलगहरू विकास र वितरण गर्नु पर्छ। यसले जनचेतना फैलाउन र संरक्षण प्रयासलाई सहयोग गर्नेछ।

६. **डिजिटल जीनबैंक सिर्जना गर्ने**: भूमि-जातहरूको विवरण, व्यवस्थापन, र पहुँचलाई सहज बनाउन डिजिटल जीनबैंक वा डिजिटल नक्सा स्थापना गर्नु पर्छ।

७. **कृषि-मैत्री क्षेत्रहरू प्रवर्द्धन गर्ने**: कृषि क्षेत्रमा जैविक विविधता प्रवर्द्धन गर्न कृषि-कीरा, कृषि-शुक्ष्म जीवाणु, र कृषि-चरा मैत्री अभ्यासहरूलाई प्रोत्साहन गर्नु पर्छ।

८. **प्रकृति-मैत्री अभ्यासहरू**: प्रकृति-मैत्री **कृषि-घुम्ती गोठ-चरनवन प्रणाली** (ATP) र प्रकृति-मैत्री भण्डारण प्रणालीहरू अवलम्बन गरेर संरक्षण र दिगो अभ्यासलाई एकीकृत गर्नु पर्छ।

९. **जोखिममा रहेका प्रजाति/ जातहरूको संरक्षण**: जोखिममा रहेका प्रजाति/जातहरूका लागि जैविक विविधता हब वा संरक्षण क्षेत्रहरू घोषणा गर्नु पर्छ। कृषि आनुवंशिक स्रोतहरु (AGRs) र औषधीय वनस्पतिहरूका जङ्गली नातेदारहरूको बासस्थान सुरक्षित गर्दै दीर्घकालीन संरक्षण सुनिश्चित गर्नु पर्छ।

उपयोग

१. **सहभागितामुलक भूमि-जात सुधार कार्यक्रम**: स्थानिय आनुवंशिक स्रोतहरूको प्रभावकारी उपयोग र संरक्षणका लागि सहभागितामुलक भूमि-जात सुधार तथा संरक्षण (LEC) कार्यक्रम लागू गर्नु पर्छ।

२. **आनुवंशिक विविधता प्रवर्द्धन गर्ने**: खेत, भान्छा, र खाद्य प्रणालीमा आनुवंशिक विविधता बढाउन उत्परिवर्तनशिल बाली प्रजनन्, जातीय मिश्रण, र विविधतासम्बन्धी अभ्यासहरू गर्नु पर्छ।

३. **महत्त्वपूर्ण प्रजातिहरूलाई घरेलुकरण गर्ने**: कृषि, पोषण, र आर्थिक लाभका लागि सम्भावित उच्च-मूल्यका प्रजातिहरू पहिचान गरी घरेलुकरण गर्नु पर्छ।

४. **जलवायु-प्रतिरोधी बाली र पशुहरू**: दिगो उत्पादन प्रणालीका लागि पारिस्थितिक उत्पादन (Ecological Yield) र खाद्य स्वास्थ्य सूचकांकलाई प्राथमिकता दिँदै जलवायु-प्रतिरोधी बाली र पशुहरूको पहिचान र प्रवर्द्धन गर्नु पर्छ।

५. **विविधता ब्लकहरू स्थापना गर्ने**: नयाँ जात/ आनुवंशहरूको चयन, प्राकृतिक अनुकूलन, र विकासलाई समर्थन गर्न विविधता ब्लकहरू स्थापना गर्नु पर्छ।

६. **हराएका भूमिस्थान पुन:स्थापना गर्ने**: राष्ट्रिय र अन्तर्राष्ट्रिय बैंक हरुबाट उक्त स्थान वाट हराएका भूमिस्थानहरू पुन:स्थापना गरी स्थानिय कृषि जैविक विविधतालाई पुनर्जीवित गर्नु पर्छ।

७. **जलवायु परिवर्तन प्रभाव अध्ययन गर्ने**: स्थानिय कृषि जैविक विविधतामा जलवायु परिवर्तनको प्रभावको अध्ययन गरि र बदलिँदो वातावरणीय परिस्थितिमा नयाँ जातहरूको विकासको अनुगमन गर्नु पर्छ।
८. **भूमि-जात दर्ता गर्ने**: स्थानिय भूमि-जातहरूलाई निजी/ समुहको सम्पत्तिका रूपमा दर्ता गरी संरक्षण र उपयोगलाई प्रोत्साहन गर्नु पर्छ, जसले गर्दा समुदायका अधिकार र लाभ सुनिश्चित होस्।
९. **पारिस्थितिक रोग-कीरा व्यवस्थापन**: कीरा र रोग समस्याहरूलाई वातावरणमैत्री र दिगो तरिकाले समाधान गर्न पारिस्थितिक रोग कीरा व्यवस्थापन रणनीतिहरू विकास र कार्यान्वयन गर्नु पर्छ।
१०. **मूल्य अभिवृद्धि र बजार सम्बन्ध**: प्रजनन र गैर-प्रजनन दृष्टिकोणद्वारा कृषि जैविक विविधताको मूल्य अभिवृद्धि गरि र ती सुधारिएका उत्पादनहरूको लागि बलियो बजार सम्बन्ध स्थापित गर्नु पर्छ।
११. **उत्पादन विविधीकरण**: विभिन्न बजारहरूको आवश्यकता पूरा गर्न र बजारको उतारचढावप्रति सहनशीलता बढाउन कृषि उत्पादनहरूको विविधीकरण गर्नु पर्छ।
१२. **स्थानिय उपकरण र यान्त्रीकरण सुधार गर्ने**: स्थानिय कृषि अभ्यासहरूलाई थप प्रभावकारी र उत्पादक बनाउन परम्परागत उपकरणहरू र यान्त्रीकरण प्रणालीमा सुधार गर्नु पर्छ।
१३. **खाद्यहरूको आवधिक तालिका विकास गर्ने**: स्वस्थ, स्मार्ट, र सहनशील आहारका लागि कृषि जैविक विविधतालाई समेट्दै स्वस्थकर खाद्यहरूको आवधिक तालिका तयार र सुधार गर्नु पर्छ।

सांस्कृतिक र आध्यात्मिक अखण्डता

१. **स्थानिय ज्ञान र अभ्यासको संरक्षण गर्ने**: समुदायका सांस्कृतिक र आध्यात्मिक मुल्यलाई प्रतिबिम्बित गर्ने परम्परागत कृषि अभ्यासहरूको दस्तावेजीकरण, सुरक्षा, र प्रवर्द्धन गर्नु पर्छ।
२. **कृषिमा आध्यात्मिक मुल्यहरू समाहित गर्ने**: कृषि विकास रणनीतिहरूमा कृषि र स्थानिय परम्पराहरू बीचको सन्तुलन कायम राख्न कृषि प्रक्रियामा आध्यात्मिक र सांस्कृतिक महत्त्वलाई समावेश गर्नु पर्छ।
३. **परम्परागत चाडपर्व र अनुष्ठानहरूको समर्थन गर्ने**: बिउ रोप्ने, बिउ सँग्रह गर्ने र अन्य कृषि गतिविधिहरूको सम्मानमा हुने कृषि चाडपर्व, अनुष्ठान र कर्मकाण्डहरूको लागि स्रोत र समर्थन उपलब्ध गराउनु पर्छ।
४. **संस्कृतिक दृष्टिले महत्त्वपूर्ण बाली र पशुहरूको प्रवर्द्धन गर्ने**: स्थानिय समुदायसँग गहिरो सांस्कृतिक र आध्यात्मिक जडान भएका बाली र पशु प्रजातिहरूको संरक्षण र प्रवर्द्धनलाई प्राथमिकता दिनु पर्छ।
५. **समुदाय आधारित कृषि पर्यटनको प्रवर्द्धन गर्ने**: कृषि पर्यटन र होम-स्टे जस्ता सांस्कृतिक पर्यटनलाई प्रवर्द्धन गरी उक्त क्षेत्रको अनौठो कृषि धरोहर र आध्यात्मिक मुल्यलाई उजागर गर्नु पर्छ।
६. **संस्कृतिक कृषि जैविक विविधता सम्बन्धी शिक्षा प्रदान गर्ने**: कृषि अभ्यासहरूमा सांस्कृतिक र आध्यात्मिक अखण्डताको महत्त्वबारे जनचेतना फैलाउन कृषि जैविक विविधतामा आधारित शैक्षिक कार्यक्रमहरूको विकास गरि, विशेष गरी युवा पुस्ताका लागि जोड दिनु पर्छ।
७. **परम्परागत अभ्यासहरूको लागि बौद्धिक सम्पत्ति अधिकारको व्यवस्था गर्ने**: परम्परागत कृषि अभ्यास, ज्ञान, र उत्पादनहरूलाई बौद्धिक सम्पत्ति अधिकार (IPR) अन्तर्गत सुरक्षा गर्नुपर्छ, जसले ती अभ्यासहरूको स्थायी महत्व र समुदायको सांस्कृतिक पहिचानमा योगदान सुनिश्चित गर्दछ।
८. **सांस्कृतिक धरोहर क्षेत्रहरू सिर्जना गर्ने**: उक्त क्षेत्रको अनौठो कृषि धरोहरलाई जोगाउन र सम्मान गर्न निश्चित कृषि परिदृश्य वा अभ्यासहरूलाई सांस्कृतिक धरोहर क्षेत्रको रूपमा पहिचान गर्नु पर्छ।

जागरूकता र क्षमता वृद्धि

१. **प्रशिक्षण र सीप विकास:** स्थानीय र स्वदेशी कृषि जैविक विविधता को मूल्यवृद्धि गर्ने, र यी स्रोतहरूको उपयोग र प्रवर्द्धनमा समुदायका सीपहरूलाई सुधार गर्न लक्षित प्रशिक्षण कार्यक्रम र क्रियात्मक अनुसन्धान सञ्चालन गर्नु पर्छ।

२. **मूल्यवृद्धि सम्बन्धी जागरूकता:** परम्परागत र कृषि जैविक स्रोतहरूलाई मूल्यवृद्धि गर्ने र प्रवर्द्धन गर्ने महत्त्वबारे जागरूकता फैलाउने, जसले दिगो कृषि प्रणालीमा तिनीहरूको भूमिका सुदृढ पार्नेछ।

३. **समुदायमा आधारित कार्यक्रमहरूको आयोजना:** समुदायलाई संलग्न गर्न र ज्ञान साट्नका लागि नियमित रूपमा खाद्य मेला, विविधता मेला, बीउ आदानप्रदान कार्यक्रम, भ्रमण, यात्रा सेमिनार, र कार्यशालाहरू आयोजना गर्नु पर्छ।

४. **स्थानीय अभ्यासहरूको दस्तावेजीकरण र आदानप्रदान गर्ने:** स्थानीय कृषि अभ्यास र परम्परागत ज्ञानको व्यवस्थित रूपमा दस्तावेजीकरण गरि र यसलाई प्रोत्साहन र संरक्षणको लागि व्यापक रूपमा आदानप्रदान गर्नु पर्छ।

५. **पहुँचयोग्य सामग्रीको विकास गर्ने:** कृषकहरूका लागि उपयुक्त भाषामा र ढाँचामा किसान मैत्री सामग्री प्रकाशित र वितरण गर्ने, जसले कृषि जैविक विविधता सम्बन्धी जानकारीलाई अन्तिम प्रयोगकर्ताहरूको लागि व्यावहारिक र पहुँच योग्य बनाउँछ।

६. **शिक्षामा कृषि जैविक विविधता समावेश गर्ने:** स्कूलका पाठ्यक्रममा कृषि जैविक विविधता विज्ञानलाई समावेश गर्ने, जसले प्रारम्भिक जागरूकता सिर्जना गर्नेछ र दिगो कृषि अभ्यासहरूको पक्षमा नयाँ पुस्ताका वकालत गर्नेहरूलाई प्रोत्साहन गर्नेछ।

नीतिगत क्रियाकलापहरू

१. **संरक्षण र उपयोगका लागि प्रोत्साहन प्रदान गर्ने:** स्थानीय संसाधनहरूको संरक्षण र उपयोगको समर्थन गर्न प्रोत्साहन संयन्त्र कार्यान्वयन गर्ने, जसले दिगो कृषि अभ्यासहरू प्रवर्द्धन गर्ने व्यापक रणनीतिहरूसँग मेल खाने सुनिश्चित गर्दछ।

२. **स्थानीय कृषि जैविक स्रोतहरूलाई औपचारिक प्रणालीमा समाहित गर्ने:** स्थानीय कृषि जैविक संसाधनहरूलाई औपचारिक कृषि प्रणालीमा स्वचालित रूपमा समावेश गर्ने, र तिनीहरूको प्रयोग र संरक्षणको लागि उपयुक्त प्रोत्साहन संयन्त्रहरू लागू गर्ने।

