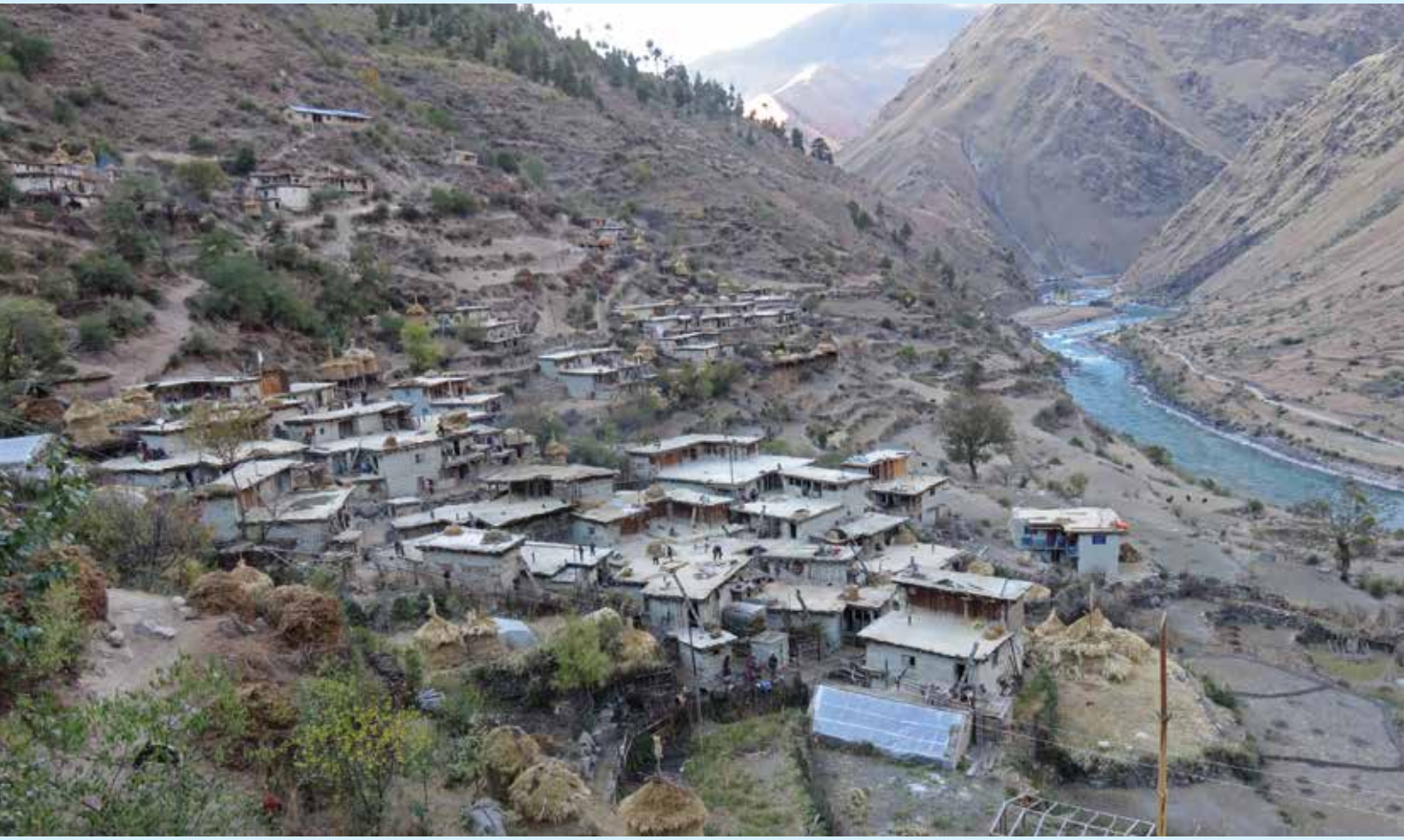

Integrating Traditional Crop Genetic Diversity into Technology:
Using a Biodiversity Portfolio Approach to Buffer against Unpredictable Environmental Change in the Nepal Himalayas

BASELINE SURVEY REPORT

CHHIPRA, HUMLA | DECEMBER 2016

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This publication is prepared by the UNEP/GEF supported project Integrating Traditional Crop Genetic Diversity into Technology: Using a Biodiversity Portfolio Approach to Buffer against Unpredictable Environmental Change in the Nepal Himalayas. The project is coordinated by the Bioversity International in collaboration with Nepal Agricultural Research Council (NARC), Department of Agriculture (DoA) and Local Initiatives for Biodiversity, Research and Development (LI-BIRD).

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 Project
ASC	Agriculture Services Centre
CBM	Community based Biodiversity Management
CBS	Central Bureau of Statistics
DADC	District Agriculture Development Committee
DADO	District Agriculture Development Office
DDC	District Development Committee
DFS	Diversity Field School
DoA	Department of Agriculture
EDA	Explorative Data Analysis
FAO	Food and Agriculture Organisation
FFS	Farmers' Field School
FGD	Focus Group Discussion
FYM	Farmyard Manure
GEF	Global Environment Facility
GO	Government Organisations
HDI	Humla Development Initiative
IRD	Informal Research and Development
KIRDARC	Karnali Integrated Rural Development and Research Centre
LAPA	Local Adaptation Plan of Action
LCP	Local Crop Project
LI-BIRD	Local Initiatives for Biodiversity Research and Development
LSC	Livestock Services Centre
Masl	meters above sea level
MFD	Meteorological Forecasting Division
NAGRC	National Agriculture Genetic Resources Centre
NARC	Nepal Agriculture Research Council
NCCSP	Nepal Climate Change Support Programme
NFC	Nepal Food Corporation
NGO	Non-Government Organisation
NPC	National Planning Commission
NUS	Neglected and Utilized Species
PAF	Poverty Alleviation Fund
PCI	Participatory Crop Improvement
PSE	Participatory Seed Exchange
PRA	Participatory Rural Appraisal
RVWRMP	Rural Village Water Resources Management project
SHIP	Self Help Initiative Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children Emergency Fund
USD	United States Dollar
VDC	Village Development Committee
WFP	World Food Programme
WUPAP	Western Upland Poverty Alleviation Programme
WWS	Women Welfare Service

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, Chomrong Dhan, an indigenous variety of cold tolerant red rice from Nepal has now spread to over 85% of the world's rice growing areas, reaching countries as far as 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 resistance, and wide adaptability.

