Integrating Traditional Crop Genetic Diversity into Technology:
Using a Biodiversity Portfolio Approach to Buffer against Unpredictable Environmental Change in Nepal Himalayas

BASELINE SURVEY REPORT

HANKU, JUMLA | DECEMBER 2016

Epsha Palikhey, Sajal R Sthapit, Subash Gautam, Devendra Gauchan, Bharat Bhandari, Bal Krishna Joshi and Bhuwon Ratna Sthapit



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LI-BIRD (Pokhara, Nepal; www.libird.org)
Local Initiatives for Biodiversity, Research and Development (LI-BIRD) is a non-profit, non-governmental organization established in 1995 to reduce poverty and promote social justice by empowering rural poor and marginalized smallholder farmers, especially women, who depend primarily on agriculture, biodiversity, and natural resources for their livelihoods. To achieve these goals, LI-BIRD is committed to capitalizing on local initiatives, synergy, and partnerships for sustainable management of renewable natural resources. Through development-oriented research in agriculture and natural resource management, LI-BIRD contributes to several innovative methods and approaches, aiming to achieve a positive impact on the livelihoods of rural poor and marginalized farmers through appropriate technological, social, and policy changes. LI-BIRD plays an instrumental role in institutionalizing these approaches in national systems.

NARC (Singhadarbar Plaza, Kathmandu, Nepal; www.narc.gov.np)
The Nepal Agricultural Research Council (NARC), established in 1991 as an autonomous organization,is an apex body for agricultural research in Nepal. It includes many commodity programmes, research stations located across the country, and disciplinary divisions as well as a national gene bank in Khumaltar. NARC carries out research on various aspects of agriculture, identifies solutions to existing problems in agriculture,and assists the government in formulating agricultural policies and strategies.

Bioversity International (Rome, Italy; www.bioversityinternational.org)
Bioversity International is a member of the CGIAR consortium. Its vision is that agricultural biodiversity nourishes people and sustains the planet. Bioversity International produces scientific evidence and develops management practices and policy options to safeguard agricultural and tree biodiversity and attain sustainable global food and nutrition security.

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ABBREVIATIONS AND ACRONYMS

AFSP	Agriculture Food Security Programme
BEE	Bheri Environmental Excellence
CBM	Community Based Biodiversity Management
CDMA	Code Division Multiple Access
CFUG	Community Forest Users Group
CSB	Community Seed Bank
CP	Cross Pollinated
DADO	District Agriculture Development Office
DFS	Diversity Field School
DoA	Department of Agriculture
FFS	Farmers Field School
FGD	Focus Group Discussion
GEF	Global Environment Facility
GOs	Governmental Organizations
ha	Hectare
HDI	Human Development Index
HH	Household
HPI	Human Poverty Index
INGO	International Non-Governmental Organization
KIS	Key Informant Survey
LAPA	Local Adaptation Plan of Action
LCP	Local Crop Project
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
masl	meters above sea level
MoF	Ministry of Finance
MoSTE	Ministry of Science, Technology and Environment
NAGRC	Nepal Agriculture Genetic Resources Centre
NAPA	National Adaptation Programmes of Action
NARC	Nepal Agricultural Research Council
NFC	Nepal Food Corporation
NCCSP	Nepal Climate Change Support Programme
NGO	Non-Governmental Organizations
OS	Often Self pollinated
PACE	Partnership Aid Center
PAF	Poverty Alleviation Fund
PPB	Participatory Plant Breeding
PRA	Participatory Rural Appraisal
PSE	Participatory Seed Exchange
PVS	Participatory Varietal Selection
SE	Standard Error
SP	Self Pollinated
SPSS	Statistical Package for the Social Sciences
SQCC	Seed Quality Control Centre
UN	United Nation
UNEP	United Nations Environment Programme
VDC	Village Development Committee
WELI	Women Empowerment & Livelihood Improvement

1. INTRODUCTION

1.1 Background Information

The Himalayan ecosystem in Nepal, with its steep rises in elevation, rugged terrains, and patchworks of ethnic and cultural diversity, has imposed unique selection pressures on high mountain agricultural biodiversity. Cold tolerance acts as a severe bottleneck to diversity in this environment. Despite this, farming communities have been maintaining a rich diversity of food crops for generations. For instance, Chhomrong, an indigenous variety of cold tolerant red rice from Nepal has now spread to over 85% of the high altitude rice growing areas of Bhutan (Matsushita et al., 2011; Ghaley et al., 2012; Shrestha 2004) and Madagascar (Raboin et. al., 2014). This illustrates its immense value, which is largely due to its rare combination of cold tolerance, stable blast and bacterial brown sheath rot resistance traits and wide adaptability.

In addition to cold tolerant rice, farming communities in this region also rely on the diversity of under-researched but locally important crops, such as proso millet, foxtail millet, finger millet, buckwheat, naked barley, barley, amaranth and common bean. The Nepal's Himalayas represent the primary and secondary centers of diversity for rice, amaranth, barley, buckwheat, millets and bean (Hawkes, 1998).

Despite the existence of tens of thousands of edible plants, only 10 cereal grains, legumes and oilseeds dominate 80% of the world's cropland (Glover et al., 2007). Wheat, rice and maize by themselves account for two-thirds of the world's arable lands. This is starkly reflected in the diets we consume, in which 90% of our plant-based calories can be traced back to only 30 or so crops (FAO, 2009). Consequently, about 60% of the world's population is currently malnourished, either due to lack of calories or because of too much of the wrong kind of calories (Pimentel, 2011).

In the context of changing climate, over-reliance on a handful of commodity crops also puts our global food security at a great risk, as it can expose people to rampant speculation of food prices and even result in food crises. It can also lead to the loss of crop biodiversity which represents a significant reservoir of potentially useful traits for coping with changing global environments. Because traditional mountain crops are under-researched, mountain farming communities have not had the benefit of better yielding varieties and advanced processing technologies. International breeding efforts in mountains crops are also limited in spite of its importance locally as nutritionally dense, climate resilient and low input agriculture system.

Human Development Index (HDI) of Jumla is 0.409 (15th district of Nepal with least HDI) according to Nepal Human Development Report 2014. Jumla suffer from limited access to basic infrastructure, education, healthcare and nutrition. Poor nutrition, especially in early childhood, can have dire repercussions into adulthood, as it compromises cognitive and social development (Ruel and Hoddinott, 2008), which puts these communities at elevated risk of further marginalization. Furthermore, climate change impacts are predicted to be more acute in the Himalayas, where warming has been much greater than the global average. A changing climate in the high mountains is also likely to exacerbate the risk of crop disease damage and frequency of blast breakdown is reported by farmers. For instance, rice blast (*Magnaporthe oryzae* B. Couch) is a major disease in Nepal that is affecting the beloved *Jumli Marshi* variety of rice in Jumla and Karnali region.

1.2 Project Context

Considering the global and local importance of these high mountain crops, the Global Environment Facility (GEF) has funded a project titled, "*Integrating traditional crop genetic diversity into technology: using a biodiversity portfolio approach to buffer against unpredictable environmental change in the Nepal Himalayas*". The objective of the project is "to mainstream the conservation and use of agro-biodiversity in the mountain agricultural production landscapes of Nepal to improve ecosystem resilience, ecosystem services and access and benefits sharing capacity in mountain ecosystems." It aims to develop and promote diverse sets of varieties, improve access to diverse sets of planting materials, create and distribute drudgery-reducing processing technologies, and promote an enabling environment for access to the benefit-sharing of seeds and other planting materials. 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 and elsewhere. The project is known as the Local Crop Project (LCP) for short.

The project has set mandate to work on eight neglected and underutilized mountain crops that are nutrient dense, climate resilient and indigenous to mountain region of Nepal (Table 1). These crops are: amaranth (A*maranthus hypochondriacus, A. caudatus* and *A. cruentus*), barley and naked barley (*Hordeum vulgare* and *H. vulgare var. nudum*), common bean (*Phaseolus vulgaris*), buckwheat (*Fagopyrum esculentum* and *F. tararicum*), finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*), proso millet (*Panicum miliaceum*) and cold tolerant rice (*Oryza sativa*).

Table 1. Mandate crop species, their local and scientific names, type of pollination system and genetic features

S.N.	Crop	नेपाली नाम/अन्य नाम	Scientific name/synonym	Pollination	Genetics
1.	Amaranth	लट्टे	*Amaranthus hypochondriacus* *A. caudatus L.* *A. cruentus L.*	CP	2n=32 2n=34 2n=32
2.	Barley	जौ	*Hordeum vulgare L.*	SP	2n=2x=16
3.	Naked barley	ऊवा	*Hordeum vulgare L. var. nudum Hook F.*	SP	2n=2x=14
4.	Bean	सिमी	*Phaseolus vulgaris L.*	SP	2n=22
5.	Buckwheat (Tartary)	तिते फापर	*F. tataricum Gaertn.*	SP	2n=2x=16
	Buckwheat (Common)	मिठे फापर	*Fagopyrum esculentum Moench*	CP	2n=2x=16
6.	Finger millet	कोदो	*Eleusine coracana Gaertn.*	OS	2n=36
7.	Foxtail millet	कागुनो	*Setaria italica Beauv.*	SP	2n=18
8	Proso millet	चिनो	*Panicum miliaceum L.*	SP	2n=36
9	Rice	धान	*Oryza sativa L.*	SP	2n=2x=24

The project is being implemented since 2014 by the United Nations Environment Programme (UNEP) and is executed in Nepal by Bioversity International, Nepal Agriculture Genetic Resources Centre (NAGRC) within the Nepal Agricultural Research Council (NARC), Local Initiatives for Biodiversity, Research and Development (LI-BIRD) and the Department of Agriculture (DoA). This project has been designed through extensive consultation with Nepalese agriculture scientists and extension experts with specializations in germplasm conservation, plant breeding, plant pathology and community empowerment. The project was endorsed by the Government of Nepal's Ministry of Finance (MoF) on 24 November 2010 (Project Document Annex 1). The project is being implementing in four mountain Village Development Committees (VDCs)[1] of four districts within Nepal (Figure 1).

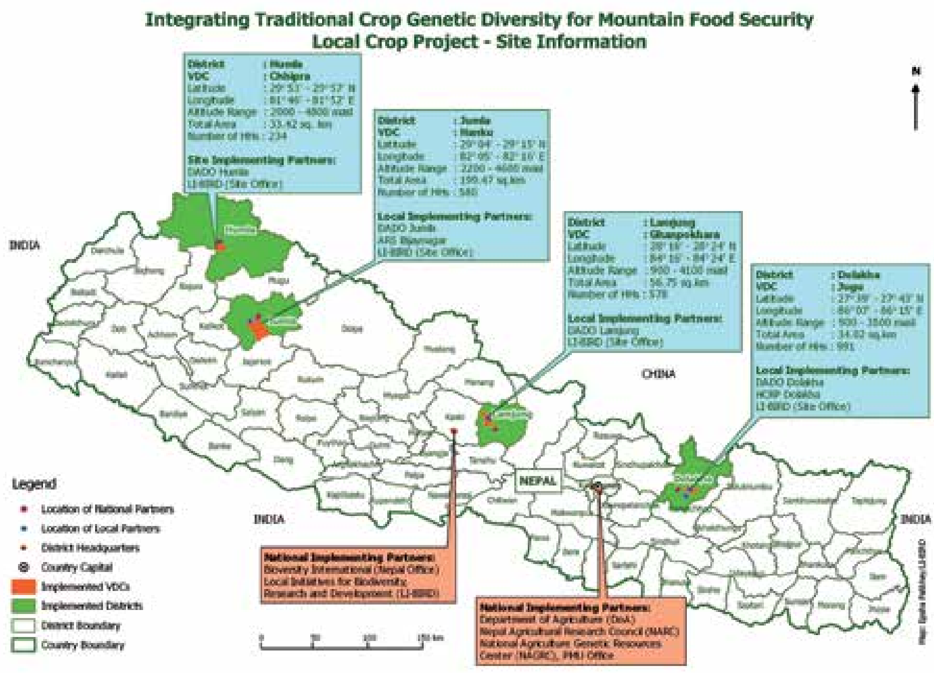


Figure 1. Project sites of the Local Crop Project, Illustration by: Epsha Palikhey/LI-BIRD

1 Village Development Committee (VDC) is an administrative unit of local government of Nepal. Several VDCs make up a district

In the first year of the project, a variety of field visits, participatory rural appraisal exercises, group discussions, diversity fairs, and household surveys were conducted to establish a benchmark for the project sites.

1.3 Objectives of Baseline Study

In the first year of the project, field visits, participatory rural appraisal exercises, group discussions, diversity fairs and household surveys were conducted to establish a benchmark of the project sites. The specific objectives of the baseline study are:

- To understand the socio-economic and demographic context of the farming communities
- To document the extent of genetic diversity in the mandate crops as well as associated traditional knowledge
- To assess the problems with the sustainable use of crop diversity and factors that play important roles in maintaining diversity within crop species
- To understand the traditional knowledge of the area, especially regarding the use of intra-specific diversity, seed, and processing management of these crops
- To establish baseline and provide guidelines for the planning of future programs in the sites.
- This site baseline report provides a summary of the various facets of the mandate crops' genetic resources, traditional knowledge and socioeconomic context of the farming systems present in the project site.

This site baseline report provides a summary of the various facets of the mandate crops' genetic resources, traditional knowledge of the farmers, and socioeconomic contexts of the farming systems present in the project site.

2. METHODOLOGY

2.1 Primary Information Collection

General information about the district and VDC was collected from secondary data sources of local Government such as District Profile and VDC Profile. Additionally, this information was used for sampling design and questionnaire preparation for conducting the baseline survey. It also helped in understanding the farming systems, mandate crop situations, socioeconomic details and livelihood situations of the farming communities.

2.2 Participatory Rural Appraisal (PRA)

Participatory rural appraisal was conducted using the following tools: Focus Group Discussions (FGD), key informant survey, four cell analysis, resource mapping and seasonal calendar. With these tools, information was collected regarding crop diversity, production ecology and seasons, variety details, farmer's knowledge, field practices, processing methods and issues associated especially with mandate crops. In addition, PRA was used to gather information on community based organizations, ongoing programs conducted by different International/Non-Governmental Organizations (I/NGOs), Governmental Organizations (GOs), other agencies and their respective working area and present status.

We organized four group discussions for PRA involving all the wards[2] of Hanku VDC to gain a better understanding of the local context of mandate crops diversity and knowledge, paying special attention to special traits, present status and reasoning for current trends, and consumption patterns. After consulting with the project site team, the participants in the PRA were chosen based on their traits of being progressive, knowledgeable and interested in agricultural activities.

2.3 Diversity Fair

A district level diversity fair was organized in Jumla in collaboration with District Agriculture Development Office (DADO), Jumla and other relevant stakeholders during 6-7 May 2015 (after postponement from 26-27 April 2015 due to earthquake on 25 April 2015). The diversity fair was linked with District level food fair coordinated by DADO of Jumla in order to raise awareness about local crops and their use value with wider audience at district level. Food fair promoted consumption of local foods while diversity fair helped in creating public awareness of the value of local crops and access the extent of diversity of mandate crops and associated traditional knowledge in the district including project site.

The fair included participation of 18 Community Seed Banks (CSBs) and 7 farmer organizations from 16 VDCs and one municipality in Jumla to showcase the diversity of mountain crops. Three members of Jalpa Devi Community Seed Bank from Hanku participated in the event. They were ranked second in the competition by the evaluation team. Two-day orientation of diversity fair, information collection, passport data and exposure visit to Bhawani CSB in Talium were provided to the participants on 22-23 April 2015 in Jumla through resource person from LI-BIRD and Bhawani CSB in Talium.

Diversity fair helped to document current status of overall crop diversity and associated mandate crop information (crop name, variety name, distinguishing characters, special traits and uses, problems, population status and source). In addition, it also helped to sensitize the community on availability of the crop diversity, taught them how to use a diverse set of crops, and plan for diversity conservation.

2.4 Household Survey

A household survey of Hanku, Jumla was conducted during the month of December in 2014 to collect detailed information on demographic status, crop diversity status, diversity related problems, mandate crop production, and mandate crop seed sources. Additionally, an understanding of the local perception of promotion and conservation of local crops was gained. The specific steps employed in baseline household survey are presented in Figure 2.

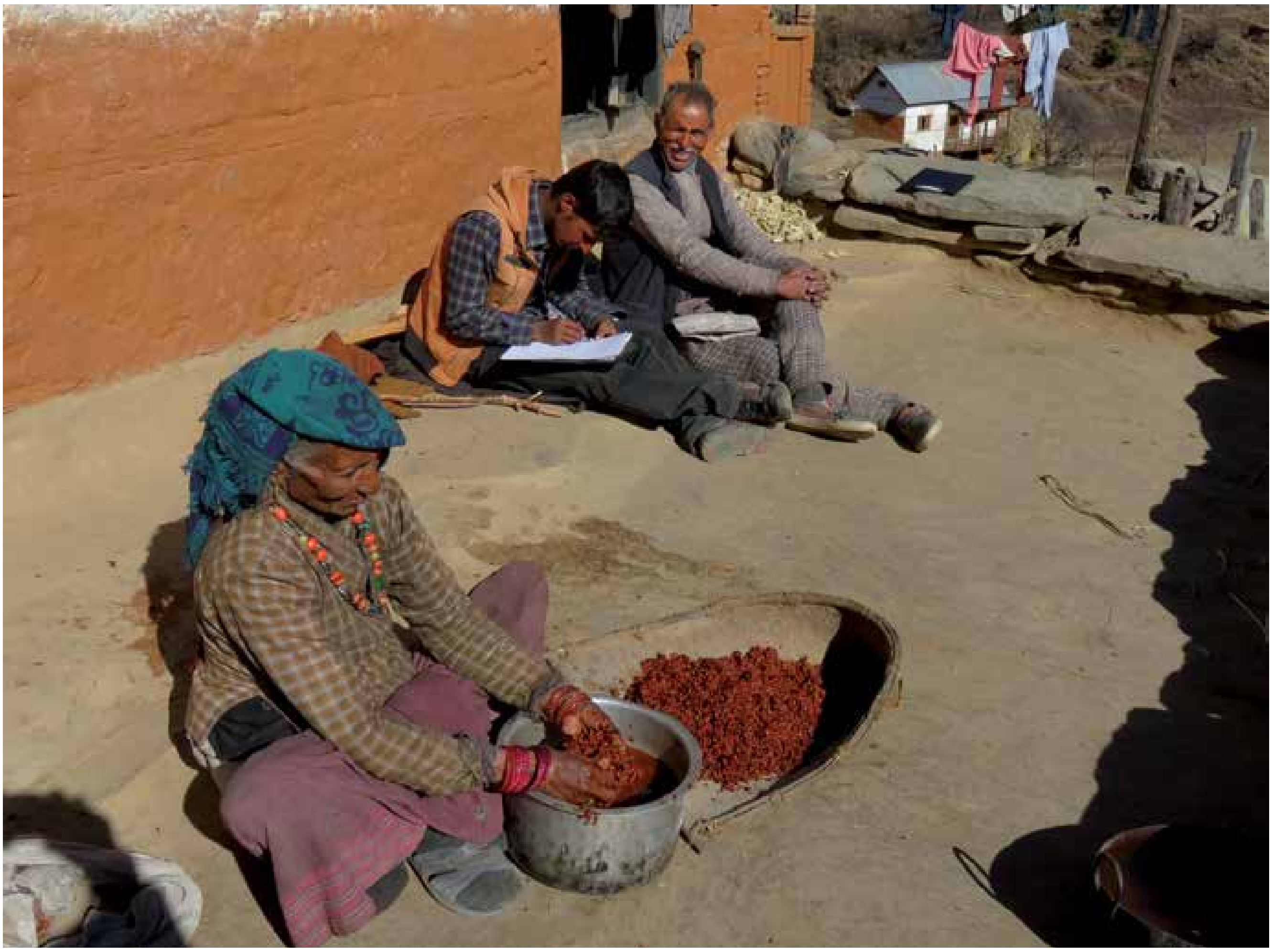
2 Ward is the lowest administrative unit of local government of Nepal. Nine wards make up a Village Development Committee (VDC).