३. **कृषि जैविक विविधता वृद्धि गर्ने:** कृषि नीतिहरूमा आनुवंशिक विविधताको महत्त्वलाई स्वीकृति दिनु पर्छ। स्थानीय देखि राष्ट्रिय स्तरसम्म आनुवंशिक विविधता वृद्धि गर्नका लागि रणनीतिहरू विकास गर्नु पर्छ, जसले दिगो र लचिलो कृषि प्रणालीको आधारको रूपमा काम गर्छ।

४. **परम्परागत ज्ञान र उत्पादनहरूको संरक्षण गर्ने:** परम्परागत अभ्यासहरू, स्वदेशी उत्पादनहरू र प्रौद्योगिकिहरूलाई बौद्धिक सम्पत्ति अधिकार (IPR) अन्तर्गत संरक्षण गर्नु पर्छ, जसमा भौगोलिक संकेतहरू पनि समावेश छन्, ताकि सांस्कृतिक धरोहरको संरक्षण र स्थानीय उत्पादनहरूको मूल्यवृद्धि होस्।

५. **स्थानीय प्याकेजिङ र ब्रान्डिङलाई समर्थन गर्ने:** समुदाय स्तरमा स्थानीय उत्पादनहरूको प्याकेजिङ र ब्रान्डिङलाई अनुमति दिनु पर्छ र प्रोत्साहित गर्नु पर्छ, जसले उत्पादकहरूको बजारमा बिक्री र आर्थिक लाभलाई सुधार्न मद्दत पुर्याउँछ।

६. **कृषि सामग्रीहरूको बजार पहुँच प्रवर्द्धन गर्ने:** कृषि सामग्रीहरूको बजार पहुँचलाई प्रवर्द्धन गर्नका लागि कृषि-पर्यटन, होम-स्टे, हाट-बजार, र समुदाय तथा घरायसी जीन बैंकको स्थापनाजस्ता पहलहरूलाई प्रवर्धन गर्नु पर्छ, जसले समुदायको लचिलोपन र कृषि जैविक विविधता संरक्षणलाई पनि सुदृढ बनाउँछ।

8 Conclusion

In conclusion, the agrobiodiversity of Mustang district represents a profound integration of nature, culture, and spirituality, serving as a cornerstone of the region's identity and resilience. The district's traditional farming practices, rooted in cultural and spiritual values, not only support sustainable agricultural systems but also reflect the community's deep connection to their land and heritage. Preserving this intricate relationship is crucial for maintaining food security, conserving biodiversity, and sustaining ecological balance in Mustang.

Moreover, the cultural, religious, and spiritual dimensions of Mustang's farming communities present unique opportunities for eco-tourism, the promotion of value-added agricultural products, and community-led conservation initiatives. By documenting and integrating traditional knowledge into modern agricultural frameworks, policymakers and stakeholders can ensure the sustainable development of Mustang while honoring its rich heritage. Collaborative efforts that involve local communities, development partners, and policymakers will be pivotal in achieving these goals and safeguarding the district's agrobiodiversity for future generations. Ultimately, protecting Mustang's agrobiodiversity means preserving the essence of its cultural and ecological identity, ensuring that this invaluable resource continues to contribute to the well-being of its people and the sustainability of the region.

References

Aase, TH., Chaudhary, RP and OR Vetaas. 2010. Farming flexibility and food security under climatic uncertainty: Manang, Nepal Himalaya. Area 42(2):228-238. DOI: 10.1111/j.1475-4762.2009.00911. x.

Ahmed S, de la Parra J, Elouafi I, German B, Jarvis A, Lal V, Lartey A, Longvah T, Malpica C, Vázquez-Manjarrez N, Prenni J, Aguilar-Salinas CA, Srichamnong W, Rajasekharan M, Shafizadeh T, Siegel JB, Steiner R, Tohme J, Watkins S. 2022. Foodomics: A Data-Driven Approach to Revolutionize Nutrition and Sustainable Diets. Frontiers in Nutrition 9:874312. DOI: 10.3389/fnut.2022.874312.

Annapurna Conservation Area Project (ACAP). NTNC Official Website

Giri, B., & Sharma, R. 2017. Tibetan Buddhism, Sacred Landscapes, and Ecological Conservation in Mustang District. In M. L. Koirala & A. Sharma (Eds.), The Himalayan Environment: Sustainability, Conservation, and Indigenous Practices (pp. 123-136). Cambridge University Press.

Gurung, G. S., & Thapa, K. 2004. Sustainable Livelihood Systems in the Annapurna Conservation Area.

Hossain M. S., Dearing J. A., Rahman M. M., and Salehin M. 2016. Recent changes in ecosystem services and human well-being in the Bangladesh coastal zone. Regional Environmental Change, 16, pp.429-443.

Jackson, R., & Wangchuk, R. 2001. Snow Leopard Conservation and Farmer Conflict Mitigation Strategies.

Joshi BK and D Upadhya. 2019. On-farm Conservation Approaches for Agricultural Biodiversity in Nepal. Journal of Agriculture and Natural Resources 2: 14-35. DOI: https://doi.org/10.3126/janr.v2i1.26012

Joshi BK, D Gauchan and DK Ayer. 2022. Participatory agrobiodiversity tools and methodologies (PATaM) in Nepal. NAGRC, LI-BIRD and Alliance of Bioversity International and CIAT; Kathmandu, Nepal. https://api.giwms.gov.np/storage/75/posts/1685027635_2.pdf

Joshi BK, D Gauchan, B Bhandari and D Jarvis, eds. 2020. Good Practices for Agrobiodiversity Management. NAGRC, LI-BIRD and Bioversity International and CIAT; Kathmandu. https://www.bioversityinternational.org/e-library/publications/detail/good-practices-for-agrobiodiversity-management/

Joshi BK, D Gauchan, P Chaudhary, K Aryal and RK Shrestha. 2023. Drivers of changes in the state of agrobiodiversity. Agrobiodiversity and Agroecology 3(1): 28-53. DOI: https://doi.org/10.33002/aa030102

Joshi BK, KH Ghimire, SP Neupane and D Gauchan and DK Mengistu. 2023. Approaches and advantages of increased crop genetic diversity in the fields. Diversity 15:603.

Joshi BK, MR Bhatta, KH Ghimire, M Khanal, SB Gurung, R Dhakal, and BR Sthapit. 2017. Released and Promising Crop Varieties of Mountain Agriculture in Nepal (1959-2016). LI-BIRD, Pokhara; NARC, Kathmandu and Bioversity International, Pokhara, Nepal. https://hdl.handle.net/10568/80892

Joshi BK, NA Gorkhali, N Pradhan, KH Ghimire, TP Gotame, P KC, RP Mainali, A Karkee and RB Paneru. 2020. Agrobiodiversity and its Conservation in Nepal. Journal of Nepal Agricultural Research Council 6: 14-33. DOI: https://doi.org/10.3126/jnarc.v6i0.28111

Joshi BK, R Shrestha, IP Gautam, AP Poudel and TP Gotame. 2019. Neglected and Underutilized Species (NUS), and Future Smart Food (FSF) in Nepal. National Agriculture Genetic Resources Center (NAGRC, National Genebank), NARC, Khumaltar, Kathmandu, Nepal. https://www.researchgate.net/publication/332979036_Neglected_and_Underutilized_Species_NUS_and_Future_Smart_Food_FSF_in_Nepal

Joshi BK, R Vernooy and P Chaudhary. 2017. Crop Interdependence, Adaptation to Climate Change and the Multilateral Systems of Access and Benefit Sharing: The Case of Nepal. Indian Journal of Plant genetic Resources 30(3):210-217. DOI: https://doi.org/10.5958/0976-1926.2017.00026.2

Joshi BK, RK Shrestha, RC Khanal, and D Gauchan. 2024. Agroecosystem based agricultural genetic resources for balanced and diversified food, nutrition, health, business, geographical indication and environment. Agroecology and Sustainable Food Systems 48(10):1387-1412 DOI: https://doi.org/10.1080/21683565.2024.2389289

Joshi BK, SP Neupane, D Gauchan, A Karkee, DK Ayer and DK Mengistu. 2024. Policy dimension for promoting inter and intra-varietal diversity and evolutionary crop populations. Euphytica 220:148. DOI: https://doi.org/10.1007/s10681-024-03405-3

Joshi BK, SP Vista, SB Gurung, KH Ghimire, R Gurung, S Pant, S Gautam and PB Paneru. 2020. Cultivar mixture for minimizing risk in farming and conserving agrobiodiversity. In: Traditional Crop Biodiversity for Mountain Food and Nutrition Security in Nepal UNEP GEF Local Crop Project, Nepal. NAGRC, LI-BIRD and Bioversity International and CIAT; Kathmandu, Nepal; pp.14-25. https://himalayancrops.org/project/traditional-crop-biodiversity-for-mountain-food-and-nutrition-security-in-nepal/

Joshi BK. 2017. Plant Breeding in Nepal: Past, Present and Future. Journal of Agriculture and Forestry University 1:1-33. http://afu.edu.np/sites/default/files/Plant_breeding_in_Nepal_Past_Present_and_Future_BK_Joshi.pdf

Joshi BK. 2021. Indigenous seeds, seed selection and seed bank for sustainable agriculture. Grassroots Journal of Natural Resources 4(4): 13-26. Doi: https://doi.org/10.33002/nr2581.6853.04040

Kathmandu, N. 2017. The State of Nepal's Biodiversity for Food and Agriculture. MoAD, Kathmandu, Nepal.

Ministry of Forests and Environment, Government of Nepal. 2019. Nepal Climate Vulnerability Study: Impacts and Adaptation Strategies for High-Altitude Regions. Government of Nepal.

MoFE. 2021. Vulnerability and Risk Assessment and Identifying of Adaptation options in Disaster Risk Reduction and Management (DRRM). Ministry of Forests and Environment, Government of Nepal. Kathmandu, Nepal.

MoFE. 2021. Vulnerability and Risk Assessment and Identifying of Adaptation options in Disaster Risk Reduction and Management (DRRM). Ministry of Forests and Environment, Government of Nepal. Kathmandu, Nepal.

Nepal, S.K. 2000. Tourism in protected areas: The Nepalese Himalaya. *Annals of Tourism Research* 27(3): 661–681.

Neupane, N. 2009. Political Economy of water distribution in the trans-Himalayan region of Nepal. Farming and Rural Systems Economics. Margraf Publishers. GmbH 2001. Vol. 128. Pp 1-225.

Neupane, N. 2009. Political-economy of water distribution in the trans-himalayan region of Nepal. Farming and Rural Systems Economics. Margraf Publishers. GmbH 2001. Vol. 128. Pp: 1-225.

Oli, M. K., Taylor, I. R., & Rogers, M. E. 1994. Snow leopard predation of livestock in a Himalayan mountain valley. *Biological Conservation* 68(1): 63–68.

Regmi, B. R., & Bhattarai, K. 2019. Climate Change and Agricultural Systems in Mustang: Impacts on Crop Planting and Harvesting Timelines. In Climate Change and Mountain Agriculture in Nepal (pp. 115-132). Kathmandu: Nepal Climate Change Support Programme (NCCSP).

Regmi, B. R., & Bista, D. B. 2018. Climate Change Impacts on Mountain Communities in Nepal: A Case Study of Mustang District. In Climate Change and Adaptation in the Himalayas (pp. 103-120). Kathmandu: Nepal Climate Change Support Programme (NCCSP).

Shrestha, U. B., & Shrestha, K. K. 2018. Spirituality, Agriculture, and Ecological Conservation in Mustang: The Interconnectedness of Culture and Biodiversity. Mountain Research and Development 38(4): 331-344.

SQCC. 2024. Seed Quality Control Centre. Retrieved from https://www.sqcc.gov.np/pages/publication, on Dec 25. 2024.

Thapa P, BK Joshi, P Shrestha, D Gauchan, B Rijal, RP Mainali, M Bhattarai. 2024. Community seed bank for promotion and conserving localized crop genetic resources. In: Proceedings of 15th National Outreach Research Workshop, 15 & 16 May, 2024, Lumle, Kaski, Nepal; pp.125-137. https://www.researchgate.net/publication/383092757

Thapa, S., & Hubacek, K. 2011. Drivers of human-wildlife conflict in the Annapurna Conservation Area, Nepal. Environmental Conservation 38(1): 45–52.

