BASELINE AGROBIO SURVEY REPORT: MANANG DISTRICT

कृषि जैविक विविधता आधार-रेखा सर्वेक्षण प्रतिवेदन: मनाङ 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, Bikash Bhusal, Mukunda Bhattarai, Deepa Singh Shrestha, Mahesh Sapkota, Bhoj Raj Pokhrel, Rubina Karki, Tek Prasad Gotame and Bal Krishna Joshi

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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/

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Contents

	Acknowledgements	ii
	Acronyms	iii
	Executive summary	1
1	Introduction	3
1.1	Background Information	3
1.2	Deep regenerative agriculture	3
1.3	Project Context	4
2	Objectives of baseline survey	5
3	Methodology	5
3.1	District selection	5
3.2	District level Inception Workshop	6
3.3	Study site selection	6
3.4	Targeted agriculture genetic resources	6
3.5	Sampling design and sample size	7
3.6	Methods of data collection	8
3.7	Secondary data collection	10
3.8	Data Entry and Cleaning	10
3.9	Data Analysis	11
3.10	Ethical considerations	11
4	Site characteristics	11
4.1	Overview of Manang District	11
4.2	Overview of Chame Rural Municipality	12
4.3	Overview of Manang Ngisyang Rural Municipality	13
5	Findings	15
5.1	Socio-economic and Demographic characteristics	15
5.2	Agro-transpastoral system in Manang	18
5.3	Food sufficiency status	19
5.4	Targeted crop diversity and production system	20
5.5	Targeted livestock species and production system	28
5.6	Targeted medicinal plant species	31
5.7	Soil health management	32
5.8	Seed source and management practices	34
5.9	Buying and selling trend of targeted commodities in Manang	35
5.10	Post harvest practices and techniques in targeted commodities	37
5.11	Climate change and other challenges	38
5.12	Traditional knowledge on agrobiodiversity management	38
6	Discussion	39
6.1	Socio-economic and demographic context	39
6.2	Diversity and use of targeted crops	40
6.3	Product diversification and marketing opportunities	42
6.4	Dietary habit	43
7	Recommended technologies in Manang district	43
8	Recommendation and way forward	45
8.1	Mountain agriculture	45
8.2	Conservation	46
8.3	Utilization	46
8.4	Cultural and spiritual integrity	47
8.5	Awareness and capacity	48
8.6	Policy actions	48
9	Conclusion	52
	References	52
	Annexes	56

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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 Manang 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. Manang, located in Nepal's high-altitude Himalayan region, boasts a rich yet threatened agricultural biodiversity. This biodiversity has immense value for food, nutrition, health, and environmental security, yet it is endangered by climate change, modern agricultural practices, and socio-economic transitions. The interconnection between agrobiodiversity, human life, and the environment has been weakened, resulting in the loss of traditional knowledge and native species.

To counteract 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. By doing so, the project aims to advance sustainable agriculture across the Eastern Himalayan region while preserving the cultural identity and ecological integrity of Indigenous farming communities.

This baseline survey was designed to explore and document the current agrobiodiversity status of Manang's farming communities. This report guides to understand and capture the cultural, religious, and spiritual context influencing agricultural practices, document traditional knowledge systems for managing agrobiodiversity and establish a baseline for future planning and interventions in regenerative agriculture. Two rural municipalities—Chame and Manang Ngisyang—were selected based on their reliance on traditional farming systems, vulnerability to climate change, and accessibility for data collection. The survey targeted nine agricultural crops**,** three livestock species**,** and three medicinal plants central to local livelihoods. Key activities included data collected from 97 randomly selected households actively involved in traditional agriculture. Focus Group Discussions and Key Informant Interviews were conducted to gather insights from community leaders and farmers and Secondary Data was collected to supplement primary findings. Quantitative data were analyzed using descriptive and inferential statistics with Microsoft Excel and Statistical Packages for Social Sciences (SPSS). Qualitative data were thematically analyzed to identify patterns and trends, and triangulation ensured consistency across data sources.

Demographics showed that an average household size was 4.68 members**,** with slightly larger households in Chame (5.06) than in Ngisyang (4.23). Agriculture was the dominant occupation (87.6%), with 56.7% of households involved in joint decision making in farming activities.Women played a significant role in seed selection and agricultural decision-making, highlighting gender-inclusive practices. Households owned an average of 0.49 hectares of land, with significant differences between Chame (0.60 ha) and Ngisyang (0.37 ha). Commonly cultivated crops included potatoes, common beans, buckwheat, naked barley, and broadleaf mustard**,** while the main livestock included Lulu cattle, yaks, and Himalayan goats (Chyangra)**.** Medicinal plants such as sea buckthorn and jimbu were widely used, while wild garlic faced collection challenges.

Climate change has caused reduced snowfall, earlier apple ripening, and increased pest infestations, affecting crops like apples and buckwheat. However, it has also enabled the cultivation of new crops, such as green peas**,** in apple orchards, enhancing soil fertility. Farmers rely on traditional pest management methods, including ash application, cow urine, and homemade sprays, but expressed interest in adopting biopesticides with appropriate training.

Chame households demonstrated better food security, with 47.2% having year-round food sufficiency. In contrast, only 22.7% of households in Ngisyang reported similar sufficiency, with 36.4% facing food shortages for less than three months annually. Traditional agricultural practices, such as intercropping, spiritual planting rituals, and ecological pest control, remain integral to Manang's farming systems. Practices like Ter Puja (to prevent infestations and natural disasters) demonstrate a strong link between spirituality and agriculture. Farmers use traditional tools like markyang and ghesi for harvesting, emphasizing sustainability and resource efficiency. Labor shortages and lack of expertise in managing specific crops and livestock were major barriers. The cultivation and sale of local crops, such as common beans and potatoes, indicate opportunities for market linkages and value addition.

Key recommendations for safeguarding and enhancing Manang's agrobiodiversity emphasize the adoption of regenerative agricultural practices to build sustainable and climate-resilient farming systems. Establishing a conservation bank is crucial for preserving native landraces and protecting genetic resources, while participatory breeding programs can reintroduce and improve traditional crop and livestock breeds. Efforts should also focus on integrating spiritual and cultural values into agriculture, preserving Indigenous knowledge, and promoting community-based cultural and eco-tourism. Capacity-building initiatives, including training and awareness programs, are vital for equipping local farmers with skills in value addition, regenerative farming, and conservation techniques. Policy support is essential to provide incentives for conservation, integrate native genetic resources into formal frameworks, and facilitate market access for traditional agricultural products. Collaborative efforts among local communities, policymakers, and development stakeholders will be instrumental in creating a resilient and sustainable agricultural system that preserves Manang's unique biodiversity and cultural heritage for future generations.

1 Introduction

1.1 Background Information

Nepal is a culturally rich and diverse Himalayan nation in South Asia, known for its breathtaking landscapes, including Mount Everest, and its vibrant history and traditions. Mountain communities have a deep spiritual and cultural connection with the land and its biodiversity in traditions that blend Indigenous and Buddhist beliefs (Shrestha et.al., 2004). Manang (1880m–8136m), is a Himalayan district, with least population among the districts of Gandaki province of Nepal. It boasts a distinctive natural landscape, diverse socio-cultural and religious features, abundant biodiversity, and rich water resources, offering essential ecosystem services to the lower hills and the Terai region. Agrobiodiversity plays a vital role within the broader scope of biodiversity, especially in Nepal, where it is classified into six main components: crops, forages, livestock, aquatic life, insects, and microorganisms. Agrobiodiversity is declining globally, and mountain areas of Nepal are not an exception. 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 study conducted by the Government of Nepal has found this high-altitude mountain region to be vulnerable to climate change impacts because of its low adaptive capacity (MoFE, 2019).

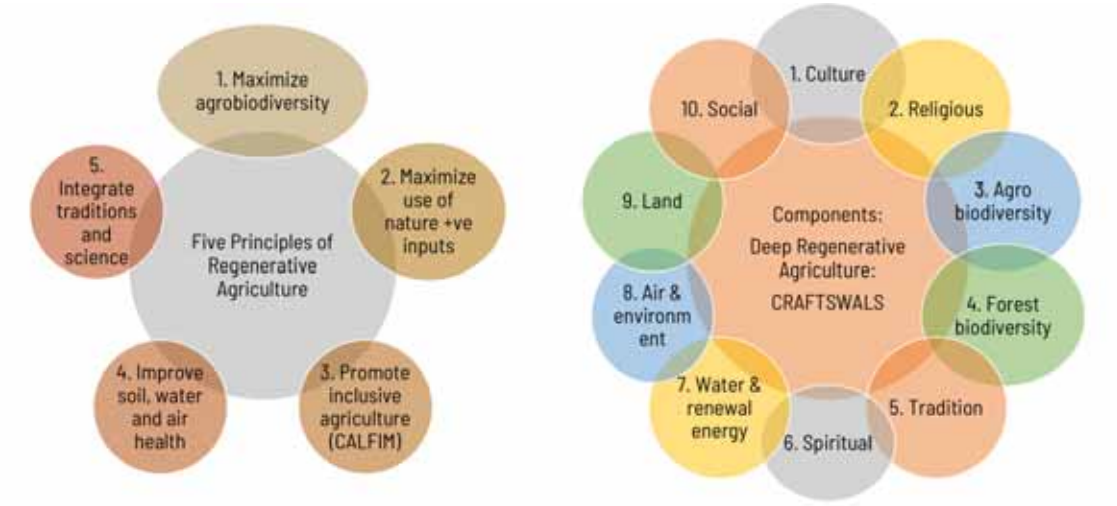
Rising temperatures, including are expected to reduce local yields in tropical regions, which are major global food-producing areas, while also posing a significant threat to species in mountain regions (Schleussner et al., 2016). Adapting agricultural systems to climate change impacts can involve various strategies, including utilizing native landraces, breeds, and their wild relatives to create a genetically diverse pool resilient to climate shocks and long-term temperature changes (Thornton and Herrero, 2014), enhancing fodder and feed management (Bell et al., 2014; Havet et al., 2014), and implementing effective disease prevention and control measures (Skuce et al., 2013; Nguyen et al., 2016). Recent concerns about sustainability and global change have highlighted these issues and renewed interest in traditional agroecosystems abundant in agrobiodiversity (Maikhuri et al., 2001).

In Manang naked barley, buckwheat and wheat have traditionally been major crops while yak and mountain goat meat have high protein values for these communities, and traditional medicinal plants support health and livelihoods. However, climate change is threatening the survival of all. In particular, the Manang district proposed as one of the project sites, is experiencing a rapid rise in temperatures that disrupt the timing of planting and harvesting of crops (Bajracharya et.al., 2018). Due to increasing rate of agro-biodiversity loss from climate change and other socio-economic factors, Deep Regenerative Agriculture in the High-Altitude Mountain Region of Nepal (REGAGRI) Project was developed.

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

This project presents an opportunity to promote deep regenerative agriculture across the Eastern Himalayan region that extends from Mustang district of Nepal covering Manang district. The initiative will document the chemical composition of 9 crop species, 3 livestock species and 3 medicinal plant species, 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 intensive techniques that contribute to environmental degradation and loss of biodiversity. By elevating the Indigenous and Buddhist practices, knowledge, and values of the high-altitude mountains of Nepal, we can bring this perspective to the agroecology space and other global forums. In addition, the proposed 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.

Considering the global and local importance of high mountain crops regarding nutrient profiles, 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). 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 Manang and 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 biodiversity and food security of mountain agricultural systems. The initiative aims to strengthen these native varieties/breeds to help buffer against the growing uncertainties of climate change, ensuring the sustainable development of agriculture in these vulnerable regions. The project has been implemented since 2023 by WWF Nepal and is executed by the NAGRC under the Nepal Agricultural Research Council (NARC). It has been designed through extensive consultations with Nepalese agricultural research scientists and extension experts specializing in conservation, plant breeding, plant pathology, and community empowerment.

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 agrobiodiversity status of Manang 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.

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 data collection from various organizations/institutions' reports and several academic papers published in journals.

3.1 District selection

The project focused on Manang district, a region characterized by high-altitude agro-ecological systems and unique socio-economic conditions. The vulnerability and risk assessment of the Government of Nepal (MoFE, 2021) has revealed that these two districts are 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. These 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 Manang are majorly dependent on animal husbandry for their livelihood while some are also engaged in agriculture and tourism.

3.2 District level Inception Workshop

An inception workshop was held on September 26, 2024, at the seminar hall of agriculture knowledge center, Chame, Manang. There were 33 participants from diverse stakeholders including the Chief District Officer (CDO), local police officers, representatives from agriculture knowledge centre, Veterinary hospital, and local farmers **(Annex 1)**. The workshop was helpful in collecting recommendations from the stakeholders in prioritizing the crop, livestock and medicinal plants for detailed assessment.

Figure 1: District level inception workshop at Chame, Manang

3.3 Study site selection

Within Manang, two rural municipalities namely Chame and Manang Ngisyang were purposively selected to represent the whole district. 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 complexity.

3.4 Targeted agriculture genetic resources

The REGAGRI project intends to collect detailed information of the district and targeted 9 agricultural crops (Table 1) 3 livestock species (Table 2) and 3 medicinal plant species (Table 3) for chemical analysis and profiling.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.*

S.N	Crop name	Nepali name/local name	Scientific name
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 manang 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 around 1,547 households in Manang district scattered in an area of 2,246 square kilometers and residing total of 5,658 population in the whole district. The population was found least as compared to other districts of Nepal, and within these population also, there were more numbers of peoples migrated to urban areas for employment. As per the population census 2021, there were around 389 households in Chame and 561 households in Manang Ngisyang rural municipality. A total of 100 samples were selected from Manang district for household level data collection. Due to some missing important information, three sampled households were dropped. Therefore, the total number of sampled households for the Manang district was 97. In total, 53 households were selected randomly for Chame and 44 for Manang Ngisyang for household level data collection. The households that were actively involved in agricultural farming using traditional knowledge and growing indigenous crops and varieties of agricultural crops and medicinal and aromatic plants and breeds of livestock and were directly impacted by agricultural practices in high-altitude regions were randomly selected for household level data collection. The half day community level consultations with different stakeholders (chief district officer, local level leaders, lead and progressive farmers, aged people) were done to ensure accuracy and inclusion. As Chame served as the district headquarters and featured less topographical complexity compared to Manang Ngisyang, coupled with a higher concentration of agricultural activities, a greater proportion of households was sampled from Chame for this study, despite its smaller proportion of households. Apart from this, two FGDs and eight KIIs were conducted on 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 Methods of data collection

3.6.1 Questionnaire preparation

Two days writeshop was conducted at Nagarkot, Bhaktapur to prepare the questionnaire for household survey,KII and FGD. The experts from various fields such as agri-economist, livestock specialist, climate and environmental specialist, spiritual experts and breeders, actively participated in the writeshop workshop. 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.

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 24 September 2024 to 3 October 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 plants and Livestock (CML).

3.6.3.1 Enumerator orientation

On September 27, 2024, seven enumerators were selected to assist with data collection for the project. The NAGRC and WWF Nepal team provided a comprehensive orientation session by briefing on questionnaire content, sampling, and data collection process to the enumerator.

Figure 3:Project team and enumerator interaction meeting at Chame, Manang

3.6.3.2 Household level data collection

The household level survey was conducted in local languages, with trained enumerators ensuring clarity on the questionnaire. The seven enumerators from agricultural background from Manang district were trained for half a day. The pretested semi-structured questionnaire was administered to 100 randomly selected households using the face-to-face interview method. Due to some important missing information, the data of 3 households was dropped. Thus, 53 households were interviewed in Chame rural municipality, and 44 households were interviewed in Manang Ngisyang rural municipality which totals 97 sampled households.

Figure 4: Household survey at Chame, Manang

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. A total of two FGDs were conducted, one in Chame rural municipality and another one in Ngisyang rural municipality. FGD provided qualitative insights into local agricultural practices, climate adaptation strategies, and challenges faced by farmers in transitioning to regenerative agriculture

Figure 5: Focus group discussion with farmers (Left: Manang Ngisyang, right (Chame)

3.6.3.4 Key Informant Interviews

In total, eight 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 (Table 4)

Table 4: Details of Key Informant Interviews

S.N	Name	Age/Gender	Organization/designation
1	Kamal Gurung	35, Male	Ward president
2	Chhiring Dorje Lama	46, Male	Hotel, owner
3	Seraph Bista	32, Male	Bista Apple Farm, owner
4	Khusi Raut Kumi	49, Male	ACAP, ranger
5	Krishna Lama	49, Male	Ward chairperson
6	Lokendra Bahadur Ghale	40, Male	Chame Rural municipality chairperson
7	Arand Parajuli	38, Male	District forest office
8	Sonam Gurung	54, Male	Ward chairperson

Figure 6: Key Informant Interviews at Manang (Left: Custodian farmer, right: Representative of ACAP, Manang)

3.7 Secondary data collection

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

- Government publications, such as profiles of rural municipalities, Krishi Gyan Kendra handbook, annual progress reports and specific crop wise reports
- Research studies on high-altitude farming systems in Nepal (e.g., ICIMOD)
- Project documents from WWF Nepal 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 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 up by making phone calls to the respective household. The results and their interpretation are presented in this report.

3.9 Data Analysis

3.9.1 Quantitative data

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

- Descriptive statistics (mean, standard deviation, frequency, percentage) to summarize key variables
- Inferential statistics, such as independent sample t-test and chi-square test to 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 summarized the findings 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. Informed consent was sought from all participants, who were briefed about the study's purpose, confidentiality of responses, and their right to withdraw at any time.

4 Site characteristics

4.1 Overview of Manang District

Manang is one of the sites where the project is being implemented. It is located in the Gandaki Province of Nepal. Manang spans an area of 2,246 square kilometers and lies between 28°30' to 28°45' North latitude and 83°50' to 84°45' East longitude. The district headquarters is Chame. The elevation of Manang ranges from approximately 1,880 meters at the Marsyangdi River to 8,091 meters at the summit of Annapurna I. According to the National Census 2021, the population of Manang is 5,658, comprising 3,091 males (55%) and 2,567 females (45%). The district consists of four rural municipalities. The Human Development Index (HDI) of Manang is 0.536, reflecting moderate development status, while the Human Poverty Index (HPI) stands at 29.3 (NHDR, 2014).