2.4.1 Survey Design and Sampling Procedure

The questionnaire and survey methodology was developed by the project team and was refined using the inputs from various experts within the project team of Bioversity International, NAGRC, and LI-BIRD. The responsibility of coordinating and facilitating the consultation process was assigned to project leaders. A stratified sampling method, followed by a random sampling method, were adopted.

2.4.2 Questionnaire Preparation and Pre-Testing

The household survey was prepared by reviewing questionnaires of other similar projects, especially the Community Biodiversity Management (Subedi et al., 2009) and In situ/On-farm Conservation of Agricultural Biodiversity in Nepal (Rana et al., 2000). The questionnaire was brief as general information had already been collected through various PRA exercises, the site selection study and the diversity fair. The drafted questionnaire was shared with a team of experts from Bioversity Nepal, NARC Gene bank, and LI-BIRD for reviewing and commenting. The final questionnaire was refined and finalized (Annex I) by incorporating suggestions from experts of Bioversity International, NAGRC, and LI-BIRD. It was pre-tested with 10 farmers in Aarba[3] VDC of Kaski district before field administering.



Baseline Household Survey Team with Respondent Farmer. Photo: Epsha Palikhey

3 Aarba VDC now has been merged in Pokhara Sub-metropolitan city and so it is no more a VDC.

2.4.3 Sampling Method and Size

Latest household list of all nine wards of Hanku VDC was collected from recent survey conducted by the VDC office for drinking water supply and sanitation program. Sample size was then determined using the following relation through an online sample calculator, Raosoft[4].

$$n = \frac{NZ^2pq}{Nd^2+z^2pq}$$ ....Equation 1

Where,

n = size of sample;

Z = value of standard variate at a given confidence level and to be worked out from table showing area under normal curve;

p = largest possible proportion (0.5) or sample proportion

q = 1 - p

d = the sampling error (0.05)

N = size of population (total household number in the VDC = 583)

A sample size of 83 was calculated for 580 households in Hanku VDC, Jumla. The probability proportion to size sampling technique was adopted because of the differing population size throughout the scattered wards. The proportional sample size from each ward was calculated using equation 2.

$$n_w = \frac{N_w}{N} \times n$$ .... Equation 2

Where,

n_w = sample size for the ward

N_w = total number of households in the ward

N = total number of households in the VDC

n = total VDC sample size from Equation 1 (i.e. 83)

A ward-wise sampling frame was constructed and data were collected from a sample household in each ward. Sample households from each ward were selected using simple random methods. The total household number, and the sample number of each ward are given in Table 2.

Table 2. Sample size for each ward

Ward No.	Total No. of HHs	No. of sampled HHs
1	47	7
2	52	7
3	70	10
4	68	10
5	67	10
6	66	9
7	58	8
8	57	8
9	95	14
Total	580	83

4 Raosoft, an online sample calculator was used to calculate the sample size using Equation 1.

2.4.4 Administration of Survey

A team of eight members (two project's staff, two LI-BIRD's staffs working in other projects in Jumla, and four hired enumerators) conducted and completed the survey. An orientation was organized for staffs and enumerators on 9 December 2014 mainly focusing on clarification on content, sampling, and interviewing process. Interviewing of farmers started on 12 December 2014. Every day, after interviews were completed, the interviewers' team and site officer jointly crosschecked data in the field to minimize response errors. Due to the remoteness of the interview site, data entry into computer spreadsheets was not immediately possible in Hanku.

2.4.5 Data Entry, Cleaning and Analysis

Data compilation and entry was done using the standard format developed by previous projects and the technical support from data management specialists of LI-BIRD. Data entry in Microsoft Excel was completed by the end of March 2015 in LI-BIRD, Pokhara office. Entered data was reviewed and cleaned by the site team with the regular technical inputs and support from project team members. Before analysis, cleaned data was converted to standard units through cross-site sharing and experiences of the team members. Data was analyzed using Microsoft Excel 2013 and Statistical Package for the Social Sciences (SPSS) version 16. Both qualitative and quantitative data were analyzed primarily with the use of descriptive statistics, such as mean, frequency and standard error of mean.

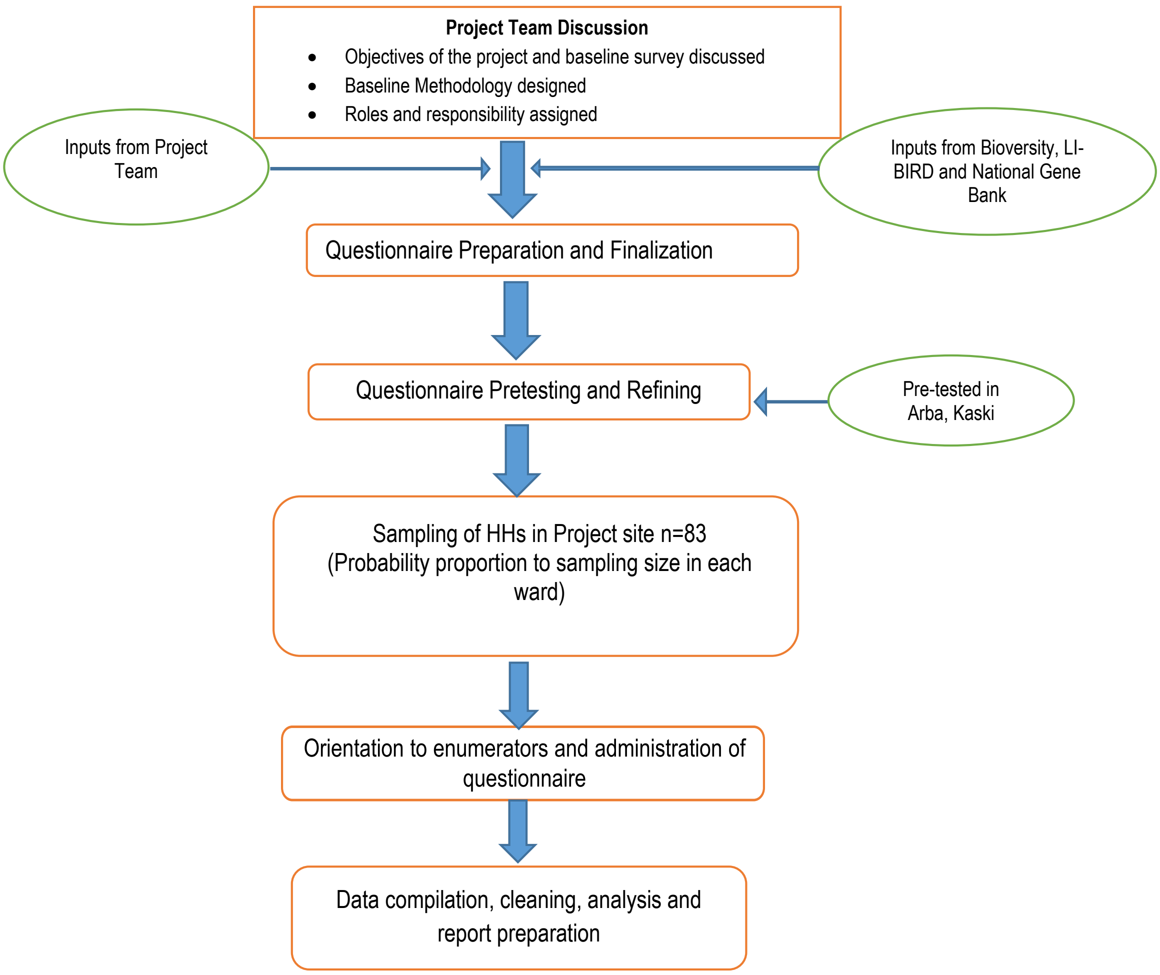


Figure 2. Steps involved in baseline survey

3. SITE CHARACTERISTICS

3.1 Overview of Jumla district

Jumla is one of the five districts of the Karnali Zone. The district shares its borders with Dolpa to the east, Kalikot to the west, Mugu to the north and Jajarkot to the south. Jumla is located between 28° 58′ to 29°30′ latitudes and 82° 57′ to 82° 18′ longitudes. Elevation in Jumla ranges from 2000 masl (Nagma village) to 6424 masl (Patarasi Himal). There are twenty-six VDCs and one municipality -- Chandannath Municipality[5] – which is also the district headquarter.

The total area of the district is 2,531 sq km. Jumla's topography is characterized by three parts: high hill and rocky mountain partially covered by snow; lower hill, with grazing meadows; and low lands where agricultural land is available. A significant portion of its territory is grassland and highland meadow, often used for grazing Himalayan goats, sheep, and yaks, and abundant in medicinal herbs with great potential for sustainable economic development. The district is covered with pasture land, rivers and bushy rocky area of 213,614 ha. Most human settlements are at elevation below 2700 masl on the slopes of mountains along the Tila and Sinja River basins, and cultivated lands make up only about 12% of the district's total land use. The total arable area of the district is 39,486 ha, out of which 26,435 ha is cultivated (DADO, 2014). Of the total cultivated land, irrigated land constitutes 3269 ha and rain fed 23,166 ha. The major rivers in the district are Tila, Jaba and Hema, and the valleys bordered by Tila and Hema are relatively better off in terms of development.

Figure 3. Map of Jumla showing Hanku VDC highlighted in green

5 In 2014, four VDCs of Jumla naming Chandannath, Talium, Kartikswyami, and Mahat were merged to form Chandannath Municipality.

3.1.1 Climate

The district has a sub-alpine and alpine climate. Snow fall starts from November and ends in April in all VDCs, particularly heavily in Dillichaur, Guthichaur, and Brumadichaur, making it difficult to access those areas. Pre- and post-monsoon winds also impact livelihoods, as the air is very dry. The average temperature in Jumla varies between 30°C in the summer and 12°C in the winter. In the winter (November to January) the minimum temperature can reach -11°C. Jumla gets relatively less precipitation with annual rainfall ranging between 667 mm and 852 mm (DDC, 2009).

3.1.2 Demography

The total population of the district is 108,921 with an even 1:1 sex ratio. The population is distributed across 19,291 households with an average household size of 5.65 people (CBS, 2011). Major ethnic group of Jumla is Brahmin, Chettri and Dalit. Human Development Index (HDI) of Jumla is 0.409 (15th from the bottom) according to Nepal Human Development Report 2014, which is lower than national average of 0.49. Similarly, Human Poverty Index (HPI) value of Jumla is 42.09 which is only less with a value of 7.17 from district with highest HPI of Nepal, i.e. Humla (49.26). Literacy rate of Jumla is 56% (CBS, 2011). Around 42% of the population own their own land and adopted their main occupation as agriculture.

Jumla is considered the original home of the Khas ethnic group. Sinja Valley, in the western part of the district is known as the origin of Khas Bhasa, from where Nepali language evolved. Therefore, the Nepali dialect, Khas Bhasa is still spoken among the people in this region.

Jumla is major administrative centre and also considered as commercial centre of Karnali Zone. However, high-hill location of Jumla, irregular air and road accessibility dependent on weather, difficulty in communication, lack of modernization, and remoteness has led it to be categorized as one of the nine backward or remote districts[6] by the Government of Nepal. Regardless, all twenty-six VDCs of Jumla can be reached from district headquarter within a day. Recent construction of Karnali Highway, connecting district headquarter and various VDCs in Jumla to Surkhet, a regional hub, has brought significant changes in socio-economic development (Happychuck et al., 2014) and lifestyles of Jumli people.

3.2 Overview of Hanku VDC

3.2.1 Geographic Information

Hanku VDC is about 8 km away from the district headquarter, Chandannath Municipality. It lies between 29˚04' to 29˚15' North and 80˚05' to 82˚41' East covering an area[7] of 199.47 sq km. Hanku is surrounded by Kartikswaymi VDC in the East, Tamti in the West, Lamra and Tatopani in the North and Jajarkot district in the South. The altitude ranges from 2000 to 4600 masl. Although being right across the Karnali Highway, there are no motorways to link Hanku. Foot trails connect Hanku with the highway at two points: narrow wooden bridge at Hanku village (ward 3 and 4), and metal suspension bridge at Gautamwada village (ward 1). However, within the VDC, about 20 km agricultural road is under construction.

According to Local Adaptation Plan of Action (LAPA)[8], the total household number of Hanku is 494 with a population of 6,203 out of which around 56% are male and 44% female. In Hanku, 23% of the total households belong to Chettri and Thakuri Community, 29% belong to Dalit Community and the rest 48% belong to Brahman Community (MOSTE, 2014).

Community still follow various social norms such as chuwachut, chaupadi, dhami. About 30% of the community in Hanku are under poverty. With four primary schools and one secondary school, the literacy rate in Hanku is 53% out of which female literacy

6 Article 10.A.1.f in the Scholarship Rules (2003) lists Accham, Bajhang, Bajura, Dolpa, Humla, Jajarkot, Jumla, Kalikot, and Mugu as the districts that are "backward or remote area."

7 The demarcation of Hanku VDC had been revised with the declaration of Chandannath Municipality. Certain areas of adjoining VDC, Kartikswaymi was merged with Hanku increasing its total area.

8 Local Adaptation Plan of Action (LAPA) is a community plan prepared under National Adaptation Programmes of Action (NAPA) at local level by multi-stakeholder team including the communities vulnerable to climate change. The aim of LAPA is to integrate climate change adaptation activities into local and national development planning processes to ensure climate resilient development. LAPA of Hanku VDC was prepared by LI-BIRD in close collaboration with Nepal Climate Change Support Programme (NCCSP) in 2013.

is 57%. However, literacy is usually defined as people being able to write their names. There is a public heath post in ward number 3 for health services.

3.2.2 Climate and Agroecology

Hanku experiences cool temperate to alpine climate. Most of the areas of Hanku is covered by forest and grasslands. There is also large pasture land in eastern corner of the VDC. The VDC has at least 13 small high altitude lakes. The major lakes in the area are: Gidi daha, Sanka daha, Hudke daha, THankur Jyu, and Bista Jyu. These lakes are also among the holy places in Hanku and have high cultural and religious importance to the community. There is a village named Gidikhola due to river flowing from Gidi daha. Tila Nadi, Giri khola and Bhal Khola are the other major rivers in Hanku.

Through November to February it is very cold with snowfall and remaining months are medium to warm. A chilling breeze is usually blowing in the area due to which, some areas of the VDC are very hard to stay out in for long periods of time.

Hailstones are one of the major climatic hazards that have been affecting major crops in the VDC. Farmers have reported experiencing hailstones regularly for past 3-4 years during the month of October (which affects rice and other crops in maturity season) and during April (does not affect crops). There is also severe problem of drought. Some has also stated problem of flood and landslide during months with heavy rainfall.

Based on climate change vulnerability assessment for Nepal Jumla falls under high vulnerable district in drought (Durbar and Kathmandu, 2010). The study used data on the spatial distribution of various climate-related risks/exposure in 75 districts. Most of the people living in the mid and far western region are amongst the most vulnerable mainly due to high poverty rates in those areas and heavy reliance on small scale agriculture which is increasingly at risk from more erratic rainfall patterns and the lack of basic services and alternative livelihood options. LAPA for Hanku was prepared during the second phase of LAPA making process as Hanku is among the vulnerable VDC of Jumla.

3.2.3 Settlement Pattern

Settlement in Hanku is usually clustered in villages although a few households were found to be scattered on the periphery. Major seven villages/settlement clusters are Gautamwada, Jaitpur, Hanku, Partheni, Gidi khola, Kutel gaun and Niyapani, and some small clusters of villages are named as Samal gaun, Sejuwal, Pandey wada and Rokaya wada. Although Hanku extends up to 4600 masl, settlement is found only between 2000 to 2500 masl. All the villages are within a walking distance of one to two hours from Karnali highway.

3.2.4 Livelihood and Farming System

Staples, horticulture (apple, walnuts, peach), and livestock are the important components of the integrated farming system and basis of livelihood in Hanku. Majority of the households rely on agriculture and subsistence farming. Crop based farming systems are mainly rice/barley based in *khet* land and millet/wheat based in the upland. The widely cultivated crops are rice, millets and beans during summer season. Barley is the major winter crop. Only a handful of farmers grows proso millet and foxtail millet. Cow and ox are the major livestock reared. Goats, sheep and horses are reared by only few households but in larger numbers mostly for business . Off-farm wage labor is another important livelihood option. Herb collection is not as prominent in other parts of Jumla. Although being so close to the highway, Hanku is still far from commercial surrounding which is increasing rapidly along the highway. Almost all households in Hanku are using firewood to cook food.

3.2.5 Agricultural Land-use System and Irrigation

Forest and pasture land are the major land use system in Hanku. There are four community forests, namely, Mahadev Gaira Community Forest, Chaupat Community Forest, Jalpa Devi Community Forest, and Thala Chaur Community Forest in Hanku that are managed by respective community forest user groups.

Agriculture is the next major land use system in Hanku. Hanku is considered to have fertile and larger agricultural lands compared to other VDCs in Jumla which is irrigated by major rivers Giri Khola and Tila Nadi.

Altitudinal variation, topography, and irrigation availability are the major basis of classification of agricultural land. Broad distinction of land is made between *khet*[9], *bari*[10] and *lek*[11] areas. *Khet* land is further classified into *sim, gadkulo* (river canal), and *kholapani* (stream water) was made on the basis of availability of moisture/sources of irrigation. *Sim* is waterlogged marshy land with poor drainage. Only rice is cultivated here, otherwise it is left barren. *Gadkulo* supplies water throughout the year whereas *kholapani* mainly during the monsoon season. *Kholapani* was the major source of irrigation water with almost 60% of the total irrigated area covered by it.

Likewise *bari* can be classified into *ghar bari* and *pakho bari* according to use and proximity from the settlement. *Bari* lands are more intensively cultivated compared to *khet* lands. Only major cereal crops such as rice, barley and finger millet are grown in *khet* whereas all other crops are grown in *bari*.

3.2.6 Status of Use of External Inputs (Fertilizers, Micronutrients and Pesticides)

Accessing chemical fertilizers, herbicides and pesticides has never been practical in Jumla. Hence, to find national market for foods produced in Jumla, District Agriculture Development Office (DADO) through District Development Council declared Jumla as an organic district in 2007 (Happychuck et al., 2014). However, availability of alternative options to use for organic productions are very limited in the district.

Farmyard manure and compost manure prepared at home is the major source of nutrients for the soil. Generally, farmer apply manure to the fields in the beginning of the season during the planting of rice and sometimes during the planting of finger millet. On average, farmers broadcast around 400-500 kg of manure per ropani.

There are few agrovets in Jumla bazaar (Neupane agrovet, Malika agrovet, Mahat agrovet) that provide services to farmers whereas in Hanku VDC there are no agrovets. Farmers do not use micronutrients and pesticides as they are rarely available.

3.2.7 Status of Access of Technologies, Information and Support Services

Hanku is located three hours walk from district headquarter, Khalanga Bazaar/ Chandannath Municipality. Aireni is another nearby market (10-15 minutes walk), which is right across the Tila river. Since there is only a small wooden bridge to reach Hanku, all the goods and any technology must be carried on foot. Since there is no motorable bridge, people feel that it is hard to get to Hanku even though it is physically close to the district headquarter.

Hanku does not have good facilities for information exchange and communication. Mobile network of Sky is available but has poor reception. Only CDMA based technologies get reception while other mobile networks do not get any reception.

Three FM radio stations in Jumla serve information and news for the people of Hanku VDC. The national newspaper takes a few days to reach Hanku and is only available in government offices. Television is rare in Hanku. It is easy to see that Hanku is far behind in terms of modern sources of information.

Farmers of Hanku have limited access to new technologies, information and support services in mandate crops such as amaranths, buckwheat, naked barley, beans, finger millet, proso millet, foxtail millet and cold tolerant rice. Improved varieties of cold tolerant rice such as Chandannath-1 and Chandannath-3 are promoted and distributed by the DADO widely. However, people still prefer to cultivate Jumli Marshi for its taste. The nearest Agricultural Service Centre (ASC) is in Tatopani VDC and the nearest Livestock Service Centre (LSC) is in Chandannath Municipality (Talium). Support and services from these institutions is limited as they have to provide services to 4-5 VDCs.