जोशी, बाल कृष्ण, बलराम रिजाल, देवेन्द्र गौचन र पीताम्बर श्रेष्ठ (स.)। २०८१। कृषि जैविक विविधता संरक्षण तथा उपयोग: असल अभ्यासहरु। बाली विकास तथा कृषि जैविक विविधता संरक्षण केन्द्र र राष्ट्रिय कृषि अनुवांशिक स्रोत केन्द्र (जीन बैंक)। ललितपुर।

जोशी, बाल कृष्ण। २०८०। कृषि वंशाणु आरक्ष स्थल र सत बिज छर्ने दिन: कृषि जैविक विविधता संरक्षणको एक असल अभ्यास। कृषि त्रैमासिक ६०(१): १-६। https://www.researchgate.net/publication/380031194

जोशी, बाल कृष्ण। २०८१। सात-भाइ कोदे बाली (औषधीय अनाज): खाध्य, पोषण, स्वास्थ्य, व्यवसाय र वाताबरण सुरक्षाको लागि। कृषि त्रैमासिक ६1(4): 24-34। https://www.researchgate.net/publication/382064732

थापा, प्रदिप, बालकृष्ण जोशी, कृष्ण हरि घिमिरे, निरन्जन पुडासैनी, सन्तोष श्रेष्ठ, श्रीप्रसाद न्यौपाने र देवेन्द्र गौचन। २०७९। उपयोग मार्फत संरक्षणको लागि सिफारिस भएका बालीका रैथाने जातहरुको सम्क्षिप्त परिचय। राष्ट्रिय कृषि आनुवंशिक स्रोत केन्द्र, खुमलटार।

Annexes

ANNEX 1: INCEPTION WORKSHOP ATTENDEES

S.N.	Name	Office/ Address	Designation	Contact number
1	Shreemati Maya Gurung	Jilla Samanbaya Office	Jilla Samanbaya Pramukh	9857650775
2	Bishnu Prasad Bhusal	CDO		
3	Kirtan Raj Poudel	Jilla Samanbaya Office	Jilla samanbaya adhikari	9857636222
4	Ram Prasad Subedi	District Administration Office	CDO	9857650133
5	Bharat Raj Gautam	Gharpajong Rural Municipality	PMAMP	9846222629
6	Pabhanath Aatreya	Horticulture	Kendra pramukh	9851161952
7	Manoj Rana Bhat	Forest Division	di. ba. ah	9857650217
8	Kamal Raj Joshi	ACAP, Jomsom	Prasasan sahayek	9857683236
9	Manisha Sunar	Thasang Rural Municipality	Agriculture technician	9844735820
10	Dr. Nabin Poudel	Veterinary hospital	Vet technician	9867107263
11	Arati Khadgi	WWF Nepal	Head and Climate and Energy	9802794665
12	Dilip Nepali	Krishi Gyan Kendra	adhikrit	9857657158
13	Aita Bahadur Thakali	Gharpajong Rural Municipality	Livestock specialist	9867608404
14	Pradip Thapa	NAGRC	Technical officer	9846593083
15	Sanjaya Karki	NAGRC		9860625648
16	Bhoj Raj Pokharel	NARC	Livestock specialist	9851145640
17	Sumitra Tamang	NAGRC	Intern	9813984133
18	Bijaya Tamang	Kirtipur	Driver	985795230
19	Palchang Gurung	Gharpajong RM	Kisan samuha sahajkarta	9867691710
20	Basu Thakali	Varagung Muktichhetra RM		9847742602
21	Roshan Thakali	Gharpajong Rural Municipality	Kri. Bi. Ah	9846187435
22	Suraj B.K.	NAHFA(FCG)	Krisak samuha sahajkarta	9844738386
23	Anusha Chinal	Gharpajong Rural Municipality	Naa. Pra. Sa.	9860298896
24	Dr. Saroj Kumar Raay	District Ayurved	Ka. Pra.	9857640153
25	Mahesh Kumar Gautam	Jilla Samanbaya	Kharidar	9849141737
26	Laxmi Poudel	Jilla Samanbaya	Ka. Sa.	9867766077

ANNEX 2. QUESTIONNAIRE FOR FIELD SURVEY

HOUSEHOLD SURVEY (घरधुरी सर्वेक्षण)

SECTION A: GENERAL INFORMATION (सामान्य जानकारी)

1. Address:

District (जिल्ला) 1. Manang (मनाङ) 2. Mustang(मुस्ताङ)

Rural/municipality (गाउँपालिका/नगरपालिका) ..... Ward No (वार्ड न): ..... Tole Name (टोल): .....

	Name (नाम)	Age (year) (उमेर)	Gender (M/F) (लिङ्ग)	Major occupation (मुख्य पेशा)	Family Type (परिवारको आकार)	Ethnicity (जात-जाति)
Respondent (उत्तर दिने व्यक्ति)					1. Joint (सयुंक्त) 2. Nuclear (एकल)	
Household head (घरमुली)						

2. GPS coordinates (भौगोलिक अवस्थिति)

Longitude (आक्षास): Latitude (देशान्तर): Altitude (उचाई):

3. Contact No (सम्पर्क नः)

4. Family members (परिवार सदस्य संख्या):

	Age group in years (उमेर समूह)			Members involved in agriculture (कृषिमा पूर्ण रुपमा सहभागी सदस्य)	Migrated members (बसाईसराई गरेका सदस्यहरु)	Decision maker in HH in agri-related activities (परिवारमा कृषि कार्य सम्बन्धिको निर्णय कसले गर्छ)	
	<15	15-60	≥60				
Male (पुरुष)						a. Male (पुरुष) b. Female (महिला) c. Both (दुवै)	
Female (महिला)							

5. Land ownership status (in ropani) (जमिनको स्वामित्व)

S.N. क्र. स.	Based on cultivation (खेतिको आधारमा)	Area (क्षेत्रफल)	Land type (जग्गाको प्रकार)	Area (क्षेत्रफल)	Based on ownership (स्वामित्व)	Area (क्षेत्रफल)
1	Cultivated (खेति गरिएको)		Upland (बारी)		Leased in (भाडामा लिएको)	
2	Non cultivated (बाझो)		Low land (खेत)		Leased out (भाडामा दिएको)	
	Total (जम्मा)					

SECTION B: BIO-DIVERSITY (जैविक विविधता)

6. Agrobiodiversity status in the farm (फार्ममा कृषि जैविक विविधताको अवस्था):

S.N.	**AGR categories** (कृषि आनुबंशिक स्रोत)	**Landrace** (स्थाने/स्थानीय जात)	**Improved varieties/breeds** (उन्नत जात)	**Wild edible** (जंगली खान मिल्ने चिजहरु)
1	Crop (बालीजन्य)			

2	Livestock (पशुपंक्षी जन्य)			
3	Aquatic (जलीय)			
4	Forage/Pasture (घाँसेबाली)			
5	Insect (किटजन्य)			
6	Microorganisms(सुक्ष्मजीवहरु)			
7	MAPs (औषधिजन्य बनस्पति)			
8	Others (अन्य)			

7. Agriculture genetic resources diversity and production system (कृषि आनुबंशिक श्रोत र उत्पादन प्रणाली) ।

S. N.	Crops (बाली)	Varieties (जातहरु)	Type of seed (1. Native/local, 2. Improved, 3. Hybrid)	Years of cultivation (लगाउदै आइरहेको वर्ष)	Area (क्षेत्रफल)	Production (उत्पादन)	Key distinguishing traits (जात छुट्याउने गुणहरु)	Functional traits (महत्त्वपूर्ण गुणहरु)	Present status (हालको अवस्था)
1	Barley (जौ)								
2	Naked barley (उवा)								
3	Common buckwheat (मिठे फापर)								
4	Tartary buckwheat (तिते फापर)								
5	Common bean (सिमि)								
6	Rapeseed (तोरी)								
7	Broad leaf mustard (रायो)								
8	Potato(आलु)								

9	Amaranthus (लट्टे)								
10	Others(अन्य)								

S.N. (क्र.स.)	Livestock (पशु)	Breeds (जात)	Type of breed (1. Local, 2. Exotic)	Years of Rearing (पाल्दै आइरहेको वर्ष)	Total number (जम्मा संख्या)	Production (उत्पादन)	Key distinguishing traits (जात छुट्याउने गुणहरु)	Functional traits (महत्त्वपूर्ण गुणहरु)	Present status (हालको अवस्था)
1	Yak (याक)								
2	Lulu cow (लुलु गाई)								
3	Mountain goat (च्यांग्रा)								
4.	Others (अन्य)								

S.N. (क्र.स)	Medicinal Plant (औषधिजन्य बिरुवा)	Varieties (जातहरु)	Years of cultivation (लगाउदै आइरहेको वर्ष)	Area (क्षेत्रफल)	Production (उत्पादन)	Key distinguishing traits (जात छुट्याउने गुणहरु)	Functional traits (महत्त्वपूर्ण गुणहरु)	Present status (हालको अवस्था)
1	Paanch aunle (पांच औले)							
2	Somlata (सोमलता)							
3	Sea buckthorn (डालेचुक)							
4	others (अन्य)							

8. What are the main sources of your seeds? तपाइले प्रयोग गर्ने बिउका मुख्य स्रोतहरु के के हुन्?

   A. Own saved seeds (आफनै)

B. Local market (स्थानीय बजार)

C. Government farm and support from NGOs (सरकारी तथा गैरसरकारी संस्था)

D. Others (Neighbors, Relatives, Diversity fair, Hatbazar) (अन्य)

Seed selection methods (बीउ छनोट बिधिहरु)

S.N.	Seed selection method (बीउ छनोट गर्ने बिधिहरु)	Gender involvement (M/F) (लैंगिक संलगता)	Reason/s (कारणहरु)
1		A. Male (पुरुष) B. Female (महिला)	
2		A. Male (पुरुष) B. Female (महिला)	

Agrobiodiversity in the farmland (फार्ममा कृषि जैविक विविधताको अवस्था)

AGR	**0**	**1**	**2**	**3**
Crops (बालीहरु)	no crops cultivated (बालि नलगाउने)	Only one crop species (1 मात्र)	Two or three crop species (दुइ वा तिन)	More than 3 crop species (तिन भन्दा बढी)
Animals (पशुपंक्षी)	No animals raised (पशुपंक्षी नपाल्ने)	Only one species (1 मात्र)	Two or three species (दुइ वा तिन)	More than 3 crop species (तिन भन्दा बढी)
Medicinal plants (औषधि जन्य बनस्पति)	No medicinal plants (औषधिजन्य बनस्पति नलगाउने)	One species only (1 मात्र)	Two or three species (दुइ वा तिन)	More than 3 crop species (तीन भन्दा बढी)

SECTION C: SOIL HEALTH (माटोको स्वास्थ्य)

9. Are you aware of soil degradation issues in your locality? तपाईको क्षेत्रको माटो बिनाशको बारेमा थाहा छ?

   1. Yes (छ)

   2. No (छैन)

10. What are the major reasons for soil declining in your locality? माटो बिनाशका कारणहरु के के हुन्?

   1. Deforestation (जंगल फडानी)

   2. Flood/landslide

   3. Overgrazing (अतिचरन)

   4. Modern Agricultural Practices (monocropping, excessive chemical use) (आधुनिक कृषि कार्यहरु)

   5. Urbanization (सहरीकरण)

   6. Others (अन्य)

11. What types of soil fertility management practices are commonly used in your area? तपाईको समुदायमा माटोको उर्वराशक्ति व्यबस्थापनको लागि गरिने अभ्यासहरु के के हुन्?