Manang is known for its breathtaking landscapes, unique trans-Himalayan ecosystem, rich biodiversity, and cultural heritage. It serves as an important hub for tourism, with attractions like the Annapurna Circuit, Tilicho Lake, Gangapurna Lake, and ancient monasteries. The difficult geography poses challenges for economic and social progress. The road network connecting Kathmandu to Chame via Besisahar in Lamjung , spans 60 kilometers but takes nearly six hours to

travel due to its challenging terrain. During monsoons, landslides and floods often block roads, requiring people to undertake risky hikes. Despite the road connection to Tilicho Lake in Manang Ngisyang Rural Municipality, one of the world's highest-altitude lakes, transportation services remain irregular. Additionally, Manang faces significant challenges from climate change. Rising temperatures, erratic rainfall patterns, glacial retreat, and the increasing threat of landslides and desertification pose serious risks to its fragile ecosystem and the livelihoods of its people.

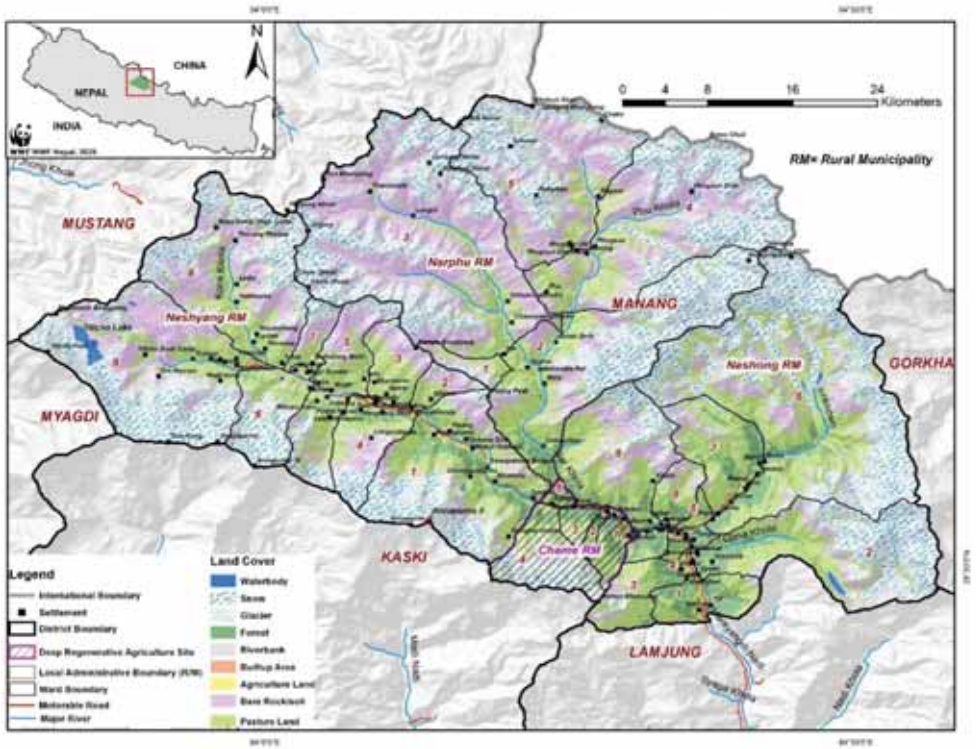


Figure 7: Map of Manang

4.2 Overview of Chame Rural Municipality

Chame Rural Municipality, located in the central part of Manang district, lies at an altitude ranging from 2,650 meters to 6,780 meters above sea level. The municipality is located at 28°33'7" N and 84°14'27" E, covering an area of approximately 1,006.74 square kilometers. The municipality has five wards, which are located in Timang, Thanchok, Koto, Chame New Bazaar, and Pari Chame. The total population of the municipality is 1,276 comprising, 730 (57.2%) males and 546 (42.8%) females, residing in 389 households (CBS, 2021). The population is diverse, with the most prominent ethnic groups being Gurung (37.9%), Bhote (11%), Magar (8.2%), and Ghale (7.9%). Other groups include Chhetri (6.2%), Bishwokarma (5.8%), Brahmin-Hill (5%), Tamang (4.8%), and Newar (3.9%). The literacy rate of Chame is approximately 86.3% (CBS, 2021).

Agriculture and livestock rearing are the primary sources of livelihood, engaging approximately 48% of the population. Business, tourism, and trade are other significant economic activities. Cultural festivals such as Ghode Jatra (Yartung), Lhosar, Bade, Thelo, and archery festivals (Metha and Dhajyang) are celebrated. The total land area comprises 32.04 hectares of cultivable land, 19.37 hectares of government land, 507.59 hectares of forest, 346.85 hectares of pastureland, and 100.88 hectares of other land. From a tourism perspective, Chame is a vital destination, serving as a route

to Annapurna Circuit Trek and Tilicho Lake. Prominent natural tourist destinations include Lamjung Himal, Kajin Sara Lake, Tatopani Kunda, trekking trails, and rhododendron gardens.

During the winter months, temperatures in Chame can drop significantly, with average lows around -6°C. Summers are relatively mild, with average high near 18°C. The region experiences a distinct monsoon season, typically from June to September, during which it receives the majority of its annual precipitation. Overall, Chame's climate is influenced by its elevation and geographical location, leading to cold winters, mild summers, and a monsoon season that brings the majority of its annual rainfall. Most of the forests and rangelands of Chame Rural Municipality lie within the Annapurna Conservation Area. The area is also home to valuable medicinal plants such as yarsagumba (*Cordyceps sinensis*), nirmansi (*Delphinium himalayai*), jatamasi (*Nardostachys jatamansi*), paanch aaunle (*Dactylorhiza hatagirea*), bhutkesh (*Onosma spp.*), paakhanved (*Bergenia ciliata*), satuwa (*Paris polyphylla*) and other wild edible mushrooms like khoya chyau (*Morchella spp.*), guchchi chyau, cauli chyau and chiple chyau.

The region is inhabited by several endangered wildlife species, including the musk deer (*Moschus spp.*), Himalayan tahr (*Hemitragus jemlahicus*), naur (*Pseudois nayaur*), thatar (*Hemitragus spp.*), snow leopard (*Panthera uncia*), and bears (*Ursus spp.*). Additionally, it is home to a variety of bird species, such as the Danphe (*Lophophorus impejanus*), Munal (*Tragopan satyra*), Kalij (*Lophura leucomelanos*), Lophophorus, Dhikur (*Alectoris chukar*), Chyakhura (*Lerwa lerwa*), crows (*Corvus spp.*), and other small bird species.

The primary occupation of the majority of the population is agriculture and livestock farming. However, the limited availability of arable land results in relatively low economic returns. Trade-related employment, including jobs in hotels, restaurants, and shops, serves as the second most significant source of livelihood. Additionally, other occupations include foreign employment, wage labor, government services, and various other sectors. The primary crops grown in the region include common buckwheat, maize and wheat, with common bean being the predominant legume. Potato is the main vegetable crop, alongside other vegetables such as mustard, turnip, carrot, cauliflower, pumpkin, tomato, and cucumber. Livestock farming is also prominent, featuring mountain goats (Chyangra), goats (Sinhal breed), sheep, cows (Lulu breed), and yaks. Irrigation in Chame is primarily dependent on natural water sources such as rivers, streams, and seasonal snowmelt from mountains. The region's topography and elevation make irrigation a challenge, especially during the dry season when water availability is limited. Traditional irrigation systems, including canals and water diversion methods, are commonly used to channel water from nearby streams to agricultural fields. Local farmers have developed adaptive strategies such as rainwater harvesting to sustain crop production.

4.3 Overview of Manang Ngisyang Rural Municipality

Ngisyang Rural Municipality is situated in the northern part of Manang District, encompassing an area of approximately 694.6 square kilometers. It lies near the Annapurna Conservation Area, with coordinates around 28.312°N latitude and 84.330°E longitude. The region is known for its rugged terrain and high-altitude landscapes, ranging from about 1,000 meters to 6,000 meters above sea level. It consists of 9 wards. The total population of the municipality is 1,595, with 779 males (48.8%) and 816 females (51.2%), residing in 593 households as per the 2021 Census. The primary ethnic

group in this region includes Gurung, Ghale, Lama, and Bishwakarma. The literacy rate is 64.3%, with 1,027 individuals (64.3%) being literate, 116 individuals (7.3%) being able to read only, and 369 individuals (23.1%) being illiterate. The main occupations of the people here are agriculture, livestock farming, and hotel businesses. Of the total area, 5% is arable land, 10% is forest, 50% is used for livestock grazing and pasture, and 35% is mountainous and alpine region (Manang ngsiyang, 2024).

This rural municipality is home to several religious, historical, archaeological, and tourist sites such as Tilicho Lake, Gangapurna Lake, Ice Lake, Mamcho Lake, Green Lake, Ghaley Raja's Palace, Yak Kharka, Thorong La Pass, Kang La Pass, Mesokanto Pass, Ne Cave, Milarepa Monastery, Bhraka Monastery, Tare Monastery, Pocho Monastery, Pisang Monastery, Potonche Monastery, Dhyaru Monastery, Ngawal Monastery, Tanki Monastery, Khangsar Monastery, Karki Monastery, and Sher Monastery.

The average temperature in this municipality ranges from 2°C to 10°C. The winter months (December to February) are very cold and snowy, making it difficult to access high-altitude areas. The monsoon season (June to August) is prone to heavy rains, landslides, and cloud cover. The windiest month is April, with an average wind speed of 9 mph. Most of the land in this area is covered by hard Himalayan rocks, with some regions having pine trees and grassy meadows. The types of tree species found are lothre salla (*Pinus wallichiana*), bhojpatra (*Betula utilis*), dhupi (*Juniperus spp.*), laligurans (*Rhododendron arboreum*), salla (*Pinus roxburghii*), and katus (*Quercus spp.*). At lower altitudes, temperate species like gobresalla (*Pinus wallichiana*), okhar (*Juglans regia*), and uttis (*Alnus nepalensis*) dominate, while higher altitudes feature alpine shrubs and grasses. The area is also home to valuable medicinal plants such as yarsagumba (*Cordyceps sinensis*), nirmansi (*Delphinium himalayai*), jatamasi (*Nardostachys jatamansi*), paanch aaunle (*Dactylorhiza hatagirea*), satuwa (*Paris polyphylla*), and kutki (*Picrorhiza kurroa*). The region is inhabited by several endangered wildlife species, including kasturi mirga (*Moschus spp.*), tahr (*Hemitragus jemlahicus*), goral (*Naemorhedus goral*), jharal (*Pseudois nayaur*), hiun chituwa (*Panthera uncia*), and himali rato bhalu (*Ursus thibetanus*). Additionally, it is home to a variety of bird species, such as danphe (*Lophophorus impejanus*), munal (*Tragopan satyra*), chilimey giddha (*Gypaetus barbatus*), himali giddha (*Gyps himalayensis*), chyakhura (*Lerwa lerwa*), and other small bird species.

The main occupations of the people are agriculture, livestock farming, and hotel businesses. Crops such as buckwheat, wheat, barley, along with vegetables like potatoes, cabbage, carrots, cauliflower, raddish, and pumpkins are cultivated only in one season. Livestock in the region includes yaks, cows (Lulu breed), mountain goats (chyangra), and sheep. Hotel business is the primary source of income for the locals. Similarly, some youths are engaged in foreign employment, while others have adopted local carpentry and masonry as their professions. Although the pace of development has not accelerated much, the Lamjung, Besisahar, Chame to Khangsar road network has connected to this rural municipality, and electricity is provided through micro-hydropower. Telephone and internet services are effectively available in all wards of this rural municipality (Manang ngsiyang, 2024).

In Ngisyang, irrigation primarily relies on snowfall. Snowfall usually begins in the last week of Kartik (mid-November) and lasts until Falgun and Chaitra (February to April), ensuring that water reaches

the roots of plants and provides essential irrigation for agriculture. This timely snowfall plays a vital role in supporting farming activities by replenishing water sources and improving soil moisture, ultimately leading to better agricultural production.

5 Findings

5.1 Socio-economic and Demographic characteristics

5.1.1 Demographics and household composition

The overall average age of the respondents was 46.82 years, with statistically no significant difference between Chame (45.28 years) and Ngisyang (48.68 years) rural municipalities ($p = 0.208$). Similarly, the overall average age of the household head was 51.57 years, with statistically no significant difference between Chame (52.45 years) and Ngisyang (50.50 years) ($p = 0.463$).

The overall average household size was 4.68 members, slightly higher in Chame (5.06) as compared to Ngisyang (4.23). This difference was found to be statistically significant at 10 percent level of significance ($p = 0.057$). On an average, household comprised of 2.37 male members, with statistically no significant variation between the two rural municipalities ($p = 0.202$). With respect to number of female members in the household, average female members is 2.31, slightly more in Chame (2.53) than in Ngisyang (2.05), and the difference between the two rural municipalities was statistically significant at 10 percent level of significance ($p = 0.055$).

5.1.2 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 is 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 to 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 0.44, statistically significantly higher in Chame (0.57) than Ngisyang (0.28) ($p = 0.011$). This showed that 100 economically active members had to fulfill the basic necessities of 44 dependent members in the study sites.

The overall economically active and dependent members in a household was found to be 3.49 members, with statistically no significant difference between the rural municipalities ($p = 0.980$). Whereas the overall dependent member in a household was found to be 1.19 members, Chame had statistically significantly more dependent members (1.57) compared to Ngisyang (0.73) ($p = 0.001$).

5.1.3 Landholding patterns

On average, the households owned 0.49 hectares of land, with a statistically significant difference between Chame (0.60 ha) and Ngisyang (0.37 ha) ($p = 0.051$).

Among the total land owned by the households, the overall cultivated land was found to be 0.32 hectares, with households in Chame cultivating statistically significantly more (0.39 ha) compared to Ngisyang (0.24 ha) ($p = 0.025$). The rest of the land, which is categorized as non-cultivated land, was found to be 0.17 hectares, with statistically no significant difference between the two rural municipalities ($p = 0.230$).

5.1.4 Involvement in agriculture and migrated members

On average, 2.25 household members were involved in agriculture, with statistically no significant difference between Chame (2.11) and Ngisyang (2.41) (p = 0.281).

The households had an average of 0.21 migrated members, with a higher average in Chame (0.32) compared to Ngisyang (0.07). However, this difference was statistically non-significant (p = 0.124).

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

Variables	Overall (n=97)	Rural municipality		Mean difference	t-value	p-value	Min.	Max.
		Chame (n=53)	Ngisyang (n=44)					
Age of respondent (year)	46.82 (13.18)	45.28 (14.13)	48.68 (11.83)	-3.40	-1.269	0.208	18.0	82.0
Age of household head (year)	51.57 (12.97)	52.45 (13.37)	50.50 (12.54)	1.95	0.736	0.463	19.0	87.0
Household size	4.68 (2.14)	5.06 (2.26)	4.23 (1.93)	0.83*	1.924	0.057	1.0	12.0
Male member	2.37 (1.33)	2.53 (1.32)	2.18 (1.32)	0.35	1.286	0.202	0.0	7.0
Female member	2.31 (1.24)	2.53 (1.28)	2.05 (1.14)	0.48*	1.942	0.055	1.0	5.0
Dependency ratio (n=94)	0.44 (0.55)	0.57 (0.60)	0.28 (0.43)	0.29**	2.610	0.011	0.0	2.5
Active member	3.49 (1.87)	3.49 (1.84)	3.50 (1.93)	-0.01	-0.025	0.980	0.0	10.0
Active male	1.70 (1.15)	1.66 (1.11)	1.75 (1.20)	-0.09	-0.381	0.704	0.0	5.0
Active female	1.79 (1.11)	1.83 (1.07)	1.75 (1.16)	0.08	0.353	0.725	0.0	5.0
Dependent member	1.19 (1.27)	1.57 (1.37)	0.73 (0.97)	0.84	3.415	0.001	0.0	5.0
Dependent male	0.67 (0.81)	0.87 (0.88)	0.43 (0.66)	0.44	2.716	0.008	0.0	3.0
Dependent female	0.52 (0.71)	0.70 (0.77)	0.30 (0.55)	0.40	2.890	0.005	0.0	3.0
Total land (ha)	0.49 (0.59)	0.60 (0.69)	0.37 (0.39)	0.23	1.974	0.051	0.0	3.75
Cultivated land (ha)	0.32 (0.33)	0.39 (0.41)	0.24 (0.18)	0.15	2.278	0.025	0.00	2.00
Non-cultivated land (ha)	0.17 (0.33)	0.21 (0.35)	0.13 (0.30)	0.08	1.208	0.230	0.00	1.90
Member involved in agriculture	2.25 (1.34)	2.11 (1.51)	2.41 (1.09)	-0.30	-1.085	0.281	0.00	6.00
Migrated members	0.21 (0.80)	0.32 (1.03)	0.07 (0.33)	0.25	1.554	0.124	0.00	6.00

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.
The socioeconomic and sociodemographic characteristics of categorical variables of sampled household is described below:

5.1.5 Gender of Respondent and Household Head

The majority of the respondents were female (52.6%). Higher proportion of male respondents was seen in Ngisyang (56.8%) compared to Chame (39.6%) and the difference was found statistically significant at 10 percent level of significance (p=0.091).

Most of the household head were male (60.8%), and the male headed households were found slightly more common in Ngisyang (68.2%) as compared to Chame (54.7%), but this difference was statistically non-significant (p = 0.176).

5.1.6 Ethnicity

The dominant ethnic group was found Janajati (90.7%), followed by Dalits (5.2%), Chhetri (3.1%), and Brahmin (1.0%). In both the rural municipalities, Janajati was found to be predominant, with a higher proportion in Chame (94.3%) compared to Ngisyang (86.4%). However, the differences in ethnic composition were statistically non-significant (p = 0.502).

5.1.7 Family Type

The overall household family type was nuclear (70.1%) and the rest was joint family (29.9%). Within the two rural municipalities, joint families were more common in Chame (37.7%) than in Ngisyang (20.5%). This difference was found to be statistically significant (p = 0.064).