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9 Irrigated/Rainfed land where mainly puddled rice is grown.

10 Unbunded and unirrigated upland.

11 Agricultural land situated at high altitude far from village.

4. FINDINGS

4.1 Demographic Status

Of the 83 survey respondents, 55% were female and 45% were male. The majority of households were Dalit (41%), followed by Brahmin (36%) and Chettri/Thakuri (23%). Hanku had prevalence of both joint and nuclear families. Family of Chettri and Thakuri ethnicity had highest percentage of nuclear family (74%) followed by Brahmin and Dalit (Figure 4).

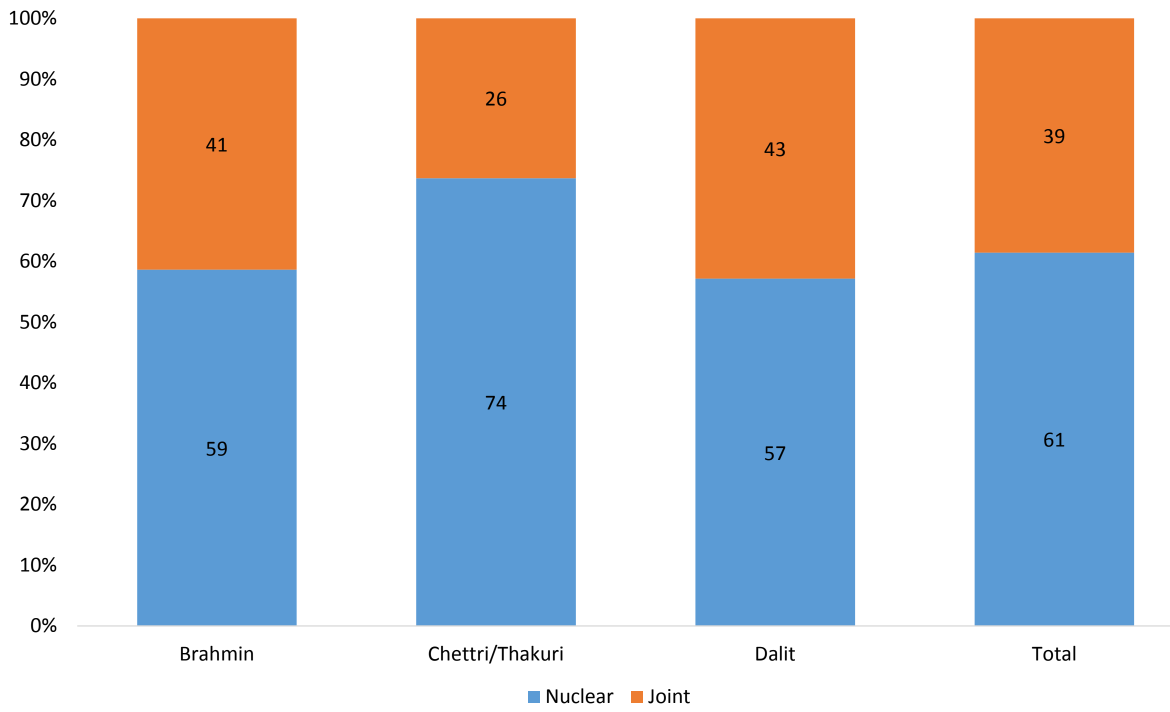

Figure 4. Percentage of family types in Hanku, Jumla by ethnicity in 2014.

The average family household size of Hanku was five people. As expected, joint families had larger families with an average of seven members compared to an average of four in nuclear families. Dalit families, both nuclear and joint, were larger than other ethnicities (Table 3).

Migration is less common for families in Hanku compared to the project sites in Dolakha and Lamjung. Over a quarter of households had family members migrating outside the village (Table 3). Most of the migrants were men and around half of the migrants were away for more than 6 months at a time (Figure 5). Migration in Dalit families was found to be more common with over half of the surveyed households reporting migration. Surkhet in Nepal and India are the common destination for migration.

Table 3. Family and migration details of households in Hanku in 2014

Family size*	Brahmin	Chettri / Thakuri	Dalit	Total
Nuclear	3.94 ± 0.32	3.78 ± 0.29	4.5 ± 0.19	4.11 ± 0.16
Joint	7.00 ± 0.71	6.60 ± 0.39	7.66 ± 0.87	7.25 ± 0.48
Total	5.20 ± 0.44	4.52 ± 0.37	5.85 ± 0.46	5.32 ± 0.27
Migrants**				
Male	6	5	9	20 (24)
Female	1	0	1	2 (2)
Total	7	5	10	22 (27)

Note: Figure in parenthesis are percentages of the total surveyed households.

*Family size in average family size ± SE (Standard error of mean) **Migrants in number of households with migrating family members

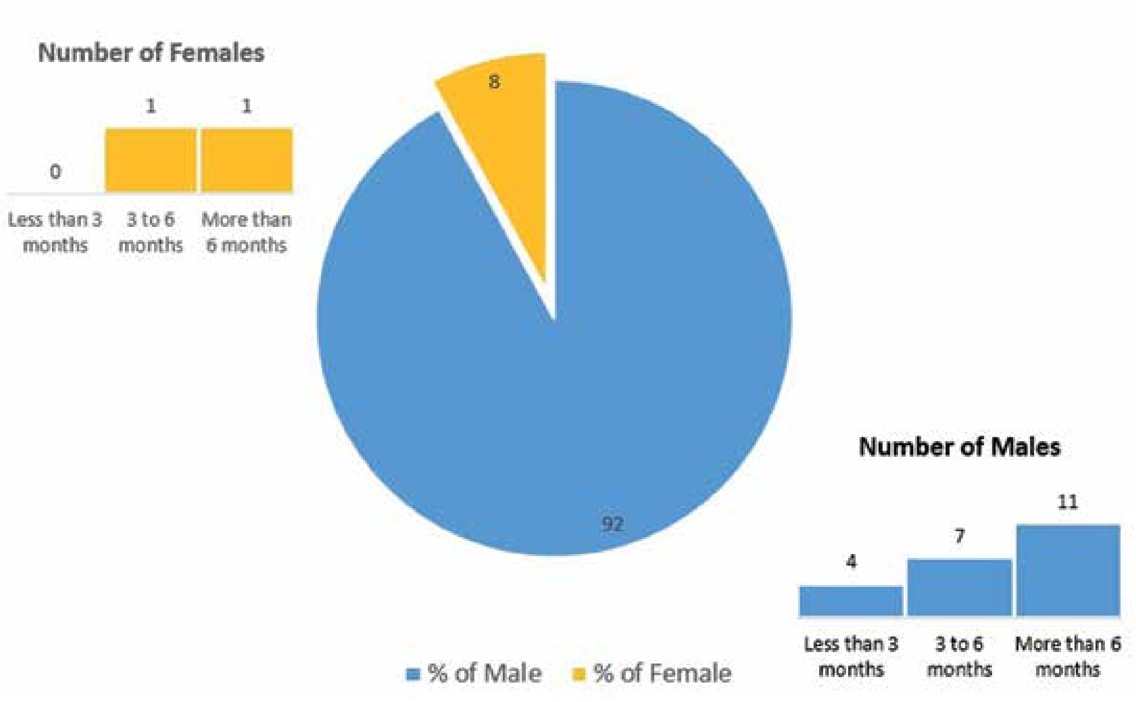

Figure 5. Migrant workers from Hanku VDC are predominantly men.

Agriculture remains the primary occupation of most families (83%) in Hanku with the rest identifying business, job/service and agricultural labour as their primary occupation (Figure 6). None of the respondents mentioned medicinal herb collection as their main occupation. Despite over a quarter of households having migrant family members (Table 3), none of them considered remittance as the primary income.

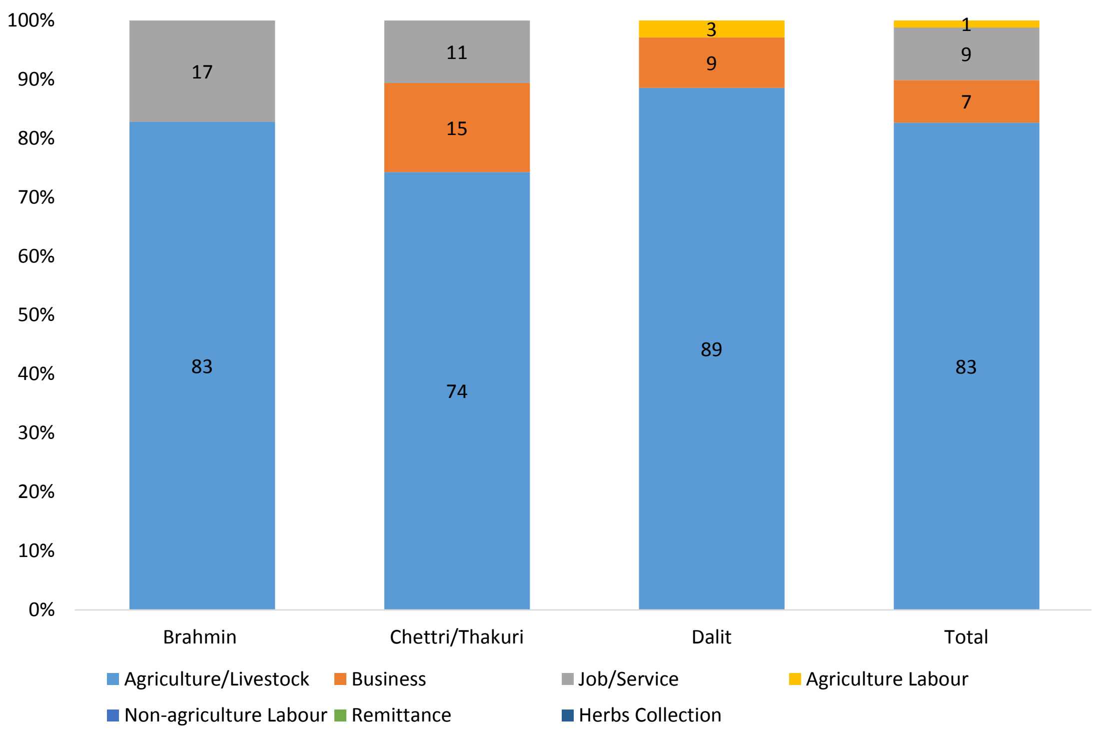

Figure 6. Primary occupation of households in Hanku in 2014.

Joint household level decision making in terms of agriculture is the most common practice for all ethnicities in Hanku. Interestingly, none of the surveyed Chettri/Thakuri households had women as decision makers, while Dalit households had twice as many women decision makers as men (Figure 7). Nearly 50% of Dalit households had migrant men, perhaps leading to women taking decision making roles.

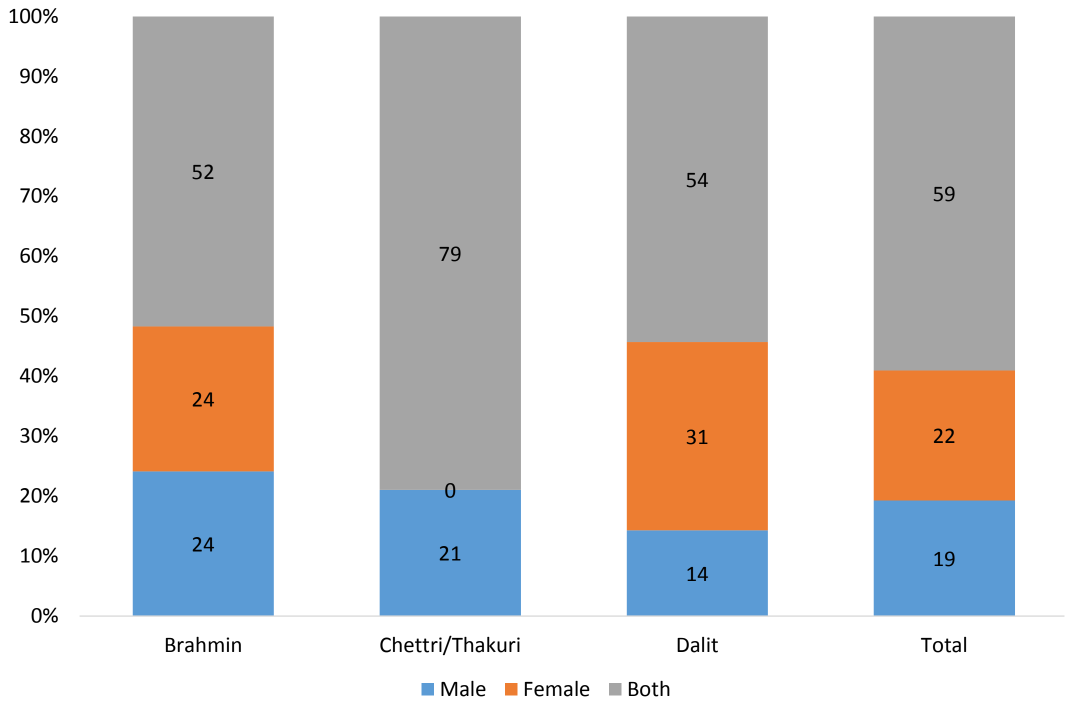

Figure 7. Gender of decision makers at the household level on farming matters in Hanku.

In terms of agricultural resources, Brahmin, Chettri and Thakuri families had above average *khet* land and *bari* land in their family ownership while the Dalit families had less than average *khet* and *bari* land of their own. However, in terms of farm labour, both Dalit and Brahmin households had similar number of working farmer members, while the Chettri/Thakuri families, who tend to have smaller families in Hanku, had less than the average (Table 4).

Table 4. Household agricultural resources in Hanku in 2014

Farm labour*	Brahmin	Chettri / Thakuri	Dalit	Total
Male	1.46 ± 0.22 (97)	1.07 ± 0.07 (100)	1.47 ± 0.13 (100)	1.39 ± 0.10 (99)
Female	1.57 ± 0.2 (90)	1.21 ± 0.09 (68)	1.48 ± 0.15 (97)	1.45 ± 0.09 (88)
Khet land**				
Family ownership	3.59 ± 0.48 (100)	2.89 ± 0.35 (100)	1.68 ± 0.18 (97)	2.64 ± 0.22 (100)
Shared-in	1.2 ± 0.12 (24)	2.40 ± 0 (11)	1.4 ± 0.13 (34)	1.42 ± 0.11 (26)
Share-out	5.2 ± 0 (3)			5.2 ± 0 (1)
Leased-in	1.2 ± 0.23 (10)	1 ± 0.2 (11)	1.2 ± 0.23 (9)	1.15 ± 0.11 (10)
Leased-out				
Fallow	0.9 ± 0.3 (14)	2.1 ± 0.9 (11)	0.63 ± 0.1 (11)	1.03 ± 0.25 (12)
Bari land**				
Family ownership	3.28 ± 0.3 (100)	3.72 ± 0.74 (95)	2.96 ± 0.31 (100)	3.24 ± 0.23 (99)
Shared-in	1.5 ± 0 (7)			1.50 ± 0 (2)

Shared-out				
Rented-in			0.75 ± 0 (3)	0.75 ± 0 (1)
Rented-out				
Fallow	1.12 ± 0.37 (7)	1.50 ± 0 (11)	1.7 ± 0.33 (14)	1.52 ± 0.2 (11)
Orchard**	1.58 ± 0.25 (69)	1.5 ± 0.22 (84)	1.17 ± 0.13 (54)	1.41 ± 0.12 (66)
*Kharbari***				
Family ownership	1.32 ± 0.17 (14)	1.28 ± 0.42 (42)	1.41 ± 0.22 (31)	1.35 ± 0.17 (28)
Fallow *Kharbari*			2.62 ± 0.37 (6)	2.62 ± 0.37 (2)
Av. Family owned	8.35±0.77	8.23±1.14	5.68±0.52	7.13 ± 0.45
Av. Family cultivated	7.95±0.76	7.85±1.06	5.39±0.50	6.77 ± 0.43

Note: Figure in parenthesis are percentages of the total surveyed households.

** Average HH ± SE (Standard error of mean)*

***Average HH Area ± SE (Standard error of mean)*

Orchard area is becoming increasingly common among people in Hanku due to interventions of local government and non-government organizations. Apple is cultivated by 69% of the surveyed households and is the major commercial fruit grown in Hanku. Walnuts and peach are the other major fruits. Since the canopy cover of walnut is larger than apple, farmers prefer to have a few more apple trees in the orchard than walnut. Apricot, chuli, mol, plum, pear and grapes are grown by very few households in Hanku (Table 5).

Table 5. Fruits grown in Households in Hanku in 2014

Fruit	Brahmin	Chettri / Thakuri	Dalit	Total
Apple	47 ± 9	66 ± 17	50 ± 8	53 ± 6 (69)
Walnut	7 ± 2	7 ± 3	5 ± 2	6 ± 1 (43)
Peach	7 ± 2	5 ± 1	2 ± 1	5 ± 1 (37)
Pear	4 ± 1	3 ± 2	2 ± 0	3 ± 1 (8)
Plum	4 ± 2	2 ± 1	3 ± 0	3 ± 1 (12)
Apricot	2 ± 1	0 ± 0	2 ± 1	2 ± 1 (8)
Chuli (*Prunus armeniaca* L.)	0 ± 0	1 ± 0	2 ± 0	2 ± 0 (2)
Grape	1 ± 0	1 ± 0	0 ± 0	1 ± 0 (4)
Mol (*Pyrus pashia* L.)	0 ± 0	0 ± 0	1 ± 0	1 ± 0 (1)

Note: All values in average number of plants ± SE
Figure in parentheses are percentage of HHs growing the fruit out of total HHs surveyed.

Cow and ox are the major livestock raised by 61% and 57% of the households respectively while buffaloes are not common (Table 6). Cows are mostly used for milk and manure whereas ox are used for draught power and manure. Goats are raised by about a quarter of the households and more commonly by Dalits. Horses are mostly raised for business by Chettri/Thakuri and Brahmans. Sheep are also raised in large number by very few people in Hanku mostly by Chettri /Thakuri for business and wool. During festival or event sheep are also sold for meat purpose in market which is the economical business for them. Only one of the surveyed households had a bee hive, which shows that bees are not very common in Hanku. However, based on discussions with the communities, bees used to be much more common in the past and has now decreased as people did not find any immediate benefit of keeping them.

Table 6. Household ownership of animal resources in Hanku in 2014

Animal resources*	Brahmin	Chettri / Thakuri	Dalit	Total
Bee boxes	2 ± 0 (3)	-	-	2 ± 0 (1)
Buffalo	1.25 ± 0.25 (14)	1.5 ± 0.5 (11)	1.16 ± 0.16 (17)	1.25 ± 0.13 (14)
Cow	3.26 ± 0.33 (66)	3.09 ± 0.57 (58)	2.85 ± 0.39 (60)	3.05 ± 0.23 (61)
Goat	4.8 ± 2.57 (17)	2 ± 0 (5)	4.83 ± 1.39 (34)	4.66 ± 1.13 (22)
Horse	2.2 ± 0.58 (17)	2 ± 0.44 (26)	3 ± 0 (3)	2.18 ± 0.32 (13)
Ox	2 ± 0.15 (55)	2.1 ± 0.31 (53)	1.76 ± 0.18 (60)	1.91 ± 0.11 (57)
Poultry	5.5 ± 0.5 (7)	5.16 ± 1.51 (32)	2.66 ± 0.66 (9)	4.54 ± 0.88 (13)
Rabbit	5 ± 0 (3)	4 ± 0 (5)	2 ± 0 (3)	3.66 ± 0.88 (4)
Sheep	50 ± 0 (3)	27.50 ± 2.50 (11)	9 ± 1 (6)	24.6 ± 7.62 (6)

Note: Figures in parenthesis are percentages of the total surveyed households
**Average number of animals per HH*

Rice, barley and finger millet are the major cereal crops grown in Hanku. Beans is also a major crop grown in Hanku and mostly consumed as dry pulse crop rather than green vegetable. Average food sufficiency for cereal crops and pulses is less than six months for households in Hanku, which also points to the widely known high food insufficiency in the region (Table 7). Similar to ownership of agricultural area, Dalit households have lower food sufficiency than other ethnicities for all food groups.