   A. Crop rotation (बाली चक्र)

   B. Organic amendments (प्रांगारिक पदार्थको प्रयोग)

C. Others (अन्य)

12. How frequently do you or any governmental and non-governmental organizations assist in testing soil? तपाईको समुदायमा कुन कुन समयमा माटो परिक्षण गर्ने गर्नुभएको छ?
    A. Yealy (प्रत्येक वर्ष)
    B. Occasionally (समय समयमा)
    C. Rarely (एकदमै कम)
    D. Never (हालसम्म गरेको छैन)

SECTION D: COMMUNITY AND SOCIAL WELLBEING (सामाजिक स्वास्थ्य)

13. Main Source of Income (आम्दानीको मुख्य स्रोत)
    A. Agriculture (कृषि)
    B. Livestock (पशुपालन)
    C. Herbs collection (औषधिजन्य बनस्पति संकलन)
    D. Service work (सेवा)
    E. Business (व्यापार)
    F. Remittance (बैदेशिक आम्दानी)
    G. Social security allowance (सामाजिक सुरक्षा भत्ता)
    H. Others (अन्य)
14. Annual Household Income (वार्षिक आम्दानी)
    A. Less than Rs.5,00,000/- (पाच लाख भन्दा कम)
    B. Rs.5,00,001 to Rs.7,00,000/- (5 देखि 7 लाख सम्म)
    C. Rs.7,00,001 to Rs.10,00,000/- (सात देखि 10 लाख सम्म)
    D. Rs10,00,001-Rs 20,00,000 (10 देखि 20 लाख सम्म)
    E. Rs 20,00,001-Rs 50,00,000 (20 देखि 50 लाख सम्म)
    F. Above Rs. 50,00,000 (50 लाख भन्दा बढी)
15. Which are the major staple foods over the year? (मुख्य खाद्यबस्तु)

AGRs (कृषि आनुबंशिक स्रोतहरु)	10 years back (10 वर्ष पहिले)	Current (अहिले)
Crops (बालीजन्य)		
Livestock products (पशुपंक्षी जन्य)		

16. How many months is food sufficient from your own production? (आफ्नै उत्पादनबाट कति महिनालाई खान पुग्छ?)

Time (समय)	Crop (बाली)	Alternate Crop source (अन्य स्रोत)	Livestock(पशुपन्छी)	Alternate Livestock source (अन्य स्रोत)	
<3 months (तिन महिना सम्म)		A. Buying from market		A. Buying from market	
3-6 month (छ महिना सम्म)					

6-9 months (नौ महिना सम्म)		B. Neighbor C. Aid/Relief (अनुदान/राहत) D. Others (अन्य)		B. Neighbor C. Aid/Relief (अनुदान/राहत) D. Others (अन्य)	
9-12 months					
Year round (वर्ष भरि)					

Alternate sources (अन्य स्रोतहरु)

A. From neighbor (छिमेकी)
B. Market Purchase (बजारबाट)
C. Aid/Relief (अनुदान/राहत)
D. Others (अन्य)

17. Do you sell your (CML) product? तपाईंले बाली, पशु र औसधिजन्य बनस्पतिहरु बेचबिखन गर्ने गर्नुभएको छ?

1. Yes (छ)
2. No (छैन)

If yes, which product and how, amount and selling cost? यदि बेच्ने गर्नुभएको छ भने कुन बस्तु, कति, कति मुल्यमा र कसरी बेच्ने गर्नुभएको छ?

S.N.	CMLs product (बेच्ने बस्तु)	Whom do you sell (बेच्ने तरिका)	Sold amount, kg (बेच्ने मात्रा)	Price (मुल्य)(NPR)	Decision maker (M/F)
1					
2					
3					

18. Dietary uptake (पोषण उपलब्धता)

S.N.	AGRs (कृषि आनुबंशिक स्रोतहरु)	Weekly consumption (gm) (साप्ताहिक रुपमा खाने मात्रा)
1	Barley (जौ)	
2	Naked barley (उवा)	
3	Common buckwheat (मिठे फापर)	
4	Tartary buckwheat (तिते फापर)	
5	Common bean (सिमि)	
6	Rapeseed (तोरी)	
7	Broad leaf mustard (रायो)	
8	Potato(आलु)	
9	Amaranthus (लट्टे)	
10	Yak (याक)	
11	Lulu cow (लुलु गाई)	

12	Mountain goat (च्यांग्रा)	
13	Paanch aunle (पांच औले)	
14	Somlata (सोमलता)	
15	Sea buckthorn (डालेचुक)	

- What kind of organizations exist for conserving and promoting agrobiodiversity in your locality? कृषि जैविक विविधता संरक्षण र प्रवर्धनको लागि यस क्षेत्रमा कुन कुन संस्थाहरु रहेका छन् ?
- What types of support are received from these institutions? (ति संस्थाहरु बाट कस्तो प्रकारको सहयोग प्राप्त गर्नुभएको छ??)

KEY INFORMANT INTERVIEW

1. Name (नाम):	2. Age (उमेर):	3. Gender (लिंग):
4. Ethnicity (थर/जाति:	5. Occupation (पेशा):	6. Organization and designation (संस्था र पद):
7. Education (शिक्षा):	8. Address (ठेगाना)	9. GPS coordinates (भौगोलिक अवस्थिति):
10. Contact No (सम्पर्क नः)	11. Family members (परिवार सदस्य संख्या):	

1. How many members are directly involved in agriculture related activities? तपाईको परिवारका कतिजना सदस्य प्रतक्ष्य रुपमा कृषि पेशामा संलग्न छन्?
2. How many members are migrated from your family? तपाईको घरबाट कतिजना सदस्य बसाइसराई गरि अन्यन्त्र जानुभएको छ?

3. Who makes agriculture-related decisions in the household? तपाईको घरमा कृषि सम्बन्धिको कार्यहरुमा कसले निर्णय लिने गर्नुहुन्छ?

4. Total land area (जग्गाको कुल क्षेत्रफल): ..... Ropani(रोपनी)

S.N. क्र. स.	Based on cultivation (खेतिको आधारमा)	Area (क्षेत्रफल)	Land type (जग्गाको प्रकार)	Area (क्षेत्रफल)	Based on ownership (स्वामित्व)	Area (क्षेत्रफल)
1	Cultivated (खेति गरिएको)		Upland (बारी)		Leased in (भाडामा लिएको)	
2	Non cultivated (बाझो)		Low land (खेत)		Leased out (भाडामा दिएको)	

5. Number of Plots (कित्ता संख्या):
6. Mandated agriculture genetic resources diversity and production system (कृषि आनुबंशिक श्रोत र उत्पादन प्रणाली)

S.N.	Crops (बाली)	Varieties (जातहरु)	Years of cultivation (लगाउदै आइरहेको वर्ष)	Area (क्षेत्रफल)	Production (उत्पादन)	Key distinguishing traits (जात छुट्याउने गुणहरु)	Functional traits (महत्त्वपूर्ण गुणहरु)	Present status (हालको अवस्था)
1	Barley (जौ)							
2	Naked barley (उवा)							
3	Common buckwheat (मिठे फापर)							

4	Tartary buckwheat (तिते फापर)							
5	Common bean (सिमि)							
6	Rapeseed (तोरी)							
7	Broad leaf mustard (रायो)							
8	Potato(आलु)							
9	Amaranthus (लट्टे)							
10	Others(अन्य)							

S.N. (क्र.स.)	Livestock (पशु)	Breeds (जात)	Years of Rearing (पाल्दै आइरहेको वर्ष)	Total number (जम्मा संख्या)	Production (उत्पादन)	Key distinguishing traits (जात छुट्याउने गुणहरु)	Functional traits (महत्त्वपूर्ण गुणहरु)	Present status (हालको अवस्था)
1	Yak (याक)							
2	Lulu cow (लुलु गाई)							
3	Mountain goat (च्यांग्रा)							
4.	Others (अन्य)							

S.N. (क्र.स)	Medicinal Plant (औषधिजन्य बिरुवा)	Varieties (जातहरु)	Years of cultivation (लगाउदै आइरहेको वर्ष)	Area (क्षेत्रफल)	Production (उत्पादन)	Key distinguishing traits (जात छुट्याउने गुणहरु)	Functional traits (महत्त्वपूर्ण गुणहरु)	Present status (हालको अवस्था)
1	Paanch aunle (पांच औंले)							

2	Somlata (सोमलता)							
3	Sea buckthorn (डालेचुक)							
4	others (अन्य)							

7. Which are the major staple foods over the year? (मुख्य खाद्यबस्तु)

AGRs (कृषि आनुबंशिक स्रोतहरु)	10 years back (10 वर्ष पहिले)	Current (अहिले)
Crops (बालीजन्य)		
Livestock products (पशुपंक्षी जन्य)		

8. How many months iin a year is your household able to meet its food needs from your own agricultural production? (आफ्नै उत्पादनबाट कति महिनालाई खान पुग्छ?)

Time (समय)	Crop (बाली)	Livestock(पशुपंक्षी)	Alternate Livestock source (अन्य स्रोत)	Alternate Crop source (अन्य स्रोत)
3 months (तिन महिना सम्म)				
6month (छ महिना सम्म)				
9 months (नौ महिना सम्म)				
Year round (वर्ष भरि)				

9. Do you sell your (CML) product? If yes, which product and how, amount and selling cost? तपाईंले बाली, पशु र औसधिजन्य बनस्पतिहरु बेचबिखन गर्ने गर्नुभएको छ? यदि बेच्ने गर्नुभएको छ भने कुन बस्तु, कति, कति मुल्यमा र कसरी बेच्ने गर्नुभएको छ?

S.N.	CMLs product (बेच्ने बस्तु)	Selling method (बेच्ने तरिका)	Selling amount (बेच्ने मात्रा)	Selling decision (बेचबिखनको निर्णय)	Selling price (बेच्ने मुल्य)
1					
2					
3					

10. Are there any changes of AGRs calender in your locality over the year? If yes, what is the changing pattern? तपाईको क्षेत्रमा अपनाइने बालीपात्रोमा केहि वर्ष यता कुनै परिवर्तन आएको छ? छ भने कस्तो परिवर्तन आएको छ ?
11. Do you think agrobiodiversity is declining in your region? If yes, in your perception, what are the major causes of loss of diversity in your locality? तपाईको बिचारमा तपाईको क्षेत्रमा कृषि जैविक विविधता घटीरहेको छ ? यदि हो भने तपाईको बिचारमा तपाईको क्षेत्र कृषि जैविक विविधता लोप हुदै जानुका कारणहरु के के हुन्?
12. Any varieties/breeds that have been lost over the period of time? Name of them and lost year? तपाईको क्षेत्रबाट विभिन्न समयमा हराएर गएका रैथाने तथा स्थानीय जातहरु के के छन्?

13. What kind of organizations exist for conserving and promoting agrobiodiversity in your locality? कृषि जैविक विविधता संरक्षण र प्रवर्धनको लागि यस क्षेत्रमा कुन कुन संस्थाहरु रहेका छन् ?
14. Which agriculture genetic resources do you consider the most nutritious in your locality? Reason? तपाईको बिचारमा तपाईको क्षेत्रमा पाइने कुन चाहिं आनुबंशिक स्रोत सबभन्दा बढी पोषणयुक्त हुन्छ र त्यसको कारण के हो?
15. Are there specific CMLs or plants that are exclusively cultivated by certain groups in your community due to cultural reasons? Name them. तपाईको समुदायमा कुनै समुदायले सांस्कृतिक महत्त्वका साथ लगाउने/उत्पादन गर्ने कृषि आनुबंशिक स्रोतहरु छन्? तिनीहरु के के हुन्?
16. Are there any efforts to revive or protect culturally significant crops that are at risk of loss? सांकृतिक रुपले महत्त्वपूर्ण आनुबंशिक स्रोतहरुको संरक्षणको लागि अगाडी सारिएका पहलहरु के के छन्?
17. How is product diversification progressing in your locality, and what is the current approach to branding? तपाईको क्षेत्रमा खाद्य विविधिकरण कसरि भैरहेको छ ? कुनै कृषि बस्तुलाई ब्राण्डीङको लागि पहल भएको छ ?
18. What tools or implements are traditionally used for farming in your community? तपाईको समुदायमा कृषि कार्यमा प्रयोग हुने परम्परागत ज्ञान र सामग्रीहरु के के हुन्?
19. What are the major medicinal plants grown in your locality and their medicinal value? तपाईको क्षेत्रमा पाइने औसधीजन्य बनस्पतिहरु र तिनका महत्त्वहरु के के छन्?
20. What are the major reasons for soil declining in your locality? माटो बिनाशका कारणहरु के के हुन्?
21. What types of soil fertility management practices are commonly used in your area? तपाईको समुदायमा माटोको उर्वराशक्ति ब्यबस्थापनको लागि गरिने अभ्यासहरु के के हुन्?
22. How frequently do you or local farmers test soil? तपाईको समुदायमा कुन कुन समयमा माटो परिक्षण गर्ने गर्नुभएको छ?
23. What is the major impact of climate change in your locality? तपाईको क्षेत्रमा देखिएका जलबायु परिवर्तनका मुख्य असरहरु के के हुन्?
24. Local adaptation strategies adopted for minimizing the effects of climate change? What are the barriers to implementation? तपाइको क्षेत्रमा जलबायु परिवर्तनका असरहरु न्यूनीकरण गर्नको लागि अगाडी सारिएका अनुकुलन रणनीतिहरु के के छन् र तिनको कार्यन्वयनका समस्याहरु के के छन्?
25. What are the Cultural spiritual and religious practices followed for agriculture and livelihood? Who and how do you pass these practices from generation to generation? तपाईको क्षेत्रमा कृषि तथा जीवनयापनको लागि अवलम्बन गरिने सांस्कृतिक, आध्यात्मिक तथा धार्मिक अभ्यासहरु के के छन् र ति अभ्यासहरुको स्थानान्तरण कसरि हुने गरेको छ?
26. How did the homestay can conserve and promote cultural, spiritual and religious practices? तपाईको ठाउँमा संचालन भएका होमेस्टेले कसरि सांस्कृतिक,आध्यात्मिक तथा धार्मिक अभ्यासको संरक्षण तथा प्रवर्धन गरेका छन्
27. 38. Are there any specific rituals or ceremonies associated with farming in your community? तपाइको समुदायमा कृषि कार्य संग सम्बन्धित कला तथा संस्कृतिहरु के के छन्?
28. Any location in your locality with year-round snow, road access, and electricity? तपाईको क्षेत्रमा वर्षेभरि हिउ पर्ने, सडक तथा बिजुलीको सुबिधा भएको कुनै ठाउँ छ?
29. What are the major challenges current agriculture techniques practicing in your locality? तपाइले हाल अवलम्बन गरेका कृषिका प्रमुख समस्याहरु के के हुन्?