5.1.8 Occupation

The overall primary occupation of respondents was dominated by agriculture (87.6%), consistent within the two rural municipalities as well; however, the difference was found to be statistically non-significant. Similarly, the primary occupation of the household head was also agriculture (86.6%), slightly higher proportion of household heads in Ngisyang were engaged in agriculture (90.9%) compared to Chame (83.0%), but this difference was statistically non-significant (p = 0.256).

5.1.9 Decision Maker in Agriculture related Farming Activities

The decision in agriculture related farming activities were made jointly in majority of the households (56.7%), followed by female-only decision-making (30.9%) and male-only decision-making (12.4%). A higher proportion of joint decision-making was observed in Chame (60.4%) compared to Ngisyang (52.3%), but this difference was statistically non-significant (p = 0.283).

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

Variables	Overall (n=97)	Rural municipality		χ2-value	p-value
		Chame (n=53)	Ngisyang (n=44)		
Gender of respondent					
Male	46 (47.4)	21 (39.6)	25 (56.8)	2.851*	0.091
Female	51 (52.6)	32 (60.4)	19 (43.2)		
Gender of household head					
Male	59 (60.8)	29 (54.7)	30 (68.2)	1.829	0.176
Female	38 (39.2)	24 (45.3)	14 (31.8)		
Ethnicity					
Brahmin	1 (1.0)	0 (0.0)	1 (2.3)	2.355	0.502
Chhetri	3 (3.1)	1 (1.9)	2 (4.5)		
Janajati	88 (90.7)	50 (94.3)	38 (86.4)		
Dalit	5 (5.2)	2 (3.8)	3 (6.8)		
Family type					
Joint	29 (29.9)	20 (37.7)	9 (20.5)	3.426*	0.064
Nuclear	68 (70.1)	33 (62.3)	35 (79.5)		

Variables	Overall (n=97)	Rural municipality		χ2-value	p-value
		Chame (n=53)	Ngisyang (n=44)		
Occupation of respondent					
Agriculture	85 (87.6)	47 (88.7)	38 (86.4)	1.219	0.544
Business	11 (11.3)	5 (9.4)	6 (13.6)		
Other	1 (1.0)	1 (1.9)	0 (0.0)		
Occupation of household head					
Agriculture	84 (86.6)	44 (83.0)	40 (90.9)	1.290	0.256
Business	13 (13.4)	9 (17.0)	4 (9.1)		
Decision maker in agriculture farming					
Male	12 (12.4)	4 (7.5)	8 (18.2)	2.526	0.283
Female	30 (30.9)	17 (32.1)	13 (29.5)		
Both	55 (56.7)	32 (60.4)	23 (52.3)		

Notes: Figures in parentheses indicate percent. p-values are the result of the Pearson Chi-square test. * Indicates significant at 10 percent level of significance.

5.1.10 Primary Source of Income

Households in Manang are engaged in various occupations e.g. agriculture, livestock, tourism, hotel business, foreign employment, non-agricultural labour, jobs/services) as their primary source of income. In Chame 38% of households primarily rely on agriculture, while 9% households depend on business with 5% engaged in both agriculture and business activities. In Manang Ngisyang, agriculture serves as the main source of income for 33% of households. Similarly, 6% of households engage in business and 5% households engage in both agriculture and business.

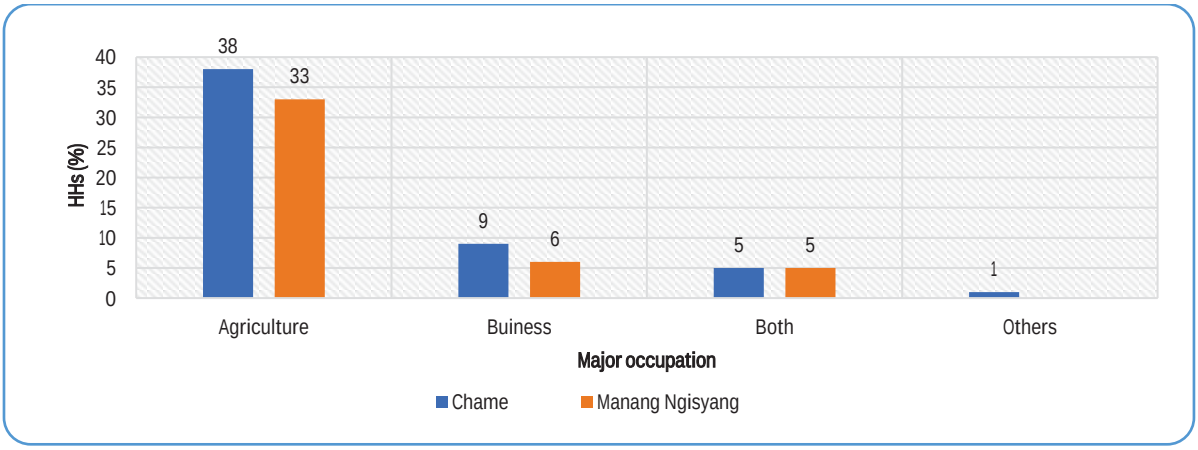


Figure 8: Major occupation of respondents in Chame and Ngisyang, Manang

5.2 Agro-transpastoral system in Manang

Apple, naked barley, buckwheat, potato and vegetables are the important crops in Manang district. The impact of climate change includes reduced snowfall, earlier apple ripening, and an increase in pests and diseases affecting productivity of apples, buckwheat, and other crops. The community's 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. Changes in climate have also enabled the cultivation of new vegetable varieties, like green peas in apple orchards, which improve soil fertility. There is a variation in the crop calendar between lower and upper Manang. In upper Manang, only one crop is cultivated per year, while in lower Manang, two

crops can be grown annually. The detailed crop calendar for both regions is presented in Table 7 and 8.

Table 7: Cropping system in lower belt of Manang (below Chame)

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

Table 8: Cropping system in upper belt of Manang (above Chame)

S.N	Name of crop	Time for sowing	Time for harvesting
1	Naked barley/wheat/ barley	Chaitra - Baisakh	Asoj - Kartik
2	Naked barley/wheat/ barley	Asoj - Kartik	Asad - Shrawan
3	Buckwheat	First week of Jestha	Kartik
4	Potato	Chaitra - Baisakh	Asoj
5	Vegetable crops (broad leaf mustard, cabbage, cauliflower, raddish, carrot,etc)	Baisakh	Bhadra - Kartik

Source: Agriculture Knowledge Centre (AKC), Chame, Manang

Manang is renowned for its variety of apples such as red delicious, red royal, golden delicious, gala, fuji, and so on. Along with apples, farmers also grow fruits like pears, apricots, peaches, plums, and walnuts. Vegetables commonly grown in the district include green peas (tangar), cauliflower, cabbage, chinese greens (saag), and pumpkins. Farmers in Manang also grow forage crops such as jai grass, thung mra and chuku grass. Some households occasionally harvest honey from bees. The district is also rich in mushroom diversity, with varieties such as chiple, guchchi, cauliflower mushroom, red mushroom, yellow mushroom, white mushroom, gobhang, dalle, aasyamo, mirmi, oyster mushroom, jaali, mudey, mrigey, gobre, yarsagumba, korpung, thopale (dallo), fokale, and bhudi chyau as reported by respondents. Farmers in Manang have also identified several medicinal and aromatic plants, including jimbu, dhupi, kutki, padamchaal, jatamasi, timur, maarpalang, pongkhar, chiraito, paanch aaunle, simey, satuwa, nirmasi, yarsagumba, wild garlic, and wild potato. Additionally, they raise various animals such as Lulu cows, yaks, chyangra goats, sheep, horses, pigs, and Giriraj chickens.

5.3 Food sufficiency status

Naked barley, buckwheat and wheat are the major cereal; common bean (black, tateypaatey) is the major legume; and potato is the major vegetable grown in both municipalities of Manang. Leafy and other vegetables are sufficient only for an average of 4 months as they are grown seasonally in Manang. Similarly, common beans and peas are used as pulses. Detailed data on food sufficiency status is presented in Figure 3.

The food sufficiency data reveals a notable contrast between Chame and Ngisyang Rural Municipalities. In Chame, nearly half of the households (47.2%) have year-round food sufficiency, indicating better food security, while only 3.8% of households face food insufficiency for less than

three months. Additionally, 26.4% and 22.6% of households in Chame have food sufficiency for 3–6 months and 6–9 months, respectively, with no households falling into the 9–12 months category of food sufficiency.

In contrast, Ngisyang Rural Municipality faces more significant challenges regarding food sufficiency. Only 22.7% of households report having year-round food sufficiency, while a substantial 36.4% experience food sufficiency for less than three months. Furthermore, 34.1% and 2.3% of households have food sufficiency for 3–6 months and 6–9 months, respectively, with 4.5% managing food sufficiency for 9–12 months. These figures indicate a more pronounced issue of food insecurity in Ngisyang compared to Chame.

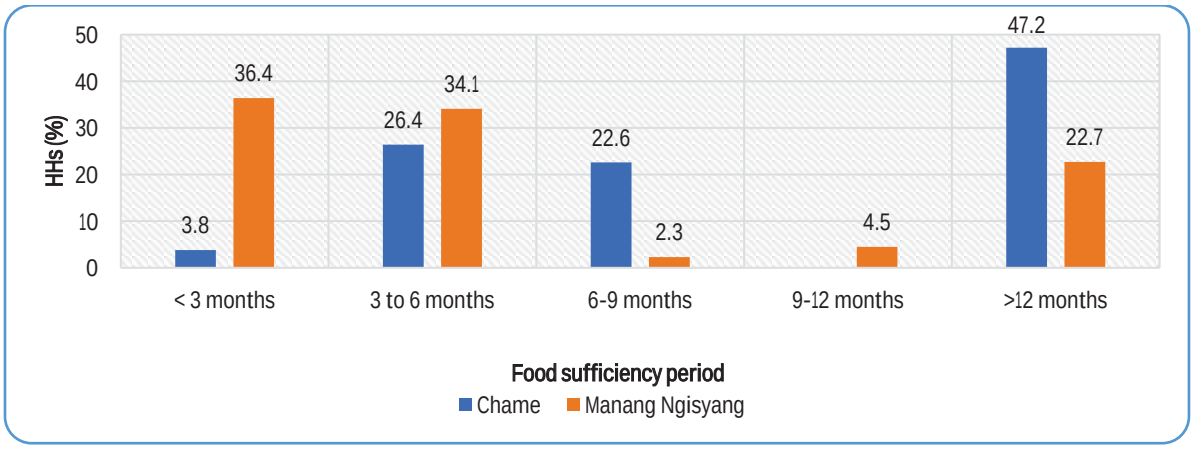


Figure 9: Food Sufficiency in Chame and Manang Ngisyang

5.4 Targeted crop diversity and production system

In Chame, out of 52 households, 39 cultivated common bean and broad leaf mustard, 31 grew potatoes, and 24 cultivated both common buckwheat and naked barley. Additionally, 3 households grew rapeseed, 2 cultivated tartary buckwheat and wheat, and only 1 household grew barley. However, no household cultivated broad leaf mustard as a standalone crop. In Ngisyang, out of 45 households, 41 cultivated potatoes, 34 grew common buckwheat, and 22 cultivated common bean. Seven households grew broad leaf mustard, 4 cultivated naked barley, and 2 cultivated barley. Only 1 household cultivated tartary buckwheat and wheat, while no household grew rapeseed Figure 10.

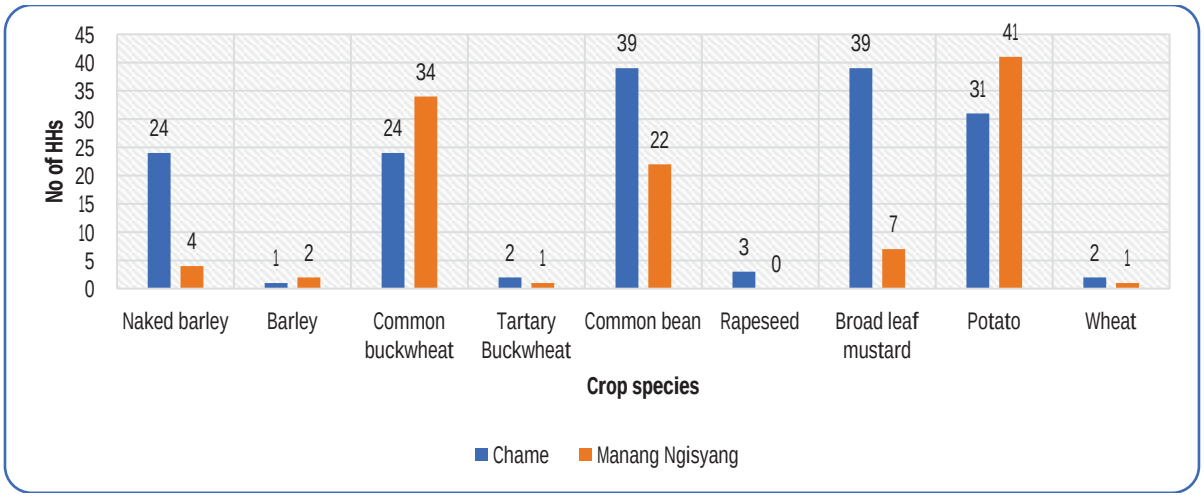


Figure 10: Status of targeted crop species in Chame and Manang Ngisyang

5.4.1 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 labor shortage. 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. 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.

In Chame, 88% of the households have been cultivating naked barley for more than 60 years, while only 12% have been cultivating it for less than 60 years. The current cultivation status shows a decline, with 67% of households reporting a decrease in cultivation, 27% maintaining a constant level, and only 6% seeing an increase. Regarding the crop area, most households (73%) cultivated less than 5 ropani and 27% cultivated between 5-10 ropani. In terms of crop production, the majority (85%) produced less than 500 kg, and 15% produced between 500-1000 kg.

In Ngisyang, 80% of households have been cultivating naked barley for less than 60 years, while 20% have a cultivation history of more than 60 years. Similar to Chame, the cultivation status is decreasing, with 80% reporting a decrease, 20% maintaining a constant level, and no increase in cultivation. Most households (80%) cultivated less than 5 ropani, and 20% cultivated between 5-10 ropani. Regarding crop production, 80% produced less than 500 kg, and 20% produced between 500-1000 kg.

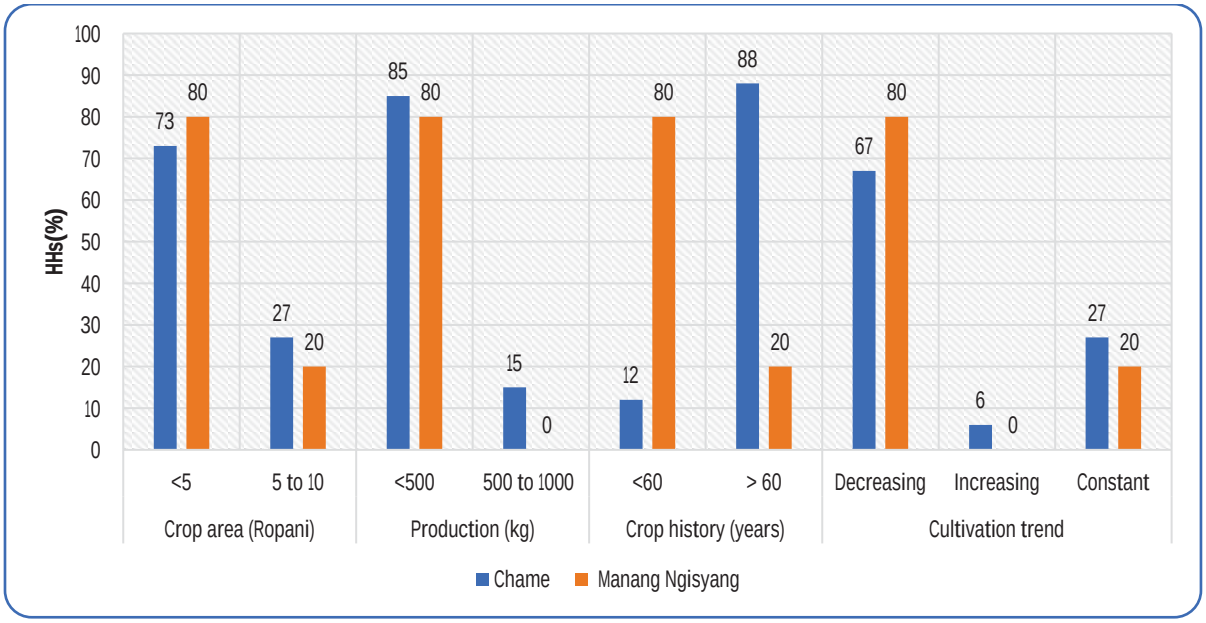


Figure 11: Status of naked barley in Chame and Manang Ngisyang

5.4.2 Barley (Hordeum vulgure L.)

Barley is a winter crop, like naked barley. 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 labur shortage, cultivation is decreasing. This is especially a problem for barley because of its double husk and awn. 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 Chame, all households (100%) reported cultivating barley for less than 60 years, with none cultivating for more than 60 years. The cultivation status is uniformly reported as decreasing (100%). The crop area is limited to less than 5 ropani for all households, with no households cultivating in areas greater than 10 ropani. Production levels are similarly constrained, with all households producing less than 500 kg annually, and none achieving production levels of 500–1,000 kg or above 1,000 kg.

In Ngisyang, barley cultivation also has a history of less than 60 years for all households (100%). However, the present status of cultivation remains constant for all households (100%), with no reports of either an increasing or decreasing trend. The crop area in Manang Ngisyang is similarly limited to less than 5 ropani for all households. In terms of production, 50% of households produce less than 500 kg annually, while the remaining 50% achieve production levels between 500–1,000 kg. No households report production exceeding 1,000 kg. These findings reflect significant constraints in land availability, production levels, and the declining cultivation trend in Chame.