Leafy and other vegetables are sufficient only for less than or equal to three months except for Chettri/Thakuri ethnic groups. Limited seasonal vegetables used to be grown in Hanku but these days, off-season vegetables are also grown by some families with support from various government and non-government organizations.

Table 7. Food sufficiency in Hanku in 2014

Food self-sufficiency*	Brahmin	Chettri / Thakuri	Dalit	Total
Cereal	6.31 ± 0.56	7.73 ± 0.72	3.67 ± 0.29	5.52 ± 0.33
Leafy vegetables	3.80 ± 0.46	4 ± 0.63	3.21 ± 0.43	3.59 ± 0.28
Other vegetables	3.42 ± 0.35	5.27 ± 1.04	3.04 ± 0.34	3.61 ± 0.30
Pulses	6.55 ± 0.76	8.55 ± 0.92	4.16 ± 0.57	5.99 ± 0.45

** Average month within a year ± SE*

4.2 Cropping Pattern and Crop Calendar

The farming systems of Hanku include integration of crops, livestock and forestry. Rice, maize, wheat, barley, finger millet and beans are the major crops in Hanku. Buckwheat, potato, amaranth, foxtail millet, proso millet, soybean, blackgram and horsegram are minor crops. Rice in summer/rainy season and barley in winter is a major cropping pattern adapted in *khet* land (paddy land). In *bari* (upland), finger millet or beans followed by barley is commonly practiced (Table 8).

Table 8. Major cropping pattern in Hanku

Type of agricultural land	Major cropping pattern
Lowland (sim)	Rice – Barren
Lowland (khet)	Rice (+ Soybean along border) – Barley
	Rice (+ Soybean along border) – Potato

	Finger millet (+ Foxtail millet intercropped + amaranths in border) – Barley
	Finger millet – Barren
Upland (bari)	Beans – Barley
	Beans – Wheat
	Finger millet – Barren
	Finger millet – Barley
	Maize – Barren
	Potato – Barley
	Proso millet – Barley

Crop such as rice, naked barley and barley have longest cropping period at around seven months whereas crop such as bean and buckwheat have short cropping period at around four months (Figure 8).

Cropping system: Finger millet and foxtail millet intercropping with amaranth in the border. Photo: Subash Gautam, LI-BIRD

Cropping system: Rice + Soybean in the border. Photo: Photo: Subash Gautam, LI-BIRD

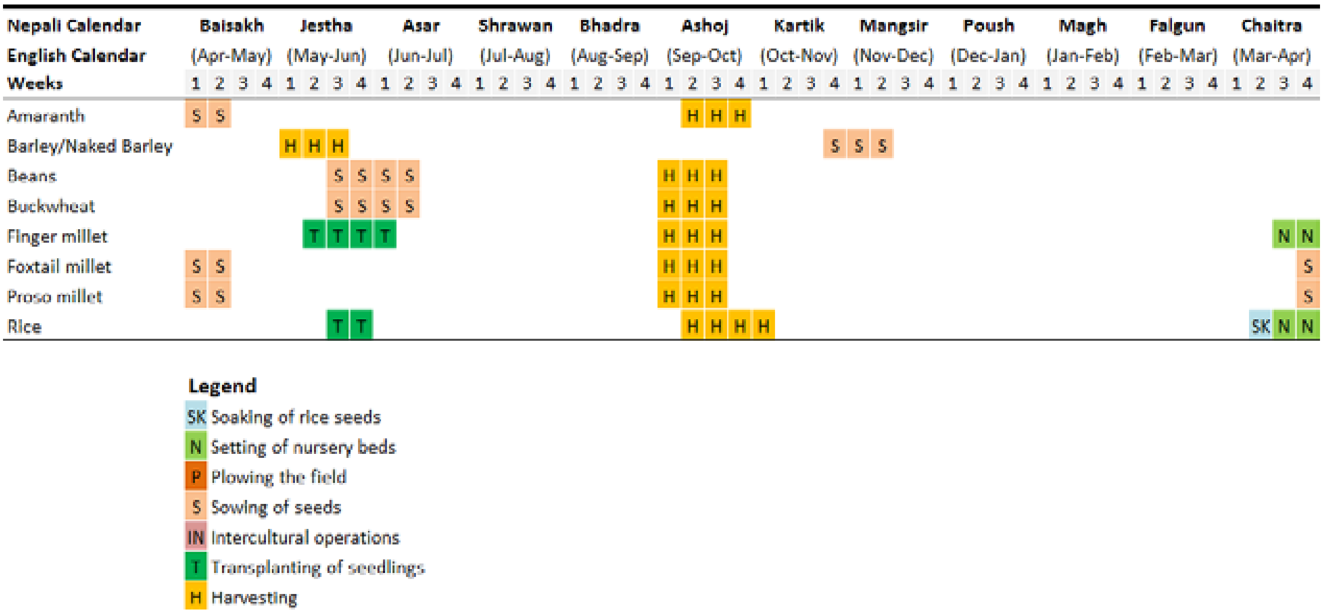

Figure 8. Seasonal cropping calendar of the project's mandate crops in Hanku.

4.3 Amount and Distribution of Crop Genetic Diversity in Mandate Crops

Information on varietal diversity of mandate crops in the project site has been collected using a variety of methods. A comparison of these methods in Jumla shows that diversity fair captured the greatest richness of varieties, while household survey and site selection exercise brought up the least number of varieties (Table 9). Since diversity fair in Jumla was organized at district level, 13 CSBs in Jumla participated in the fair and as a result more names of local varieties were mentioned and displayed. Also, in preparation for a diversity fair, farmers seek out and collect even the rarest of varieties, which may not be sampled in the sampling process of a household survey.

Greatest discrepancy appeared in beans, while comparing information collected from district level diversity fair and other methods. Local names of beans identified by farmers differed a lot from person to person, which partially explains the inflation of variety names in diversity fair. Moreover, farmers cultivate and harvest beans in mixture traditionally, which means they hardly differentiate between beans varieties and their names. This leads to farmers naming the beans in their individual way.

Table 9. Varietal richness of mandate crops in Hanku as assessed by various methods

Crop	Site selection exercise in 2014	Diversity fair in 2015	Diversity fair (Hanku only)	FGDs in 2014/15	Baseline Survey in 2014	Cumulative Total
Amaranth	2 (2)	5 (5)*	2 (2)	3 (3)	4 (4)	5 (5)
Barley	1 (1)	4 (4)*	1 (1)	2 (2)	1 (1)	4 (4)
Bean	5 (5)	28 (25)*	13 (13)	13 (13)	11 (10)	32 (29)
Buckwheat	3 (3)	6 (6)*	4 (4)	5 (5)	3 (3)	7 (7)
Finger millet	2 (2)	5 (5)*	3 (3)	4 (4)	3 (3)	6 (6)
Foxtail millet	2 (2)	5 (5)*	3 (3)	4 (4)	4 (4)	6 (6)
Naked barley	-	3 (2)*	-	-	-	3 (2)
Proso millet	2 (2)	3 (3)*	1 (1)	2 (2)	2 (2)	3 (3)
Rice	4 (2)	9 (5)*	4 (2)	7 (5)	6 (4)	10 (6)
Total Richness	21 (19)	68 (60)	31 (29)	40 (38)	34 (31)	76 (68)

** Indicates the highest richness among the methods used.*
Figure in parenthesis is the richness of local varieties.

Among the mandate crops, rice is the most widely cultivated crop (100% of the surveyed households) in largest average area of 2.57 ropani per household (Table 10). Barley (2.2 ropani per HH) is another major crop grown in larger average area followed by beans (1.88 ropani per HH) and finger millet (1.03 ropani per HH). Amaranth and foxtail millet had the least average area under cultivation as many households grow amaranth as a border crop and foxtail millet is intercropped very sparsely with finger millet. Buckwheat and proso millet are cultivated in larger land parcels but by fewer households. Amaranth had highest productivity (345.18 kg/ropani) but this is likely affected the crude estimation of area planted. Among the more commonly grown crops, rice had the highest productivity (187.01 kg/ropani), followed by barley (101.87 kg/ropani) and finger millet (90.18 kg/ropani) .

Table 10. Household and Community richness and evenness of mandate crops

Crop	Area ± SE (Ropani)	Productivity** (kg/Ropani)	# HHs (%)	Avg. HH richness ± SE	Community richness	Avg. HH Evenness
Amaranth	0.027 ± 0.004	345.18± 113.05	25 (30)	1.08 ± 0.06	4	0.040
Barley	2.20 ± 0.15	101.87 ± 5.35	81 (98)	1.00 ± 0.00	1	0.000
Bean	1.88 ± 0.14	49.84 ± 3.86	82 (99)	2.10 ± 0.14	11	0.336
Buckwheat	0.69 ± 0.09	43.99 ± 11.35	17 (20)	1.12 ± 0.08	3	0.059
Finger Millet	1.03 ± 0.09	90.18 ± 7.11	74 (89)	1.00 ± 0.00	3	0.000
Foxtail Millet	0.07 ± 0.02	2.24E2 ± 88.39	8 (10)	1.00 ± 0.00	4	0.000
Naked Barley*	-	-	-	-	-	-
Proso Millet	0.95 ± 0.18	33.96 ± 11.07	4 (5)	1.25 ± 0.25	2	0.125
Rice	2.57 ± 0.18	187.01 ± 6.29	83 (100)	1.49 ± 0.07	6	0.187

*Note: Figures in parenthesis are HH percentages of their respective columns. *Cultivation of naked barley (uwa) is not reported from the site.*

*** Average productivity in Kg per ropani ± SE*

4.3.1 Amaranth

Amaranth (*Amaranthus* spp.) is known as marshe in Jumla. Amaranth is cultivated by 30% of the surveyed households in Hanku in 2014 (Table 11). Grain color and inflorescence attitude tend to be used by farmers to distinguish between varieties.

It is grown by farmers as border/edge crops especially around finger millet. There are several reasons mentioned by farmers for growing amaranth in border. It demarcates one farmer's land from another farmer's. It is an attractive plant and does well as a border/edge crop.

The average area per household is low compared to other crops. Based on existing cultivation practice perimeter would be a better measure of amaranth population than area. For the survey, respondents were asked to approximate how much area the crop would cover if it was grown in a plot. Hence, the area and therefore productivity of amaranth is an approximation, at best.

Table 11. Amaranth varieties, their area, productivity and key traits grown in Hanku VDC

Variety	Area per HH (Ropani)	Productivity* (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Ladi	0.033 ± 0.000	135.60 ± 75.33	2	Few HHs in small area	Drooping inflorescence; white seeds	High yield and late maturing
Lal (Rato)	0.022 ± 0.005	343.32 ± 212.75	13	Many HHs in small area	Erect inflorescence, red grain	High yielding, early maturity
Seto	0.027 ± 0.007	229.14 ± 87.85	12	Many HHs in small area	Erect inflorescence; red plant and white seeds	High yield

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.
**Amaranth Productivity: While amaranth is grown as a border crop the respondents were asked to estimate the area the seed would cover if grown in a plot. Hence, the area and productivity of amaranth is a crude approximation. Since variety Lal and Rato was found to be same vaiety during the FGD made for validation of the data their average data is taken.*

4.3.2 Barley

Hulled barley (*Hordeum vulgare* L.; local name: jau) is a commonly grown winter crop in most parts of Jumla including Hanku (Table 12). Although four local landraces of barley (Chawali, Lekali, Bhuwali and Pawai) have been documented by previous studies in Jumla (Bajracharaya et al. 2012) only Chawali was found in Hanku. Chawali is mainly grown in irrigated rice field during winter season and some time in upland too. It has small spike and short maturity period. Harvested barley is typically stored on the top of the roof as a heap (Photo 3).

Table 12. Varieties of barley, their area, productivity, and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Chawali	2.20 ± 0.15	101.87 ± 5.35	98	Many HHs in large area	Round white grains	Soft and good eating quality, early maturity

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.3.3 Naked Barley

Hulless or naked barley (*H. vulgare* L. var. *nudum* Hook. f.; local name: uwa) is a type of barley that has a covering or hull so loose that it usually falls off during harvesting. It is rare throughout Jumla and was not observed in Hanku VDC by this study. Although naked barley is easy to thresh, it matures later than barley and thus delays the rice and bean cropping season.

The small Mugal community are the ones who grow naked barley in Jumla. Farmers from the Mugal community have mentioned that naked barley is a very easy crop to process and nutritious because the bran and germ are retained. The Mugal are the people from Mugu that migrated to Jumla. They reside in about six VDCs of Jumla, namely, Patarasi, Dillichaur, Chumchaur, Garjyankot, Guthichaur, and Chandannath Municipality. Naked barley used to be cultivated in larger area in Chaudabis area (close to Patarasi himal). Nowadays in Jumla, it is hard to find naked barley even in Chaudabis area.

Brahmin and Chettri farmers do not cultivate naked barley in Jumla, although some recall their parents used to cultivate naked barley in small areas. Consumption of *sattu*, a drink made from the flour of roasted barley and other grains such as soybeans, is not common among Brahmins and Chettri. They instead mostly cultivate hulled barley to be used for preparing *roti* and feed for livestock.

In Talium, only two or three households cultivate naked barley, and they had to bring seeds from Dolpa. They started cultivating naked barley as they became more aware about cultivation and conservation of local crops. It appears that farmers have difficulty accessing naked barley seed even if they were interested in growing it.

4.3.4 Buckwheat

Buckwheat, commonly known as phapar is grown in upland areas (*bari*). Two species of buckwheat are grown in Hanku, one is Mithe (*Fagopyrum esculentum* L.) and the other is Tite (*Fagopyrum tataricum* L.). Although seven landraces of buckwheat were documented from different methods, only three landraces of two types of buckwheat were found to be grown in Hanku (Table 13). Tite phapar is more popular in Hanku because it has better yield than Mithe phapar. Compared to the other major upland crop finger millet, productivity of buckwheat is low and post-harvest processing is more difficult.

Buckwheat is grown by 20% of the surveyed households on Hanku VDC. Buckwheat used to be grown in larger areas, but these days its cultivation has shrunk. New roads have improved people's access to cheap white rice and the consumption of buckwheat flatbread has declined. In some farms buckwheat is still grown to be consumed leafy greens.

Table 13. Varieties of buckwheat, their area, productivity, and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Chuche	0.58 ± 0.18	42.17 ± 32.83	2	Common	Pointed triangular grans	Bitterness
Mithe	0.48 ± 0.12	38.50 ± 24.62	5	Few HHs in small area	Triangular smooth and big grain	Good taste, medicinal value, low production, prestigious
Tite	0.69 ± 0.09	42.72 ± 13.02	12	Common	Taller plant, elongated triangular grains	Bitterness, early maturity, medicinal value, low production, low flour recovery

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.3.5 Rice

Rice (*Oryza sativa* L.) is grown in low land areas (khet) in Hanku mainly along the banks of the Tila and Gidi rivers. Growing rice is attached with high traditional and cultural values of farmers in Jumla. Rice cultivation practices in Jumla follows fixed date and procedures. For instance, rice seeds need to be soaked on Chaitra 12 (late March). Seeds of rice are kept in a plastic sack and left to soak for four days either in the river or at home. Seeds are soaked to increase moisture content and aid in germination. In past, soaking in the river was more common. Soaking in the river is also intended to provide cold adaptation but these days some farmers choose to soak at home as they think that cold river water delays the germination. After soaking, excess water is drained and the seeds are dried in the sun for few hours. After drying, seeds are kept in warm area of their home for four days, sometimes wrapped in the papery bark of *Betula utilis* (bhoj patra)[12]. During this period of four days, they frequently spray some water to maintain the moisture and turn the seeds over. This involved practice is believed to improve the germination of seeds. The nursery bed is prepared by applying ashes of dried cow dung disks (*guitha*) one to two times. The soaked and sprouted seeds are broadcast on wet nursery bed. After approximately 60 days these seedling is transplanted in the field. Similar practice has been described by Paudel (2013).

The productivity of rice is on higher side than average of Jumla. It is because, rice fields are the fertile land of banks of Giri khola, has higher productivity than other areas in Jumla. Farmers have also mentioned that productivity has increased with increase in cultivation of improved varieties. However, these improved varieties are difficult to thresh and poor taste.

Locals in Jumla prefer Jumli Marshi, a cold tolerant variety of rice with characteristic red grain colour, for its taste and require it for rituals and social events. Jumli Marshi is known for growing at the highest elevations in the world in Chhumchaur VDC (3000 meters above sea level). In Hanku, 87% of households grow Jumli Marshi. However, due to its blast susceptibility, alternative varieties mostly improved such as Chandannath-1 and 3 are grown by 23-24% households (Table 14).

Table 14. Varieties of rice, their area, productivity, and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Chandannath-1	0.94 ± 0.17	168.30 ± 14.17	24	Many HHs in small area	Black grain color, shorter plant height	Higher yield, harder to thresh, good eating quality
Chandannath-3	1.11 ± 0.16	208.30 ± 18.94	23	Many HHs in small area	White grain color, longer leaves	Higher yield, rise in quantity while cooking, not good to taste, harder to thresh, disease and pest tolerant, resists hailstones

12 Bhoj-Patra (*Betula utilis* L.) is a birch tree widely found in the Himalayas, well-known for the use of its bark and leaves for writing in ancient Hindu books.

Darime	2.00 ± 0.69	254.17 ± 60.52	3	Few HHs in large area	Shorter plant, bold red grains	Resistant to hailstones, good eating quality
Jumli Marshi	2.16 ± 0.16	185.10 ± 7.05	87	Many HHs in Large area	Red (some mixed with white) and bold grain	Best eating quality, adilo (longer stay in stomach, delay in appetite), susceptible to disease, easy to thresh
Melte	2.00 ± 0.00	150.0 ± 0.00	1	Few HHs in small area	Red and bold grain	Best eating quality, adilo (longer stay in stomach, delay in appetite), susceptible to disease, easy to thresh
Tinmase	2.00 ± 0.00	150.0 ± 0.00	1	Few HHs in large area	Red and bold grain, small plant height	Early maturity

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.3.6 Finger Millet

Finger millet (*Elusine coracana* L.), commonly known as *kodo* in Nepali is also one of the major crops grown in Hanku. A landrace Rato *kodo* is cultivated by more farmers compared to other varieties and has good yield (Table 15). Finger millet in Hanku is cultivated by two different methods; direct seeding and transplanting. In some fields, finger millet is seeded and left for germination. This type requires the land to be empty earlier than the other type. Transplanting of finger millet is also done in areas where the land is empty in smaller area.

Table 15. Varieties of finger millet, their area, productivity, and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Kalo	0.83 ± 0.22	80.97 ± 34.91	6	More HHs in small area	Reddish hint on stem and leaves, black grain	Early maturity, good eating quality, medicinal value
Murali	1.05 ± 0.22	98.40 ± 24.09	9	Few HHs in small area	Shorter plant height, white grains	Good eating quality
Rato	1.05 ± 0.10	89.86 ± 7.52	59	More HHs in large area	Green plants	Stem preferred by livestock, red bread and good taste

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.3.7 Proso Millet

Proso millet (*Panicum milliaceum* L.) is called chino in local language and it is grown for its grains which is used to prepare *bhaat* (grains cooked as rice is cooked), *roti*, chiura (flattened grains) and *selroti*. Only 5% of surveyed households grow porso millet (Table 16) in Hanku. Dudhe proso millet was found to be more common than Haade because it is tastier and easy for dehusking.

Cultivation of proso millet is decreasing as farmers do not consider it to be a valuable crop. In the past, women would eat *bhaat* of proso millet so that men would have enough rice. With better access to rice and wheat, the whole family can now eat flatbread or rice. There is currently little demand in the local market and limited consumption at home. Proso millet can grow well in drought condition but post-harvest grain processing is difficult and time consuming for women.