In addition to cold tolerant rice, farming communities in this region also rely on the diversity of under-researched but locally adapted crops, such as proso millet, foxtail millet, finger millet, buckwheat, naked barley, barley, amaranth, and the common bean. The Nepali Himalayas are the primary and secondary centres of diversity for rice, amaranths, 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-third 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 a lack of calories or because of too much of the wrong kind of calories (Pimentel, 2011).

In the context of climate change, over-reliance on a handful of commodity crops 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 and riots like those seen in 2008 in multiple developing as well as developed countries. It can also lead to the loss of crop biodiversity (and the associated genetic diversity), which represents a significant reservoir of potentially useful traits for coping with changing global environments. Because traditional mountain crops are highly under-researched, mountain farming communities have not had the benefit of better yielding varieties and advanced processing technologies. High-mountain districts of Nepal, such as Humla (ranking 73rd out of 75 districts in the Human Development Index), already 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. For instance, rice blast (fungus *Magnaporthe oryzae* B. Couch) is a major disease in Nepal that has been increasingly affecting the beloved *Marshi* variety of rice in Karnali region in recent years. These high mountain areas are also sources of water for over a billion people in the Indian sub-continent, and diversity-based and integrated pest management practices are needed to ensure the area can continue to provide clean, disease-free water for the foreseeable future.

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 agrobiodiversity 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 rich and unique intra-specific diversity of crops in mountain agricultural environments to buffer against increasing unpredictability in the amount and occurrence of rainfall, temperature extremes, and the frequency and severity of pest and pathogen occurrence. The project is known as the Local Crop Project (LCP) for short.

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

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* L. *A. caudatus* L. *A. cruentus* L.	Self Pollinated	2n=32 2n=34 2n=32
2.	Barley	जौ	*Hordeum vulgare* L.	Self Pollinated	2n=2x=16
3.	Bean	सिमि	*Phaseolus vulgaris* L.	Self Pollinated	2n=22
4.	Buckwheat	मिठे फापर तिते फापर	*Fagopyrum esculentum* Moench *F. tataricum* Gaertn.	Cross Pollinated Self Pollinated	2n=2x=16 2n=2x=16
5.	Finger millet	कोदो	*Eleusine coracana* Gaertn.	Self Pollinated	2n=36
6.	Foxtail millet	कागुनो	*Setaria italica* Beauv.	Self Pollinated	2n=18
7.	Naked barley	उवा	*Hordeum vulgare* L. var. *nudum* Hook. f.	Self Pollinated	2n=2x=14
8.	Rice	धान	*Oryza sativa* L.	Self Pollinated	2n=2x=24

The project is being implemented from 2014-19 by the United Nations Environment Programme (UNEP) and is being 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 agricultural research scientists and extension experts with specializations in germplasm conservation, plant breeding, plant pathology, and community empowerment. The project was endorsed by the Nepal Government's Ministry of Finance on 24 November 2010. The project is being implemented in four mountain Village Development Committees (VDCs) of four districts within Nepal (Figure 1).

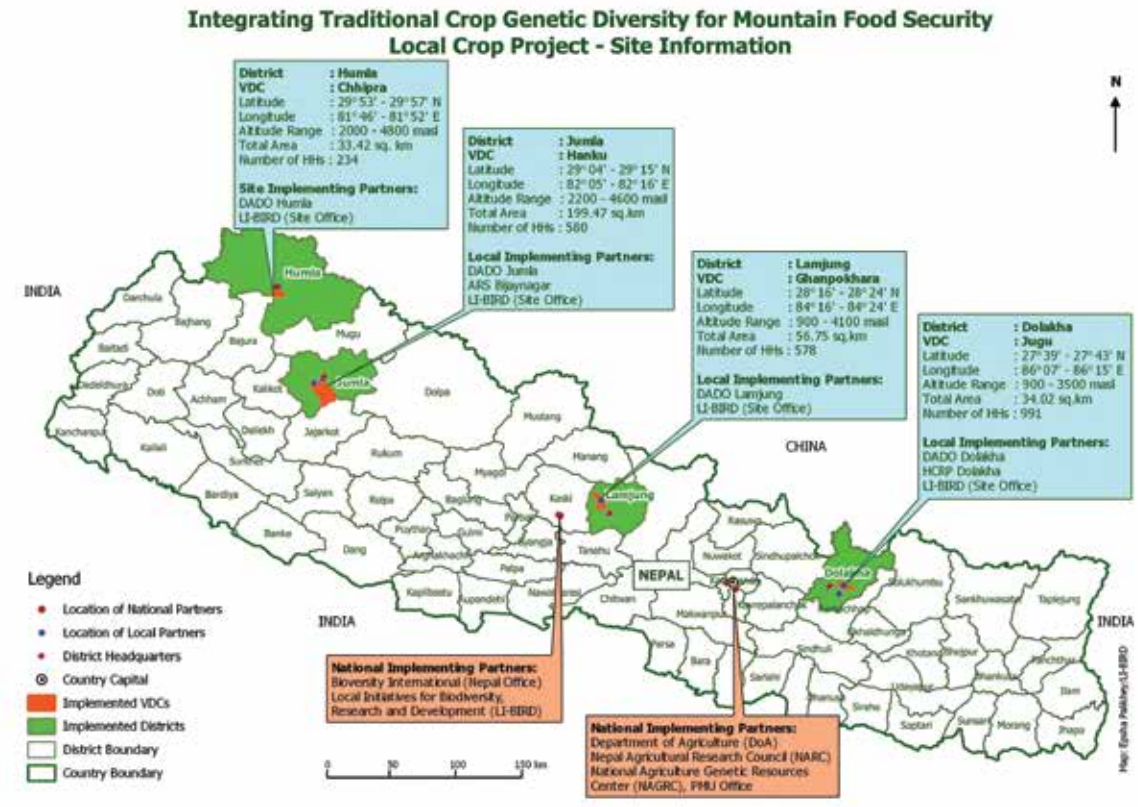

Figure 1. Project sites of the Local Crop Project, Illustration by: Epsha Palikhey/LI-BIRD

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

The specific objectives of the baseline study are given below:

- To understand the socio-economic and demographic context of the farming communities
- To document the extent of genetic diversity in the mandate crops (amaranths, bean, buckwheat, naked barley, finger millet, proso millet, foxtail millet, and cold tolerant rice) as well as associated traditional knowledge
- To assess the problems with the sustainable use of crop diversity and the 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 a baseline and provide guidelines for the planning of future programmes in the sites

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

General information about the district and VDC was collected from secondary data sources of district profile and VDC profiles. 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.