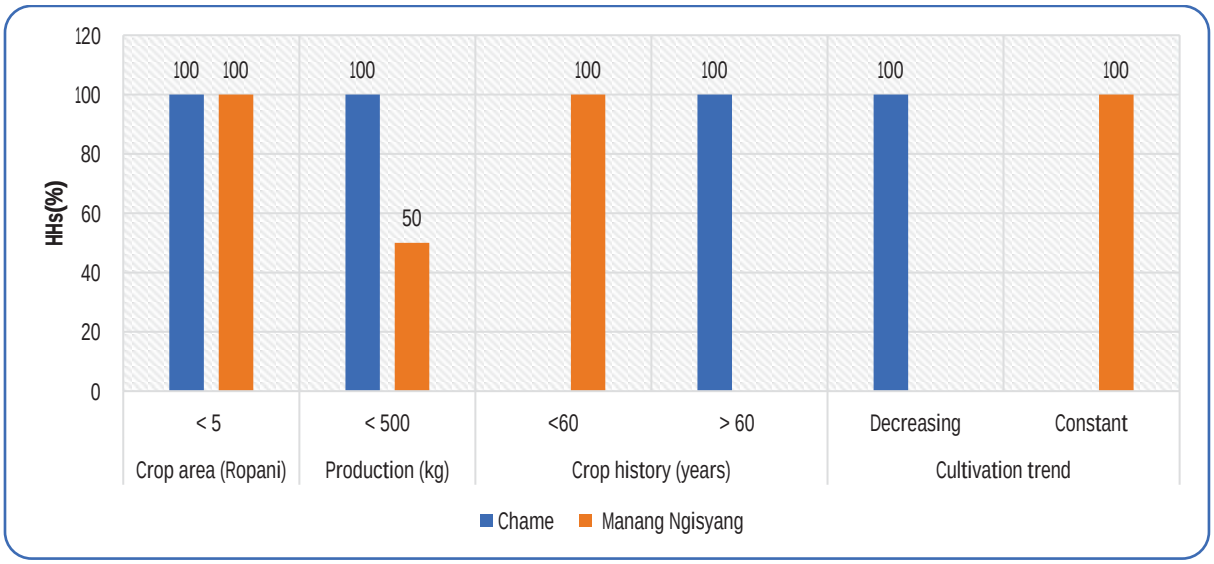


Figure 12: Status of barley in Chame and Manang Ngisyang

5.4.3 Common buckwheat (Fagopyrum esculentum)

Common buckwheat, phapar/gheprey in a local language, has been cultivated as a 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 (*sukulg*). 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. 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.

In Chame, 53% of households have a common buckwheat cultivation history of more than 60 years, while 47% have been cultivating for less than 60 years. The current cultivation status shows that 66% of households report a decrease in cultivation, 25% maintain a constant level, and only 9% report an increase in cultivation. Regarding crop area, the majority (75%) cultivate less than 5 ropani, and 25% cultivate between 5-10 ropani. No household cultivates more than 10 ropani. In terms of crop production, a vast majority (97%) produce less than 500 kg, with only 3% producing between 500-1000 kg.

In Ngisyang, 72% of households have been cultivating common buckwheat for less than 60 years, while 28% have a cultivation history of more than 60 years. The cultivation status is primarily decreasing, with 66% reporting a decline, 36% maintaining a constant level, and 13% seeing an increase in cultivation. Most households (87%) cultivate less than 5 ropani, and 13% cultivate between 5-10 ropani. For crop production, 95% produce less than 500 kg, and 5% produce between 500-1000 kg.

These findings suggest that buckwheat cultivation, like other crops in both Chame and Ngisyang, is generally experiencing a decline. The production levels are low, with most households producing less than 500 kg and cultivating small areas of land (less than 5 ropani). The trend reflects challenges in maintaining common buckwheat cultivation over time.

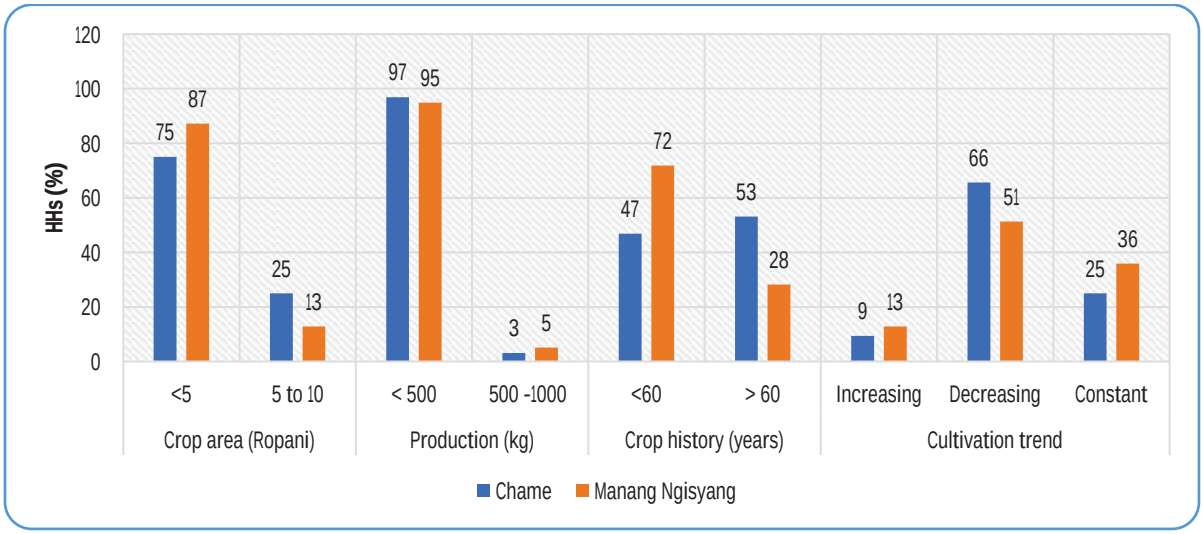


Figure 13: Status of common buckwheat in Chame and Ngisyang

5.4.4 Common bean (Phaseolus vulgaris)

Common bean, kolo in local language, 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 as an integral part of *dalbhat*) is common and provides an important source of protein, fibre and energy to the high mountain diet. S*imi ko daal* remains a recipe for special occasions, however, its popularity is increasing for its taste.

In Chame, 59% of households have been cultivating common bean for less than 60 years, while 39% have a cultivation history of more than 60 years. The current cultivation trend shows that 61% of households report a decrease in cultivation, 23% maintain a constant level, and 16% report an increase. Regarding crop area, the majority (89%) cultivate less than 5 ropani, while 11% cultivate between 5-10 ropani. In terms of production, all households produce less than 500 kg, with no households producing between 500-1000 kg.

In Ngisyang, 77% of households have a cultivation history of less than 60 years, while 23% have been cultivating common bean for more than 60 years. The current status indicates that 41% of households report a decrease in cultivation, 45% maintain a constant level, and 14% report an increase. All households cultivate less than 5 ropani, and the production level is uniformly low, with all households producing less than 500 kg. These findings reveal that common bean cultivation in both Chame and Ngisyang is predominantly declining or stagnant, with minimal production levels and cultivation confined to small areas (less than 5 ropani).

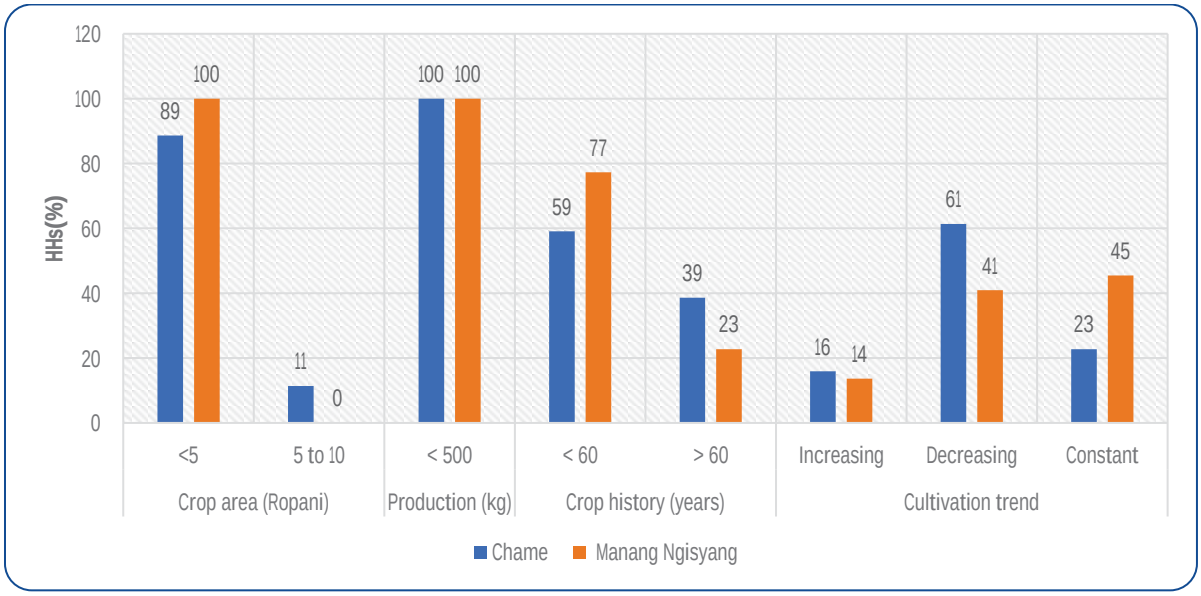


Figure 14: Status of common bean in Chame and Manang Ngisyang

5.4.5 Tartary buckwheat (*Fagopyrum tataricum*)

Tartary buckwheat, titey phapar in the local language, is an important winter crop in the high-altitude regions, 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.

In Chame, all households (100%) have a cultivation history of more than 60 years for tartary buckwheat. The current status indicates that 50% of households report a decline in cultivation, while the remaining 50% maintain a constant level. All households cultivate tartary buckwheat on less than 5 ropani of land, with no households cultivating larger areas. The production is uniformly low, with all households producing less than 500 kg.

In Ngisyang, tartary buckwheat has been cultivated for more than 60 years by all households (100%). However, the cultivation trend is entirely declining, with 100% of households reporting a decrease. The crop is grown exclusively on less than 5 ropani of land, and production levels remain low, with all households producing less than 500 kg. These findings indicate that tartary buckwheat is deeply rooted in both Chame and Ngisyang, with a long cultivation history. However, the crop faces significant challenges, including declining cultivation trends and limited production confined to small areas.

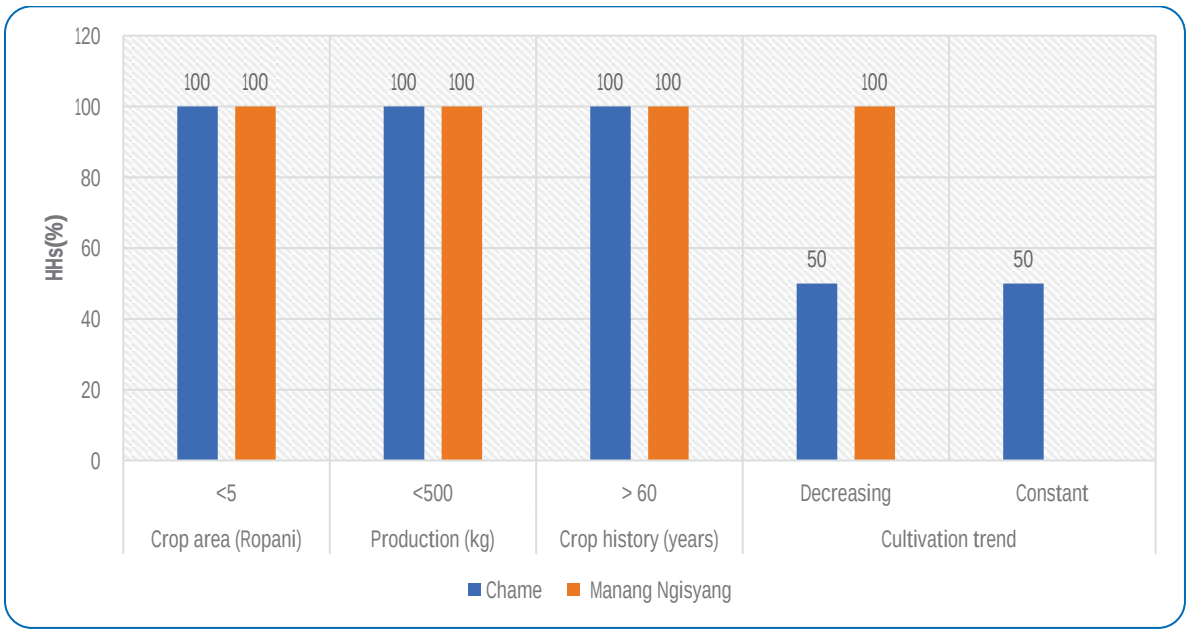


Figure 15: Status of tartary buckwheat in Chame and Manang Ngisyang

5.4.6 Rapeseed (Brassica napus)

Rapeseed, tori in local language 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 Chame and Ngisyang. No households in Ngisyang were cultivating rapeseed. In Chame, all households had traditionally cultivated rapeseed for less than

60 years. The cultivation status remained constant for 33.3% households and that of 66.7% households had decreasing status. All farmers grew rapeseed on less than 5 ropani of land, with yields falling below 500 kg.

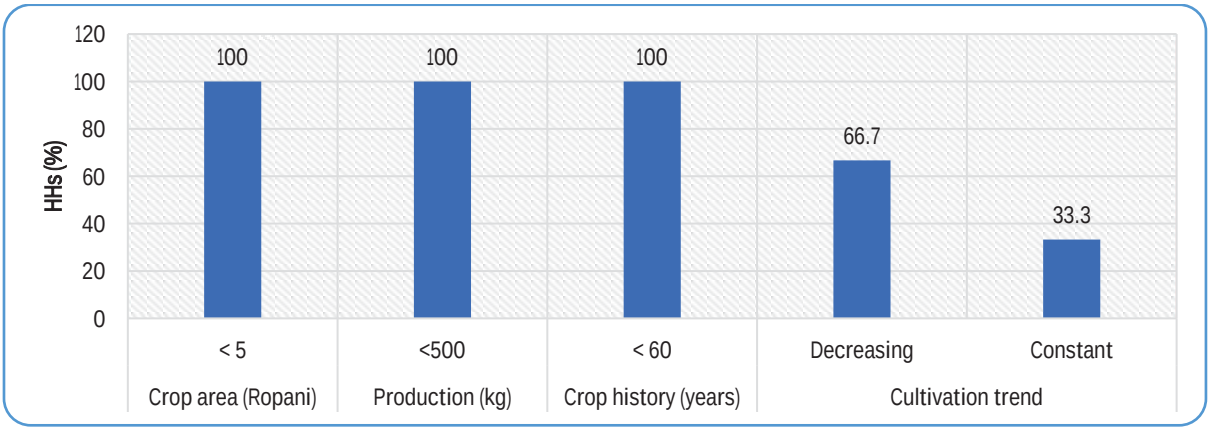


Figure 16: Status of rapeseed in Chame

5.4.7 Broad leaf mustard (*Brassica juncea*)

Broadleaf mustard, raayo in local language 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.

In Chame, 79.3% of households have been cultivating broad leaf mustard for less than 60 years, while 20.7% have a history of more than 60 years. Regarding the current cultivation status, 13.8% of households report an increase in cultivation, 17.2% report a decrease, and 44.8% indicate no change. The crop is grown exclusively in areas of less than 5 ropani, with production levels consistently below 500 kg for all households.

In Ngisyang, all households (100%) have been cultivating broad leaf mustard for less than 60 years. Currently, 14.3% report an increase in cultivation, 28.6% report a decrease, and 57.1% maintain constant cultivation levels. Similar to Chame, cultivation is limited to areas smaller than 5 ropani, and production remains uniformly low, with all households producing less than 500 kg.

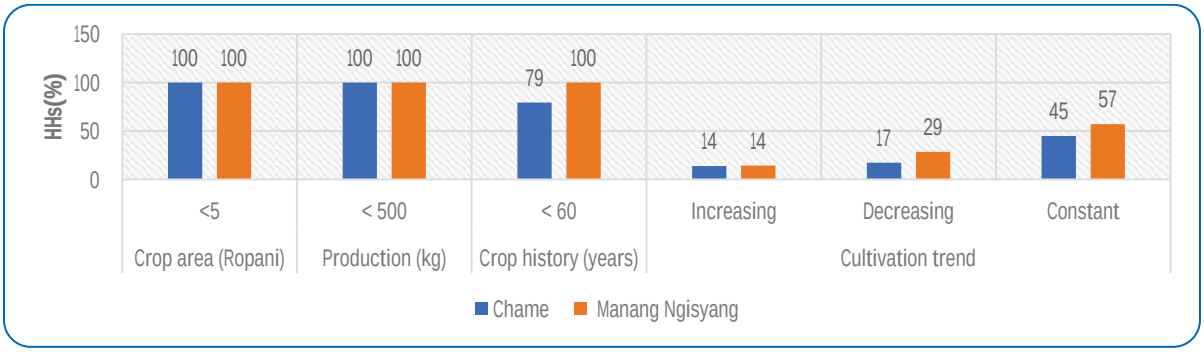


Figure 17: Status of broadleaf mustard in Chame and Manang Ngisyang

5.4.8 Potato (Solanum tuberosum)

Potato,aalu in local language is an important staple and highly valued crop in the himalayan region. They are prized for their distinctive flavor, firm texture and ability to retain their shape during cooking. 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 three varieties of potato- samdo, 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.

In Chame, 74% of households have been cultivating potato for less than 60 years, while 49% have a history of more than 60 years, indicating overlapping data for longer-term cultivation. The current cultivation trends show that 14% of households report an increase, 67% report a decrease, and 33% maintain constant levels. Regarding crop area, 72% cultivate on less than 5 ropani, 35% on 5-10 ropani, and 7% on more than 10 ropani. Production levels vary, with 35% producing less than 500 kg, 26% producing between 500-1000 kg, and 53% producing more than 1000 kg.

In Ngisyang, 67% of households have been cultivating potato for less than 60 years, while 33% have been doing so for more than 60 years. The cultivation status shows that 21% report an increase, 40% report a decrease, and 40% remain constant. Cultivation is primarily done on small plots, with 95% of households growing potato on less than 5 ropani and 5% on 5-10 ropani. Production levels are lower compared to Chame, with 77% producing less than 500 kg, 19% producing between 500-1000 kg, and only 5% producing more than 1000 kg.