Table 16. Varieties of proso millet, their area, productivity and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Dudhe	0.85 ± 0.23	33.96 ± 11.07	4	Few HHs in small area	Smaller panicle, shorter plant, white grain color	Better in taste and cooking quality
Haade	0.40 ± 0.00	62.50 ± 0.00	1	Few HHs in small area	Larger panicle and grain size, yellowish orange grain color	Better for roasting and high yield

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.3.8 Foxtail Millet

Foxtail millet (*Setaria italic* L.) or kaguno is grown for its nutritious grains which are used to prepare as *bhaat*. Only 10% of surveyed households grow foxtail millet in Hanku (Table 17). Usually, foxtail millet is seeded during the time of seeding of finger millet and is often grown intercropped with finger millet. Therefore, in fields where finger millet is transplanted, foxtail millet is not grown. Farmers mentioned that when foxtail millet is intercropped with finger millet, it does not lodge and performs well. Foxtail millet grown in high density does not yield very well.

Rato foxtail millet is grown by five households in Hanku. Only one household was found to cultivate varieties like Aulel, Lude, and Seto. Cultivation of foxtail millet is declining as majority of local people do not consume it as much as they used to do in the past.

Table 17. Varieties of foxtail millet, their area, productivity and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Aulel	0.038 ± 0.00	1.33 ± 0.00	1	Few HHs in small area	Pale yellow grains	Early maturity
Lude	0.23 ± 0.00	2.22 ± 0.00	1	Few HHs in small area	Yellowish grains	*Small panicle*
Rato	0.04 ± 0.06	1.68 ± 45.23	5	Few HHs in small area	Red grains	Medicinal value (dadura)
Seto	0.08 ± 0.00	8.00 ± 0.00	1	Few HHs in small area	White grains	Late maturing

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.3.9 Beans

Bean (*Phaseolus vulgaris* L.) is a major grain legume (pulses) of this region and is grown for both consumption and commercial purpose. Although 28 varieties of beans were documented during district wide diversity fair, the baseline survey responses recorded community richness of only eleven varieties (Table 10). Beans are traditionally grown as a mixture of different varieties, harvested together and sold or consumed in mixture. However, there are also some of the varieties that are grown separately as they differ in maturity time compared to other varieties. Rato and Kalo beans are most common in Hanku as these are the local varieties and have better eating quality (Table 18). Population of Rato bean has been purified by NARC Jumla Station as PB0002.

There may be more varieties of beans in Hanku than farmers can actually name. As beans are grown in mixture, farmers do not separate them and give separate names for different varieties, and this is also one of the reasons why usually they come up with only names of two most common varieties by grain colour (rato and kalo) even though their mixture may contain more varieties in terms of shape, size and weight. In comparison, when preparing for diversity fair, farmers look for diversity and it is possible to farmers from different villages to come up with different names even for the same components of their mixture.

Since beans are also cultivated for commercial purpose, a lot of upland areas where proso millet and buckwheat used to be grown are now replaced by bean cultivation and apple orchards.

Table 18. Varieties of beans, their area, productivity and percent households growing in Hanku VDC

Variety	Area per HH (Ropani)	Productivity (kg/Ropani)	%HH	Four cell analysis	Key distinguishing traits	Functional traits
Bhote	1.00 ± 0.00	26.50 ± 6.50	2	Few HHs in small area	White and light pink seed, round shape	Drought tolerant
Kalo	0.96 ± 0.11	49.59 ± 4.90	37	Few HHs in large area	Black grain	Low yielding, tasty
Kalo Kirbire	1.10 ± 0.60	50.20 ± 3.14	2	Few HHs in large area	Black seed with white spots	Good eating quality, drought tolerant
Kirbire	1.24 ± 0.34	62.17 ± 21.15	5	More HHs in large area	Spotted bean	High yielding, good eating quality
Lamre	0.75 ± 0.00	44.00 ± 0.00	1	Few HHs in small area	Flat shaped pod and seed, Black	Vegetable purpose
Maale	0.69 ± 0.12	34.25 ± 5.27	4	More HHs in large area	Spotted	High yielding, good eating quality
PB0002	1.50 ± 0.00	40.00 ± 0.00	1	More HHs in small area	Big red grain	High yielding, consumable green pods
Rajma	0.62 ± 0.06	54.29 ± 20.00	3	Few HHs in small area	Red and white spotted seed, kidney shaped	Low yielding
Rato	1.12 ± 0.09	52.75 ± 4.36	72	More HHs in large area	Red colored flower pod and seed	Preferred for making soup
Rato Kirbire	0.43 ± 0.04	90.36 ± 19.42	3	More HHs in small area	Red colored seed with white spot	High yield
Seto	0.76 ± 0.16	37.44 ± 9.07	7	Few HHs in small area	White seed	Low yielding
Ralibali/ Chyasmisse (Mix)	2.04 ± 0.73	36.55 ± 5.09	7	More HHs in more area	Mixed population of variable seed colour, shape, size and weight	Good taste, drought tolerant

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 83 households in Hanku. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

4.4 Use of Amaranth and Buckwheat as Green Vegetable

Amaranth and buckwheat are crops that are also cultivated for leafy greens in many parts of Nepal. In Hanku however, amaranth is cultivated mainly for grain. Green leaves of wild amaranth is consumed by 30% of the households and there is no selling or buying of leafy vegetable of amaranth (Figure 9). Farmers do not consume greens of cultivated amaranth and they are also not aware of this use.

In case of buckwheat, 86% of the respondents mentioned consumption of buckwheat as leafy green vegetable although the number of farmers growing buckwheat is less. Most of the respondents might have answered consumption of buckwheat as they have consumed buckwheat greens at some point of their life although they do not cultivate it themselves. Very few farmers buy buckwheat from market. Usually people get buckwheat leafy greens from their neighbors or relatives who grow buckwheat.

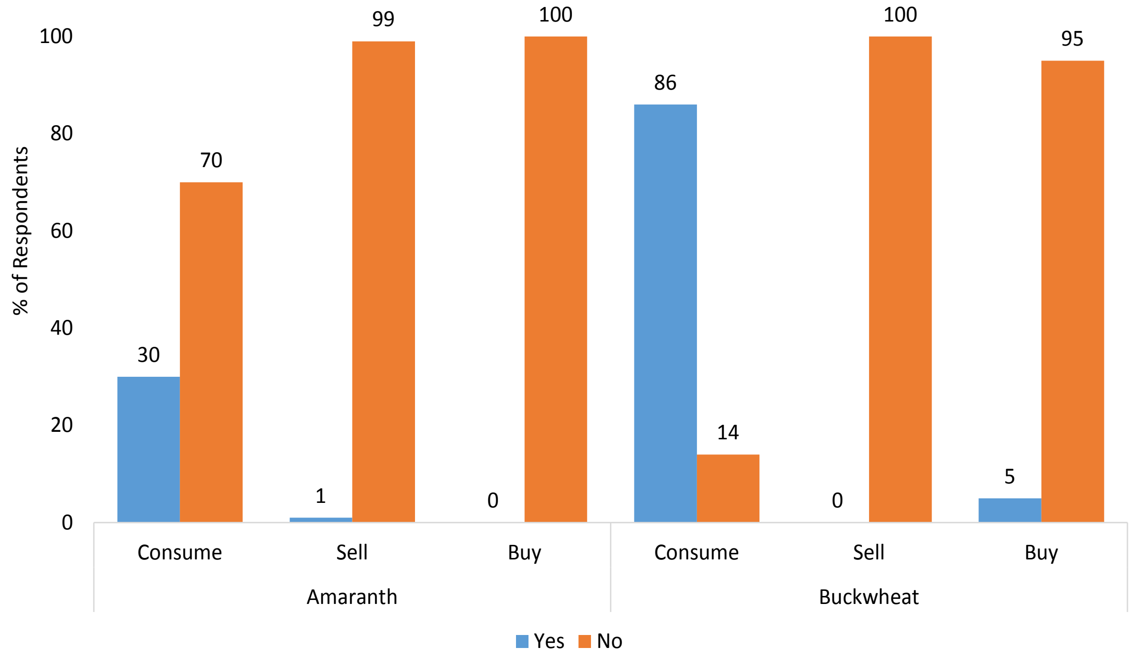

Figure 9. Use of amaranth and buckwheat as leafy green vegetables.

4.5 Seed Sources and Management practices of Mandate Crops

Farmers access seed through formal and the informal systems. A system is formal if seed in the system can be traced to who produced it and where. This is typically the case for certified seeds of notified varieties as they are sold with a label that allows for tracing to the source. On the other hand, a system is considered informal if the seeds are difficult to trace to the origin using a paper trail because they are not sold with a label. Seed can get to farmers through a variety of avenues. Agro-vets and public breeding programmes are more typical for formal seed system while farm saved seeds and farmer to farmer seed exchanges are more typical of informal seed systems. Local markets such as Haat Bazaar can be seed sources for both formal and informal sector depending on whether the seed is sold with or without label.

The seed system of mandate crops in Hanku is mainly on informal. While eight different seed sources were recorded, 77% of the seeds planted were farm-saved seed (Table 19). This is comparable to seed source diversity of Jungu in Dolakha and more diverse than Ghanpokhara in Lamjung and Chippra in Humla. In Hanku, reliance on outside seed sources (not farm-saved) were similar between Brahmin, Chettri and Dalit households (Table 19). In other project sites, Dalit households relied more on outside source than the average.

For amaranth, barley, buckwheat, finger millet, foxtail millet, and proso millet, all the seeds are informally sourced, almost exclusively as farm-saved or from the neighbours (Figure 10). Only rice and beans have greater diversity in terms of seed sources with agro-vet, government line agencies, local market (haat bazar) accounting for sourcing of 14% of beans and 23% of rice seeds. DADO in Jumla has been promoting improved varieties of rice and beans.

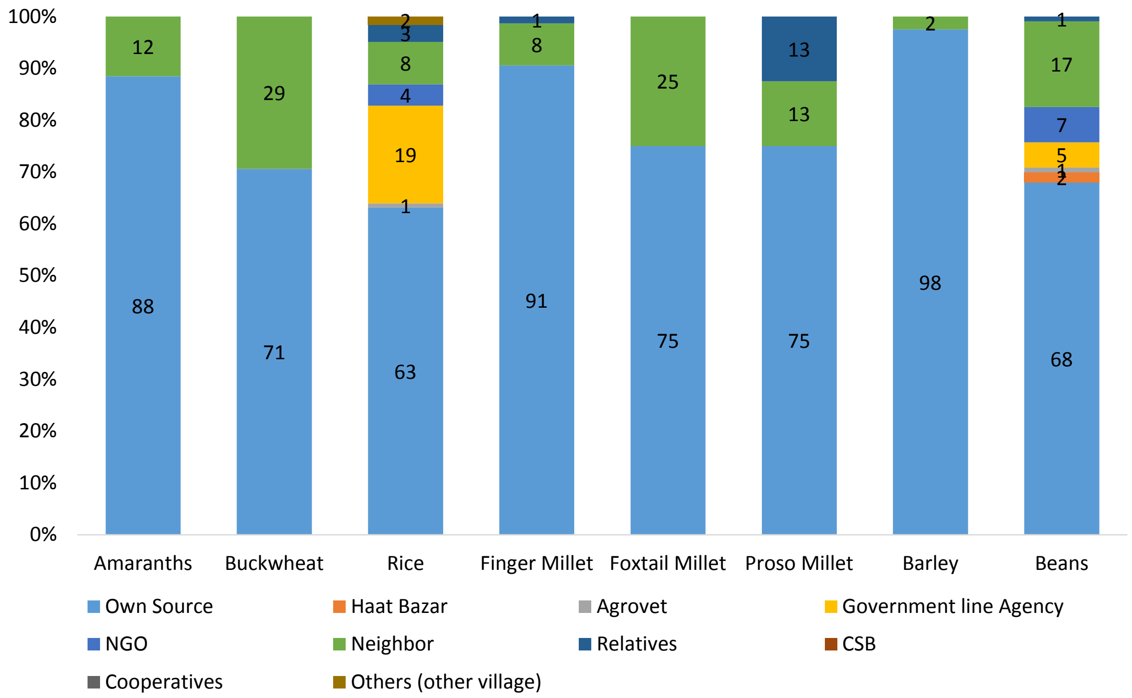

Figure 10. Seed source of mandate crops in Hanku.

Table 19. Frequency of seed sources used by ethnicity for planting decisions in a year.

Seed Source	Brahmin	Chettri/Thakuri	Dalit	Total
Own saved	128 (79%)	72 (78%)	137 (76%)	337 (77%)
Neighbours	16 (10%)	7 (8%)	22 (12%)	45 (10%)
Government	11 (7%)	7 (8%)	10 (6%)	28 (6%)
NGOs	5 (3%)	1 (1%)	6 (3%)	12 (3%)
Relatives	1 (<1%)	5 (6%)	1 (<1%)	7 (2%)
Haat bazaar	0	0	2 (1%)	2 (<1%)
Agrovet	1 (<1%)	0	1 (<1%)	2 (<1%)
Outside VDC	1 (<1%)	0	1 (<1%)	2 (<1%)

Figure in parenthesis is the percentage of the ethnicity's seed need met by the seed source.

Seed management practices by farmers was studied based on practice of variety selection, seed access, seed selection, harvesting, cleaning, storing and germination testing of seeds. Traditional methods in seed management of mandate crops is prevalent in Hanku (Table 20). Usually seed selection is not given much priority mainly due to lack of awareness about the difference between seed and grain. Seeds are usually not separated from grains from selection to storage for most of the mandate crops except finger millet.

The study shows that farmers have limited choice of varieties in mandate crops. Diversity in most of the mandate crops except beans is low and usually the choice is between few local landraces. The findings showed that farmers select variety for rice and finger millet, as these are major crops, though the selection/choice is limited within available diversity/landraces within community through exchange between neighbors and relatives. Harvesting is done manually with simple local tools like sickle. Threshing is also done manually using sticks or by rubbing by hand and/ or foot. Seed is dried under sun and is stored in traditional storage practices like *dahara*[13], wooden *bhakari* (bamboo reeds) and copper vessels. Some crops are stored in sacks and plastic bags while others are hanged on ceiling and wall using ropes (Table 20).

13 *Dahara* is a earthen seed storage pot which is used traditionally to store seeds and grains of different crops through out Karnali region

14 *Suppa* is a bamboo made traditional open type basket which is often used by Jumli female for winnowing of the crop after harvest. They lift small heap of amaranth in *suppa* and drop down to the ground while air is blowing from one side so that the inert material get separated.

Table 20. Seed management practices of mandate crops in Hanku

Crops	Variety Choice	Seed Choice	Seed Selection	Drying	Processing	Refining	Storage	Seed Monitoring	Germination Testing	Seed Access/ Exchange
Amaranth	Mainly rato marse is cultivated	Farmers' own-saved seeds.	No separate selection, whole plant/yield is harvested	Sun dried for 4-5 days.	Beating by sticks (also rubbed by hands).	Winnowing by *suppa*[14]	*bhakari*, *dhehari* or *dherra*, sack	-	-	-
Barley/ Naked Barley	Only one variety (Chawali)	Farmers' own-saved seeds.	No separate selection, whole plant/yield is harvested	Sun dried for 4-5 days.	Beating by sticks	Winnowing by *suppa*	*bhakari*, *dhehari* or *dherra*, sack	-	-	-
Bean	All varieties they have are cultivated in mixture.	Farmers' own-saved seeds. And sometimes seeds provided by Govt. and NGOs.	No separate selection, whole plant/yield is harvested	Sun dried for 4-5 days.	Beating by sticks (sometimes separated by hand as well).	Winnowing by *suppa*	*bhakari*, *dhehari* or *dherra*, sack)	-	-	Seeds are exchanged between neighbors/relatives to get good seeds.
Buckwheat	Among two local varieties (Tite and Mithe). Many prefer Tite over other varieties for higher yield.	Farmers' own-saved seeds.	No separate selection, whole plant/yield is harvested	Sun dried for 4-5 days.	Beating by sticks	Winnowing by *suppa*	*bhakari*, *dhehari* or *dherra*, sack	-	-	-
Finger Millet	Among two local varieties (Kalo and Rato). Some prefer Rato *Kodo* over other varieties for higher yield.	Farmers' own-saved seeds.	Best panicles are selected and harvested separately on field.	Sun dried for 4-5 days.	Beating by sticks (*mungro*)	Winnowing by *suppa*	*bhakari*, *dhehari* or *dherra*, sack	-	-	Seeds are exchanged between neighbors/relatives to get good seeds.
Foxtail millet	Just one variety (cultivate whatever variety they have).	Farmers' own-saved seeds.	No separate selection, whole plant/yield is harvested	Sun dried for 4-5 days.	Beating by sticks (also rubbed by hands).	Winnowing by *suppa*	(*bhakari*, *dhehari* or *dherra*, sack).	-	-	-

Crops	Variety Choice	Seed Choice	Seed Selection	Drying	Processing	Refining	Storage	Seed Monitoring	Germination Testing	Seed Access/ Exchange
Proso millet	Among two local varieties (haade and dudhe). Many prefer haade over other varieties for higher yield and less shattering.	Farmers' own-saved seeds.	No separate selection, whole plant/yield is harvested	Sun dried for 4-5 days.	Rubbed by hands/legs.	Winnowing by *suppa*	(*bhakari*, *dhehari* or *dherra*, sack).	-	-	-
Rice	Three varieties are common: Jumli Marshi, Chandannath-1 and Chandannath-3. Farmers usually prefer local variety (Jumli Marshi) over improved ones as it tastes better and is easier to thresh.	Mostly farmer's use their own saved seeds; if they decide to plant other variety, they usually get it from neighbour, relatives and GO & NGOs.	Selection is usually not done (only when their field is destroyed by blast or some other disease, they search for seeds from neighbors).	All harvest is sun-dried 2-3 days before threshing.	By beating bunches of tied rice stalks on ground for Jumli Marshi or on rocks for improved varieties	Cleaned by winnowing by *suppa*	*bhakari*, *dhehari* or *dherra*, sack. *Dhehari* are usually sealed so that the grains are safe from mouse and dhan putali (rice moth).	Usually seeds are not monitored; however during storage some keep powder of titepati to prevent insects/ pests	For rice, germination testing is done and seeds are kept in nursery beds only after proper germination.	Seeds are exchanged between neighbors/relatives to get good seeds (esp. when their rice this year has disease). Newly established CSB but has not done more work on access. No agrovets in the VDC.

Source: Ward level community group discussions and key informant interview 2014.

4.6 Harvesting and Post-harvest Techniques of Mandate Crops

Harvest and post-harvest handling of crops is traditional and vulnerable to pest infestation in Hanku. Indigenous knowledge on post-harvest handling and processing are summarized in Table 21. Most of the crops are harvested during September-October expect winter crops such as barley and naked barley (harvested in May-June). Farmers are very busy during the harvest season with involvement of all family members (men, women and even children) for major crops (rice and barley) in activities like harvesting and threshing while children help them in arranging rice stalks and carrying the harvest back home.

Sickle is the most commonly used tool for harvesting. Threshing is carried out by either beating on ground or beating with stick (*lauro*[15] and *mungro*[16]) for most of the crops except proso millet which can be easily threshed by rubbing the panicles by hand or leg. Finger millet is a difficult crop to thresh as twice much effort is required. Harvested heads have to be left outside the house usually on the roof in a pile (*kunyo*) for 10-30 days depending on the quantity of finger heads to loosen the grains from the heads. After sun drying for 2-3 days, threshing is done by threshing the heads with a stick (*lauro*) and grains are separated by winnowing (in *suppa*). To get remaining grains, the threshed heads are sieved through a locally made sieve called *chanllo*. Finally the sieved heads are again beaten by a *mungro* get the rest of the grains.

Processing, mainly dehusking is done in traditional *okhal*[17] which is laborious and source of great drudgery to women. Three rice mills are available in Hanku for easier dehusking of rice. A modern rice mill is available in ward 6 that is specially for dehusking of rice. About 250 HHs in Hanku use this rice mill. There are two other rice mills for dehusking of rice in wards 3 and 4 powered by generator but people rarely use it as they prefer rice milled in *okhal*. Some households use the facility while most prefer milling and dehusking rice in *okhal* for better eating quality. Dehusking of proso millet and foxtail millet is more difficult. These millets have to be sun dried, followed by parboiling for about half an hour to one hour, drying once again and then only it can be processed in *okhal*. Grinding is done using stone made traditional equipment. There are two slabs of the stone, one slab of stone is mounted over another having rough surface carved by the local people. Top slab of stone is used to scrub the whole grain of the crop using hand to make flour.