2.1 Participatory Rural Appraisal (PRA)

We conducted group discussions and transect walk to gain a better understanding of the local context of mandate crop diversity and knowledge, paying special attention to special traits, present status, and reasoning for current status and consumption patterns

Group discussions were organized in the month of August 2014. These involved 23 women and 15 men farmers. After consulting the project site team, the participants of the PRA were chosen based on their traits of being progressive, knowledgeable, and interested in agricultural activities. Participatory Rural Appraisal was conducted using focus group discussions (FGD), four cell analysis, resource mapping and seasonal calendar. Information on crop diversity, production ecology and seasons, variety details, farmer's knowledge, field practices, processing methods, and issues associated especially with mandate crops were collected. In addition, information on community based organisations, ongoing programmes conducted by different I/NGOs, GOs, other agencies, and their respective working area and present status were also recorded.

PRA exercise being conducted in Chhipra, VDC

2.2 Diversity Fair

A diversity fair was organized on the premises of the Sita Lower Secondary School in ward number 1 of Chhipra VDC, Humla, on 22 November 2014 with the help of the Karnali Dovan Krishi Cooperative. Fourteen VDCs of Humla took part in this seed fair, where the main objectives were to assess local crop diversity (both mandate and non-mandate) and raise awareness of the value of local crop diversity. Seed of various crops (especially mandate crops) were collected along with passport data and additional associated information. This helped document the status of overall crop diversity and associated mandate crop information (crop name, variety name, distinguishing characteristics, special traits and uses, problems, population status, and source). In addition, it also helped sensitize the community to the availability and importance of crop diversity.

2.3 Household Survey

A household survey of Chhipra, Humla was conducted during the month of November 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 the baseline household survey are presented below.

2.4 Survey Design and Sampling Procedure

The questionnaire and survey methodology was developed by the project team, and was refined using the input 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. The detailed baseline survey methodology is presented in Figure 2.

2.4.1 Questionnaire Preparation and Pre-testing

The household survey was prepared by reviewing questionnaires of other similar projects, like the Strengthening the Scientific basis for on farm Conservation of Agrobiodiversity (*in situ*) project (Rana et al., 2000) and the Community Biodiversity Management (CBM) project. It was decided to prepare a brief questionnaire because basic information had already been collected from the PRA exercises and site selection surveys. The drafted questionnaire was shared with a team of experts from Bioversity Nepal, NARC Gene bank, and LI-BIRD for reviewing and commenting. The questionnaire was refined by incorporating the suggestions from the consulted experts, and was pre-tested with a few sample farmers in Arba, Kaski before field administration. The findings of pre-testing were used to finalize the survey questionnaire (Annex 1).

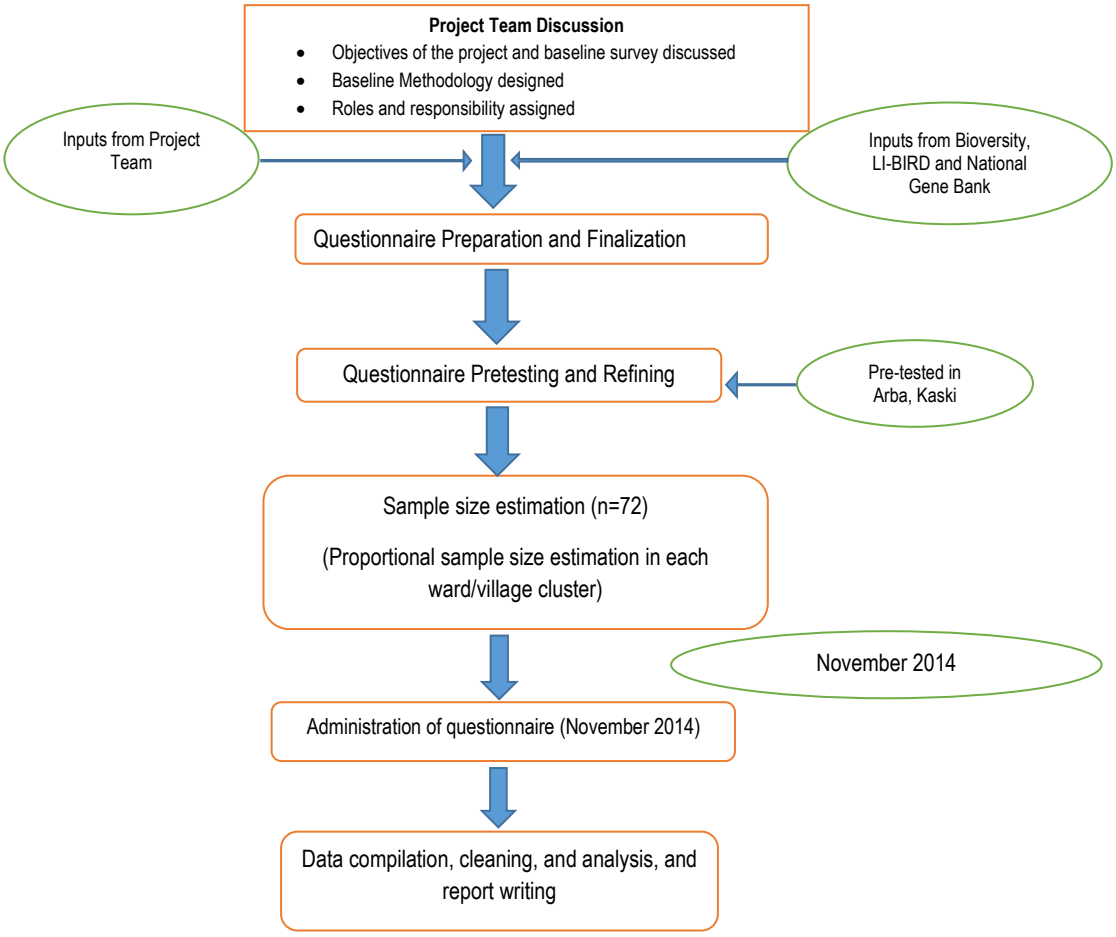

Figure 2. Diagrammatic representation of processes underlying the baseline household questionnaire survey

2.4.2 Sampling and Sample Size

A list of all households within the ward, as well as the household's name, was prepared. Using the following formula, sample size was calculated from the total number of households.