FOCUS GROUP DISCUSSION

1. Province (प्रदेश): District (जिल्ला): UM (गाउँपालिका): Ward No (वडा नः) Tole (टोल):
2. GPS coordinates (भौगोलिक अवस्थिति)
   - Longitude (आक्षास):
   - Latitude (देशान्तर):
   - Altitude (उचाई):
3. Total participants (सहभागीहरुको संख्या) ..... Male (पुरुष) ..... Female (महिला).....
4. Cropping calender (बाली पात्रो)

Cropping pattern (बाली चक्र)	Reason for choosing (कारणहरु)	Intercrop/Mixcrop (मिश्रीत र घुसुवा बालीहरु)	Reasons (कारणहरु)	Yield comparison (उत्पादकत्व तुलना)

5. Are there any changes of AGRs calender in your locality over the year? If yes, what is the changing pattern? तपाईको क्षेत्रमा अपनाइने बालीपात्रोमा केहि वर्ष यता कुनै परिवर्तन आएको छ? छ भने कस्तो परिवर्तन आएको छ ?
6. What benefits do you associate with high agrobiodiversity on your farm? तपाईको फार्ममा भएको कृषि जैविक विविधताका के के फाइदा छन होला?
7. Do you think agrobiodiversity is declining in your region? If yes, in your perception, what are the major causes of loss of diversity in your locality? तपाईको बिचारमा तपाईको क्षेत्रमा कृषि जैविक विविधता घटीरहेको छ ? यदि हो भने तपाईको बिचारमा तपाईको क्षेत्र कृषि जैविक विविधता लोप हुदै जानुका कारणहरु के के हुन्?
8. Any varieties/breeds that have been lost over the period of time? Name of them and lost year. तपाईको क्षेत्रबाट विभिन्न समयमा हराएर गएका रैथाने तथा स्थानीय जातहरु के के छन्?

Landraces (रैथाने/स्थानीय जातहरु)	हराएर गएको वर्ष

4. In your opinion, which local crops, medicinal plants/ Livestock should be conserved and promoted in your locality? तपाईको बिचारमा कुन कुन बाली, पशुपंक्षी र औषधिजन्य बनस्पतिलाई प्रथामिकताका साथ संरक्षण र प्रवर्धन गर्नुपर्छ होला?
9. What actions do you think are necessary to preserve agrobiodiversity in your locality? कृषि जैविक विविधता संरक्षणको लागि के के पहलहरु आवश्यक होलान?
10. Are there specific CMLs or plants that are exclusively cultivated by certain groups in your community due to cultural reasons? Name them. तपाईको समुदायमा कुनै समुदायले सांस्कृतिक महत्वका साथ लगाउने/उत्पादन गर्ने कृषि आनुबंशिक स्रोतहरु छन्? तिनीहरु के के हुन्?
11. Are there any efforts to revive or protect culturally significant crops that are at risk of being lost? सांकृतिक रुपले महत्वपूर्ण आनुबंशिक स्रोतहरुको संरक्षणको लागि अगाडी सारिएका पहलहरु के के छन्?
12. Which agriculture genetic resources do you consider the most nutritious? Why? तपाईको बिचारमा कुन चाहिं आनुबंशिक स्रोत सबभन्दा बढी पोषणयुक्त हुन्छ?

Condition (बिशेष अवस्था)	Agricultural produce/product (प्रयोग गरिने चिज/बस्तु)	Reason/s (प्रयोग गरिने कारणहरु)
Weakness (कमजोरी)		
Pregnancy and delivery (गर्भवती र सुत्केरी अवस्था)		
Lactating period (बच्चालाई दुध चुसाउने समय)		
Stunting and wasting (पुड्कोपना)		
labour intensive work (शारीरिक श्रमको समयमा)		
Altitude adaptation (लेक लागेमा)		
Others (अन्य)		

13. What are the different structure and method used for storage of seed, produce and product? तपाईको क्षेत्रमा बिउ तथा अन्य बस्तुहरु भण्डारण गर्ने तरिका र ठाउंहरु के के छन्?

भण्डारण गर्ने बस्तु	भण्डारण गर्ने तरिका/ठाउँ

14. How is product diversification progressing in your locality, and what is the current approach to branding? तपाईको क्षेत्रमा खाद्य विविधिकरण कसरि भैरहेको छ ? कुनै कृषि बस्तुलाई ब्राण्डीङको लागि पहल भएको छ ?
15. What are the major medicinal plants grown in your locality and their medicinal values? तपाईको क्षेत्रमा पाइने औसधीजन्य बनस्पतिहरु र तिनका महत्त्वहरु के के छन्?
16. Do you practice any traditional methods for enhancing the nutritional value of your mandated CLMs? माथिका कृषि आनुबंशिक स्रोतहरुको पोषक तत्व बढाउनको लागि कुनै परम्परागत पद्दति अवलम्बन गर्नुभएको छ ?
17. Have you noticed any changes in the climate (temp, precipitation, extreme event) in your region over the past 15 years? तपाइले बिगत 15 सम्ममा जलबायुमा कुनै परिवर्तन भएको पाउनुभएको छ? If yes, what changes have you observed? (यदि छ भने के परिवर्तन पाउनुभएको छ?
18. Impact of climate change in mandated AGRs (जलबायु परिवर्तनका असरहरु)

Hazards (प्रकोपहरु)	AGRs (कृषि आनुबंशिक स्रोतहरु)	Effects (असरहरु)	Adaptation measures (अनुकुलनका उपायहरु)	ITK (Local) (परम्परागत उपायहरु)	Effectiveness (प्रभावकारिता)

19. Local adaptation strategies adopted for minimizing the effects of climate change? What are the barriers for implementation? तपाइको क्षेत्रमा जलबायु परिवर्तनका असरहरु न्यूनीकरण गर्नको लागि अगाडी सारिएका अनुकुलन रणनीतिहरु के के छन् र तिनको कार्यन्वयनका समस्याहरु के के छन्?
20. What are the major challenges current agriculture techniques practicing in your locality? तपाइले हाल अवलम्बन गरेका कृषिका प्रमुख समस्याहरु के के हुन्?
21. What tools or implements are traditionally used for farming in your community? तपाईको समुदायमा कृषि कार्यमा प्रयोग हुने परम्परागत ज्ञान र सामग्रीहरु के के हुन्?

S.N.	Indigenous knowledge used in Agriculture (कृषि कार्यमा प्रयोग हुने परम्परागत ज्ञान)	Indigenous tools used in agriculture (कृषि कार्यमा प्रयोग हुने परम्परागत सामग्रीहरु)

22. Are there any specific rituals or ceremonies associated with farming in your community? (तपाइको समुदायमा कृषि कार्य संग सम्बन्धित कला तथा संस्कृतिहरु के के छन्?)
23. Any location in your locality with year-round snow, road access, and electricity? (तपाईको क्षेत्रमा वर्षेभरि हिउ पर्ने, सडक तथा बिजुलीको सुबिधा भएको कुनै ठाउँ छ?)
24. What is the potential eco friends of 15 species.

S.N.	AGRs (कृषि आनुबंशिक स्रोतहरु)	Eco friends

25. Input mgmt. for CLMs. बाली, पशुपंक्षी तथा औषधिजन्य बनस्पति उत्पादनको लागि आवश्यक स्रोत व्यबस्थापन कसरि गर्नुभएको छ?
26. What are the major challenges for marketing of CMLs product? बाली, पशु तथा औसधिजन्य बस्तुहरुको बेचबिखनमा देखिएका समस्या तथा चुनौतीहरु के के छन्?
27. What are the Cultural spiritual and religious practices followed for agriculture and livelihood? Who and how do you pass these practices from generation to generation? तपाईको क्षेत्रमा कृषि तथा जीवनयापनको लागि अवलम्बन गरिने सांस्कृतिक, आध्यात्मिक तथा धार्मिक अभ्यासहरु के के छन् र ति अभ्यासहरुको स्थानान्तरण कसरि हुने गरेको छ ?
28. How did the homestay can conserve and promote the cultural, spiritual and religious practices? तपाईको ठाउँमा संचालन भएका होमेस्टेले कसरि सांस्कृतिक,आध्यात्मिक तथा धार्मिक अभ्यासको संरक्षण तथा प्रवर्धन गरेका छन्?
29. What kind of organizations exists for conserving and promoting agrobiodiversity in your locality? कृषि जैविक विविधता संरक्षण र प्रवर्धनको लागि यस क्षेत्रमा कुन कुन संस्थाहरु रहेका छन् ?

ANNEX 3: ENUMERATORS AT MUSTANG

S.N.	Name	Office	Contact number
1	Sumitra Tamang	NAGRC, NARC	9813984133
2	Roshan Thakali	Gharapjhong RM	9846187435
3	Anusha Chinal	Gharapjhong RM	9860298896
4	Manisha Sunar	Thasang RM	9844735820
5	Basu Thakali	Varagung RM	9847742602
6	Suraj B.K.	NAFHA	9844738386
7	Palchang Gurung	Gharapjhong RM	

ANNEX 4: FARMERS INVOLVED IN HOUSEHOLD SURVEY

S.N.	Name	Tole Name	S.N.	Name	Tole Name
1	Babukaji Thakuri	Khinga	51	Rinjing Gurung	Phlyak
2	Dhundu Gurung	Dhee	52	Dhowa Gurung	Phlyak
3	Chawang Nomgya Gurung	Khinga4	53	Karma Gurung	Phlyak
4	Urkin Gurung	Ghiling	54	Kamal Bdr Gurung	Jhong
5	Nosang Gurung	Ghiling	55	Nhobu Gurung	Jhong
6	Dorje Dhoma	Charang	56	Takla Gurung	Khinga
7	Nughing Bista	Charang	57	Mangal Sunar	Dhakarjhong
8	Dhawa Gurung	Charang	58	Lakpa Gurung	Dhakarjhong
9	Pasang Bhurra Gurung	Ghiling	59	Pema Gurung	Pakling
10	Chenga Gurung	Ghami	60	Rapten Gurung	Jhong
11	Hikka Gurung	Ghiling	61	Chaiwang Aangtak Gurung	Phlyak
12	Yangju Lama	Yara	62	Naar Bdr Gurung	Putak
13	Sonam Ghyoten Gurung	Yara	63	Tasi Gurung	Putak
14	Yangjing Dhoka Gurung	Ghara	64	Ram Bdr Gurung	Jhong
15	Dhunten Gurung	Dhee	65	Indra Gurung	Chhusang
16	Tasi Chhiring	Ghara	66	Ram Kumar Gurung	Chhusang
17	Pasang Gurung	Dhee	67	Nhatu Gurung	Chhusang
18	Pema Gurung	Ghami	68	Pema Gurung	Tiri
19	Pasang Bangdi	Ghami	69	Nhundu Gurung	Tiri
20	Sonam Dhargel	Tangya	70	Namdul Gurung	Jharkot
21	Karsang Thakuri	Ghami	71	Saano Kanxa Gurung	Tiri
22	Ghosang Gurung	Ghami	72	Chhiring Dorje Gurung	Pakling
23	Pema Gurung	Ghami	73	Ramchu Gurung	Khinga
24	Ongdi Gurung	Marang	74	Kunjom Gurung	Chhusang
25	Kunga Dhunduk Gurung	Charang	75	Nima Lama	Dhakarjhong
26	Kimik Gurung	Charang	76	Mendok Gurung	Pakling
27	Tasi Chosang Gurung	Marang	77	Khetop Gurung	Jharkot
28	Jhanyang Palden	Charang	78	Setey Bishwokarma	Khinga
29	Nutuk Dorje Gurung	Marang	79	Palken Gurung	Jharkot