Traditional and improved watermills are also available that reduce the time required for flouring. There are about 15 traditional and modern water mills located in various wards of Hanku for dehusking and flouring. Usually traditional mills are owned by a farmer who takes a small amount of the crop processed as a charge for using the mill. Modern mills are owned by a group of farmers. They take turns to run the mill. For members of the group, processing is free of cost while for others, the person whoever is taking the turn takes small amount of crop processed as a charge. In Hanku, people from other VDCs also come to use the mill as they can be operated even in dry season.

Grains are stored mainly in traditional storages called *bhakari*, *dhehari* or *dherra*, and sack. *Dhehari* are usually sealed so that the grains are safe from mouse and other insects. When necessary, grains are taken out, dried in the sun for about two days and processed in either mill or *okhal*.

15 *Lauro* is a long stick prepared from branch of khasru (*Quercus semecarpifolia*) tree. The stick is bent on one side by heating over fire for easier use.

16 *Mungro* is a short stick prepared from wood which has a big flat head for beating and a short handle. It resembles a paddle with big head.

17 *Okhal* is usually prepared on a big stone by carving a hole. Some people also use *okhal* prepared from wood. A long cylindrical piece wood (with or without metal surrounded on the base depending on the grain) is used to process grains in *okhal*.

Table 21. Post-harvest practices in Hanku VDC

Crop	Dehusking/ Pearling of grains	Flour	Split, cracking, groats	Processing Facilities: processing equipment; their accessibility; problems associated		
				Threshing	Dehusking	Flouring
Rice	Yes. Grains are used to make bhat, kheer.	Yes. Flour is prepared sometimes to make *selroti*.	No	By beating/striking bunches of tied rice stalks on ground/ stone. Usually for Jumli Marshi rice, beating on the ground separates grain from panicle easily but improved varieties like Chandannath-3 requires beating against stone. Winnowing by *suppa* is performed to remove any straw chaff and other foreign materials from the grain.	*Okhal* is the major dehusking tool. Three rice mills are available in Hanku for easier dehusking of rice. Some households use the facility while most prefer milling/dehusking rice in *okhal* for better eating quality.	Using *okhal*.
Finger millet	Yes. Grains are dehusked for flouring.	Yes. Flour is used to make flat bread (*roti*).	No	By beating with a long stick (*lauro*) after keeping the finger heads in a pile (*kunyo*). And those not separated are sieved by challo and again beaten by short stick with flat head called *mungro*. Threshing of finger millet is labor intensive and time consuming.	Using *okhal*.	In water mill (ghatta) There are about fifteen traditional water mills about four modern water mills in Hanku.
Foxtail millet	Yes. Grains are used to make bhat, kheer.		No	By beating with a long stick (*lauro*).	Parboiling for about half an hour to one hour followed by drying and then processed in *okhal*.	No
Proso millet	Yes. Grains are used to make bhat, kheer.		No	Rubbing the panicles by legs.	Parboiling for about half an hour to one hour followed by drying and then processed in *okhal*.	No

Crop	Dehusking/ Pearling of grains	Flour	Split, cracking, groats	Processing Facilities: processing equipment; their accessibility; problems associated		
				Threshing	Dehusking	Flouring
Amaranth	Grains are toasted to prepare different snacks (toasted grains, laddu) without dehusking.	Yes. Flour is used to prepare *roti*.	No	Manually by rubbing with hands. In larger amount, rubbing by legs is also performed.	No	Flouring is done either at home using silauta or at water mill (ghatta).
Barley/ Naked Barley	Yes. Grains are dehusked for flouring. For feeding livestock, grains are usually not dehusked.	Flour is used to make roti and saatu (mainly naked barley).	No	Beating with a long stick (lauro) and trampling bullocks.	Using okhal. Naked barley does not need to be dehusked.	In water mill (ghatta).
Beans	Yes. Beans are dehusked to consume (geda khane).	No	Split in half to make daal in silauta or ghatta.	Beating with a long stick (lauro).	Beating with a long stick (lauro).	No

Source: Ward level community group discussions and key informant interview 2014.

4.7 Major Production and Post-production Constraints

Hanku lies in high Himalayan range and in recent times has become vulnerable to changing climate and adverse weather conditions. Temperatures and the incidence of pest and diseases have increased. Drought has been a limiting factor for agriculture production. Wild animals have hampered production in fields near forest. The major post production constraint is threshing, milling and grinding (Table 22). Women are mostly responsible for these activities and hence experience great drudgery.

Table 22. Major production and post-production constraints in mandate crops

Crop	Production constraints	Post-production constraints
Amaranth	Shattering loss	Need to raise awareness on its nutritional value and consumption. Lack of market linkage and post-harvest technology
Barley and Naked barley	Loose smut and yellow rust is common	Diversity and seed of naked barley not available in local seed system
Beans	Damaged by improper and untimely drainage due to unpredictable heavy rains in some years; drought during flowering stage; susceptible to disease like rust, anthracnose and leaf spot; lack of technical knowledge for commercial production.	Need proper marketing with packaging and grading
Buckwheat	Downy mildew is common	Problem in threshing and grinding.
Finger millet	Difficult in weeding, labour intensive	Laborious to thresh.
Foxtail millet	panicles are cut and taken by snakes to lure prey; only intercropped with finger millet in directly sown areas.	Difficult to dehusk; difficult to protect harvest from rats; need to raise awareness on its nutritional value and consumption.
Proso millet	high shattering problem	Difficult to dehusk; need to raise awareness on its nutritional value and consumption.
Rice	Jumli Marshi is highly susceptible to blast, also is more likely to be damaged by hailstones	Difficult to thresh (Chandannath-1 and Chandannath-3); damaged by rats, rice moth (dhan putala) in storage .

Source: Ward level community group discussions and key informant interview 2014.

4.8 Marketing (buying and selling) Practices and Trend in Mandate Crops

In general, local trade (buying and selling) of most of the mandate crops except rice and beans is rare in Hanku. According to the household survey, crops such as amaranth, foxtail millet, proso millet, and naked barley are not traded at all. Rice and beans are exception with about 86% of the respondents purchasing 334 kg rice on average per year and 43% of the respondents purchasing 59 kg beans on average per year for household consumption (Table 23).

Rice is mainly purchased to supplement the lack of production and availability of local rice. The Jumli people use the name "white rice" to refer to most polished rice that was subsidized and distributed through the Nepal Food Corporation (NFC) and the World Food Programme (WFP) in the past during periods of high food insecurity. It is now widely available in the market, is one of the most commonly purchased goods. The name conveys the contrast with the traditional Jumli Marshi rice that has red grain colour.

Beans are traded by individual households through co-operatives and individual traders during the season or bartered with rice. Beans are purchased by households with lower production for consumption.

Table 23. Quantity of mandate crops being purchased by respondents for consumption

Crop	% HHs	Quantity purchased per HH/ year (kg)		
		Average	Min	Max
Rice	86	334	30	870
Beans	43	59	3	200
Barley	13	131	50	300
Finger Millet	10	84	30	200
Buckwheat	2	6	1	10

4.9 Training and Awareness

Only five percent of the respondents have received training on mandate crops from DADO, VDC or NGOs. All the trainings have been on rice and beans, which priorities for farmers as well as government research and extension offices.

Only thirteen percent of the respondents know that Nepal Food Corporation has started purchasing local crops especially from Karnali region that are produced there. Just five percent people have received Farmers Field School (FFS) training (Figure 11). Although a community seed bank, namely, Jalpa Devi Community Seed Bank has been established in Hanku in 2014, only four percent people have knowledge about community seed bank.

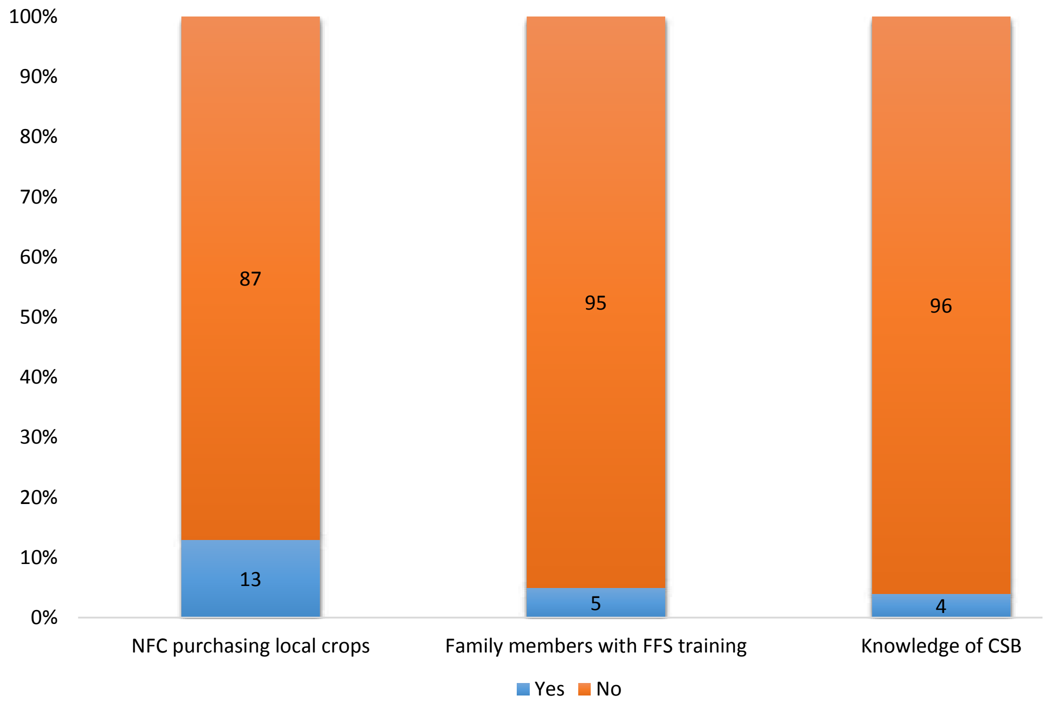

Figure 11. Training and awareness of respondents.

4.10 Locals' Perception on Promotion and Conservation of Local Crops

Over 90% of the respondents mentioned the necessity of promotion of local crops. This concern for promotion of local crops mainly comes from their traditional importance, high medicinal and nutritional value, and good eating quality. Highest percentage of households (55%) shared their interest in conservation of beans (Figure 12) followed by buckwheat (52%), rice (47%) and finger millet (45%). Bean is an important crop traditionally which is also gaining popularity for commercial production. Farmers' preference for conservation of amaranth, barley, foxtail millet and proso millet was found to be lower than other crops because these crops are not given equal preference. Potato and wheat were also other two crops mentioned by farmers for conservation in addition to mandate crops.

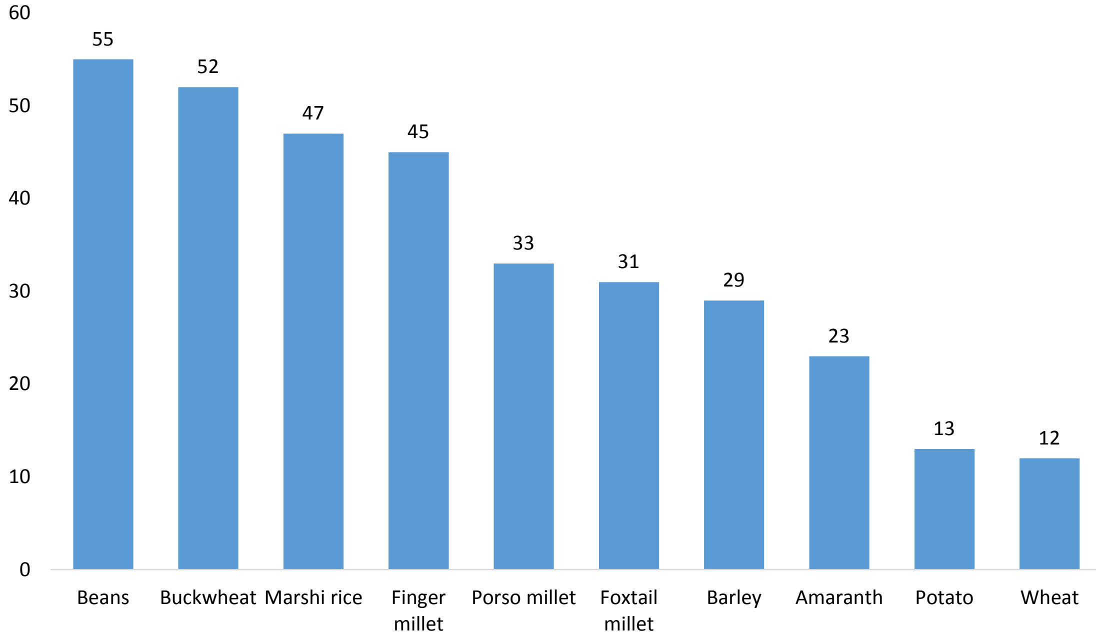

Figure 12. Percentage of respondents showing interest in conservation of various local crops.

4.11 Local Institutions/Organizations in Hanku

In contrast to large numbers of I/NGOs working in various parts of Karnali region, there are rather few organizations working in Hanku VDC especially in biodiversity and agriculture sector. Among the programs launched, majority are focused on women's empowerment, human rights and income generation for livelihood improvement (Table 24). Two major programmes ongoing in Hanku (since 2015) are Local Adaptation Plan of Action (LAPA) implementation by the Government of Nepal and Nepal Climate Change Support Programme (NCCSP) and Agriculture Food Security Programme (AFSP) by the Government of Nepal.

Table 24. Organizations / Programmes in Hanku.

SN	I/NGOs / Programmes	Objective and working area
1.	Partnership Aid Center-Nepal (PACE Nepal)	Local NGO registered in Jumla (2006); works in the sector of human rights; help conflict management for victims (women and children)
2.	Bheri Environmental Excellence Group (BEE-Group)	NGO working in Jumla primarily in field of social justice, peace, environmental conservation, and community development; various activities for community support and women empowerment through the WELI[18] project; establishment of community seed bank; income generating activities; active projects in Hanku between 2009-2015.
3.	Poverty Alleviation Fund (PAF)	Poverty Alleviation Fund (PAF) established by Government of Nepal in 2003 through a succession of IDA grants from the World Bank; major objective is to reduce extreme poverty in Nepal and build a democratic, just, equitable and sustainable society; group formation and community mobilization; saving, credit & empowerment; income generation activities; revolving fund; worked in Hanku between 2005-2010.
4.	Nepal Climate Change Support Programme (NCCSP)	Implementation of LAPA in Hanku since 2015 in collaboration with district Government line agencies to help local communities adapt to the effects of climate change.
5.	Agriculture Food Security Programme (AFSP)	Programme jointly implemented by government line agencies; enhance food and nutritional security of target communities by increasing productivity of agriculture (both crop and livestock) and improving dietary intake; Hanku is one of the project sites of AFSP in Jumla since 2015.

Source: Ward level community group discussions and key informant interview 2014.

18 WELI (Women Empowerment & Livelihood Improvement) Project implemented by BEE-Group in Talium, Lamra and Hanku VDCs of Jumla is supported by Italian Foundation, FRL Nepal. The programme supports for various activities for women empowerment such as workload reduction, sexual and reproductive health support, and food and nutritional security.

Number of community level farmer's groups and/or institutions are formed in Hanku mainly for saving and credit, fruit and vegetable production and management of community forests. Saving and credit groups, mostly established in facilitation through implemented programmes, are common who are actively conducting their regular activities. However, their scope is limited to 1-2 wards. Mother's group, ward citizen forum, and Community Forest User Groups (CFUGs) are also functional and active. On the other hand, farmer's groups established mainly for agriculture related activities are mostly inactive. It is typical for these groups to become dormant after conducting one or two activities. As a whole farmer's groups and local organizations in the VDC are not very strong (Table 25).

Table 25. Local groups and community based organizations in Hanku

S.N.	CBOs / Local Institution	Scope (VDC/ Ward)	Background and Establishment	Objective and Working Area	Status
Community Based Organizations/ Local Organizations					
1.	Kailash Samudayik Sanstha	Ward 5,8	Local group; established by PAF (2063-2067) to implement revolving fund for various income generating activities; an NGO, BEE-Group also worked with them.	Monthly saving and credit; various activities for women empowerment (WELI Project by BEE-Group).	Active
2.	Bhadadik Samudayik Sanstha	Ward 8,9	Local group; established on self-initiative for savings collection in 2060 with only 5 members; an NGO, BEE-Group also worked with them.	Monthly saving and credit; community activity; various activities for women empowerment (WELI Project by BEE-Group).	Active
3.	Namuna Dalit Samudayik Sanstha	Ward 3,4	Local group; established by PAF (2063-2067) to implement revolving fund for various income generating activities; an NGO, BEE-Group also worked with them.	Monthly saving and credit; community activity; various activities for women empowerment (WELI Project by BEE-Group).	Active
4.	Naya Malika Samudayik Sanstha	Ward 1	Local group; established by PAF (2063-2067) to implement revolving fund for various income generating activities; an NGO, BEE-Group also worked with them.	Monthly saving and credit; community activity; various activities for women empowerment (WELI Project by BEE-Group).	Active
5.	Pancheshowr Multipurpose Co-operative	Hanku and other VDCs in Jumla	Co-operative covering 10 VDCs in Jumla.	Saving and Credit, selling of beans; seed production of potato.	Active
6.	Jalpa Devi Community Seed Bank	Hanku VDC	Local organization; established by an NGO, BEE Group (2014) through WELI Project.	Collecting seeds of local crops and distributing in community.	Active
7.	Masta-Madu Debit and Credit Cooperative	Ward 5,6	Local group; established on self-initiative for savings collection.	Monthly saving and credit.	Active
Farmer's Groups					
8.	Mother's Group (*Aama Samuha*)	Hanku VDC	Volunteer women's group; groups in all wards.	Traditional cultural programmes; social work; improve women's lives.	Active

9.	Ward Citizen Forum	Hanku VDC	Ward level group of local people (in absence of ward level formal committee); groups in all wards.	Forum for discussion of local issues; ward coordinator presents issues and raise needs in VDC level discussion.	Active
10.	Dalit Group	Hanku VDC	Farmer's group; established through National Dalit Kalian Parisad.	National Dalit Kalian Parisad	Active
11.	Deurali Potato Production and Saving Farmers' Group	Ward 2	Farmer's group; established on self-initiative.	Seed production of potato; monthly saving.	Not Active
12.	Poor Farmers' Group	Ward 5,6,7	Farmer's group; established on self-initiative.	Monthly saving.	Not Active
13.	Bhurichyula Fruit Production Farmers' Group	Ward 3,4	Farmer's group; established mainly for saplings collection from Government Agencies and a small irrigation project.	Fruit production; sapling collection from Government Organizations.	Not Active
14.	Gautam Fruit Production Group	Ward 1	Farmer's group; established on self-initiative.	Fruit production.	Not Active
15.	Bhandar Forest and Vegetable Farmer's Group	Ward 5,6	Farmer's group; established on self-initiative.	Vegetable production.	Not Active
16.	Kalika Fruit Production Farmers' Group	Wards 3,4	Farmer's group; established on self-initiative.	Fruit production.	Not Active
17.	Jharana Dalit Fruit Production Farmers' Group	Wards 3,4	Farmer's group; established on self-initiative.	Fruit production; maintenance of irrigation system from DADO with financial support from DADO.	Not Active
18.	Bhurichyula Farmers' Group	Ward 1	Farmer's group; established on self-initiative.	Fruit production; distributed saplings of apple.	Not Active
19.	Punarmilan Farmers' Group	Ward 5,8	Farmer's group; established on self-initiative.	Saving and credit, however only 7 out of 15 members are active; irrigation project.	Active
Community Forest User Groups					
20.	Gautambada CFUG[19]	Ward 1,2	Farmer's group; established through Community Forest Programme.	Sustainable management of community forest.	Active
21.	Chaupat CFUG	Ward 3,4	Farmer's group; established through Community Forest Programme.	Sustainable management of community forest.	Active
22.	Thalachaur CFUG	Ward 8,9	Farmer's group; established through Community Forest Programme.	Sustainable management of community forest.	Active
23.	Jalapa Devi CFUG	Ward 5,8	Farmer's group; established through Community Forest Programme.	Sustainable management of community forest.	Active

Source: Ward level community group discussions and key informant interview 2014.