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

where,

n = size of sample

Z = the value of the standard variate at a given confidence level and to be worked out from table showing area under normal curve (give here the value)

p = the largest possible proportion (0.5) or sample proportion

q = 1-p

d = the sampling error (0.05)

N = size of population (= 234)

A total of 72 households (52 men and 20 women) were selected from the 234 households in Chhipra VDC, Humla. The households were distributed into 4 clusters, each with a different number of wards and population size. To ensure proportional representation of households from each ward, a probability proportional to size sampling technique was adopted. The proportional sample size from each ward was calculated by using the following formula:

Number of households to be sampled from the ward (n)

$$\frac{\text{Total HHs in ward}}{\text{Total HHs in VDC}} \text{ X size of sample (i. e., 72)}$$

After determining the number of households to be surveyed in each ward, households were selected randomly. The total number of households surveyed, along with the HH ID, name, and village name of each is presented in Annex II. Table 2 shows the number of HHs in each ward of Chhipra VDC.

Table 2. Number of samples in each ward of Chhipra VDC

Ward no.	Name of village/cluster	Number of sample HHs
1	Chhipra	7
2	Chhipra	7
3	Chhipra	5
4	Chhipra	6
5	Majha	7
6	Majha	10
7	Majha	9
8	Nalla	9
9	Lekha	12
	Total	72

2.4.3 Administration of the Survey

In Chhipra, Humla, the baseline survey was conducted from 26-28 November 2014. A team of seven members (six from LI-BIRD, Pokhara and one from NAGRC, Khumaltar), conducted the survey. Mr. Mukunda Bhattarai from NAGRC, who had extensive prior field experience with conducting baseline surveys, gave a short orientation on the content, sampling, and interviewing process to the team members. At the end of each day of interviews, the two project officers' cross-checked data and discussed whether any questions were missing from the questionnaire.

2.4.4 Data Entry, Cleaning and Analysis

Data compilation and entry was done in the standard format prepared with the technical support of data management specialists of LI-BIRD, Pokhara. Data entry was completed by the end of March 2015 in the Pokhara office. Entered data was reviewed and cleaned by the site team following five explorative data analysis (EDA) tests. Cleaned data was converted to standard units before analysis through cross-site sharing and experiences of the team members. The data analysis was done using Microsoft Excel 2013 and SPSS 16. The analysis mainly focused on descriptive statistics such as mean, frequency and standard error of the mean. Results and their interpretation are presented in this report.

3. SITE CHARACTERISTICS

3.1 Location and Overview of the Site

Humla is one of the five districts of the Karnali zone in Nepal's Mid-Western Development Region.Humla is bordered by Mugu district in the east, Bajura and Tibet Autonomous Region of *China* in the west and north, and Bajhang and Bajura districts in the South. It lies between latitudes the 29° 35′ and 30° 10′, and longitudes 81° 18′ and 82° 10′. The minimum and maximum elevations of Humla are 1524 and 7337 meters above sea level (masl) respectively.

After Dolpa, it is Nepal's second largest district in terms of area. Humla district spreads across an area of 5655 sq. km and has 27 VDCs. Humla has 9708 ha of arable land of which 5020 ha land is cultivated Intensive Study and Research Centre (2013) Forest and pasture lands account for 747.83 and 1414.49 sq. km or 13% and 25% of the total land, respectively (DDC, 2015)

Maximum temperature ranges between 10°C to 25°C and the minimum temperature ranges from 10°C to -28°C. Over 75% of land in the district is in the High Himalaya, while 22% is High Mountain and two percent is Mid-mountain. The three regions differ in terms of elevation and soil characteristics. Humla has five climatic zones; sub-tropical (1000-2000 masl), temperate (2000-3000 masl), sub-alpine (3000-4000 masl), alpine (4000-5000 masl) and nival (above 5000 masl). Average maximum annual rainfall is 68.3 mm (UNICEF, 2000).

The total population of the district is 50,858, with 25,025 females (49%) and 25,833 males (51%). The population is distributed across 9479 households, with an average household size of 5.37 people (CBS, 2011). The majority of the population in Humla is Hindu (82%), followed by Buddhist (18%), and the remaining percentage is split among other religions (CBS-NPC, 2011). The district has the following ethnic composition: Chhetri (44.2 %), Thakuri (19.5%), Lama (16.1%), and Brahmin (6.2%), as well as the following occupational castes: Kami (blacksmiths, 5.66 %), Damai (tailors, 2.36%) and Sarki (cobblers, 1.2 %). In 2011, the majority of males (62%) in Humla aged five and above were literate, but only a third of females could read and write (CBS, 2011). According to the Nepal Human Development Report of 2014, the Human Development Index and Human Poverty Index values of Humla are 0.432 and 49.26 respectively. The annual per capita income of Humla district is NRs. 35,515 (491 USD) (Humla (DDC, 2015).

Chhipra is situated near the middle of Humla district (Figure 3). It is surrounded by Humla Karnali in the east, Thama Hill and Bajura district in the west, Syanda VDC (Mehalgad) in the north and Raya VDC in the south. Chhipra VDC has a total area of 282 sq. km, which is roughly 5% of the total area of the district. Its coordinates are 29° 55′ 25.64″ N and 81° 50′ 56.4″ E. Human settlement is concentrated in four villages in Chhipra VDC, namely, Chhipra, Lekha, Majha and Nalla. The site is 4-hour hike from (12 Km South-East) from the district headquarter of Simkot.

Figure 3. Map of Humla showing Chhipra VDC highlighted in green

3.2 Agro-ecology of the Site

3.2.1 Climate

The altitude of Chhipra ranges from 2000-4800 masl, and features both warm temperate and cool temperate environments. The temperature of Chhipra varies between 0-20°C and the average annual rainfall is about 50 mm (MFD, 2005).

Humla is one of the five districts of the Karnali zone in Nepal's Mid-Western Development Region.Humla is bordered by Mugu district in the east, Bajura and Tibet Autonomous Region of *Chin*a in the west and north, and Bajhang and Bajura districts in the South. It lies between latitudes the 29° 35′ and 30° 10′, and longitudes 81° 18′ and 82° 10′. The minimum and maximum elevations of Humla are 1,524 and 7,337 meters above sea level (masl) respectively.

3.2.2 Soil Type and Soil Fertility

Most of the land of this VDC is rocky, which makes agricultural activities such as ploughing difficult (VDC Profile, 2010). Arable land is estimated to be less than 1%. There is a deficiency of nitrogen and phosphorus in the soil, but potash is abundant (VDC Profile, 2010).