These findings indicate that while potato is a staple crop in both regions, Chame exhibits higher production levels, and a broader range of cultivation areas compared to Ngisyang. However, declining cultivation trends are observed in both areas.

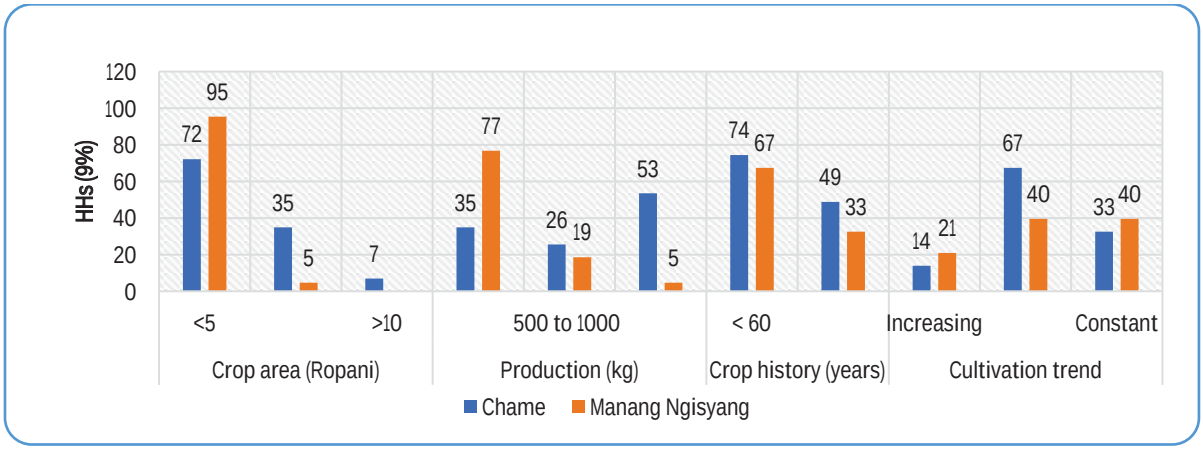


Figure 18: Status of potato in Chame and Manang Ngisyang

5.4.9 Wheat (Triticum aestivum L.)

Wheat, gahun in local language 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 Chame, wheat cultivation is evenly divided between households with less than 60 years (50%) and more than 60 years (50%) of cultivation history. The cultivation status has remained constant across all households, with 100% of the wheat being grown on plots smaller than 5 ropani. Production levels are uniformly low, with all households producing less than 500 kg.

In Ngisyang, wheat cultivation is a more recent practice, with 100% of households reporting less than 60 years of cultivation history. However, cultivation is in decline, with all households indicating a decrease in status. Like Chame, 100% of households grow wheat on plots smaller than 5 ropani, though 13% also report cultivating it on plots between 5-10 ropani. Production levels are consistently low, with all households producing less than 500 kg.

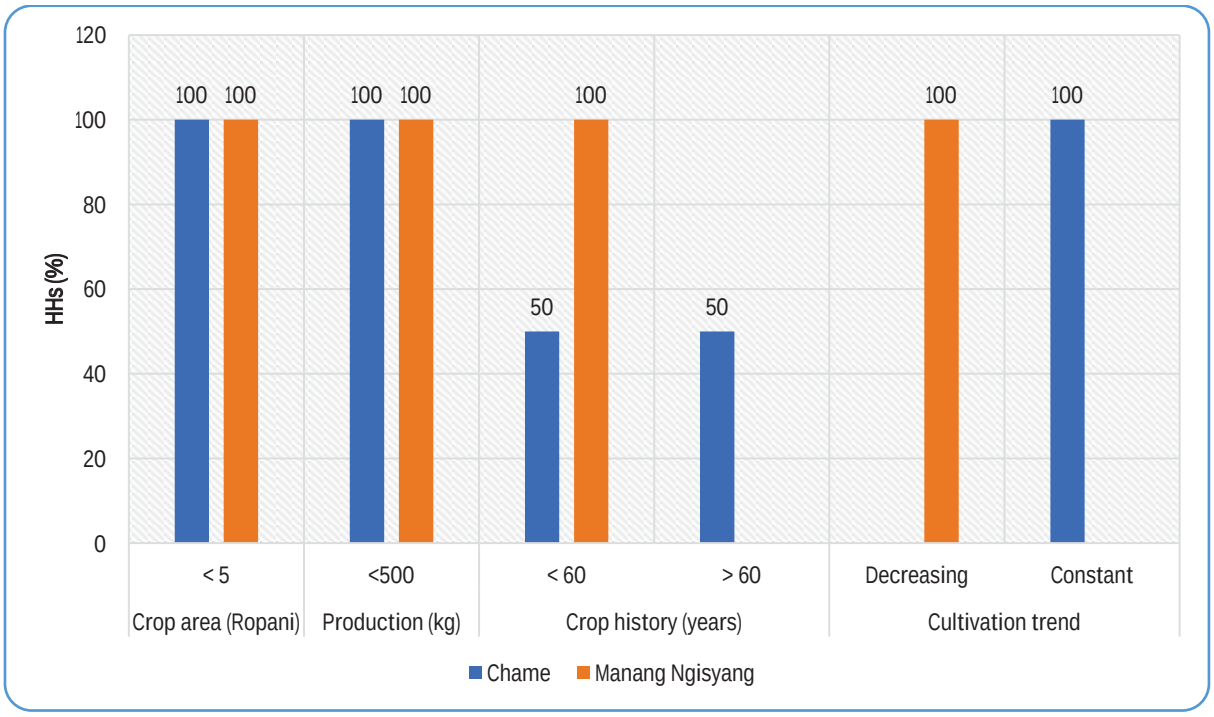


Figure 19: Status of wheat in Chame and Manang Ngisyang

5.5 Targeted livestock species and production system

In terms of livestock, 10 out of 52 households in Chame reared Lulu cows, 5 reared Chyangra goats, and 2 reared yaks. Similarly, in Ngisyang, 22 out of 45 households reared Lulu cows, followed by 7 rearing yaks and 4 keeping Chyangra goats. The frequency of the crops cultivated has been presented in Figure 20. All three targeted livestock—Lulu cattle, Yaks/Chauri and Himalayan goat (Chyangra)—are raised in the region. The Lulu cattle is the most dominant species in both sites, while Yak/Chauri rearing has been declining. Himalayan goats (Chyangra) are also reared in both

locations. These animals are valued for their milk, meat, wool, manure, and ability to thrive in cold temperatures. Additionally, they were raised for economic purposes. Other than targeted livestock, some households also raise Jersey cattle, horses, pigs, Giriraj poultry, and other livestock, contributing to a diverse production system.

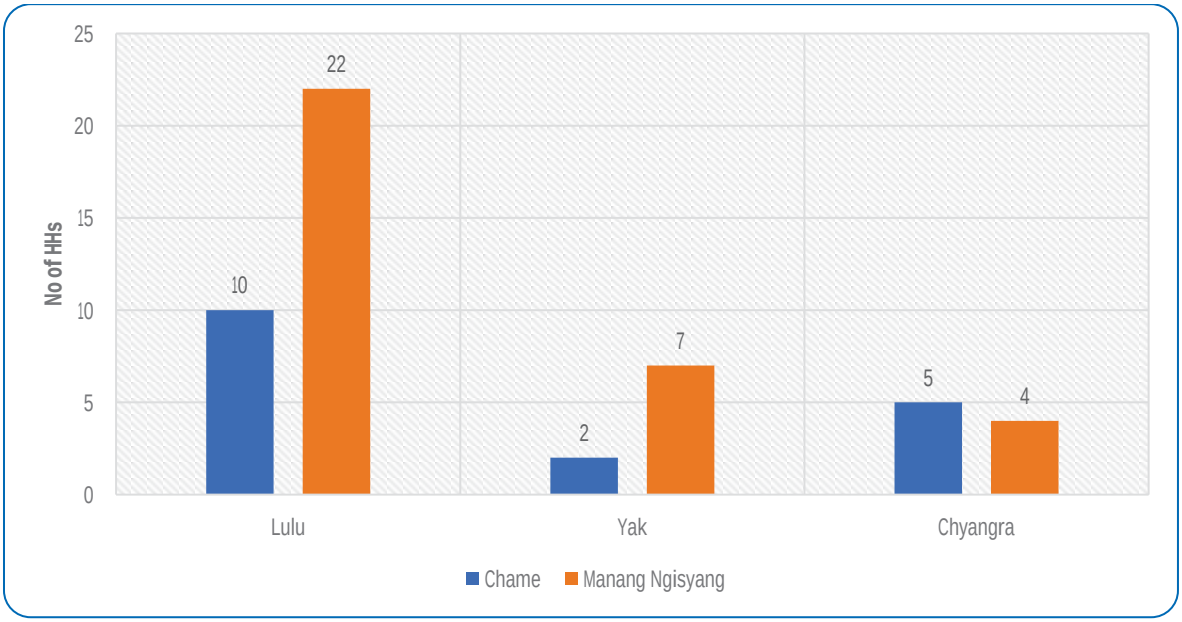


Figure 20: Status of targeted livestock species in Chame and Manang Ngisyang

5.5.1 Yak/Chauri (Bos grunniens)

Yaks, Chauri in local language have been integral to Nepal's trans-Himalayan region for centuries, supporting livelihoods and cultural practices. Found at elevations of 3,000 to 6,000 meters, yaks are raised for milk, meat, wool, and transport. Male yaks weigh about 420 kg, while females average 350 kg. Renowned for enduring harsh climates and rugged terrains, they play a crucial role in the local economy. Yak milk, rich in fat and protein, is used to produce butter, cheese, and yogurt, including the globally acclaimed "chhurpi" or hard yak cheese, which generates foreign exchange. Their manure, a vital source of organic fertilizer, enhances soil fertility. Their wool, prized for warmth and durability, is used to craft traditional clothing, blankets, and tents, including yak-hair tents still used by some families.

Yaks and their hybrids—Chauries (female) and Jhopkyos/Jhopa (male)—are unique to Nepal. Despite their importance, declining populations necessitate conservation efforts to preserve this agricultural heritage. Their meat, though consumed less frequently than milk, provides a vital protein source. Beyond nutritional benefits, 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.

In Chame, all households reared 10 or fewer yaks and had a rearing history of over 60 years. However, 100 % of households reported a decreasing trend in yak rearing.

In Ngisyang, 71% of households reared 10 or fewer yaks, while 29% reared more than 10. Additionally, 71% had a rearing history of 60 years or less, while 29% had been rearing yaks for over

60 years. Here, most households (71%) reported a decreasing trend in yak rearing, while 14% reported an increase and another 14% reported no change.

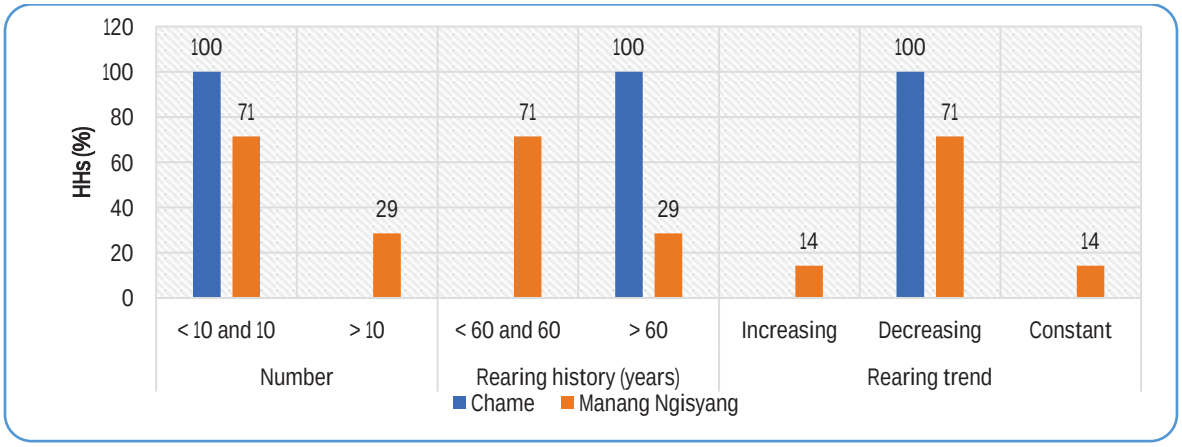


Figure 21: Status of yak/chauri in Chame and Manang Ngisyang

5.5.2 Lulu cattle *(Bos taurus)*

The Lulu cattle, Lulu gai in local language is Nepal's only hump-less breed, thrive in high-altitude, dry, and cold regions, primarily in Mustang, Manang and parts of 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. The range of milk production lies between 0.5 to 3 litres.

In Chame, 92% of households reared fewer than 10 cattle, while 8% reared more than 10. In Ngisyang, all households (100%) reared fewer than 10 cattle. Regarding rearing history, 67% of households in Chame and 68% in Ngisyang had a history of less than 60 years, while 33% in Chame and 32% in Ngisyang reported rearing cattle for more than 60 years. The rearing trends showed a decline in livestock numbers in both areas, with 50% of households in Chame and 77% in Ngisyang reporting decreasing trends. In contrast, 25% of households in Chame reported increasing trends, while no households in Ngisyang observed an increase. Additionally, 25% of households in Chame and 23% in Ngisyang reported no change in their rearing trends.

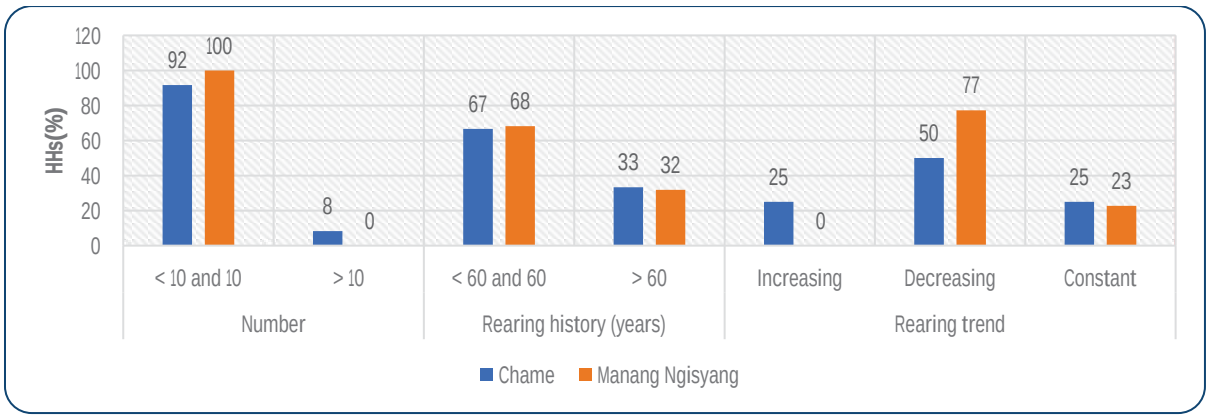


Figure 22: Status of lulu cattle in Chame and Manang Ngisyang

5.5.3 Mountain Goat *(Capra hircus)*

The mountain goat, locally known as Chyangra, is a prominent livestock species in Nepal's mountainous regions. Adapted to elevations of 2,000–6,000 meters, chyangra thrive in the cold, rugged environment due to their thick, woolly coats, which provide excellent insulation. Adult males weigh 25–40 kg, while females range from 27–30 kg. Chyangra yields approx 200 grams of finest cashmere wool annually, with an average fiber length of 45.97 mm and a diameter of 15.36 µm. The cashmere is spun by hand into premium fabrics. Additionally, chyangra contribute to the local diet with their lean meat and milk, used in traditional dairy products like cheese.

The data examines household Chyangra goat rearing trends in Chame and Ngisyang. In Chame, 60% of HHs rear more than 10 livestock, while Ngisyang is evenly split (50%). Most HHs in both areas have rearing histories under 60 years (80% in Chame, 75% in Ngisyang). Trends show Chyangra goat numbers decreasing in Ngisyang (75%) and Chame (40%), with constant trends more common in Chame (40%) than Ngisyang (25%).

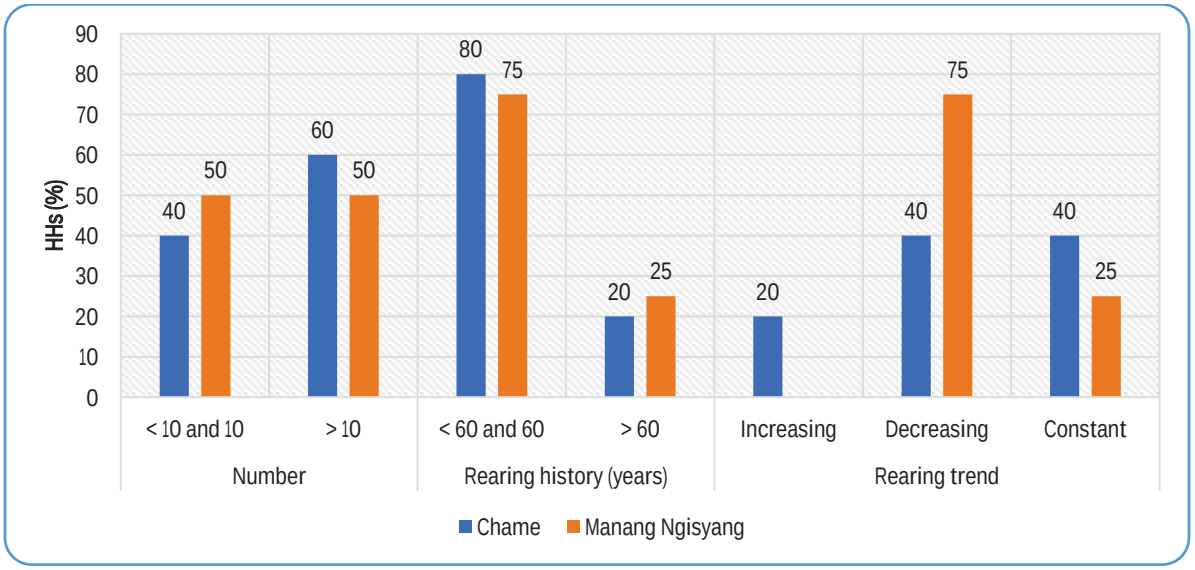


Figure 23: Status of in mountain Goat (Chyangra) in Chame and Manang Ngisyang

5.6 Targeted medicinal plant species

Among the three targeted medicinal plants, sea buckthorn and jimbu are commonly found. However, wild garlic is difficult to collect.