19 Community Forest User Groups (CFUG) operate Community Forests and its activities related to the protection, production and distribution of forest products for sustainable management of forest resources. Community Forest is a participatory forest protection and management approach where local community play a significant role in forest management and land use decision making by themselves in the facilitating support of government and other stakeholders.

5. DISCUSSION

5.1 Socio-economic and Demographic Context

Dalit, Brahmin and Chettri are the resident ethnicities in Hanku. Dalit is historically disadvantaged and socially excluded group. Even though Dalit are the largest group of people living in Hanku (41%), the community is clustered in only two/three villages (Hanku in ward 3, Niyapani in ward 9, and Jaitpur ward 1). The area of land holding of Dalit community is low in comparison to other communities of Hanku, they usually take land on lease to earn income. Higher land holding leads to higher probability of maintaining on-farm diversity. Similar findings reported earlier by Rana et al., (2007). They are also likely to have fewer livestock resources than other ethnicities.

People with small land holdings and low food security usually migrate to India prior to the start of the food-lean period and return during the crop harvesting period. While migration is less common in Hanku compared to other sites, the trend of migration in Dalit community is greater than other ethnicities. This trend shows the lack of occupation opportunity in Dalit community apart from the agriculture (Figure 5). Push factors for seasonal migration are the traditional practice of travelling to sell off handmade garments, lack of local employment, low agricultural productivity, limited crop season, freezing temperatures, herb collection and natural disasters; pull factors include high wages in non-agricultural employment and business opportunities in India, particularly in Uttarakhad and Himanchal Pradesh (UN, 2012). The practice of seasonal migration for herb collection is not very common.

5.2 Cropping System and Diversity of Mandate Crops

Farmers in Hanku generally grow two crops per year. In low land they grow rice and finger millet in the summer followed by barley, potato or fallow in the winter. In the upland they grow beans, finger millet, maize, potato and proso millet in the summer and barley, wheat or fallow in the winter. The upland summer crops are grown based on their needs and availability of seeds. Uplands are usually dry and lack irrigation facilities whereas lowlands are irrigated.

Traditional landraces remain superior on the poor, unirrigated and upland *bari* land conditions and serve as the basis for further crop improvement. In the high hills, diversity is reduced by selection pressure of chilling temperature. This has been observed in Hanku. There are no modern varieties for mandate crops other than bean and rice and even the number of landraces are limited except in the case of beans.

The choice of crop and landraces in Hanku is largely determined by what is planted in the neighbouring fields. This is important mainly to fit within the common harvesting time followed by open grazing of livestock. Hence, introduction of new varieties will also need to fit within prevailing practice of common harvesting schedule with your neighbours.

Farmers maintain and select various landraces not only based on local environments, but also based on their management practices, production and quality traits (e.g. yield and taste), and post-harvesting and processing traits (e.g. easy threshing, straw quality, climate resilience, disease and pest resistance, and drought tolerance). However, choice of variety and preferred traits vary from farmer to farmer, making the availability of a wide range of varieties an important resource.

Richness is a measure of the diversity available in an area. The extent of varietal diversity cannot be assessed only by farmer named varieties because the same variety may have different names depending upon locality (Rana et al., 2000). Thus, the very first step in accessing and characterizing local diversity with tools available such as diversity fairs, diversity block. Richness of beans is high in Hanku followed by rice. Farmers of Hanku or Jumla grow bean as one of the important cash crop. They primarily grow bean in mixture as they believe mixture bean have good taste and better chance to survive environmental adversity. Barley has the lowest varietal richness among the mandate crop and this result accords with the findings of Bajracharya et al. 2012 where she describes medium to low diversity of barley varieties.

Evenness measures how evenly diversity is distributed in an area (i.e. its distribution pattern). The higher the value of the evenness index on a scale of 0-1, the more uniformly the diversity is distributed, which indicates that no variety or species is dominant over others. A community with a high evenness index can be interpreted as a sustainable community in terms of diversity distribution. However, in Hanku, no mandate crop has high evenness with exception bean (0.336) which shows that farmers predominately cultivate single preferred variety among others (Table 10).

5.3 Use of Mandate Crops

Farmers grow Amaranth typically as a border crop of their finger millet fields. It hasn't been used as staple food in those communities but rather as sacred food for religious purpose and an occasional snack food. Consumption of amaranth as a leafy vegetable is not common in Hanku.

Hulled barley is an ancient crop in Hanku and almost all households continue to grow it. Growing barley means farmers do not have to leave their fields barren. Hence, they cultivate it year after year despite of its lower use as food and market value. Additionally, its vegetative part is used as major fodder to feed their cattle as they believe it boosts their strength during the rice planting season when the cattle are used for ploughing. Market linkage for this mandate crop would greatly benefit the community that is already growing this crop. Naked barley is not cultivated in Hanku.

In the high mountains where food is deficient and agricultural land is limited finger millet is an indispensable part of farming system (Subedi et al., 2009). Finger millet cover around 9% of total cultivated area of our country (Upreti, 2002). In Hanku finger millet is grown by most households. Rato *Kodo* is the most preferred variety among the varieties grown. It has good adaptation, taste, high production, early maturity, less shattering problem and straw is preferred by cattle. Average productivity of Rato *Kodo* is 1.94 t/ha which is greater than national average productivity of finger millet at 1.11 t/ha (MoAC, 2010).

Finger millet flour is used make *roti* for breakfast in Hanku. Finger millet is a neglected and underutilized crop in Nepal despite possessing promising nutritional and industrial potential. Moreover, local promising landrace such as Rato *Kodo* can be improved through grassroots breeding (pre-breeding) and promoted and used for further breeding.

Bean is an important cash generating crop in Jumla and adjoining hilly districts, where mixtures of landraces with different size and seed coat patterns are harvested and sold in the market (Shrestha et al., 2011). Almost every households of Hanku cultivates bean, typically in a mixture. Only a few of the varieties are early maturing and are grown separately. In recent years, farmers have started growing bean varieties such as Kalo and Kalo Kirbire separately following the promotion by research and extension. These varieties have good market value due to their taste and popularity. But during an experiment in ARS, Bijaynagar, Jumla grain yield was significantly higher and disease infection was lower in mixtures than in monoculture (Prasad et al., 2016). However, currently the mixture of bean sells 10-25 rupees cheaper than pure bean of Kalo Sano and Kalo Maale varieties. Main reason behind the mixture bean cultivation practice was the taste of the mixture bean, the diversity minimizing the risk of crop loss i.e. if one variety of bean fails to yield other will compensate. Hence, promotion of beans marketed as mixture can be win-win from the perspective of minimizing production risk, maintaining diversity and cornering the Himalayan bean market.

Farmers cultivate crop such as proso millet and foxtail millet very rarely these days. While some varieties of these crops are valued for taste and drought tolerance, farmers are not cultivating these crops because of changing food habit with easier access to white rice. These crops also require laborious post-harvest processing.

5.4 Management Practices of Mandate Crops

Farmers' traditional knowledge and practices play an important role in the conservation and use of neglected and underutilized species like amaranth, buckwheat, foxtail millet, and finger millet. Famers continue to save and plant some varieties due to their religious, cultural and medicinal value. Amaranth is considered as sacred crop and used in offerings during swasthani puja. Tite phapar (buckwheat) has medicinal value for diabetics and Jumli Marshi rice is preferred in cultural rituals including marriage ceremonies.

All the surveyed households cultivated rice and dedicated the largest area per household. Jumli Marshi is a most preferred variety of rice in Jumla. Cultivation practice of rice in Hanku is rather unique compared to other districts that begins with soaking the seeds in water on 12 Chaitra (see section 4.3.5).

Barley is another major crop grown in large average area followed by beans and finger millet. Finger millet is cultivated in two ways; direct seeding and transplanting the seedlings. Farmers having land and enough seeds prefer direct seeding method but farmers with small land holding and low amount of seed prefer seedling transplantation in the land where they grow Barley during cold winter of previous season. In case of Bean, farmers use both upland and low land for cultivation. Broadcasting is done for sowing seed followed by tillage in most of the cases, meanwhile during its vegetative stage hand weeding is done.

5.5 Seed System of Mandate Crops

Seed systems of mandate crops are informal and mostly based on farm-saved seed. As a result, farmers' knowledge and management practices like selection, harvesting, drying and storing play a key role in determining seed quality and ultimately production and genetic resource base. The seed selection from standing crop is crucial in assuring seed quality since farmer selects best (full grained and disease free) panicle and also helps in maintaining varietal purity by positive selection. Although during FGD farmers reported performing seed selection of rice, finger millet and foxtail millet from standing crop by selecting phenotypically good and disease-free panicles, it has not been further validated what percentage of farmers actually practice this. Since females are responsible for handling, selecting, and storing seed, increasing their knowledge on seed management practices and training them on basic criteria of seed selection should be another area of project intervention that ultimately helps to improve the seed system of these mandate crops.

In developing countries, 60-100% of the seed systems are farmer managed, depending on the crop. Farmer managed seed systems have a significant role in allowing landraces/varieties to evolve in a local environment, thus making them important contributors to the management of global plant genetic resources for food and agriculture (Almekinders and Louwaars, 2002). Thus, seed systems have to be healthy, as defined by four major criteria: seed knowledge base, availability of diverse seed, seed quality/purity, and ease of access. The present scenario shows poor connection between the formal and informal seed sector. Both the formal and informal seed systems have to be linked and interconnected so that they can supplement each other. The formal system gets material from farmer managed seed systems as it is rich in genetic diversity due to its continuous evolution, while informal seed systems can develop varieties based on farmer preferences and agricultural domain bases and farmers can benefit from a diverse portfolio of seeds for different domains. There is no engagement of seed producer group and seed company in local crops. The limited government extension programmes and NGO efforts seems insufficient. The bottlenecks to seed access need to be identified and addressed. Farmers predominantly rely on self-saved seeds for mandate crops and there is little introduction of new diversity or replenishment of lost diversity. The project can identify and work with custodian farmers, seed producer groups and train them to meet the demand of the community by formalizing seed system in Hanku. This will create opportunities for the local farmers to select from a wide range of mandate crop varieties according to their needs.

5.6 Key Constraints and Possible Intervention

Mandate crops have their own identity, nutritional and cultural values and associated traditional knowledge in Hanku. Documentation and raising awareness of such knowledge can contributed to conservation on farm as well as marketing of these crops to urban consumers who will be better connected with road access. Raising awareness about the importance of local crop can be done through learning forums such as Community Seed Bank (CSB) and Diversity Field School (DFS) so that farmers could recognize importance of these traditional and valuable crop in their nutrition and livelihood.

The changing climate is another reason that farmers will need to keep a diverse portfolio of traditional/mandate crops. The consequences of increased temperature and irregular rainfall pattern have resulted in occurrence of diseases/pest in mountain ecosystem having adverse effect on agricultural production. Increase in temperature has opened revenue for introduction of new agrobiodiversity, whereas negatively resulted in loss of existing diversity (Parajuli and Upadhayay, 2016). Hence a wider awareness of how diversity can be deployed to deal with adversity is also needed.

Greater awareness can only make farmers and stakeholders realize the importance of these crops. However, specific bottlenecks and constraints in the production and processing of these crops need to be addressed to reverse the trend of slow abandonment of these crops. The national census of 2011 revealed that the area under cultivation of crops like finger millet, barley, and buckwheat has significantly decreased by 19%, 35% and 40%, respectively in the 10 years since the last census (CBS, 2011).

Rice, bean, barley and finger millet are the more common mandate crops cultivated in Hanku. Proso millet, foxtail millet, naked barley, and buckwheat are less common. Cultivation of bean gets more priority from these days due to its economic value and market demand. Road access to Jumla has increased the scope commercial farming of bean. Cultivation practices used by farmer for cultivation of bean are very simple and easy and less soil nutrient demanding. Farmers prefer broadcasting during sowing, one time weeding and generally don't use fertilizer and irrigation for its cultivation. Beans have the greatest amount of diversity and there is an opportunity to market this diversity.

Rice is the major source of food and consumed in daily diet as a source of protein and is the major crop grown in the monsoon season. People of Hanku prefer Jumli Marshi over other varieties despite of its susceptibility towards the rice blast because of its early maturity, small plant height and good taste. Chandannath-1 and 3 are the two improved varieties of rice grown in Hanku.

While some farmers prefer Jumli Marshi for its taste and as part of their tradition, the fondness for Jumli Marshi may erode with the changing food habit that prefers white rice. Hence, varietal improvement of Jumli Marshi that makes it blast resistance and preserves its taste and colour is needed.

The case of beans shows that market linkage and improved or easy cultivation and processing practices are needed for all mandate crops. The case of rice shows that improved varieties are continuously needed for mandate crops. This can be achieved by selection from existing cultivation, introduction of new varieties and breeding of new varieties on a crop by crop basis. Most of the mandate crops also need improvement in processing technologies.

5.7 Processing Tools, Techniques and Services in Mandate Crops

Processing tools for mandate crops does not seem to be keeping up with the transformation of Jumla after road access. Flouring is done using water mills are powered by small streams to turn the grindstone against a fixed stone floor. Nowadays wooden turbines in water mills are being replaced by metal turbines with the support of GOs and I/NGOs. Stone mortar (*okhal*) is also used to de-husk rice and proso millet. Grinding of beans is done on a daily basis for each meal using *okhal*. These are time consuming and labour intensive processs. Processing of food is a major source of women's drudgery in Hanku, Jumla. Chandannath municipality has few processing mills which do milling of rice and wheat, but these technologies have been limited to Chandannath municipality only. There is scope of bringing appropriate technologies that can reduce time and effort for processing, thus reducing women drudgery. Improved processing technologies can help to increase quality of the local crops by removing inert materials like grit, husks and bran, making the product appealing. Improvement in processing tools also provides input to value chain of the local crop and promotes market of these crops. With easy access to polished rice and milled wheat flour in the market, it is going to be important for processing facilities of mandate crops to improve for their continued cultivation.

5.8 Institutional Setting and Awareness level in Conservation of Local Crops

The rate of agricultural development in Nepal has been slow (about 3%) and highly variable (ADS, 2014). While majority of the population are engaged in agriculture, productivity and competitiveness of the agriculture sector is low, adoption of improved technology is limited and even though most cultivated area is devoted to cereals, there is a growing food trade deficit in cereals. In Hanku most of the people are engaged in agriculture but they have food sufficiency only for four and half month on average (Table 7). This scenario shows that there is huge need of promotion of agriculture to meet food sufficiency.

Ninety percent of the survey respondents mentioned the need of promotion of local crops. Communication plays vital role in development and transformation of marginal agriculture towards commercial agriculture. Studies have indicated that access to information, social networks and institutional mechanisms for collective actions is necessary for strong seed systems (Sthapit et al., 1996; Shrestha et al., 2006). Communities with weak social networks are more vulnerable to accessing locally adapted seeds in adverse conditions, compared to those with strong social networks (Poudel et al., 2005). Thus, creating different knowledge dissemination platforms such as diversity field school, community seed bank, participatory seed exchange, diversity fair, food fair, etc. in close coordination and involvement of local CBOs could enhance awareness in community regarding new technology/ innovation introduction and its use to conserve and promote local landraces of the community.

5.9 Potential Opportunities

There is a good opportunity of promoting underutilized local crops through awareness raising, value addition and marketing. Opportunity areas of linking local product to market:

- Nepal Food Corporation has been buying local crops from farmers in Jumla especially beans, buckwheat and millets and selling them in urban markets. Finding sustainable link in market chain to supply these organic products from Jumla could be a good opportunity for promotion of local crops.
- Linking farmer with business outlets such as koseli house and co-operatives that sell local products. With better transportation links with urban areas, such a value chain can be another new opportunity for local farmers and businesses.
- Increasing community benefits by introducing traditional as well as innovative food recipes of traditional local crops for market outlets, for example, rice pudding of foxtail millet, breakfast soup of finger millet, pancake of mixture of millets, buckwheat and barley flours as nutritive diets, etc.
- Jumla is an organic district. Organic commodities of Jumla can get good national/international market. For this, market linkage and exposure of commodity should be done.

6. SUMMARY AND WAY FORWARD

6.1 Summary

Agriculture is the main occupation in Hanku yet the people of Hanku live in food deficit condition. On average, agriculture production is only sufficient for four and half months. Food self-sufficiency of Dalit households is less than the community average.

Geographically Hanku VDC is divided into hilly region and small valley which is suitable for agriculture. With Tila river and Gidi river flowing through it Hanku has good source of irrigation water improving its potential for agriculture. Farms in the upland however suffer from droughts.

Farmers usually cultivate rice as main crop and bean as a cash crop. Apart from these two crops farmers also grow finger millet, proso millet, foxtail millet, buckwheat and amaranth. Cultivation of naked barley has not been observed yet. Highest richness was found in bean (11) and rice (6). Local crops need support from the government and nongovernment sectors in terms of new varieties, processing technologies, marketing linkages to ensure continued use and conservation.

There are very few I/NGOs working in Hanku community especially in biodiversity and agriculture sector. Although the community awareness level is increasing in issues such as gender equity, sanitation, health and education, it is limited regarding the promotion and conservation of local crops.

Seed production and management practices are traditional. Seed system is predominantly informal with only rice and beans having some new varieties available for farmers. High mountain farmers already have limited access to new varieties of crops. Hence, both the formal and informal seed systems have to be bolstered in Hanku.

The major intervention areas of the project need to be research and extension on improving production, processing and marketing opportunities of the local crops. The Local Crop Project can play significant role in strengthening the capacity of the local institutions and CBOs coordinating with DADO, ARS and other key stakeholders in the district and VDC level.

6.2 Way Forward: Suggestions for Project Planning and Implementation

This study has revealed many challenges and opportunities for mandate crops in Hanku, Jumla. People of the community have special attachment to the mandate crops due to their social, cultural and traditional values. Thus, many of them are not willing to leave the cultivation of these crops. However, lack of sufficient research and extension in these crops have prevent any major advancement in their cultivation. Changing food habit with better transportation linkage and influence of urban food culture is making these crops less competitive than before. Hence today, these local crops cover the marginal and unproductive lands of Hanku, except Jumli Marshi rice and common bean. Disease and pest, climate change, post-harvest processing difficulty, etc. are the major issues that need to be addressed. Based on site situation analysis and with the support of relevant global literature, following areas of intervention have been identified as the ways forward for the project.

- **Crop diversity inventory:** High mountain agriculture has historically relied on the diversity of traditional crops and varieties that are adapted to the local climate. High mountain food security will be threatened by loss in crop diversity. Preparing an inventory of existing diversity is a first step to identify the wealth of genetic resources available. Such an inventory preparation activity will raise awareness of the crops, help identify varieties that can be disseminated immediately and varieties that can be improved through further research and breeding. Diversity fair, participatory seed exchange, focus group discussion, etc. will be very much effective to carry out this activity with ease.
- **Grassroots breeding, PVS and PPB:** These mandate crops have few, if any, released varieties in Nepal and farmers have been historically relying on local varieties and their selection. Employing grassroots breeding can rapidly improve the populations of local varieties, disseminate the improved lines and also generate potential parents for subsequent conventional or participatory plant breeding (PPB). Participatory Variety Selection (PVS) can be used to identify existing released cultivars and advanced lines that are likely to succeed in Hanku and rapidly disseminate them. If grassroots breeding and PVS are not

able to find adequate varietal options for local needs, PPB can be considered to develop varieties that improve on what the farmers grow.

- **Diversity introduction and dissemination:** Diversity is the solution to minimize the risk caused by disease and pest. Although the local landraces are more field tolerant towards the disease and pest utilization of the same crop for years can increase the chances of disease and pest outbreak. In such case diversity could be a solution to cope with such circumstances. Thus, introduction of the diversity and its dissemination in community will minimize the risk for farmers. Different participatory approaches like diversity blocks, diversity kits, Informal Research and Development (IRD) kits and Participatory Seed Exchange (PSE) can also be a promising approach to introduce and disseminate seeds and traditional knowledge.