3.3 Livelihood Systems

Agriculture, business, herb collection, wood collection, livestock, and trade are the major livelihood options available in the district. Agriculture is the most important source of livelihood in both the district and site; major sources of cash income for farmers are the sale of wood, herbs, livestock, and vegetables. The other important livelihood options are wage labour, and the collection and sale of forest products. Unlike the bordering villages of Bajura and Bajhang, seasonal migration for alternative livelihood options was not prevalent in Chhipra VDC. In contrast to Simkot, the population of Chhipra is not significantly involved in trade from *Chin*a. Agricultural production in the VDC meets food requirements for only 3-6 months.

3.4 Farming System

Agronomical crops, horticulture (e.g., apple, walnut, peach, vegetables, and potato), and livestock (cattle, goat, sheep, and poultry) are important components of the farming system in Chhipra. This farming system is also common in most of the mountain regions of Nepal. The major crops grown are finger millet, barley (both hulled and hull-less), wheat, rice, proso millet, beans, and potato. The type of crop grown varies by altitude. In lower altitudes, the major crops include rice, maize, wheat, barley, naked barley, beans, finger millet and proso millet. In higher altitudes, which the locals refer to as 'Lek', the major crops are buckwheat, finger millet, proso millet, barley, naked barley, wheat, and potato. Land abandonment (fallowing) is not a problem in the lower altitude areas of Chhipra, but does occur at higher altitudes. Specifically, this is an issue in the Lekha village of Chhipra due to poor fertility and distant land locations.

Chhipra has limited land suitable for growing rice. Photo: Achyut Raj Adhikari/LI-BIRD

3.5 Irrigation Sources and Svailability

Chhipra lies at the bank of the perennially flowing Karnali River. Despite this, the majority of the VDC relies on the seasonal monsoon for irrigation. Nalla village has water sources for irrigation that flow throughout the year, but these have been used only for running the improved water mill. Majha village also has seasonal water flow that is used to irrigate fields when cultivating rice. Apart from those, a pump irrigation plant has recently been installed which has the capacity to irrigate 132 ropani (about 6.7 ha) of land in Chhipra village of Chhipra VDC.

3.6 Status of use of External Inputs (fertilizers, micronutrients and pesticides) in Agriculture

Simkot is the major market of Humla district. However, Simkot has only one Agrovet supplier. Additionally, this supplier has a very limited stock. As all materials have to be brought by air, the cost of external inputs is very high and hence there is no benefit in using them. Farmers do not use micronutrients or pesticides as they are rarely available. Pesticides are sprayed only in apple orchards. The major source of soil nutrients is farmyard manure (FYM) and compost manure that is prepared at the household level. In Chhipra there is no external inputs supplier, and as a result the VDC is organic by default. In recent years the District Agriculture Development Office (DADO) has imported biofertilizers to distribute to farmers, but their accessibility remains very limited.

3.7 Status of Local /community based Institutions

There are a fairly good number of community based institutions and agencies in Chhipra (Table 3). The project site has two community level farmers' institutions. One of these is "Karnali Agricultural Cooperative," which is supported by Humla Development Initiatives (HDI) and LI-BIRD, at Nalla, Chhipra-6. Its focus is agricultural input supply and marketing of local products through collective action. The cooperative has 116 members. The second community farmer institution is "Dudhkunda Women Cooperative," which is supported by the Women Development Office of the district. It has approximately 100 women members and focuses on women's welfare and empowerment through credit and saving schemes, and agricultural marketing of locally produced products.

Table 3. Different government and non-government organisations working in Chhipra VDC and their respective working area

Organisation	Activities Performed
Western Upland Poverty Alleviation Programme (WUPAP)	Provide revolving funds for income generation activities and support for community infrastructures
Himali Navin Samaj	Works for the welfare of women and children
Nepal Climate Change Support Programme (NCCSP)	Supports for community infrastructures and income generation activities
Poverty alleviation fund (PAF)	Support pro poor communities for income generation activities and provide revolving fund
Women Welfare Service (WWS)	Helps in skill oriented and income generation training for at-risk or victimized women and elderly literacy classes
Rural Village Water Resources Management project (RVWRMP)	Supports rural communities for provisioning safe drinking water resources
Karnali Integrated Rural Development and Research Centre (KIRDARC)	Work to improve health and sanitation conditions
World Food Programme	Distribute food items for food for work
Women Development Office	Empower women thorough saving and credit scheme and promoting income generation activities

3.8 Status of Access to Technologies, Information and Support Services

This project site is a 4-hour walk (12 km South-East) from the district headquarter, Simkot with poor to no infrastructure for information exchange and communication. There are big hills (Lekha and Bargaun) in between this VDC and the district headquarter that block signal for mobile phone communication. Lekha village, which has a higher altitude and faces the opposite direction from Simkot has access to all mobile networks (NCell, Namaste and CDMA). Nalla and Chhipra, which are at a lower elevation on the bank of Karnali River, only have mobile signal from CDMA. Majha also intermittently receives reception from mobile networks other than CDMA. Whatever technology is present in the communities has to be carried to the site manually or by expensive helicopters. As a result, it is very difficult to bring in heavy equipment, which has significantly limited the modern technologies available to the VDC. Some improved crop varieties of rice, maize, wheat and potato have recently been introduced to the VDC by the Agriculture and Food Security Project (AFSP) of the Ministry of Agricultural Development, which is funded by the World Bank and the Humla Development Initiative (HDI) project of LI-BIRD. But currently, farmers in Chhipra have limited access to new technologies, information, or support services for important crops, such as the eight mandate crops that are the focus of this project.

There are two radio stations in Chhipra, Karnali FM and Kailash FM, which are the source of information and news for the people. The national newspaper takes a few days to reach the VDC and is only available in government offices. Televisions are rare in Chhipra and is not a common source of news or entertainment. Homes with television use DISH Home to get channels.

Because Chhipra is close to the district headquarter there is no Agricultural Service Centre (ASC) or Livestock Service Centre (LSC) in the VDC. People need to visit the district headquarter to receive any agricultural related services from these organisations. These government agricultural and livestock Centres are located far away from the site, so most people are deprived of their support and facilities.

4. FINDINGS

4.1 Household Characteristics

4.1.1 Demographic Results

Respondents were between 17 and 65 years in age and 72% of the respondents were male. Our prior knowledge indicated that family members would be out of the homestead during day time grazing animals. Hence, we conducted the survey in the morning or evening hours. At these times we found most women were busy in household work of fetching water, cooking and agricultural activities while men were free to talk to the enumerators.