5.6.1 Seabuck thorn (Hippophae rhamnoides)

Sea Buckthorn, dalechuk/ tora in local language, is grown at a height of 3500 meters from sea level. It is used to make Juice, Oil, and Chuk 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. It was reported to be found at lower Chame.

5.6.2 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. 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.

5.6.3 Himalayan Thyme (Allium przewalskianum)

Himalayan Thyme (Jimbu in local language) 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.

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 is also known for its expectorant properties, which help in treating coughs and colds.

5.7 Soil health management

5.7.1 Soil health awareness

The findings on soil health awareness revealed that, in Chame, 68% of the households were aware of soil health, while 32% remained unaware. In contrast, Ngisyang showed the opposite trend, with only 32% of the households being aware of soil health and 68% lacking awareness. This highlights a significant knowledge gap, particularly in Ngisyang, pointing to a potential area for agricultural education and intervention to improve soil health practices.

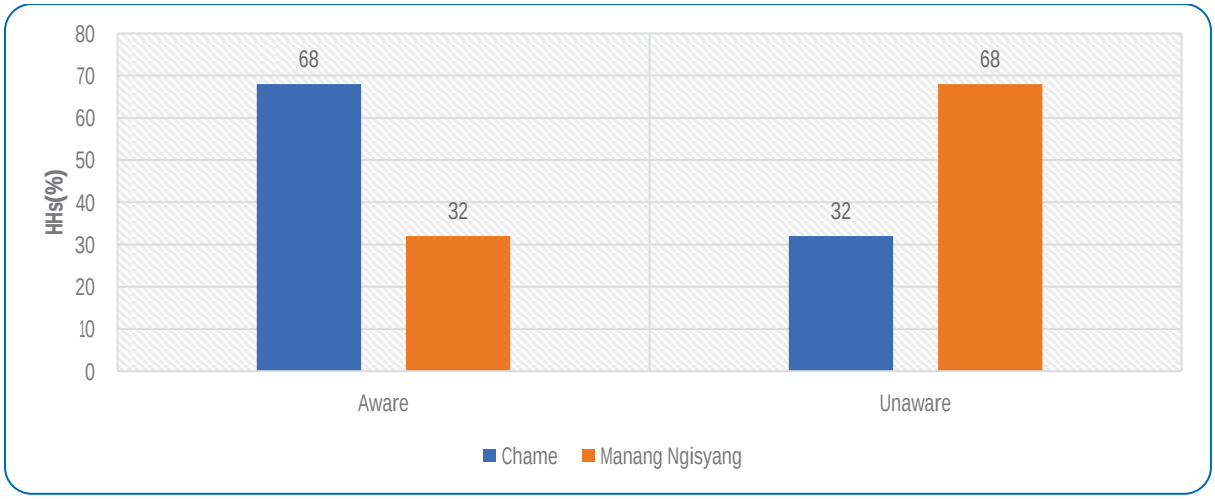


Figure 24: Status of soil health awareness in Chame and Manang Ngisyang

5.7.2 Reasons for soil degradation

In Chame, the primary reasons for soil degradation were reported as flood and landslides (44%), followed by deforestation (26%), overgrazing (20%), modern agricultural practices (17%), and urbanization (4%). In Ngisyang, the reasons for soil degradation were minimal, with floods and landslides, overgrazing, modern agricultural practices, urbanization, and deforestation each contributing only 2% to 5%.

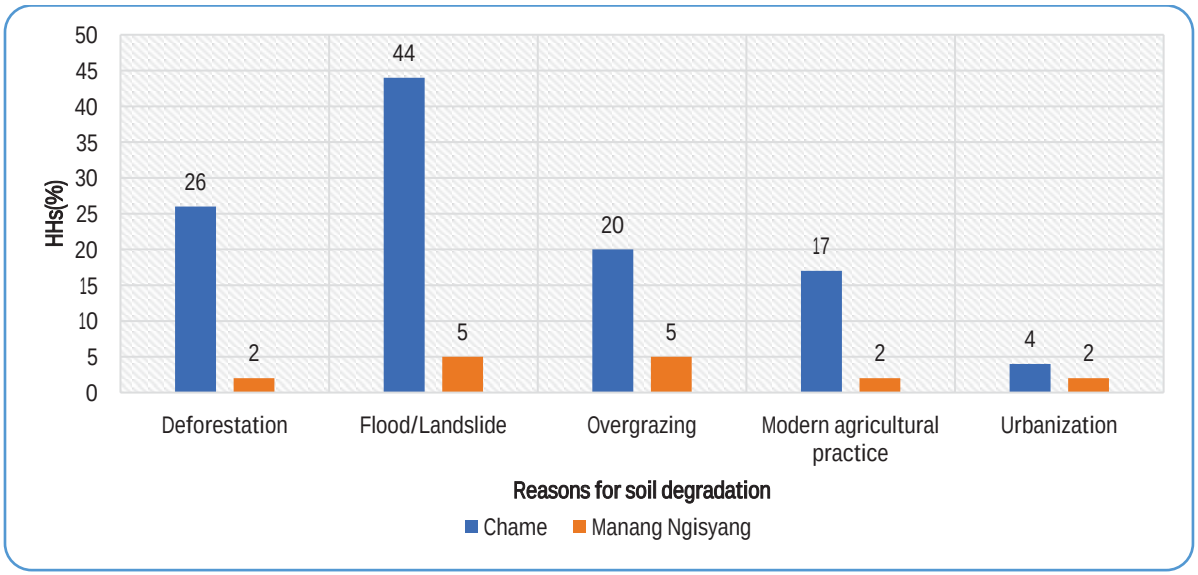


Figure 25: Reasons for soil degradation in Chame and Manang Ngisyang

In Chame, the majority of households practiced soil amendment techniques, with crop rotation being the most common at 80%, followed by organic amendments at 67%. A smaller proportion, 26%, utilized a combination of both methods, while other practices accounted for only 2%. In contrast, Ngisyang showed a different pattern, where 48% of households combined crop rotation and organic amendments, 43% relied solely on organic amendments, and only 9% practiced crop rotation independently.

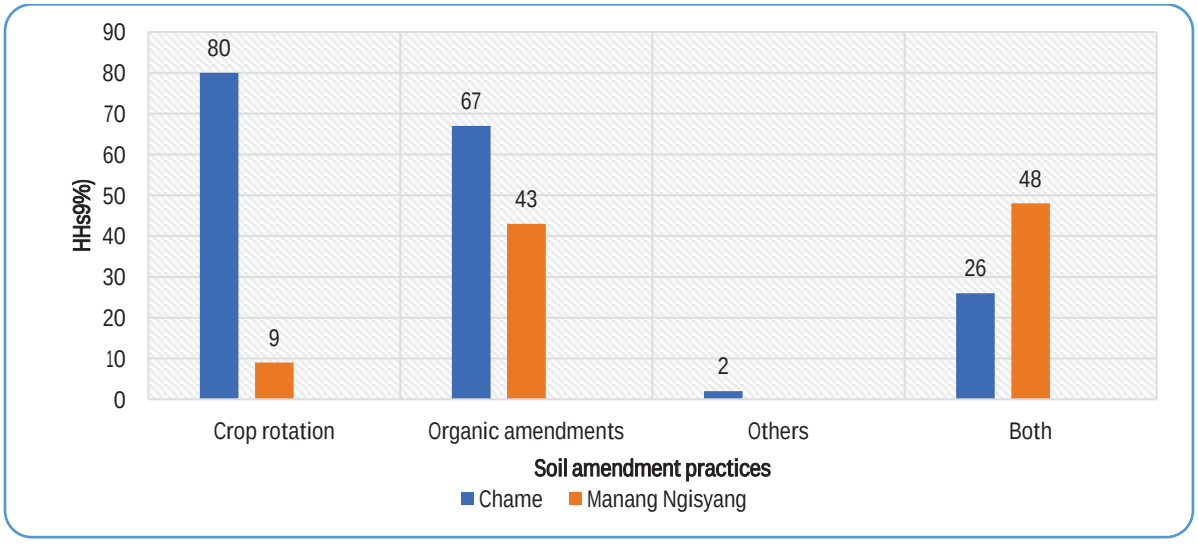


Figure 26: Soil amendment practices in Chame and Manang Ngisyang

5.7.3 Soil test frequency

In Chame, soil testing was rarely conducted, with 81% of households reporting they had never tested their soil, 17% testing it rarely, and only 2% testing it occasionally. Similarly, in Ngisyang, 75% of households had never conducted soil tests, while 25% reported testing their soil rarely.

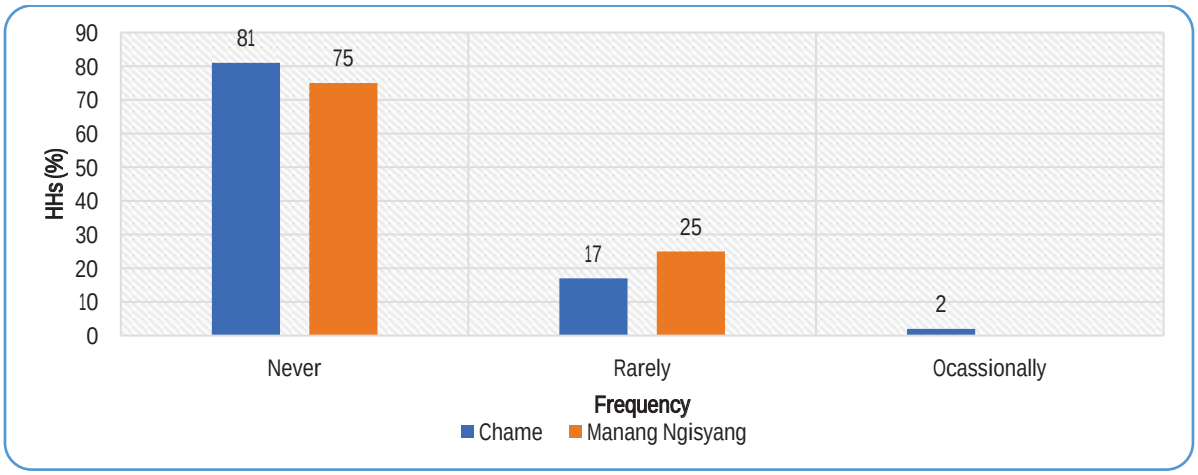


Figure 27: Soil test frequency in Chame and Manang Ngisyang

5.8 Seed source and management practices

5.8.1 Seed source of targeted crops

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 common beans receive some contributions from formal sources such as agrovets, rural municipalities, and markets in Besisahar. In Chame, 42% of households rely solely on their own seed sources, 8% combine their seeds with purchases from the local market, and 50% use a mix of their own seeds, local market, and support from government or NGO programs. In Manang Ngisyang, 41% depended on their own seeds, 5% combined them with local market purchases, and 54% used a mix of their own seeds, the local market, and external support. There are no community seed banks in either region.

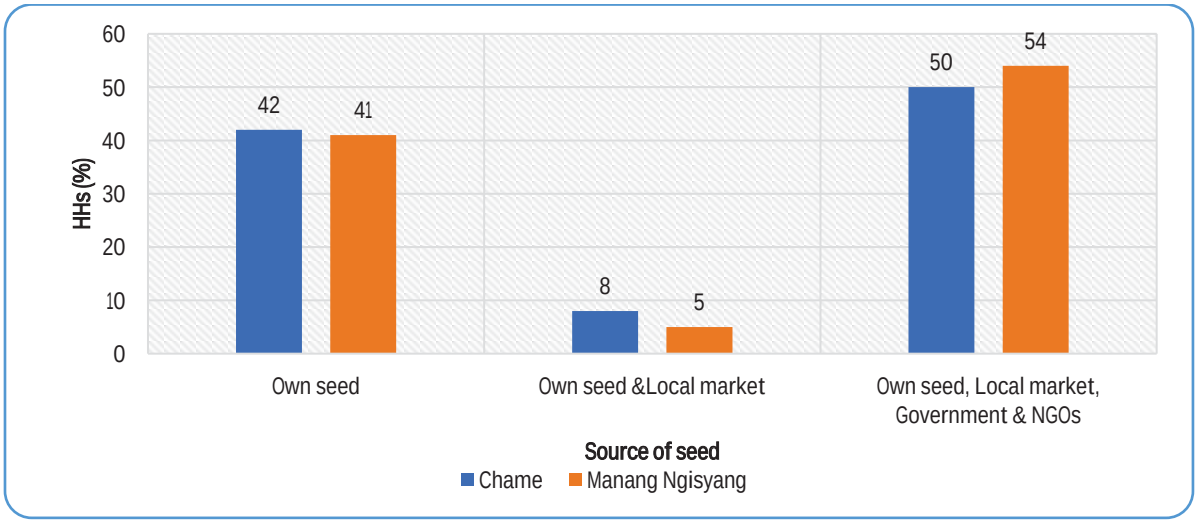


Figure 28: Seed source of targeted crops in Chame and Manang Ngisyang

Respondents reported that 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 and egg shaped, 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 storage. The seeds are typically stored in traditional wooden containers called "matus", which helps in preserving the seed quality for the next planting season.

In Chame, 54% of households reported that female members are responsible for seed selection, while 44% of households mentioned that both men and women take part in this task. Additionally, only 2 % of households stated that male members are involved in seed selection. In Manang Ngisyang, 18% of households reported male involvement in seed selection, while 45% of households indicated that women are primarily responsible. In 37% 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.

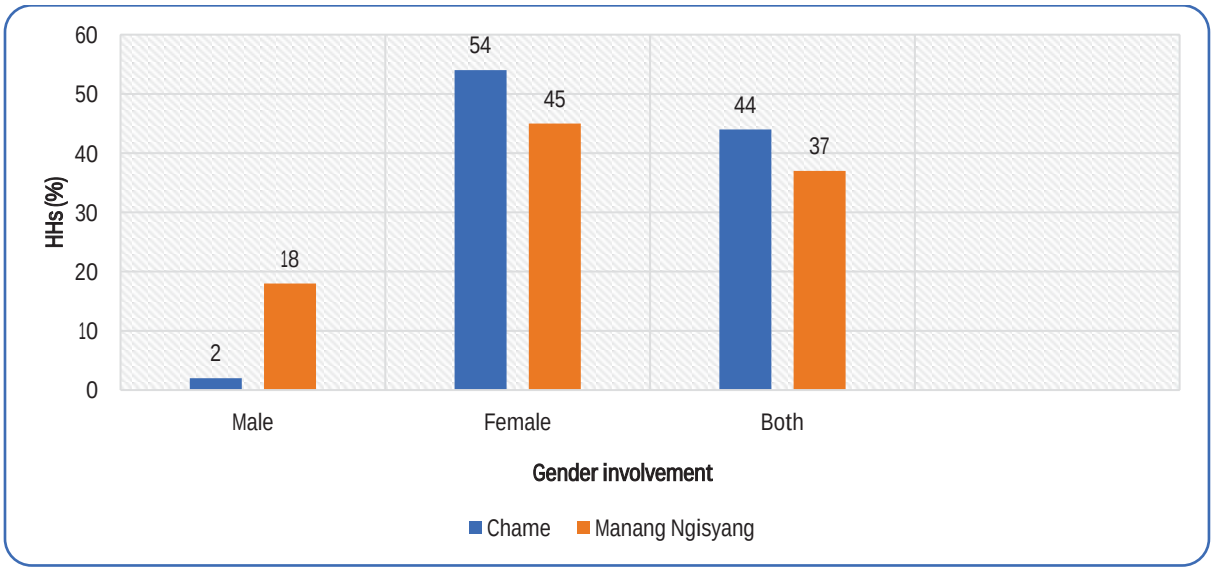


Figure 29: Gender Involvement in seed selection process

5.9 Buying and selling trend of targeted commodities in Manang

In both Chame and Manang Ngisyang, among the targeted crops, common 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, local liquor (raksi made from apple), and vegetables such as cauliflower, cabbage, and tomatoes in the local markets. The price of a kilogram of apples is typically Rs. 200, while common beans are sold for Rs. 1,200 per paathi, buckwheat for Rs. 400 per paathi, and potatoes for Rs. 200 per paathi. Additionally, mountain goats are sold for Rs. 25,000 each and yaks for Rs. 1,50,000 each, according to household respondents. Households also 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.

In Chame, the majority of households (81.1%) engaged in selling their agricultural products. In contrast, households in Ngisyang were evenly divided, with 50% selling their products and the remaining 50% not engaging in sales.

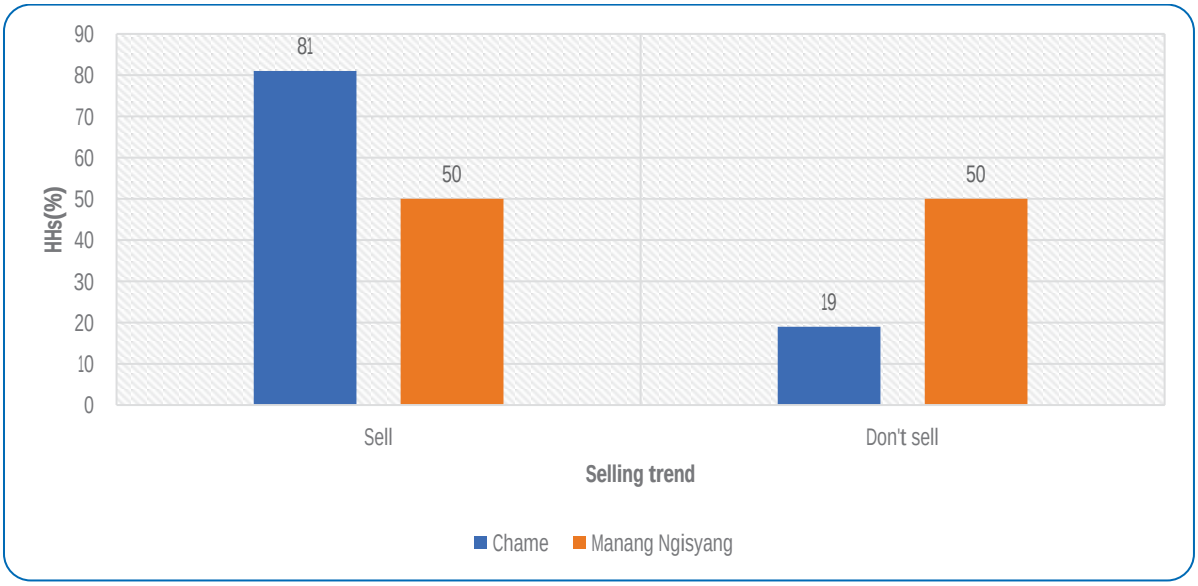


Figure 30: Selling trend of targeted cropm species in Chame and Manang Ngisyang

In Chame, the buyers of agricultural products were diverse, with 35% being local people, followed by traders (23%), employees (19%), visitors (12%), the local market (7%), and hotels (5%). In Ngisyang, the primary buyers were also local people (45%), followed by hotels (18%), traders (23%), and the local market (14%).