S.N.	Name	Tole Name	S.N.	Name	Tole Name
30	Kunga Tenzing Gurung	Marang	80	Tek Bahadur Gurung	Jharkot
31	Pasang Gurung	Marang	81	Chatri Ghyache	Khinga
32	Wangyal Gurung	Ghami	82	Dhawa Dorje	Jharkot
33	Pratap Gurung	Chusang	83	Angyal Gurung	Chhusang
34	Konchyo Doma	Kagbeni	84	Ridam Gurung	Khinga
35	Laxmi Kumari Gurung	Kagbeni	85	Nima Gurung	Khinga
36	Lhamang Gurung	Tiri	86	Prabesh Gurung	Khinga
37	Lakpa Gurung	Chhusang	87	Nima Dhawa Gurung	Khinga
38	Shanti Magar	Chhusang	88	Raju Gurung	Khinga
39	Chhichyu Gurung	Khinga	89	Purna Bdr Gurung	Chhusang
40	Sonam Doma Gurung	Kyangma Chhalang	90	Suresh Gurung	Chhusang
41	Fulmaya Gurung	Chhusang	91	Dilman Gurung	Chhusang
42	Chhiring Etin Gurung	Tiri	92	Dhan Bdr Gurung	Chhusang
43	Thech Angmo Gurung	Jharkot	93	Bishal Gurung	Chhusang
44	Ringjing Khaamo	Khinga	94	Serab Sangmo Gurung	Chhusang
45	Pema Gurung	Tiri	95	Pemba Gurung	Dhakarjhong
46	Laxmi Gurung	Chhusang	96	Chhiring Dhutuk Gurung	Kagbeni
47	Man Kumari B.K.	Jhong	97	Karchung Gurung	Kagbeni
48	Karsang Gurung	Putak	98	Yunduk Gurung	Kagbeni
49	Chyanga Gurung	Phlyak	99	Karma Gyacho Gurung	Kagbeni
50	Shanti Gurung	Dhakarjhong	100	Chhiring Thokya Gurung	Tiri

ANNEX 5: LIST OF ORGANIZATIONS

S.N.	Name of organization	Programs/Services
1	Temperate Horticulture Development Center (THDC)	Provides training, research, and development focused on temperate horticulture practices for high-altitude farming systems.
2	Krishi Gyan Kendra	Facilitates the dissemination of agricultural knowledge, offering training and technology transfer to enhance farming practices.
3	Annapurna Conservation Area (ACA)	Focuses on biodiversity conservation, sustainable resource management, and eco-tourism initiatives to promote environmental preservation.
4	Annapurna Conservation Area Project (ACAP)	Implements community-based conservation programs, water resource management, and sustainable agricultural practices in the Annapurna region.
5	Forest Division Office (FDO)	Manages forest resources, oversees reforestation projects, and ensures sustainable forest management practices to protect biodiversity.
6	Prime Minister Agriculture Modernization Project (PMAMP)	Supports agricultural infrastructure development, promotes modernization of farming techniques, and improves market access for local farmers.

7	Nepal Agricultural and Forestry Foundation (NAFHA)	Provides support for the development of agriculture and forestry sectors through capacity building, promoting sustainable practices, and enhancing farmer livelihoods.
8	Cave Nepal	Focuses on eco-tourism, conservation, and community development, especially in regions with significant natural heritage and caves.

ANNEX 6. SOCIO CULTURAL/ SPIRITUAL EVENTS RELATED TO AGRS

Yak Blood Drinking Festival (A mythology culture)

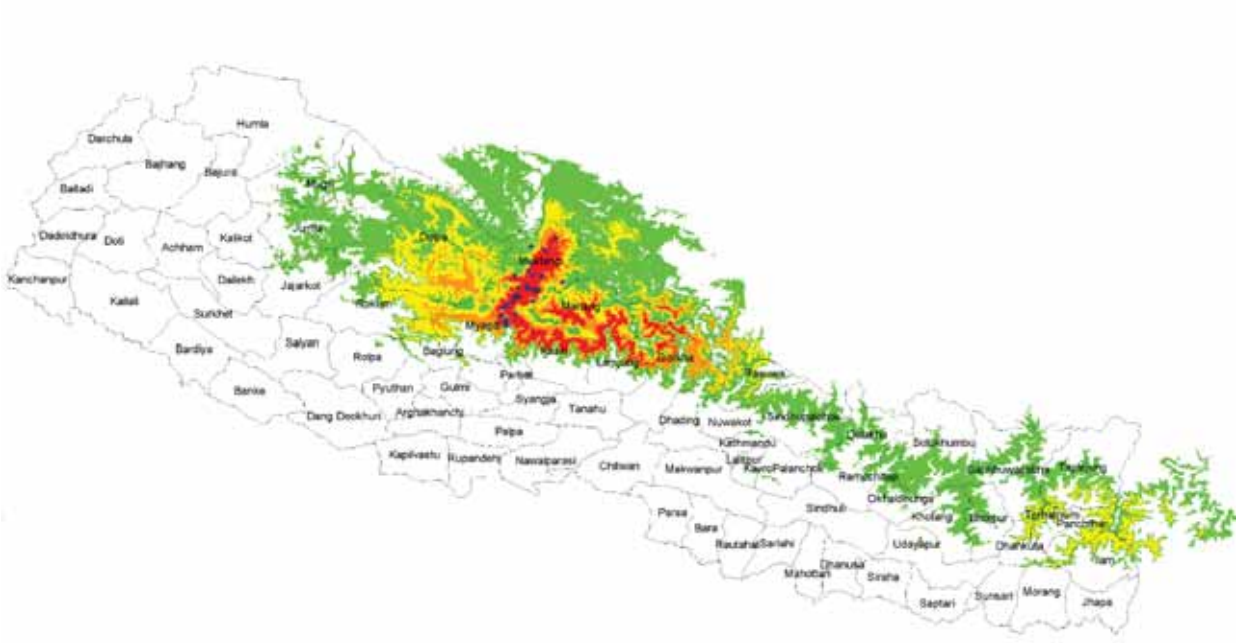
In Mustang, the Thakalis celebrate the Yak Blood Drinking Festival, a week-long event held twice yearly during Baisakh and Shrawan. Visitors from Upper Mustang, Myagdi, Baglung, Parbat, and Kaski districts gather in Gharpajhong and Thasang municipalities to partake in this unique tradition. Yaks are brought from higher altitudes for their blood, believed to have medicinal properties due to the herbs they graze on, such as Yarchagumba (Caterpillar fungus), Jatamasi (Spikenard) and other highlands medicinal plants. Trained practitioners, known as Amjis, carefully extract blood from the jugular vein using sterilized tools, drawing 3–5 liters per yak, depending on its size and strength. Up to 35 cups can be collected from one animal, with each glass sold for Rs. 200 (https://risingnepaldaily.com/news/14348, July2022). Temporary settlements spring up for 15–25 days, where locals sing, dance, and enjoy, eats yak meat and drinks blood continuously 3 days. They believe the blood boosts immunity, prevents diseases, and acts as a natural antibiotic.

ANNEX 7. TRADITIONAL FOODS/ FOOD TABLE

Traditional Food	Description	Popular Pairings
Chillu (छिलु)	Mountain goat fat and yak neck meat are sun-dried, with salt and chhang added, creating a preparation known as Chillu. Chillu is used as a substitute for oil when frying vegetables. It is stored in an oven above the fire and could be preserved for up to two years.	
Dhido (ढिडो)	A traditional staple made from buckwheat, barley, or millet flour, cooked to form a thick, dough-like consistency.	Gundruk, lentil soup, meat curry
Gundruk (गुन्द्रुक)	A popular local food in Nepal, gundruk is fermented leafy greens, dried and used in curries, pickles, or stews. It adds a tangy flavor to soups and stews.	Dalbhat, soups, pickles
Buckwheat Bread (फापरको रोटि)	A thin flatbread made from buckwheat flour.	Yak butter, honey
Thukpa (थुक्पा)	A Tibetan-inspired noodle soup rich with vegetables, spices, and sometimes yak or mutton meat. Popular for its warmth and nourishment in the cold climate.	Yak bread, Tibetan bread
Tibetan Bread (तिब्बतीयान रोटि)	An energy-rich flat bread is usually made with basic ingredients like flour (wheat or barley), water, yeast or baking powder, salt, and sometimes a bit of sugar or milk. It's a comforting and energy-rich food, perfect for the cold climates of places like Mustang.	Tea, honey, yak butter
Yak Meat Dishes (याक्को मासुको परिकारहरु)	Protein-rich dishes using yak meat, often used in stews, curries, or dried to make sukuti (jerky). It can also be used in other dishes like burgers, pizzas, sandwiches, curries, and stews.	Rice, roti, potatoes
Bhotte Tea (भोटे चिया)	A salty tea made with yak butter and salt, providing warmth and energy, especially in cold climates.	Tsampa
Tsampa (सातु)	Roasted barley flour mixed with butter tea or water to make a quick meal. A quick and energizing meal for locals and trekkers alike.	Butter tea
Chhurpi (छुर्पी)	Hardened or fermented yak cheese, eaten as a snack or in soups. A unique local delicacy with a tangy flavor.	Tea, soups
Potato Dishes (आलुको परिकारहरु)	Mustang is known for its high-quality potatoes, which are often boiled, roasted, or made into aloo achar (spicy potato salad).	Dalbhat, achar

Traditional Food	Description	Popular Pairings
Sea Buckthorn Juice (सिबेक थ्रोंन जुस)	Made from Sea Buckthorn berries, locally known as dhrub tse. Known for its tangy flavor and high vitamin C content.	Snacks
Dalbhat (दालभात)	A common Nepali meal for lunch and dinner, made up of steamed rice (bhat) with lentil soup (dal) and side dishes.	Pickles, meat curry
Apple Brandy (स्याउको ब्रान्डी)	A local alcoholic beverage made from Mustang's famous apples.	Snacks
Dried Apples (स्याउको सुकुटी)	preserved apple slices, often used as a snack.	Tea
Apple Pickle (स्याउको अचार)	A tangy, spicy side dish made with apples.	Dalbhat, roti
Apple Jam (स्याउको जाम)	A sweet spread made from Mustang apples.	Bread, roti
Tumbha (तुम्बा)	Warm fermented millet beer served with hot water.	Snacks
Syauko Raksi (स्याउको रक्सी)	A special distilled alcoholic beverage made from fermented naked barley, popular in Mustang.	Snacks
Padamchal Pickle (पदम चालको चटनी)	A tangy and spicy pickle made from locally grown Padamchal fruits. A traditional accompaniment for meals.	Dalbhat, roti
Traditional Food	Description	Popular Pairings
Dhido (ढिडो)	A traditional staple made from buckwheat, barley, or millet flour, cooked to form a thick, dough-like consistency.	Gundruk, lentil soup, meat curry
Gundruk (गुन्द्रुक)	A popular local food in Nepal, gundruk is fermented leafy greens, dried and used in curries, pickles, or stews. It adds a tangy flavor to soups and stews.	Dalbhat, soups, pickles
Buckwheat Bread (फापरको रोटि)	A thin flatbread made from buckwheat flour.	Yak butter, honey
Thukpa (थुक्पा)	A Tibetan-inspired noodle soup rich with vegetables, spices, and sometimes yak or mutton meat. Popular for its warmth and nourishment in the cold climate.	Yak bread, Tibetan bread
Tibetan Bread (तिब्बतीयान रोटि)	An energy-rich flat bread is usually made with basic ingredients like flour (wheat or barley), water, yeast or baking powder, salt, and sometimes a bit of sugar or milk. It's a comforting and energy-rich food, perfect for the cold climates of places like Mustang.	Tea, honey, yak butter
Yak Meat Dishes (याक्को मासुको परिकारहरु)	Protein-rich dishes using yak meat, often used in stews, curries, or dried to make sukuti (jerky). It can also be used in other dishes like burgers, pizzas, sandwiches, curries, and stews.	Rice, roti, potatoes
Bhotte Tea (भोटे चिया)	A salty tea made with yak butter and salt, providing warmth and energy, especially in cold climates.	Tsampa
Tsampa (सातु)	Roasted barley flour mixed with butter tea or water to make a quick meal. A quick and energizing meal for locals and trekkers alike.	Butter tea
Chhurpi (छुर्पी)	Hardened or fermented yak cheese, eaten as a snack or in soups. A unique local delicacy with a tangy flavor.	Tea, soups
Potato Dishes (आलुको परिकारहरु)	Mustang is known for its high-quality potatoes, which are often boiled, roasted, or made into aloo achar (spicy potato salad).	Dalbhat, achar
Sea Buckthorn Juice (सिबेक थ्रोंन जुस)	Made from Sea Buckthorn berries, locally known as dhrub tse. Known for its tangy flavor and high vitamin C content.	Snacks
Dalbhat (दालभात)	A common Nepali meal for lunch and dinner, made up of steamed rice (bhat) with lentil soup (dal) and side dishes.	Pickles, meat curry
Apple Brandy (स्याउको ब्रान्डी)	A local alcoholic beverage made from Mustang's famous apples.	Snacks
Dried Apples (स्याउको सुकुटी)	preserved apple slices, often used as a snack.	Tea
Apple Pickle (स्याउको अचार)	A tangy, spicy side dish made with apples.	Dalbhat, roti
Apple Jam (स्याउको जाम)	A sweet spread made from Manang apples.	Bread, roti
Tumbha (तुम्बा)	Warm fermented millet beer served with hot water.	Snacks
Uwako chyang (छयांग)	A traditional beer made from naked barley that is mildly alcoholic.	Snacks
Uwako Raksi (उवाको रक्सी)	A special distilled alcoholic beverage made from fermented naked barley, popular in Mustang.	Snacks, local pickles