Of the total 72 households surveyed 53% were Chhetri, 25% were Thakuri, 15% were Dalit and 7% were Brahmin. Sixty-nine percent of the families were nuclear and 31% were joint (Figure 4). Above average proportion of Thakuri households were nuclear at 83% while 64% and 61% of Dalit and Chettri households were nuclear respectively.

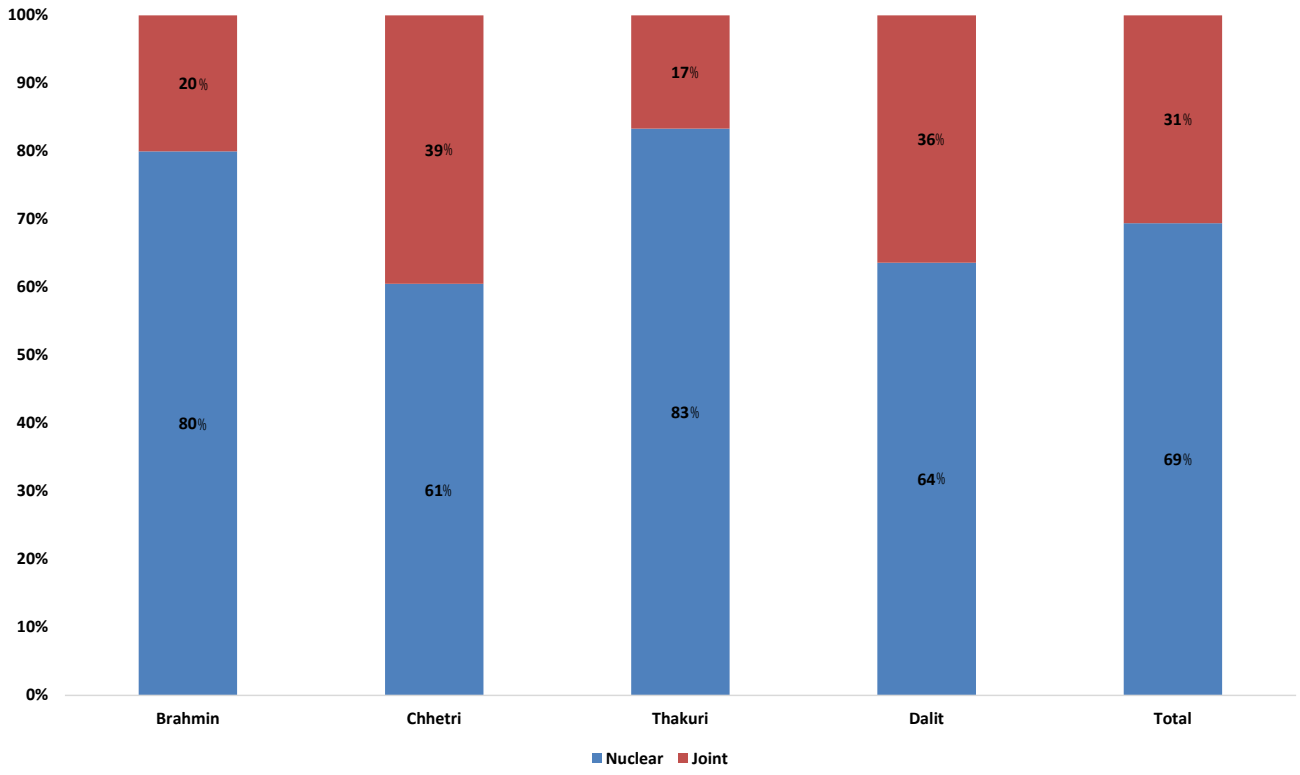

Figure 4. Frequency of family types in Chhipra in 2014

The average family size in Chhipra is 6 people with average nuclear family size at 5.1 and the joint family size at 7.9 (Table 4). Thakuri households had the highest average joint family size (10 people). Migration of families out of the district is not very common in Chhipra. Only three households reported family members migrating outside the VDC for work. All three family members that migrate for work were men, one of them for less than three months a year and two for more than six months a year.

Migration is uncommon due to off-farm income opportunities such as collection and sale of forest products and labour jobs in Simkot. Sale of agricultural produce in Simkot contribute to household income, and further lowers family migration. Many youths are employed in district headquarters in government offices.

Table 4. Family types and size by ethnicity in Chhipra 2014

Family size*	Brahmin	Chhetri	Thakuri	Dalit	Total
Nuclear	5.75 ± 0.25	4.73 ± 0.35	5.73 ± 0.48	4.71 ± 0.64	5.12 ± 0.24
Joint	9.00 ± 0	7.26 ± 0.67	10.00 ± 1.00	8.50 ± 0.65	7.91 ± 0.50
Total	6.40 ± 0.68	5.73 ± 0.39	6.44 ± 0.57	6.09 ± 0.73	6.01 ± 0.28

Note: Figures in parenthesis are percentages of their respective columns.
** Average number of family members ± Standard Error (SE) of mean*

Joint decision making is commonly reported when it comes to agricultural management at the household level (Figure 5).