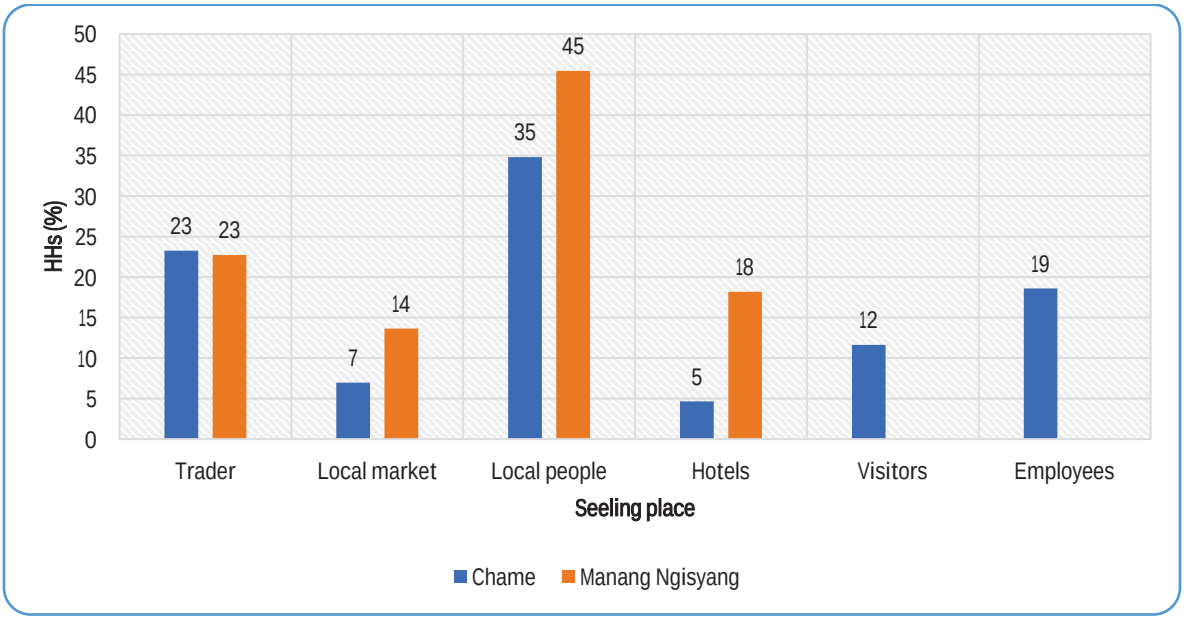


Figure 31: Buyers of targeted CMLs in Chame and Manang Ngisyang

In Manang, there is a low understanding among farmers in the region about the training and awareness campaign 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.

There is a great deal of knowledge gap among the farmers, especially in the areas of management and required good practices on mandated crops, livestock and herbs. Thus, there is a need for training and awareness programs focusing on better crop management and the crop diversifying impacts of climate change. At the same time, farmers also need to be educated on sustainable approaches to farming which promote sharing of knowledge, conserving of seeds, soil health management, and community initiatives on crop diversity. Hands-on training for integrated pest and diseases management and climate smart agricultural practices would help farmers adequately address the increasing threat to crops and animal health.

In relation to the knowledge gap, they should also include general awareness raising programs in addition to crop specific training. In order to regulate the over dealing of agricultural products such as potato, bean and broadleaf mustard varieties, training for value addition and marketing strategies should be there. Training and awareness program might allow to establish CSBs so that high-quality seeds are made available to improve agricultural productivity and build resilient cropping system. Farmers have also benefited from agricultural support services and training programs such as seedling production training, distribution of seedling, fertilizers and equipment, as well as greenhouse installation and financial assistance through grants.

5.10 Post harvest practices and techniques in 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 applied their indigenous knowledge on post-harvest practices and techniques. Most of the farmers separate seed from disease and insect pest free plant with desirable character. After harvest, farmer dried crops like wheat, naked barley, and buckwheat and leguminous crop on the rooftop in direct sunlight. Seed 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 crops like potatoes are selected only after harvesting. Oval shaped and disease and insect pest free tuber were selected and dried in shade. After shade dry, most of the farmers stored in wooden containers (*matus*). Similarly, the primary product from livestock was sukuti (dried meat). After slaughtering, the meat is separated specifically for making sukuti. The selected pieces of meat are hanged above the fire oven for fire-drying, allowing them to be preserved and used as needed. They reported no branding initiatives for local products.

5.11 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 climatic pattern 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. Pest and disease infestations have become more difficult to manage, posing a growing challenge to crop and livestock health. Insect pests such as wooly aphid, apple stem borer, tent caterpillar in apple, *Spodoptera frugiperda* in cereal crops are becoming problematic nowadays in Manang district. Biopesticide as well as botanical pesticides are commonly used for insect pest management and disease management. However, most of the farmers are using chemical pesticides for insect pests as well as disease management. Famers find difficulty in making hay and silage due to increased rainfall and rising disease and pest issues.

Additionally, shortage of labor has made it difficult for farmers to manage their crops and livestock effectively. The lack of expertise in specific crops and livestock further complicates the situation, as farmers often lack access to the specialized knowledge required to maximize production. They also struggle with the unavailability of mechanical tools, which limits their efficiency and scale up their operations.

5.12 Traditional knowledge on agrobiodiversity management

Manang showcases a profound integration of traditional knowledge and sustainable agricultural practices, reflecting the community's deep connection to their environment. Farmers commonly practice intercropping, growing potatoes, beans, and maize together, viewing mixed cropping as a low-risk strategy. Recent shifts in the agricultural calendar, such as earlier ripening of apples and naked barley, coupled with increased animal attacks on maize, have led to a preference for cultivating potato grass. Pest control combines ecological and spiritual methods, including constructing pits and performing Ter Puja to prevent infestations and natural disasters. Potato farming incorporates grading techniques, where medium-sized potatoes are preserved for seeds, smaller ones are used as livestock feed, and larger ones are consumed as vegetables. Storage methods are rooted in tradition, with potatoes stored in underground pits and grains like wheat and buckwheat kept in metal tins or wooden boxes. Product diversification includes transforming buckwheat and wheat into flour, chyang (a local alcoholic beverage), and roasted saatu. The community values medicinal plants such as yarsagumba and wild garlic for their healing properties, and they believe in the therapeutic benefits of hot spring water during a specific tithi in Bhadra. Dietary practices are deeply tied to cultural and health needs; for instance, wheat and naked barley chyang, ghee, and buckwheat flour are consumed by lactating mothers, while garlic soup and kholey aid in altitude adaptation. Indigenous practices, such as preparing animal dung manure mixed with salla leaves, crafting doko baskets from nigalo, and traditional ploughing with a halo, remain integral to their agricultural activities. This rich blend of spiritual, ecological, and agricultural wisdom highlights the resilience and resourcefulness of the community, showcasing their ability to adapt to challenges while preserving their heritage.

6 Discussion

6.1 Socio-economic and demographic context

The population of Chame and Manang Ngisyang rural municipalities is overwhelmingly dominated by Janajati, followed by Dalits, Chhetri, and Brahmin. 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. Agriculture and livestock farming are the primary occupation for the majority of respondents and household heads, highlighting the agrarian nature of both municipalities. Farming in both regions depends on resources available within the household such as land holding and farm labour.

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. Decision-making in agricultural activities revealed a collaborative approach in most households. Joint decision-making by family members was most common (56.7%), followed by involvement of female only (30.9%) and male-only during decision-making (12.4%). In the context of Manang, monk plays a vital role in all agricultural decisions such as sowing time, harvesting time and even cure for pest infestations. With males more like to migrate than females, women's role in agriculture is going to be even more crucial in near future.

The average age of respondents across both Chame and Ngisyang was 46.82 years, indicating a relatively mature population, with no significant differences between Chame (45.28 years) and Ngisyang (48.68 years). Similarly, the average age of household heads was 51.57 years, with both municipalities showing comparable trends. This reflects the broader demographic structure of rural Nepal, where older individuals often take responsibility for household management and decision-making.

Nuclear families were the dominant household type across both municipalities, reflecting a preference for smaller, independent family units. However, joint families were more commonly observed in Chame compared to Ngisyang, suggesting that traditional family arrangements are more prevalent in Chame, while Ngisyang leans towards modern family structures.

The dependency ratio, a critical measure of economic burden, was higher in Chame (0.57) compared to Ngisyang (0.28). This indicates that in Chame, every 100 economically active individuals supported 57 dependents, compared to only 28 in Ngisyang. The higher dependency ratio in Chame could point to a greater economic strain on its active population. Despite this, the average number of economically active members per household was similar across both municipalities, suggesting that the variation in dependency ratios is primarily due to differences in the number of dependent members, which was significantly higher in Chame (1.57) than in Ngisyang (0.73).

Upland ownership is higher than lowland in both municipalities, indicating a focus on hill farming or terraced agriculture. Landholding patterns varied significantly between the municipalities. Households in Chame owned larger plots of land (0.60 hectares) compared to those in Ngisyang (0.37 hectares), with the difference being significant at the 5% level. Similarly, the amount of

cultivated land was higher in Chame (0.39 hectares) than in Ngisyang (0.24 hectares), reflecting a greater reliance on agriculture in Chame. This aligns with the slightly higher number of agricultural workers per household in Chame (2.11) compared to Ngisyang (2.41), although this difference was not statistically significant.

Food sufficiency varies significantly between Chame and Ngisyang Rural Municipalities. In Chame, 47.2% of households have year-round food sufficiency, while only 3.8% face food insufficiency for less than three months. In contrast, Ngisyang reports only 22.7% of households with year-round sufficiency, and 36.4% face food insufficiency for less than three months, highlighting greater food insecurity in Ngisyang.

6.2 Diversity and use of targeted crops

Naked barley, barley, common buckwheat, tartary buckwheat, rapeseed, and wheat are cultivated as local crops, demonstrating limited genetic diversity. Two distinct varieties of potatoes i.e. *Samdo* (a white, local variety) and red are grown in studied area. On the other hand, beans have greater diversity which are mostly distinguished by color, such as black, white, red, and Chirkemirke. Overall, ,most of the mandated crops in the region consist of only one or a few local varieties, beside common bean which have broader range of diversity.

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 municipalities. Rapeseed is primarily grown for oil extraction. Potatoes have a high market demand in Manang and are commonly consumed boiled, accompanied by *timur aachar*. Common beans are utilized both as a key ingredient in preparing *daal* and as a vegetable in various dishes. The main buyers of the mandated crops in the region include local residents, visitors, and hotel businesses.

Farmers with greater access to resources and larger landholdings are more capable of maintaining a higher degree of genetic diversity. However, farmers with limited landholdings also demonstrate significant crop diversity by employing mixed cropping and crop rotation practices. Notably, the highest diversity is observed in vegetable species. Resource-rich farmers, in particular, are inclined toward transitioning to cash crops and adopting tunnel farming techniques.Manang faces numerous abiotic stresses, including rising temperatures and landslides, as well as biotic stresses such as pest and disease infestations and animal attacks. 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.

In both Chame and Ngisyang, most farmers rely on their own seed sources, with some supplementing their stocks by purchasing seeds from the local market or receiving support from government or NGO programs. Neither region has community seed banks. Farmers typically segregate seed and food grains in the field. They carefully select fully ripe, disease- and pest-free

plants with desirable characteristics and high yields for use as seed. After harvest, they dry cereal crops such as wheat, naked barley, and buckwheat, along with leguminous crops like beans, on rooftops under direct sunlight. Seeds intended for planting and those for food are stored separately in sacks. To preserve seed quality for the next planting season, farmers store seeds in traditional wooden containers known as *matus*. For potatoes, farmers select oval-shaped, disease- and pest-free tubers, which are dried in the shade before being stored in wooden containers.

Indigenous crops like amaranthus, wheat, naked barley, and potato hold cultural importance, as they are integral to nature worship rituals. Despite this, no significant efforts have been made to revive or protect these at-risk crops. Over the past 30 years, climate changes such as scorching sun, reduced snowfall, and erratic rainfall patterns have significantly impacted agriculture. Drought due to less snowfall affects production, while more snowfall reduces disease and pest prevalence, benefiting naked barley growth and development. However, increasing irrigation challenges remain unaddressed, further reducing naked barley yields. Certain crops and their derivatives serve multiple purposes, including use during special occasions and for ceremonial or cultural practices (Table 8).

Table 9: Agricultural crop/products and their uses

Condition	Agricultural product/produce
Weakness	Naked barley flour and kholay, maize and naked barley made chyang, yarsagumba
Pregnancy and delivery	Sutkeri chuniya (chyang), jwano, local chicken (cock)
Lactating period	Naked barley's chyang
Stunting and wasting	Pea
Labour-intensive work	Chyang, saatu of naked barley with hot tea
Altitude adaptation	Home garlic, naked barley's flour, garlic soup
Cold/cough	Nirmasi

Over time, several varieties have been lost in the region, including *Tangla* (a plant similar to musuro) and *Tangaar* (a small pea), with no cultivation of these crops anymore. Additionally, tartary buckwheat has been lost in Chame. The ACAP is working to conserve and promote agrobiodiversity. The most nutritious AGRs in their locality include sea buckthorn juice, red mushrooms, guchchi mushrooms, kanye mushrooms (tarkimo), mushrooms collected from the bhojpatra tree, land-grown cauli mushrooms, and mirisemo, also grown on land. Certain crops, livestock, and medicinal plants are cultivated for cultural reasons, such as naked barley, which is used to make torma (a statue-like form), and its flour, which is essential for making chhok prasad (a religious offering). For starting new work, a mix of white pea, rice, paddy, wheat, barley, naked barley, and sarsiu is offered. Traditional tools such as halo, toh, koma, and namlo are still in use for agricultural work. Major medicinal plants grown include wild garlic, known for its medicinal properties, and yarsagumba. Homestays promote cultural, spiritual, and religious practices, providing traditional meals like dhido and sisnu for dinner, and bhote chiya and saatu for breakfast, along with local dishes, traditional attire, and dance performances. Diversity and use of targeted livestocks

Lulu cattle, Himalayan goats (*Chyangra*), and yaks/chauris are commonly raised in Chame and Manang Ngisyang, 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.

The ghee from yak or chauri is used for making bhote chiya, and the yak/chauri's white tail is used for puja rituals. Efforts are observed to revive culturally significant crops including the rearing of yak and lulu, which is also done for commercial purposes. In terms of product diversification, milk is processed into ghee, churpi, curd, and labaa (made from raw milk), with the concept of paneer introduced after labaa making. Labaa is also used in religious worship.

6.3 Product diversification and marketing opportunities

Manang'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, 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. Potatoes grown in Manang can be used to produce potato flour, chips, and other processed snacks.

Seabuckthorn, known for its high nutritional and medicinal value, can be used to produce seabuckthorn juice, herbal tea, and even skincare products like seabuckthorn oil. These items can be marketed as superfood beverages and natural wellness products. Lulu cow 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 Manang's agricultural and handicraft exports, driving economic development in the region.

6.4 Dietary habit

In Manang, 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 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. The meat is dried for preservation and used during times of vegetable shortages. Seabuckthorn 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 (maida, aata) 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.

7 Recommended technologies in Manang district

The recommended farming system in Manang is a combination of animal husbandry, and crop and horticultural crops. The major staple food crops are wheat, barley, buckwheat and potatoes, and deciduous fruits dominated by apple and some vegetable species. Wheat, maize, oat and buckwheat, barley and finger millets are the main cereals whereas potato is the most popular cash crop. Farmers grow cabbage, garlic, radish, carrot and spinach as vegetables. Nepal Agricultural Research Council and seed quality control system(SQCC) has recommended limited varieties of maize, wheat, finger millet, barley, buckwheat, Forso millet, foxtail millet, cabbage, broadleaf mustard, carrot, turnip, French beans, peas and fruits like kiwifruit, apple, almond, walnut and apricot for cultivation with package of practices. Some of the crop varieties recommended for cultivation in Manang district are as below.

Table 10: Crops and varieties recommended for Manang 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

Crops	Varieties	Year of recommendation	Recommendation domain	Present practice
	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
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

Crops	Varieties	Year of recommendation	Recommendation domain	Present 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

Some recommended cultural practices in fruits in Manang district are as follows

1. Seed production methods of cole crops/crucifers (cauliflower, cabbage), carrot, broadleaf mustard, radish. Seed to seed and head to seed methods in cabbage.
2. Asexual (grafting) methods of propagation in apple by using crab apple as rootstock
3. Training and pruning in apple orchard
4. Application of bordex mixture/paint in deciduous fruits
5. Monthly calendar of operation in apple
6. High density planting of apple using spur type varieties
7. Rainbow trout farming
8. Sheep and Himalayan Goat Farming

8 Recommendation and way forward

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.

8.1 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.

8.2 Conservation

1. **Establish Conservation Banks**: Develop and promote diverse conservation banks, such as agro-gene sanctuary (in religiously protected areas), seed gene banks, field genebanks, forage field genebanks, school field genebanks, community genebanks, agro-insect field genebanks, crop-specific parks, agro-microbial field genebanks, livestock farm genebanks, and household genebanks.
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 Genebank**: Establish a digital genebank or digital map of landrace 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.

8.3 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.

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.

10. **Product Diversification**: Diversify agricultural products to cater to various markets and enhance resilience to market fluctuations.
11. **Improve Local Tools and Mechanization**: Upgrade traditional tools and mechanization systems to make local agricultural practices more efficient and productive.
12. **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.