ANNEX 8: COLLECTION AND PROBABILITY DISTRIBUTION MAP



ANNEX 9: PASSPORT DETAILS OF COLLECTED LANDRACES FROM MUSTANG

Acc no	Coll no	Crop Name	VDC	Latitude	Longitude	Altitude
NGRC00014	NPGR05998	Wheat	Jomsom	28.7720	83.7086	2710
NGRC00184	NPGR08226	Wheat	Khinga	28.8238	83.8235	3216
NGRC00185	NPGR08228	Wheat	Ghasa	28.5890	83.6456	1890
NGRC00186	NPGR08231	Wheat	Marpha	28.7347	83.6808	2594
NGRC00791	NPGR01998	Barley		28.7833	83.7250	3400
NGRC00792	NPGR01999	Barley	Syang	28.7676	83.7012	2650
NGRC00793	NPGR02000	Barley		28.7833	83.7250	
NGRC00794	NPGR02001	Barley		28.7106	83.6463	2450
NGRC00882	NPGR06286	Barley	Kagbeni	28.8316	83.7822	2800
NGRC00883	NPGR06287	Naked barley	Syang	28.7676	83.7012	2650
NGRC00884	NPGR06289	Naked barley	Ghasa	28.5890	83.6456	1800
NGRC00898	NPGR06318	Barley	Chhusang	28.9610	83.8017	2970
NGRC00899	NPGR06323	Naked barley	Chele	28.9304	83.8276	3000
NGRC00913	NPGR08253	Barley	Tukuche	28.7106	83.6463	2484
NGRC00914	NPGR08254	Barley	Syang	28.7676	83.7012	2594
NGRC01274	NPGR01630	Maize	Marpha	28.7347	83.6808	2600
NGRC01275	NPGR01631	Maize	Marpha	28.7347	83.6808	2600
NGRC01276	NPGR01632	Maize	Tukuche	28.7106	83.6463	2590
NGRC01277	NPGR01633	Maize	Tukuche	28.7106	83.6463	2590
NGRC01278	NPGR01645	Maize	Ghasa	28.5977	83.6417	2020
NGRC01279	NPGR01646	Maize	Kabre Bhir	28.5665	83.6352	1740
NGRC01281	NPGR01649	Maize	Ghasa	28.5890	83.6456	1800
NGRC01282	NPGR01650	Maize	Ghasa	28.5890	83.6456	1800
NGRC01412	NPGR00441	Finger millet	Kabre Bhir	28.5665	83.6352	
NGRC01413	NPGR00442	Finger millet	Gara	28.5665	83.6352	
NGRC01815	NPGR01458	Rice	Tukuche	28.7046	83.6352	1400
NGRC01816	NPGR01459	Rice	Tukuche	28.7046	83.6352	1400
NGRC01817	NPGR01460	Rice	Tukuche	28.7046	83.6352	1400
NGRC01818	NPGR01461	Rice	Tukuche	28.7046	83.6352	1380
NGRC02234	NPGR00204	Bean	Thinigaun	28.7748	83.7244	2800
NGRC02235	NPGR00207	Bean	Marpha	28.7347	83.6808	2600

Acc no	Coll no	Crop Name	VDC	Latitude	Longitude	Altitude
NGRC02236	NPGR00208	Bean	Kobang	28.6900	83.6165	2450
NGRC02240	NPGR00227	Bean	Lamkoria	28.4742	83.6268	1200
NGRC02245	NPGR06185	Bean	Jomsom	28.7720	83.7086	2710
NGRC02282	NPGR01555	Naked barley	Muktinath	28.8182	83.8654	3600
NGRC02283	NPGR01556	Naked barley	Jharkot	28.8201	83.8471	3450
NGRC02284	Co14705	Bean	Jharkot	28.8201	83.8471	3450
NGRC02285	NPGR01560	Naked barley	Banparg	28.8201	83.8471	3000
NGRC02286	NPGR01561	Naked barley	Dakhane	28.8201	83.8471	2660
NGRC02287	NPGR01562	Naked barley	Mulbeg	28.8201	83.8471	3330
NGRC02288	NPGR01570	Naked barley	Ghasa	28.5977	83.6417	2050
NGRC02297	NPGR01592	Naked barley	Jharkot	28.8201	83.8471	3400
NGRC02298	NPGR01593	Naked barley		28.7347	83.6808	
NGRC02299	NPGR01595	Naked barley	Marpha	28.7347	83.6808	2600
NGRC02300	NPGR01596	Naked barley	Tukuche	28.7106	83.6463	2500
NGRC02306	NPGR01623	Naked barley	Chhoser	29.1903	83.9962	3800
NGRC02307	NPGR01628	Naked barley	Syang	28.7676	83.7012	2750
NGRC02328	NPGR06046	Naked barley	Ghasa	28.5977	83.6417	2015
NGRC02329	NPGR06047	Naked barley	Marpha	28.7347	83.6808	2670
NGRC02330	NPGR06048	Naked barley	Marpha	28.7347	83.6808	2670
NGRC02331	NPGR06050	Naked barley	Jomsom	28.7720	83.7086	2710
NGRC02336	NPGR06268	Naked barley	Marpha	28.7347	83.6808	2670
NGRC02355	NPGR08237	Naked barley	Marpha	28.7347	83.6808	2530
NGRC02356	NPGR08238	Naked barley	Jharkot	28.8219	83.8435	3353
NGRC02357	NPGR08239	Naked barley	Jharkot	28.8219	83.8435	3353
NGRC02358	NPGR08240	Naked barley	Khinga	28.8238	83.8235	3216
NGRC02359	NPGR08242	Naked barley	Dom gaon	28.5977	83.6417	2591
NGRC02360	NPGR08244	Naked barley	Ghasa	28.5977	83.6417	1890
NGRC02361	NPGR08246	Naked barley	Syang	28.7676	83.7012	2594
NGRC02372	NPGR01553	Barley	Chhoser	29.1903	83.9962	2280
NGRC02373	Co14719	Bean	Jharkot	28.8201	83.8471	3450
NGRC02459	NPGR05997	Wheat	Ghasa	28.5977	83.6417	2015
NGRC02556	NPGR08225	Wheat	Jharkot	28.8219	83.8435	3353
NGRC02557	NPGR08227	Wheat	Jomsom	28.7720	83.7086	2591
NGRC02558	NPGR08229	Wheat	Tukuche	28.7106	83.6463	2484
NGRC02559	NPGR08230	Wheat	Kagbeni	28.8370	83.7836	2697
NGRC02691	NPGR00340	Soyabean	Rimi	28.5665	83.6352	2100
NGRC02692	NPGR00342	Soyabean	Kabre Bhir	28.5665	83.6352	1740
NGRC02693	NPGR00344	Soyabean	Tatopani	28.4742	83.6268	1300
NGRC02893	Co14948	Rice	Tukuche	28.7106	83.6463	1400
NGRC03008	NPGR01644	Maize	Ghasa	28.5977	83.6417	2020
NGRC03541	NPGR02593	Finger millet	Kabre Bhir	28.5665	83.6352	1740
NGRC03542	NPGR02594	Finger millet	Kabre Bhir	28.5665	83.6352	1740
NGRC03543	NPGR02595	Finger millet	Kabre Bhir	28.5665	83.6352	1740
NGRC03544	NPGR02596	Finger millet	Rupse chhara	28.5592	83.6359	1600
NGRC03727	NPGR00489	Tartary buckwheat	Muktinath	28.8182	83.8654	3600
NGRC03764	NPGR01647	Maize	Kabre Bhir	28.5665	83.6352	1740
NGRC03769	NPGR06057	Tartary buckwheat	Jomsom	28.7720	83.7086	2710
NGRC03775	NPGR08207	Tartary buckwheat	Khinga	28.8238	83.8235	3216
NGRC03843	NPGR06065	Tartary buckwheat	Jomsom	28.7720	83.7086	2710
NGRC04003	NPGR06327	Barley	Dhumba	28.7650	83.7186	2800
NGRC04010	NPGR01541	Barley	Kabre Bhir	28.5687	83.6275	2139
NGRC04015	NPGR02003	Barley	Kalopani	28.6365	83.6039	2530
NGRC04016	NPGR02004	Barley	Ghasa	28.5977	83.6417	2020
NGRC04052	NPGR06326	Barley	Thinigaun	28.7748	83.7244	2750
NGRC04081	NPGR08248	Barley	Jharkot	28.8219	83.8435	3353
NGRC04091	NPGR06049	Barley	Jomsom	28.7720	83.7086	2710
NGRC04095	NPGR02002	Barley	Tukuche	28.7106	83.6463	2500
NGRC04103	NPGR08251	Barley	Lete	28.6355	83.6060	2384
NGRC04120	NPGR08249	Barley	Kagbeni	28.8370	83.7836	2697
NGRC04237	NPGR01594	Barley	Thinigaun	28.7748	83.7244	2800

Acc no	Coll no	Crop Name	VDC	Latitude	Longitude	Altitude
NGRC04587	NPGR01637	Maize	Tukuche	28.7106	83.6463	2590
NGRC04733	NPGR00443	Finger millet	Phulchuchhe	28.5665	83.6352	2230
NGRC04740	NPGR01640	Maize	Kalopani	28.6365	83.6039	2530
NGRC04889	NPGR01624	Naked barley	Kimaling	29.1049	83.9193	3800
NGRC04890	NPGR01626	Barley	Chele	28.9304	83.8276	3000
NGRC04893	NPGR02499	Naked barley	Kagbeni	28.8316	83.7822	2820
NGRC04897	NPGR01612	Naked barley				
NGRC04898	NPGR01620	Naked barley	Tsarang	29.1049	83.9193	3800
NGRC04914	Co4719	Naked barley	MuktiNath	28.8240	83.8700	3750
NGRC04915	Co4715	Naked barley	Khinga	28.8238	83.8235	3000
NGRC04916	Co4716	Naked barley	Khinga	28.8238	83.8235	3000
NGRC04919	Co4705	Naked barley	Lete	28.6355	83.6060	2507
NGRC04920	Co4714	Naked barley	Lete	28.6070	83.6351	2507
NGRC04921	NPGR01492	Maize	Marpha	28.7347	83.6808	2680
NGRC05107	Co4720	Naked barley	Tukuche	28.8550	83.786389	2737
NGRC05539	Co4750	Bean	Marpha	29.0150	83.821667	2745
NGRC05540	Co4755	Bean	Lete	28.6500	83.698333	2507
NGRC05541	Co4761	Bean	Khinga	28.9247	83.698333	3000
NGRC05542	Co4775	Bean		29.0150	83.821667	2745
NGRC06006	Co4707	Barley	Tukuche	28.8550	83.786389	2737
NGRC06008	Co6128	Barley	Kunjo	28.7833	83.725	2450
NGRC06024	Co4710	Naked barley	Marpha	28.9247	83.698333	2695
NGRC06025	Co4711	Naked barley	Lete	28.6500	83.698333	2507
NGRC06026	Co4712	Naked barley	Khionga	28.9247	83.698333	2690
NGRC06027	Co4713	Naked barley	Khinga	28.9247	83.698333	3000
NGRC06030	Co5325	Naked barley	Kagbeni	28.8786	84.043056	2928
NGRC06031	Co5326	Naked barley	Chhusang	28.9219	83.894167	2959
NGRC06032	Co5327	Naked barley	Kagbeni	28.8786	84.043056	2928
NGRC06046	Co6129	Naked barley	Kunjo	28.7833	83.725	2450
NGRC06049	Co6119	Amaranth	Kunjo	28.7833	83.725	2450
NGRC06052	Co6143	Bean	Kunjo	28.7833	83.725	2400
NGRC06053	Co6144	Bean	Kunjo	28.7833	83.725	2400
NGRC06054	Co6145	Bean	Kunjo	28.7833	83.725	2976
NGRC06055	Co6146	Bean	Kunjo	28.7833	83.725	2976
NGRC06056	Co6147	Bean	Kunjo	28.7833	83.725	2300
NGRC06057	Co6148	Bean	Kunjo	28.7833	83.725	2679
NGRC06058	Co6149	Bean	Kunjo	28.7833	83.725	2450
NGRC06187	Co4681	Tartary buckwheat	Lete	28.6500	83.698333	2507
NGRC06505	Co6498	Radish	Kunjo			2450
NGRC06621	Co6437	Mustard	Kunjo			2450
NGRC06927		Amaranth	Kowang			
NGRC06928		Amaranth	Kowang			
NGRC06929		Amaranth	Kowang			
NGRC06930		Amaranth	Kunjo			
NGRC06931		Amaranth	Kunjo			
NGRC06932		Amaranth	Kunjo			
NGRC06933		Amaranth	Kunjo			
NGRC06934		Amaranth	Kunjo			
NGRC06935		Amaranth	Kunjo			
NGRC06936		Amaranth	Kunjo			
NGRC06937		Amaranth	Kunjo			
NGRC06938		Amaranth	Kunjo			
NGRC06939		Amaranth	Kunjo			
NGRC06940		Amaranth	Kunjo			
NGRC06941		Amaranth	Kunjo			
NGRC06942		Amaranth	Kunjo			
NGRC06943		Amaranth	Kunjo			
NGRC06944		Amaranth	Kunjo			
NGRC06945		Amaranth	Kunjo			
NGRC07005	Co4684	Tartary buckwheat	Coban	28.7422	83.831111	2573