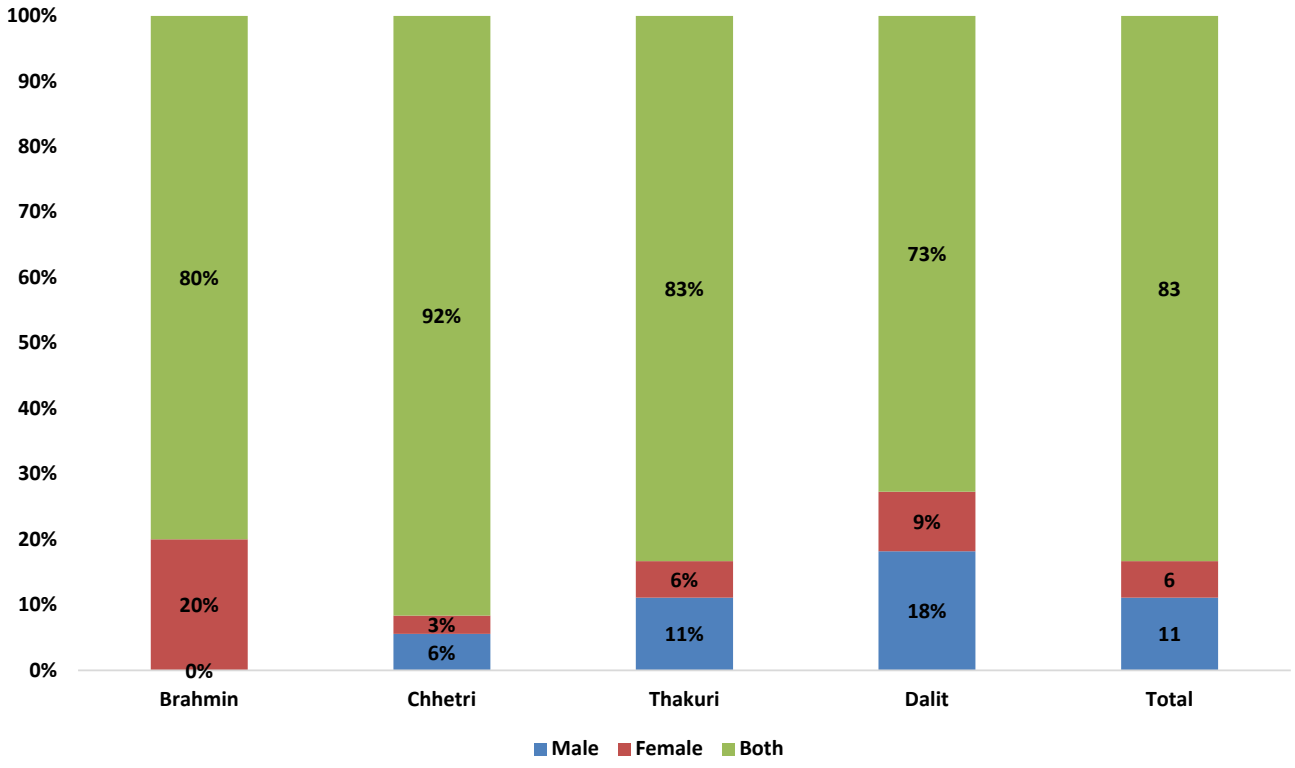

Figure 5. Gender of decision makers in agriculture in Chhipra

4.1.2 Primary Income Sources

Agriculture, i.e., working on one's own family farm, and agricultural labour, i.e., working on other's farm for pay, are the two important primary sources of income. Working on one's own farm was the primary source of income for most Chhetri (68%) and Thakuri (50%) households, while working on other people's farms was the primary source of income for most Dalit households (45%). Business, jobs and services, collection of medicinal and aromatic plants, and non-agricultural labour other sources of household income (Figure 6). Collection of medicinal and aromatic plants can be a lucrative income source in high mountain districts like Humla, but only 3 of the 72 surveyed households in Chhipra considered it their primary source of income.

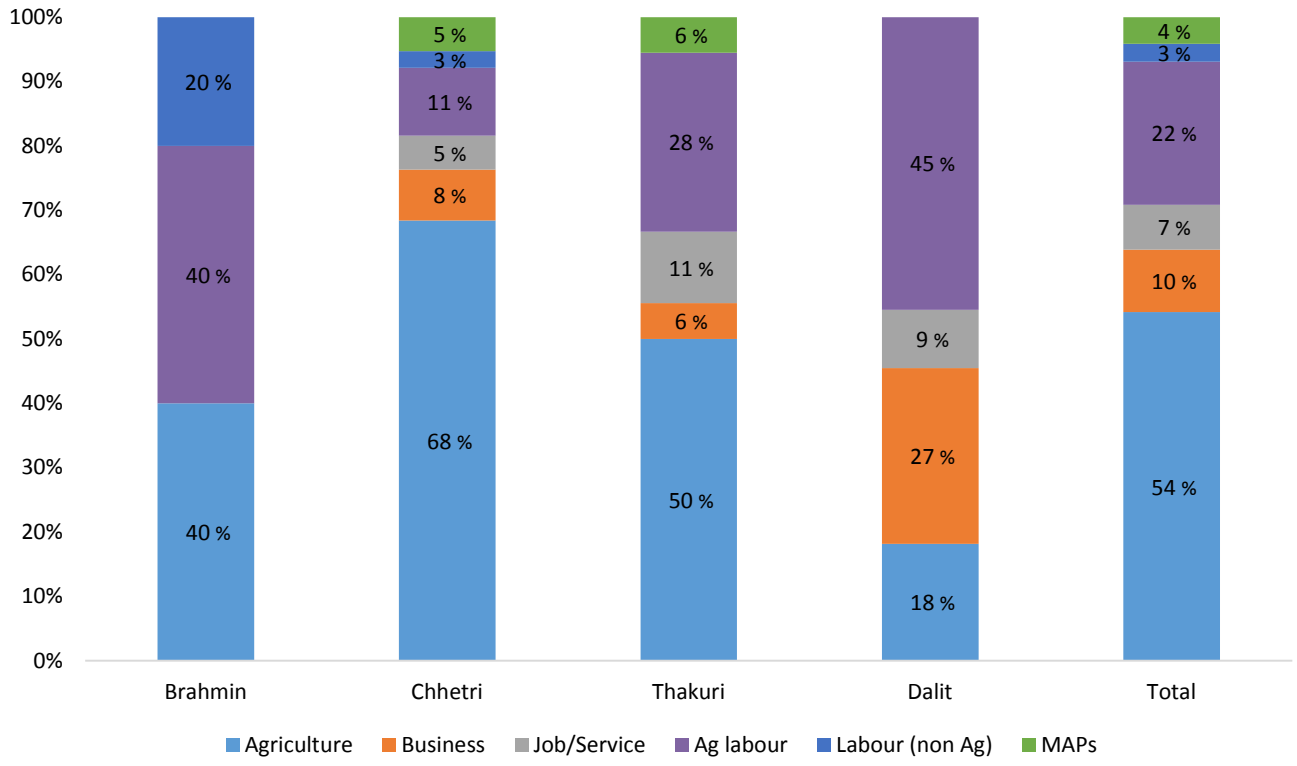

Figure 6. Primary occupation of households in Chhipra in 2014

4.1.3 Agricultural Resource Base

On average, a family in Chhipra owns 3.64 ropani of land and cultivates 3.26 ropani. Chhetris had the highest average land owned and average total land cultivated. An average household had 1.84 ropani in upland (*bari*) land and 1.66 ropani in lowland (*khet*) land. The share in and share out system was not very common in Chhipra. An average household shared in 0.10 ropani *khet*, and shared out 0.19 ropani *bari*. Only Chhetri and Thakuri households owned orchard land. This measure includes orchards of apple, walnut, chuli (*Prunus* spp.) and *khamu* (*Prunus* spp.). The average forest area is 0.06 ropani per household, and it was found that only Chhetri and Thakuri households owned forest.