- **Addressing production and post-production constraints:** Jumla is an organic district. This provides farmers with opportunities to tap into urban markets that are more concerned about agrochemical residue in their food. However, management of pest and diseases in organic agriculture can be labour and knowledge intensive. Farmers should be trained on preparation and use of organic pesticide and organic management practices. Due to the hilly terrain, only small scale and handheld mechanization may be feasible. However, there is a lot of potential for improvement in post-harvest processing of mandate crops. This is also necessary to eradicate women drudgery.

- **Coordination with local stakeholders:** Sustainability of any development brought by a research and development project depends upon involvement and mobilization of key stakeholders. For mainstreaming the good and successful practices of the project, engagement of the local stakeholders including district level key stakeholders: DADO, DDC and other relevant I/NGOs is important. Furthermore, resource leveraging from the DADO, DDC, and VDC, etc. would create a sustainable platform to carry out project activities even after project phase out. Involvement of engagement of VDC level agriculture committees and community seed banks will be very fruitful to continue and disseminate project results.

- **Social capital building:** Social capital refers to the social networks that exist within a community. Social capital is built on trust that comes for a history of collaborative and positive community action. Hanku community have good social network but they are mostly focused on health, education, drinking water, electricity and transportation. Agriculture and agriculture related forums, meetings and discussion are rare and focused mainly on irrigation management. A unique forum, group or social network should be established within community to discuss and solve their agriculture related problems (disease and pest, suitable crop varieties, post-harvest processing etc.). For this Diversity Field School (DFS) can be an innovative platform. Similarly CSB can be a relevant local institution for conservation and promotion of the local landraces and improvement of formal and informal seed system.

- **Documentation and wider sharing:** Visibility of the program depends upon dissemination of the good practices and lessons learned. For this proper documentation plays a crucial role. Outcomes of the project either success or failures should be documented which will be helpful for planning and implementation of this as well as other future projects in agriculture.

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ANNEX 1. Household Survey Questionnaire

"उच्च पर्वतीय क्षेत्रको खाद्य सुरक्षाको लागि स्थानीय बाली विविधता"
आधारभूत घरधुरी सर्वेक्षण, २०७१

नमस्ते ! म **"उच्च पर्वतीय क्षेत्रको खाद्य सुरक्षाको लागि स्थानीय बाली विविधता"** कार्यक्रममा कार्यरत छु । म तपाईलाई एक अनुसन्धानमा सहभागी हुन अनुरोध गर्दछु । शुरूमा नै तपाइलाई हामीले गर्नलागेको कामको बारेमा संक्षिप्त परिचय दिन चाहन्छु । यी जानकारीहरूलाई ध्यान दिएर सुन्नुहोस्, आफुले नबुझेको कुनै कुरा भए सहभागी हुने वा नहुने निर्णय गर्नु भन्दा पहिले नै हामीलाई सोध्नुहोस् ।

यो अध्ययन किन गरिंदै छ? Justification to the respondents about why are we doing this survey?
विश्व वातावरण कोषको आर्थिक सहयोग र बायोभर्सिटी इण्टरनेस्नलको संयोजनमा ली–बर्ड र नार्कको साझे दारीमा हुम्ला, जुम्ला, लम्जुङ्ग र दोलखा जिल्लामा यो परियोजना पांच वर्षका लागि सञ्चालनमा रहेको छ । यो कार्यक्रमको मूख्य उद्देश्य, स्थानीय कृषि जैविक विविधताको ब्यबस्थापनका लागि उपयुक्त प्रविधिहरूको विकास गर्नु, बर्तमान अबस्थामा रहेको बीउ उत्पादन प्रणालीको अध्ययन गरी बीउको गुणस्तर र उपलब्धतामा सुधार ल्याउर्नु, कृषि जैविक विविधताको दिगो ब्यबस्थापनका लागि भएका नीति नियमहरूको अध्ययन गरी आवश्यकतानुसार नीतिगत छलफल तथा वकालत गर्नु र उच्च पहाडी कृषि जैविक विविधताको संरक्षण तथा प्रयोगलाई मुल प्रवाहमा ल्याउनु रहेको छ । कार्यक्रम सञ्चालन पूर्वको अवश्था के कस्तो थियो भनी जानकारी लिन यो सर्वेक्षणले मद्दत पुर्‍याउनेछ ।

गोपनीयता We will keep the information secret provided by you.
तपाईंको घरधुरी सम्बन्धि सम्पूर्ण जानकारीहरू अति गोप्य राखिनेछन् । कुनै प्रतिबेदन वा प्रकाशनमा तपाईं र तपाईंको घरको पहिचान गरिनेछैन । आंकडाहरू GEF/LI-BIRD अनुसन्धानकर्ताहरूबीच मात्र आदान प्रदान गर्न सकिनेछ । पूर्ण गोप्यताको सुनिष्चितताको लागि हामी कटिबद्द छौं ।

सहभागिता If you are interested to particpate in this study we are going to do.
यो अध्ययनमा सहभागिता ऐच्छिक हो । अध्ययनमा सहभागी नहुन तपाईंलाई अधिकार छ । सहभागी हुन ईच्छुक भएमा, प्रश्न सोध्ने क्रममा कुनै पनि समयमा तपाईंले रोक्न सक्नु हुनेछ तथा प्रश्नावलीका कुनै प्रश्नको उत्तर दिन ईन्कार गर्न सक्नुहुनेछ । कुनै पनि अवस्थामा तपाईंले सहभागितामा भाग नलिन बिचार गर्नु भएमा, यसबाट कुनै असर हुनेछैन ।

यो सर्भेक्षणमा सोधिने प्रश्नहरूको जवाफ दिन के तपाई ईच्छुक हुनुहुन्छ? छु :____ छैन:___
If you are interested to answer those questions which will be asked in this survey? (Yes, No)

A. सामान्य जानकारी *General Information*

१. जिल्ला: ....*District* २.गा.वि.स.:*VDC*.....................

३. गाउँ / टोलको नाम: ....*Village Name* ४.वडा नं.:*Ward #*.....................

५. उत्तरदाताको नाम : ***Respondent'sName***.

६. लिङ्ग :*Gender* १. महिला ☐ २. पूरुष ☐

७. उमेर :*Age*.....................बर्ष

८. थर/ जात :*Ethnicity*..

९. सर्म्पक नं : *Phone number*..................................

१०. कृषिसम्बन्धी कार्यकोलागि निर्णय कसले गर्नु हुन्छ ?

Who takes agriculture related decision in the household? (Female, Male, both)

महिला ☐ पुरुष ☐ दुवै ☐

११. तपाई यो ठाउँमा बसोबास गर्न थाल्नु भएको कति वर्ष भयो ?

How long have you been living in the village?

वर्ष ☐ पुस्तौ देखि ☐

१२. परिवारको प्रकार : ***Family Type (Single Family or Joint Family)***

एकल परिवार ☐ संयुक्त परिवार ☐

१३. परिवार सदस्य संख्या : ***No. of Family Members (Total, Female, Male and Under 16 years)***

जम्मा ....

महिला ☐ पुरुष ☐ १६ वर्ष मुनि ☐

१४. तपाईको परिवारमा कति जना सदस्य कृषि सम्बन्धी कार्यमा संलग्न हुनुहुन्छ ?

How many members of your family are involved in agriculturerelated activities?(Female, Male)

महिला ☐ पूरुष ☐

१५. तपाईको परिवारमा कुनै सदस्य गा.वि.स. बाहिर काम गर्नुहुन्छ ?

Do any of your family members work outside the VDC? (Yes, No)

१.हुन्छ ☐ २.हुन्न ☐

१६. यदि हुन्छ भने, गा.वि.स. बाहिर गएर काम गर्ने सदस्यहरुको निम्न विवरण दिनुहोला ।

If yes then, provide detail of those members working outside the VDC.

कार्य अवधि ***Work Duration***	पुरुषको संख्या ***No. of Male***	महिलाको संख्या ***No. of Female***
३ महिना ***Upto 3 months***		

३–६ महिना *3 -6 months*		
६ महिना भन्दा बढी *>6 months*		

१७. तपाईको परिवारको आम्दानीको मुख्य श्रोतहरु के के हुन् ?

What are the major sources income for your family?

१.कृषि तथा पशुपालन*(Agriculture and Livestock)* २.व्यवसाय*(Business)*
३. जागिर/नोकरी*(Job / Service)* ४.कृषि श्रमिक*(Agricultural Labour)*
५. गैर कृषि श्रमिक *(Non- Agricultural Labour)* ६. रेमिटेन्स *(Remitance)*
७. जडीबुटी संकलन *(Herbs Collection)*
१. .... २. .... ३. ....

B. कृषि सम्बन्धी विवरण *(Detail about Agriculture)*

१८. तलको विवरणहरु लिनुहोस । *(Take details of following given below)*

जग्गा/जमिनको प्रकार *Type of Land*	आफ्नै खेतबारी (परिमाण/ईकाई) *Own Land* *(Qty/ Unit)*	अधिया (परिमाण/ईकाई) *Qty/ Unit*		भाडामा/बन्दकी (परिमाण/ईकाई) *Leased (Qty/ Unit)*		बाँझो छोडेको (परिमाण/ईकाई) *Barren Land* *(Qty/ Unit)*
		लिएको *Taken*	दिएको *Given*	लिएको *Taken*	दिएका *Given*	
खेत *Low Land*						
बारी *UpLand*						
फलफुल बगैंचा *Fruit Orchard*						
खरबारी *Pasture*						
निजी वन *Own Forest*						
अन्य *If others then specify* -खुलाउनुहोस्)						

१९. पशुको विवरण*(Detail about Livestock)*

क. सं	पशु वस्तु *(Livestocks)*	संख्या *(Number)*
१		
२		
३		
४		
५		

२०. आफ्नो कृषि उत्पादनले तपाईको परिवारलाई बर्षमा कति महिना खान पुग्छ?

How many months does your own agriculture production sustain your family in a year?

खाद्य प्रकार *Type of Food*	महिना *Month*
मुख्यवाली / अन्नवाली *Main Crop / Food Crop*	
हरियो सागपात *Green Leafy Vegetables*	
तरकारीवाली *Vegetable Crops*	
दलहनवाली *Pulse Crops*	
अन्य *Others*	

२१. तपाइँले कुन कुन फलफुल लगाउनु भएको छ ?

Which fruits trees have you grown in your home?

क. सं *S.No.*	फलफुलको नाम *Fruit Name*	बोट संख्या *No. of Trees*	क. सं *S.No.*	फलफुलको नाम *Fruit Name*	बोट संख्या *No. of Trees*

२२. तपाईंले आफ्नो खेत बारीमा तल उल्लेखित कुन कुन बालीहरु लगाउनुहुन्छ ?

Which of the following below listed crops do you grow in your field?

बालीको नाम *Crop Name*	जात *Variety*	बीउको श्रोत *Source of seed*	क्षेत्रफल *Area*		जम्मा उत्पादन (के जी) ***(KG)*** *Total Production*	उत्पादन बेच्नुहुन्छ? (के जी) *(KG)* *Do u Sell Production?*
			परिमाण *Quantity*	इकाइ *Unit*		
लट्टेवाली *Amaranth*						
फापर *Buckwheat*						
चिसो सहने धान *Cold Tolerant Rice*						
कोदो *Finger Millet*						
चिनो *Porso Millet*						
कागुनो *Foxtail Millet*						
उवा वा जौ *Naked Barley/ Barley*						
सिमि *Beans*						

बीउको श्रोत: १. आफ्नै घरको बीउ २. हाट बजार वा बजार, ३. एग्रोभेट, ४. सरकारी संस्था, ५. गैरसरकारी संस्था, ६. छिमेकी ७. नातेदार, ८. सामुदायिक बीउ बैंक, ९. सहकारी संस्था, १०. अन्य (खुलाउनुहोस्)

Source of Seed: Own Households, Haat or Market, Agrovet, Government Organisation, NGO, Neighbours, Relatives, Community seed bank, Cooperative, If others then specify.

२३. माथि उल्लेखित बालीहरुको खेती प्रविधि सम्बन्धि कुनै तालीम पाउनु भएको छ ?(धान बाहेक)

Have you received any trainings related to cultivation practices of above listed crops (except that for rice)? (Yes, No)

१.छ ☐ २. छैन ☐

छ भने कहाँबाट पाउनु भयो ?*if Yes then , from where did you get it?*

==

==

२४. फापरको साग खानुहुन्छ ?*Do you consume buckwheat as green leafy vegetable? (Yes, No)*

१.छ ☐ २. छैन ☐

२५. फापरको साग बेच्नुहुन्छ ?*Do you sell green leaves of buckwheat ? (Yes, No)*

१.छ ☐ २. छैन ☐

२६. फापरको साग किन्नुहुन्छ ?*Do you buy green leaves of buckwheat ? (Yes, No)*

१.छ ☐ २. छैन ☐

२७. लट्टेको साग खानुहुन्छ ?*Do you consume amaranth as green leafy vegetable? (Yes, No)*

१.छ ☐ २. छैन ☐

२८. लट्टेको साग बेच्नुहुन्छ ?*Do you sell green leaves of amaranth ? (Yes, No)*

१.छ ☐ २. छैन ☐

२९. लट्टेको साग किन्नुहुन्छ ?*Do you sell green leaves of amaranth ? (Yes, No)*

१.छ ☐ २. छैन ☐

३०. तल उल्लेखित कुन कुन बाली खानको लागि किन्नुहुन्छ ?

Which of the below listed crops do you purchase/buy for consumption?

बालीको नाम *Crop Name*	बाली खानको लागि किनेका *Crops purchased for consumption*	
	परिमाण *Quantity*	इकाइ *unit*
लट्टेवाली *Amaranth*		
फापर *Buckwheat*		
चिसो सहने धान *Cold Tolerant Rice*		

कोदो *Finger Millet*		
चिनो *Proso Millet*		
कागुनो *Foxtail Millet*		
उवा वा जौ *Naked Barley*		
सिमि *Beans*		

३१. तपाईंको विचारमा यस ठाउंमा कुन कुन स्थानीय बालीको प्रवर्द्धन गर्न आवश्यक छ ?

In your view which of the local crops should be promoted ?

....

३२. तपाईंको विचारमा कुन कुन स्थानीय बालीको संरक्षण गर्न आवश्यक छ ?

In your view which of the local crops should be preserved? (Not Needed, No said anything)

....

नभनेको ☐ आवश्यक छैन ☐

३३. नेपाल खाद्य संस्थानले यी स्थानीय बालीहरु खरिद गर्ने कुरा तपाइलाई थाहा छ ?

Do you know that Nepal Food Corporation purchase these crops? (Yes, No)

१.छ ☐ २. छैन ☐

३४. तपाईंको परिवारको कुनै सदस्य कृषक पाठशालामा सहभागी हुनुभएको छ ?

Has any of your family members taken part in FFS? (Yes, No)

१.छ ☐ २. छैन ☐

३५. यदि छ भने, कृषक पाठशालाको बारेमा के थाहा छ ?

If yes then, what do you know about FFS? (Yes, No)

....

३६. सामुदायिक बीउ बैंकको बारेमा थाहा छ ?

Do you know about Community Seed Bank?(Yes, No)

१.छ ☐ २. छैन ☐

संकलनकर्ताकोनाम : *Name of Enumerator*..

हस्ताक्षर :*Signature*....................... मिति :*Date*..............

तपाइको अमूल्य समय र सुचनाको लागि धन्यवाद ।

Thank you so much for your valuable time and information.

ANNEX 2. Crop inventory prepared from ward level FGDs

SN	Cereals	Pulses	Vegetables	Oil Seeds	Spices	Fruits
1	Barley	Black gram	Amaranths	Aalas	Alaichi	Aaru
2	Buckwheat	Common Bean	Balsam Apple	Jhuse til	Carrot	Almond
3	Finger Millet	Cowpea	Bitter Gourd	Mustard	Chilli	Banana
4	Maize	Horse gram	Bottle Gourd	Rayo	Coriander	Bhogate
5	Naked Barley	Lentil	Brinjal	Sarseu	Cucumber	Grapes
6	Rice	Pea	Cabbage		Garlic	Guava
7	Wheat	Rice bean	Cauliflower		Ginger	Haluwabed
8		Soybean	Chamsur		Jimbu	Junar
9			Chayote		Methi	Kiwi
10			Fava bean		Mint	Khurpani
11			Ladies Finger		Onion	Lemon
12			Niguro		Sup	Nibuwa
13			Potato		Timur	Orange
14			Pumpkin		Tomato	Pear
15			Radish		Tree Tomato	Pineapple
16			Rayo Saag		Turmeric	Pomegranate
17			Sponge Gourd		Xyapi	
18			Taro			
19			Yam			

ANNEX 3. Ward level discussion meeting record

Discussion Date	Ward No.	Janjati		Dalit		Brahmin/Chettri		Total
		Female	Male	Female	Male	Female	Male	
23rd Aug 2014	1	1	0	3	0	14	5	23
20th Aug. 2014	2	3	5	5	0	1	7	21
21st Aug. 2014	3	6	1	6	2	20	7	42
24th Aug. 2014	4	0	0	0	0	30	13	43
21st Aug. 2014	5	0	0	0	0	16	13	29
22nd Aug. 2014	6	0	0	0	0	5	8	13
11th Aug. 2014	7	10	5	0	0	5	5	25
12th Aug. 2014	8	3	5	0	0	11	10	29
13th Aug. 2014	9	29	8	0	0	3	6	46
Total		52	24	14	2	105	74	271

ANNEX 4. Check List for Seed Management Practice

- Do you keep your own seeds of these crops?
- Where do you select seeds? Before harvesting whole yield (on farm) or after harvesting?
- What are the criteria to select or distinguish seeds from normal grain?
- Do you process seeds separately or all together? Is any technique of processing different for seeds?
- Is there any special treatment for seed after process?
- Do you refine or filter seeds after they are processed?
- How do you store seeds? What are the tools/containers that you use to store seeds?
- Where do you store seeds? Inside or outside of home?
- Do you to recheck or maintain the seeds after storage?

Check List for Processing Practice:

- How do you thresh your crops after harvesting?
- What are the tools that you use to thresh and what are the difficulties?
- Does it need further processing? What are the processes and steps?
- What are the tools that you use? Are there any modern tools?
- What are the problems after the threshing process?
- Which crop has the most difficulty with processing and in which particular step/stage?
- Do you have facility of electric mills? What type of services do they provide?
- Are electric mills on feasible distance? What about its easy access and distribution?

ANNEX II: PHOTO GALLERY

Rice field of Gidikhola, Tatopani Rural Municipality-4.

Farmers observing naked barley field during diversity field school session in Jumla.

Women farmer harvesting foxtail millet with tradational sickle.

Intercroping of Porso Millet and Bean in Gautambada, Tatopani Rural Municipality-4.

Women farmer collecting Jumli Marshi rice seedlings for transplantation.

Bean disease diagonostic survey, Hanku.

Meeting with farmers group (Dhauligadh Krishi Jaibik Bibidhata Samrakshan Samuha

Women using traditional processing equipment for preparation of beaten rice.

Local Crop Project Mandate Crops

Amaranth

Finger Millet

Naked Barley

Foxtail Millet

Beans

Proso Millet

Buckwheat

Cold Tolerant Rice

Local Initiatives for Biodiversity, Research and Development (LI-BIRD)
Head Office: PO Box 324, Pokhara, Nepal
Phone: +977 61 526834, 535357 | Fax: +977 61 539956

Programme Coordination Office: Sanepa, Lalitpur
Phone: +977 01 5540330
Email: info@libird.org
Web: www.libird.org

Nepal Agricultural Research Council (NARC)
Singhadurbar Plaza, Kathmandu
Post Box No. 5459, Kathmandu, Nepal
Phone: 977-1-4256837, 4262650, 4262567
Fax: 977-1-4262500
Email: ednarc@ntc.net.np
Web: www.narc.gov.np/org/gene_bank.php

Bioversity International
93.4 Dharahara Marg, Fulbari-11
Pokhara, Nepal

Bioversity Headquarters
Via dei Tre Denari 472/a
00057 Maccarese, Rome, Italy
Phone: (39-06) 61181
Fax: (39-06) 61979661
Email: bioversity@cgiar.org
Web: www.bioversityinternational.org

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