Acc no	Coll no	Crop Name	VDC	Latitude	Longitude	Altitude
NGRC07008	Co4686	Tartary buckwheat	Chhibang	28.7422	83.831111	2573
NGRC07428	Co4701	Amaranth	Marph	28.9247	83.698333	2695
NGRC07430	Co4698	Amaranth	Lete	28.6500	83.698333	2507
NGRC07454	Co4747	Bean	Marpha	29.0150	83.821667	2745
NGRC07455	Co4749	Bean	Marpha	29.0150	83.821667	2745
NGRC07456	Co4756	Bean	Lete	28.6500	83.698333	2507
NGRC07457	Co4759	Bean	Lete	28.6500	83.698333	2507
NGRC07458	Co4760	Bean	Lete-3, Ghasa	28.6500	83.698333	2507
NGRC07459	Co4770	Bean	Marpha-8, Syang	28.9247	83.698333	2695
NGRC07460	Co4773	Bean	Bus park	29.0150	83.821667	2745
NGRC07497	Co4608	Maize	Lete	28.6500	83.698333	2507
NGRC07498	Co4610	Maize	Lete	28.6500	83.698333	2507
NGRC07499	Co4611	Maize	Lete	28.6500	83.698333	2507
NGRC07706	Co4672	Wheat	Coban	28.7422	83.831111	2573
NGRC07729	Co4702	Barley	Lete-5	28.6500	83.698333	2507
NGRC07963	NPGR-01639	Maize	Kalopani			2530
NGRC07999	Co5320	Wheat	Chhusang	29.1347	83.815000	3606
NGRC08000	Co4674	Wheat	Marpha-8	28.9247	83.698333	2695
NGRC08075	AG-017-05 SC	Wild swiss chard	Barhagaun	28.8162	83.86466667	3682
NGRC08102	Co5322	Wheat	Lomanthang	29.4158	84.064722	3817
NGRC08143	Co4700	Amaranth	Coban-4 Largan	28.7422	83.831111	2573
NGRC08162	AG-017- 02 Alfalfa	Alfalfa	Kagbeni-8	28.8389	83.72033333	2870
NGRC08163	AG-017- 03 Alfalfa	Alfalfa	Gharpajhong-1	28.7784	83.7265	2767
NGRC08164	AG-017- 04Alfalfa	Alfalfa	Gharpajhong-1	28.7355	83.68056667	2653
NGRC08165	AG-017-02 A	Wild apple	Gharapjhong-5	28.7784	83.7265	2775
NGRC08593	Co4757	Bean	Lete-5	28.6500	83.69833333	2507
NGRC08852	Co4768	Bean	Marpha-1	28.9247	83.698333	2695
NGRC08918	Co10639	Sarson				
NGRC10321	HCRP112-14	Barley	Syang			2650
NGRC10512	Co5247	C Buckwheat	Lomanthangi			3817

ANNEX 10. PROJECT BRIEF CONCEPTUALIZATION AND BRIEF

The project was initiated following a visit by the WWF Nepal team, led by Dr. Ghana Shyam Gurung, to the National Genebank on October 12, 2022, where Dr. Bal Krishna Joshi presented genebank activities and concepts. Based on these discussions, WWF Nepal developed a project concept and engaged with the Rockefeller Foundation in the USA. A Memorandum of Understanding (MoU) was signed between NARC (represented by Dr. Dhruba Bhattarai) and WWF Nepal (represented by Dr. Ghana Shyam Gurung) in Khumaltar on December 8, 2023. WWF Nepal subsequently submitted a project proposal, titled Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal, to the Rockefeller Foundation. Following its approval, WWF Nepal and NARC formalized a Letter of Agreement (LoA) in the presence of the Nepal Genebank on June 6, 2024. The project officially commenced on 1 July 2023 and is scheduled to conclude on 30 June 2026.

The project "Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal" (REGAGRI) aims to enhance agroecological resilience in Nepal's high-altitude regions by integrating Indigenous knowledge, promoting native agricultural species, and reviving traditional and spiritual agricultural practices. By documenting the cultural and spiritual significance of traditional foods and showcasing the high nutritional, health, and climate-resilient properties of local crops and livestock, the project aspires to advance regenerative agricultural practices across the Eastern Himalayan region. Funded by The Rockefeller Foundation, the project is implemented by WWF Nepal (https://www.wwfnepal.org/) in partnership with three key collaborators:

5. **Government and Technical Partner**: National Agriculture Genetics Resources Center (NAGRC, Genebank) of the Nepal Agricultural Research Council (NAGC), https://genebank.narc.gov.np/
6. **Academic Partner**: Lumbini Buddhist University (LBU), https://lbu.edu.np/
7. **NGO Partner**: Worldwide Nature Conservation Nepal (WWN), https://wwnnepal.org/

The project operates on high-altitude sites including Dhi (3950 masl) and Kagbeni (2900 masl) in Mustang, and Chame (2540 masl) in Manang. Targeted agricultural species include key crops (Barley, Naked Barley, Tartary buckwheat, Common buckwheat, Bean, Wheat, Maize, Potato, Amaranth, Foxtail millet, Proso millet, Finger millet, Rapeseed, amaranth), livestock (Yak/ Chauri, Lulu cattle, mountain goat- Chyangra), and medicinal plants (Himalayan orchid, Sea buckthorn, Mtshe idum, Jimmu and Wild garlic). The following are key activities.

1. **Documenting Food Biodiversity and Climate Change Impacts**: Mapping and assessing the effects of climate change on agrobiodiversity in high-altitude areas.

2. **Establishing Seed Gene Banks**: Conserving prioritized species for long-term preservation and adaptation.
3. **Creating Demonstration and Pilot Sites**: Showcasing climate-responsive cultivation practices for targeted species.
4. **Organizing Expert Convening**: Hosting a regional dialogue at Lumbini Buddhist University with Eastern Himalayan experts to share knowledge and foster collaboration.

परियोजना : अवधारणा र संक्षेप

परियोजना प्रारम्भ WWF नेपाल टोलीका डा. घन श्याम गुरुङको नेतृत्वमा १२ अक्टोबर २०२२ मा नेशनल जीन बैंकको भ्रमण पश्चात भएको थियो। उक्त भ्रमणमा डा. बाल कृष्ण जोशीले जीन बैंकका गतिविधि र अवधारणाको प्रस्तुति दिनुभएको थियो। छलफलको आधारमा, WWF नेपालले परियोजनाको अवधारणा तयार गरी अमेरिकी संस्था रकफेलर फाउन्डेशनसँग समन्वय गऱ्यो। ८ डिसेम्बर २०२३ मा, NARC (डा. ध्रुव भट्टराईको प्रतिनिधित्व) र WWF नेपाल (डा. घन श्याम गुरुङको प्रतिनिधित्व) बीच खुमलटारमा सहमति पत्र (MoU) मा हस्ताक्षर भयो। तत् पश्चात WWF नेपालले "नेपालको पर्वतीय क्षेत्रमा गहन पुनरुत्थानशील कृषि परियोजना" को प्रस्ताव रकफेलर फाउन्डेशनमा पेश गऱ्यो। स्वीकृति पछि, WWF नेपाल र NARC ले ६ जुन २०२४ मा नेपाल जीनबैंकको उपस्थितिमा सहमति पत्र (LoA) मा हस्ताक्षर गरे। परियोजना औपचारिक रूपमा १ जुलाई २०२३ मा सुरु भई ३० जून २०२६ मा समाप्त हुनेछ।

उक्त परियोजनाले नेपालको उच्च पहाडी क्षेत्रमा परम्परागत ज्ञानलाई समेटेर, रैथाने कृषि भुमि-जातहरु प्रवर्द्धन गरेर, र परम्परागत तथा आध्यात्मिक कृषि अभ्यासहरू पुनर्जीवित गरेर कृषि-पर्यावरणीय सहनशीलता वृद्धि गर्ने लक्ष्य राखेको छ। परम्परागत खाद्यहरूको सांस्कृतिक र आध्यात्मिक महत्व दस्तावेजीकरण गर्दै, तथा उच्च पोषण, स्वास्थ्य मूल्य, र जलवायु सहनशील विशेषताहरू प्रदर्शन गरी, यस परियोजनाले हिमालय क्षेत्रमा पुनरुत्थानात्मक कृषि अभ्यासलाई अगाडि बढाउने प्रयास गर्छ। यो परियोजना रकफेलर फाउन्डेशनको आर्थिक सहयोगमा WWF नेपालद्वारा (https://www.wwfnepal.org/) निम्न साझेदारहरूको सहकार्यमा कार्यान्वयन गरिन्छ:

- **सरकारी र प्राविधिक साझेदार**: नेपाल कृषि अनुसन्धान परिषद (NARC) अन्तर्गत राष्ट्रिय कृषि आनुवंशिक स्रोत केन्द्र (NAGRC, जीनबैंक); https://genebank.narc.gov.np/
- **शैक्षिक साझेदार**: लुम्बिनी बौद्ध विश्वविद्यालय (LBU); https://lbu.edu.np/
- **गैर-सरकारी साझेदार (NGO)**: वर्ल्डवाइड नेचर कन्जर्भेसन नेपाल (WWN); https://wwnnepal.org/

परियोजना मुस्ताङ को ढी (३९५० मिटर उच्चाई) र कागबेनी (२९०० मिटर), र मनाङ को चामे (२५४० मिटर) मा संचालित हुने छ। लक्षित कृषि प्रजातिहरू (तिनीहरु मध्ये छनौट गरिने छ):

- **बालीहरू**: जौ, उवा, तिते फापर, मिठे फापर, सिमि, गहुँ, मकै, आलु, रायो साग, कागुनो, चिनो, कोदो, तोरी।
- **पशुधन**: याक/चौंरी, लुलु गाइ, र हिमाली बाख्रा (च्यांग्रा)।
- **औषधीय वनस्पतिहरू**: पाँच औले, डाले चुक, सोमालता, जिमु, र जंगली लसुन।

मुख्य गतिविधिहरू:

१. **खाद्य विविधता र जलवायु परिवर्तन प्रभाव दस्तावेजीकरण:** उच्च पहाडी क्षेत्रमा जलवायु परिवर्तनले पार्ने प्रभावहरूको मूल्यांकन र नक्सांकन।

२. **बीउ/जीन बैंक स्थापना:** दीर्घकालीन संरक्षण र अनुकूलनका लागि प्राथमिकता प्राप्त प्रजाति/ भुमि जातहरूको संरक्षण।

३. **डेमो र पाइलट साइटहरू (विविधता ब्लक, प्रदशनी स्थल, ग्रहा/ फोकटा):** लक्षित प्रजातिहरूको लागि जलवायु अनुकूल खेती अभ्यासहरूको प्रदर्शन।

४. **प्राज्ञिक मञ्च आयोजन:** पूर्वी हिमालय क्षेत्रका विशेषज्ञहरूबीच ज्ञान साझेदारी र सहयोग प्रवर्द्धन गर्न लुम्बिनी बौद्ध विश्वविद्यालयमा क्षेत्रीय संवाद।

ANNEX 11. PHOTO GALLERY

Drying churpi

Traditional culture of hanging barley spike

Instrument used to store Bhote chiya

Lulu cattle

Mountain goat

Agriculture land of Jharkot Village

Farmland of Khinga Village

Traditional method of storing maize at Lower Mustang

Wild dried apricot

Dried apricot

Wild apricot oil

Apple and maize intercropping system in Lower Mustang