8.4 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 Manang 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 on 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** intellectual property rights (**IPR) for Traditional Practices**: Protect traditional agricultural practices, knowledge, and products under 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 Manang.

8.5 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.

8.6 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 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 genebanks, 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

१. **संरक्षण बैंकहरू स्थापना गर्ने**: विभिन्न प्रकारका संरक्षण बैंकहरू स्थापना र प्रवर्द्धन गर्नु पर्छ, जस्तै धार्मिक रूपमा संरक्षित क्षेत्रहरूमा कृषि वंशानु आरक्ष क्षेत्र, 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।

9 Conclusion

The agrobiodiversity of Manang 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 Manang. Moreover, the cultural, religious, and spiritual dimensions of Manang'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 Manang 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 Manang'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.

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Annexes

ANNEX 1. INCEPTION WORKSHOP ATTENDEES

S.N.	Name	Office	Designation	Contact Number
1	Matrika Acharya	District Administration Office	CDO	9851037196
2	Ananta Kumar Basnet	District Administration Office		98560355555
3	Naresh Kumar Singh	District Administration Office		9841683065
4	Hira Bahadur. G.C.	Armed Police Force		9856044933
5	Sanjaya Kumar Mandal	District Ayurved health post		9840933388
6	Yubaraj Aryal	District Administration Office	Sa. Pra. Ji. ah	9856075105
7	Arun Parajuli	Division Forest Office		9856049140
8	Bikash Bhusal	NAGRC, NARC	Technical Officer	9851139133
9	Jayasankar Sharma	Krishi Gyan Kendra		9864981712
10	Mahesh Sapkota	NAGRC, NARC		9857014122
11	Lalit Joshi	Krishi Gyan Kendra		9866967657
12	Bishnu Sharki	Krishi Gyan Kendra		9866219871
13	Chhiring Dorje Lama	Chame	Farmer	9856049111
14	Pramod B.K.	Chame	Student	9840938134
15	Pasang Buti Lama	Chame	Student	9864897112
16	Som Bahadur Rana	District Administration Office		9846165287
17	Bel Bahadur Ronke	No.32 Gulma		9749329787
18	Dumbar Bdr. Ale	Manang		9846229717
19	Anita Lama	Manang	Pra.ka.aa.pa.ba.kaa	9846749799
20	Serap Bista	Chame, Manang	Farmer	9846786445
21	Kamal Raj Dangi	Chame rural municipality		9866571685
22	Dhan Krishna Sharma	Chame rural municipality		9848978175
23	Sumitra Tamang	Genebank, NARC	Intern	9813984133
24	Anita Adhikari	WWF Nepal		9841314678
25	Pradip Thapa	Genebank, NARC	Technical officer	9846593083
26	Sita Ram Ojha	Genebank, NARC		9841373300
27	Dhawa Chhiring Lama	Chame ward no.4	Local representative	9846121586
28	Arati Khadgi	WWF Nepal		9802794662
29	Bijaya Tamang	Lalitpur	Driver	9845795230
30	Harka Theeng	Chame	Farmer	9841832035
31	Dolkar Lama	Chame	Student	9856049211
32	Rinku Mahatto	Manang		9841774322
33	Gita Ghale	Chame	Student	

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 नं): ..... 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 नं:)

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** रैथाने/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 (आपनै)
   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 व्यवस्थापनको 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 B. Neighbor C. Aid/Relief (अनुदान/राहत) D. Others (अन्य)		A. Buying from market B. Neighbor C. Aid/Relief (अनुदान/राहत) D. Others (अन्य)	
3-6 month (छ महिना सम्म)					
6-9 months (नौ महिना सम्म)					
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 औले)							
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

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 महत्त्वका 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 महत्त्वपूर्ण 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 महत्वहरु 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. LIST OF ENUMERATORS

S.N.	Name	Address
1.	Sumitra Tamang	Myagang-5, Nuwakot
2.	Pasang Buti Lama	Chame-4, Manang
3.	Pramod Bishwokarma	Chame-4, Manang
4.	Kamal Raj Dangi	Chame-4, Manang
5.	Dhan Krishna Sharma	Chame-4, Manang
6.	Puja Khadayat	Chame-4, Manang
7.	Jaya Sankar Sharma	Chame-4, Manang
8.	Hari bahadur Tamang	Nisang RM
9.	Nikhil Khadka	Nisang RM
10.	Pradip Thapa	Nisang RM
11.	Rajiv Dahal	Nisang RM
12.	Lalit Raj Jaisi	AKC, Manang
13.	Bishnu Sarki	AKC, Manang

ANNEX 4. FARMERS INVOLVED IN HOUSEHOLD SURVEY

S.N.	Name	S.N.	Name
1	Dhan Bdr Gauchan	51	Kulara Buda Magar
2	Man Ghale	52	Rupa Gurung
3	Bin Ghale	53	Buddhaman Gurung
4	Nanda Bdr Gurung	54	Chhiring Gurung
5	Jit Bdr Gurung	55	Bhujung Gurung
6	Mangaldev Gurung	56	Khumsum Gurung
7	Pech Bdr Ghale	57	Palten Gurung
8	Abinas Ghale	59	Pasang Gurung
9	Khem Ghale	60	Chewang Gurung
10	Serap Bista	61	Chuk Karki
11	Dinesh Magar	62	Rotey B.K.
12	Ganesh Ghale	63	Kirme Gurung
13	Man Ghale	64	Malal Lal Gurung
14	Anil Tamang	65	Pema Dundul Lama
15	Binod Lama	66	Karma Chhiring Gurung
16	Karma Lama	67	Khampa Gurung
17	Pasang Ghale	68	Gopal Rai
18	Mingmar Lama	69	Min Bdr Gurung
19	Cheo Lakpa Lama	70	Rupa Gurung
20	Dhawa Chhiring Lama	71	Kumari Gurung
21	Do Palma Lama	72	Man Kumari B.K.
22	Sun Maya Gurung	73	Karma Tasi
23	Anita Gurung	74	Tili Chema Gurung
24	Renjen Dolkar Lama	75	Anita Gurung
25	Laxmi Bishwokarma	76	Chhiring Ongma Gurung
26	Sonam Dolma Lama	77	Chhiring Diki Gurung
27	Lakpa Dolma Lama	78	Chyungda Gurung
28	Chija Tamang	79	Karma Dolma Gurung
29	Chimi Lama	80	Chyungda Gurung
30	Usha Thakuri	81	Fulmaya Damala
31	Nanda Gurung	82	Mingkhu Gurung
32	Kumari Gurung	83	Bishnu Gurung
33	Anita Lama	84	Sagar Gurung
34	Asari Gurung	85	Tanchin Gurung
35	Dolma Lama	86	Karma Dhundu Gurung
36	Maita Maya Gurung	87	Sunil Tamang
37	Gita Ghale	88	Karma Chhetri
38	Indra Maya Gurung	89	Lopsang Gurung
39	Bimaya Gurung	90	Chema Gurung
40	Kusum Gurung	91	Chhiring Gyurye Gurung
41	Sun Kumari Gurung	92	Raju Gurung
42	Mina Gurung	93	Tasi Samdeng Ghale
43	Tikan Devi Gurung	94	Chhiring Gurung
44	Kopila Ghale	95	Yangchen Gurung
45	Anita Gurung Ghale	96	Nima Lama
46	Nima Choten Gurung	97	Fulmaya B.K.
47	Bes Maya Gurung		
48	Dudhkasi Gurung		

S.N.	Name	S.N.	Name
49	Sita Gurung		
50	Bishnu Gurung		

ANNEX 5. LIST OF ORGANIZATIONS CONSULTED

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. LIST OF PARTICIPANTS DURING FGD AT CHAME

S.N.	Name
1	Tikan Devi Gurung
2	Kusum Gurung
3	Bimaya Gurung
4	Sita Gurung
5	Kopila Ghale
6	Anita Ghale
7	Mina Gurung
8	Sun Kumari Gurung
9	Laxmi Gurung

ANNEX 7. LIST OF PARTICIPANTS DURING FGD AT MANANG NGISYANG

S.N.	Name
1	Kamala Gurung
2	Pemba Gurung
3	Chhangu Gurung
4	Chhesang Gurung
5	Udkha chhoma Gurung

ANNEX 8. CULTURAL AND SPIRITUAL INTEGRITY AT MANANG DISTRICT

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, Jatamasi 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.

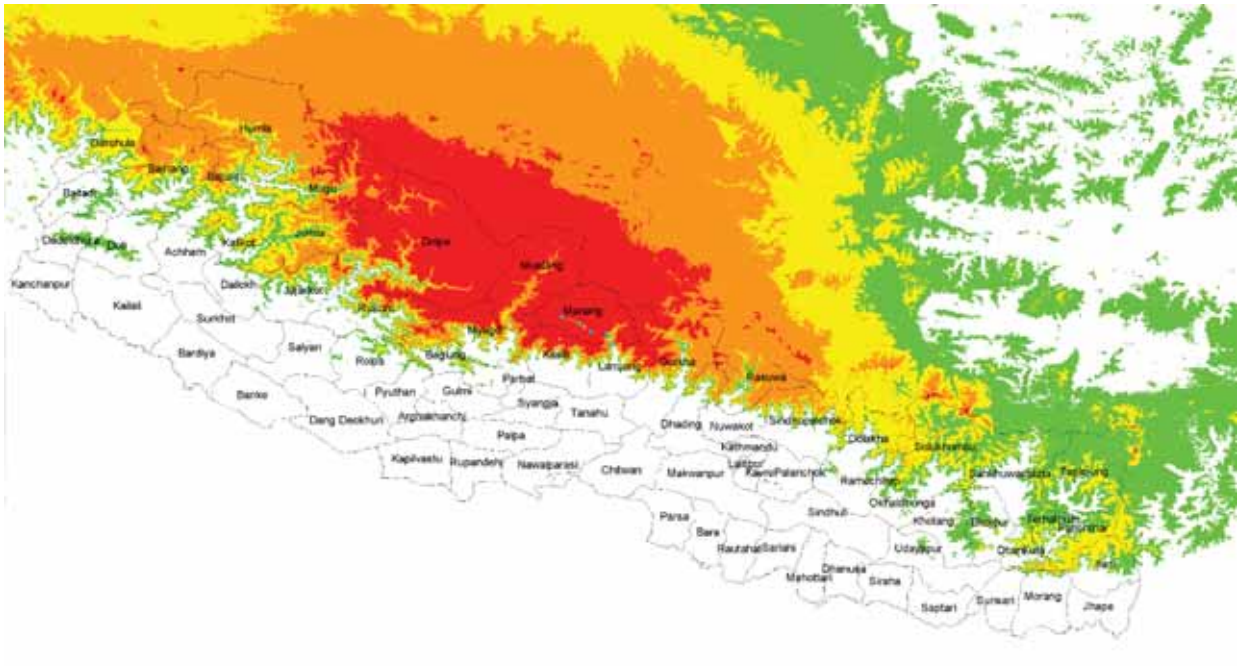
ANNEX 9. TRADITIONAL FOODS/ FOOD TABLE OF MANANG DISTRICT

Some traditional foods of Manang district in Nepal include yak meat, dal bhat, churpi, dhido, bhotte chiya, tsampa, and gundruk, as shown in the table below:

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 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 the cold climate.	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

Traditional Food	Description	Popular Pairings
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 परिकारहरू)	Manang 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 Manang's famous apples.	Snacks
Dried Apples (स्याउको सुकुटी)	A 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
Syauko Raksi (स्याउको रक्सी)	A special distilled alcoholic beverage made from fermented naked barley, popular in Manang.	Snacks
Padamchal Pickle (पदम चालको चटनी)	A tangy and spicy pickle made from locally grown Padamchal fruits. A traditional accompaniment for meals.	Dalbhat, roti

ANNEX 10. GENEBANK COLLECTION AND PROBABLE DISTRIBUTION ANALOGUE SITE



ANNEX 11. PASSPORT DETAILS OF COLLECTED ACCESSIONS FROM MANANG DISTRICT

Acc no	Coll. No	Crop	VDC	Latitude	Longitude	Altitude
NGRC00880	NPGR06055	Barley	Bagarchhap	28.5309	84.3415	2200
NGRC02246	NPGR06192	Bean	Bagarchhap	28.5309	84.3415	2200
NGRC02252	Co1723	Bean	Chame	28.5530	84.2344	1568
NGRC02332	NPGR06051	Naked barley	Manang	28.6644	84.0238	3515
NGRC02333	NPGR06052	Naked barley	Manang	28.6644	84.0238	3515
NGRC02334	NPGR06053	Naked barley	Pisang	28.6154	84.1540	3335
NGRC02335	NPGR06054	Naked barley	Bagarchhap	28.5309	84.3415	2200
NGRC02337	NPGR06269	Naked barley	Tal	28.4729	84.3812	1710
NGRC02460	NPGR06000	Wheat	Manang	28.6644	84.0238	3315
NGRC02461	NPGR06001	Wheat	Pisang	28.6154	84.1540	3335
NGRC02462	NPGR06002	Wheat	Bagarchhap	28.5309	84.3415	2200
NGRC02463	NPGR06271	Wheat	Manang	28.6644	84.0238	3515
NGRC03779	Co1593	Buckwheat	Pisang	28.6154	84.1540	
NGRC03912	Co1617	Barley	Dharapani	28.5278	84.3538	
NGRC04420	Co1636	Wheat	Pisang	28.6154	84.1540	
NGRC04696	NPGR06260	Radish	Manang	28.6644	84.0238	3515
NGRC04902	Co1633	Naked barley	Pisang	28.6154	84.1540	
NGRC05601	Co1241	Amaranth	Dharapani			
NGRC08236	Co1852	Lentil	Chame-7	28.5116	84.2229	3067

ANNEX 12. 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 in 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:

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

The project operates in 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). Followings 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/

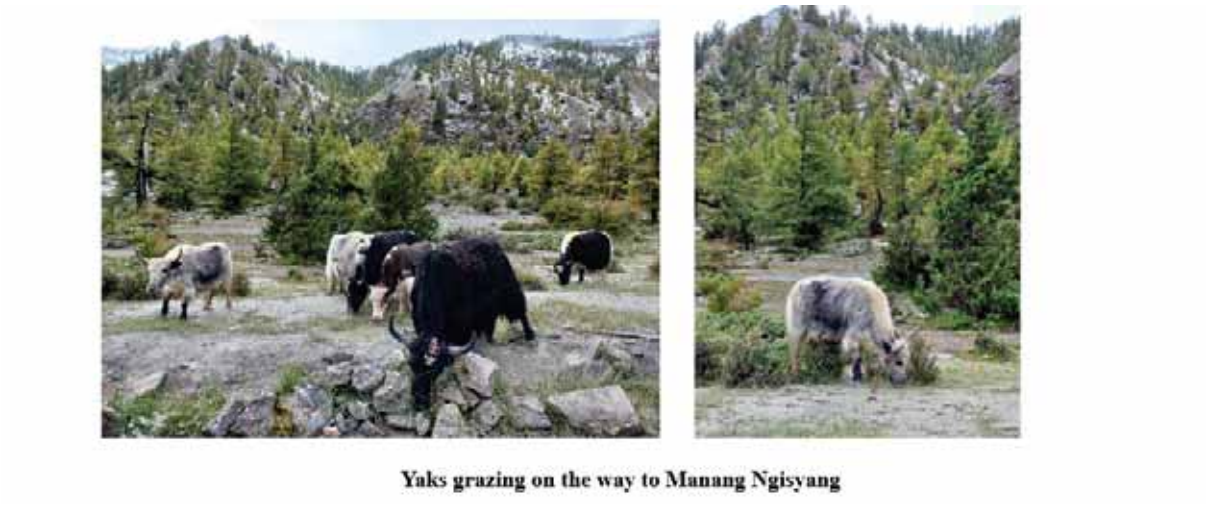
परियोजना मुस्ताङ को ढी (३९५० मिटर उच्चाई) र कागबेनी (२९०० मिटर), र मनाङ को चामे (२५४० मिटर) मा संचालित हुने छ। लक्षित कृषि प्रजातिहरू (तिनीहरु मध्ये छनौट गरिने छ):

- **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।

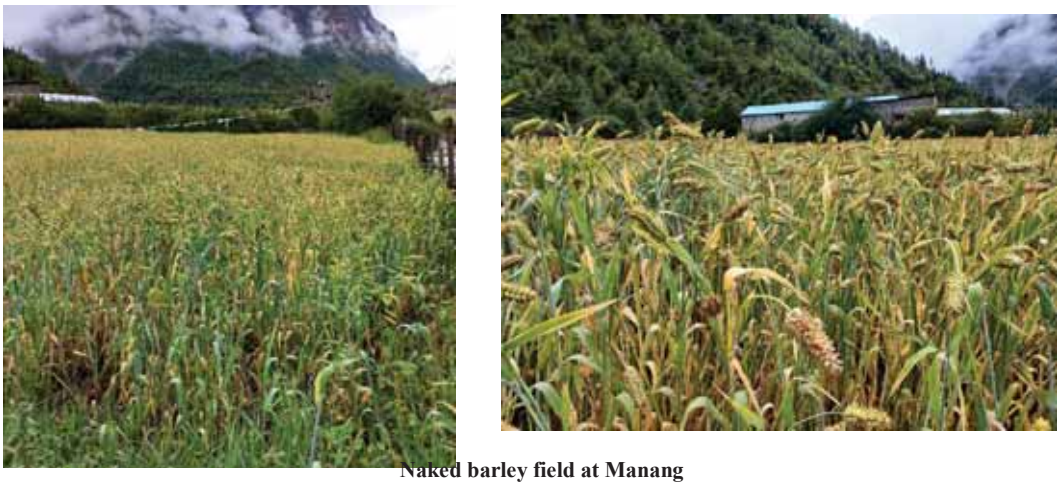
मुख्य गतिविधिहरू:

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 13. PHOTO GALLEY



Yaks grazing on the way to Manang Ngisyang



Naked barley field at Manang

Dried wild edible mushroom at Manang


Inter-cropping of different vegetables with apple


Common buckwheat land at chame, Manang


Common bean threshing operation at chame, Manang