Table 5. Status of agriculture resources (family labour and farm land) of households in Chhipra

Resources	Brahmin	Chhetri	Thakuri	Dalit	Total
Farm Labour*					
Male	1.50 ± 0.50	1.47 ± 0.13	1.11 ± 0.12	1.36 ± 0.28	1.37 ± 0.09
Female	1.40 ± 0.24	1.47 ± 0.18	1.53 ± 0.19	1.44 ± 0.24	1.48 ± 0.11
Khet land**					
HH ownership	1.00 ± 0	2.03 ± 0.28	1.36 ± 0.23	1.10 ± 0.28	1.66 ± 0.17
Share in	0	0.79 ± 0.58	0.14 ± 0.11	0.14 ± 0.10	0.10 ± 0.04
Fallow	0	0.05 ± 0.05	0	0.18 ± 0.12	0.06 ± 0.03
Bari land**					
HH ownership	1.5 ± 0.58	2.57 ± 0.66	1.19 ± 0.24	0.55 ± 0.14	1.84 ± 0.36
Shared out	0	0.37 ± 0.37	0	0	0.19 ± 0.19
Fallow	0	0.40 ± 0.23	0.06 ± 0.06	0	0.22 ± 0.12
Orchard	0	0.04 ± 0.03	0.04 ± 0.03	0	0.03 ± 0.02
Kharbari**	0	0.13 ± 0.07	0	0	0.07 ± 0.03
Forest**	0	0.08 ± 0.06	0.06 ± 0.06	0	0.06 ± 0.03

Resources	Brahmin	Chhetri	Thakuri	Dalit	Total
Average Owned Land** (All types)	2.5 ± 0.58	4.86 ± 0.71	2.65 ± 0.25	1.55 ± 0.24	3.64 ± 0.41
Average Total Cultivated** (All types)	2.5 ± 0.58	4.12 ± 0.34	2.74 ± 0.32	1.50 ± 0.23	3.26 ± 0.23

Note: Figures in parenthesis are HH percentages of their respective columns.
** Average number of family members per HH ± SE*
*** Average area unit in ropani ± SE per HH*

Livestock is an integral part of the farming system of the people in Chhipra (Table 6). A transhumance system is still practiced in Humla. In the summer animals are taken to higher altitudes for grazing. In the winter, they are brought back to the village, where they are kept in sheds and fed hay and other available fodder grass. In Chhipra, the number of animals that a household owns indicates their status in the community. Cow and jhuma[1] are reared for milk, while ox and jhopa are reared for draft purposes, including ploughing. Goats are used as pack animals to carry goods. Sampled households had 13.8 goats on average. Chhetri households had the most goats, with an average of 19.15. Dalit households owned only 1 cow and 1.29 oxen on average and did not rear any other animals, which is exacerbating their food sufficiency status (see Table 6 for additional details).

Table 6. Status of livestock of households in Chhipra in 2014.

Livestock*	Brahmin	Chhetri	Thakuri	Dalit	Total
Cow	2.33 ± 0.33 (3)	1.97 ± 0.16 (29)	2.09 ± 0.25 (11)	1.00 ± 0 (7)	1.88 ± 0.12 (50)
Ox	2.00 ± 0.71 (4)	1.86 ± 0.26 (21)	2.58 ± 0.63 (12)	1.29 ± 0.19 (7)	1.98 ± 0.23 (44)
Calf male	1.00 ± 0 (1)	1.50 ± 0.50 (2)	0	0	1.33 ± 0.33 (3)
Calf female	0	1.50 ± 0.29 (4)	0	0	1.50 ± 0.29 (4)
Jhuma	2.00 ± 0 (1)	1.75 ± 0.25 (4)	1.50 ± 0.50 (2)	0	1.71 ± 0.18 (7)
Jhopa	0	1.50 ± 0.29 (4)	1.00 ± 0 (2)	0	1.33 ± 0.21 (6)
Goat	5.00 ± 0 (2)	19.15 ± 4.46 (13)	3.40 ± 1.12 (5)	0	13.80 ± 3.32 (20)
Sheep	0	0	0	0	0
Poultry	3.00 ± 2.00 (2)	1.00 ± 0 (1)	2.00 ± 0.77 (10)	0	2.13 ± 0.64 (13)
Buffalo	0	0	0	0	0

Note: Figure in parenthesis represents the number of households that have respective animal in the row.
** Average number of livestock per HH ± SE of mean*

During the household survey it was determined that apple, peach, walnut, and orange trees are grown in the community (Table 7). Apple and peach were grown by 34 and 22 households respectively making them the most commonly grown fruits. Chhetri and Thakuri households had more trees in comparison to Brahmin and Dalit households. Of the surveyed Dalit households, only three households had apple trees (yielding an average of one) but no other fruits were grown. Orange was not very common in Chhipra, as the climate does not favour its production.

Table 7. Number of fruit trees in the surveyed households in Chhipra in 2014

Fruit*	Brahmin	Chhetri	Thakuri	Dalit	Total
Apple (*Malus pumila*)	2.67 ± 0.88 (3)	6.83 ± 2.53 (18)	6.60 ± 2.67 (10)	1.00 ± 0.00 (3)	5.88 ± 1.56 (34)
Peach (*Prunus persica*)	1.00 ± 0.00 (2)	1.91 ± 0.63 (11)	2.56 ± 1.08 (9)	0	2.09 ± 0.53 (22)
Walnut (*Juglans regia*)	0	1.67 ± 0.67 (3)	4.33 ± 1.86 (3)	0	3.00 ± 1.07 (6)
Orange (*Citrus reticulate*)	0	2.00 ± 1.00 (2)	2.00 ± 0.00 (1)	0	2.00 ± 0.58 (3)

Note: Values in parentheses indicate the total number of households with the respective fruit trees
** Average number of trees per HH ± SE of mean*

1 Jhuma is an adult female offspring of a cattle (*Bos taurus*) sire and yak (nak) (*Bos grunnines*) dam while Jhopa is male offspring from the same cross. Jhuma are used for milk while Jhopa are used for draught.

4.1.4 Agricultural Labour and Gender-based Discrimination

Members of the household are also generally the providers of agriculture labour. On average, 1.48 females and 1.37 males contribute to agricultural labour (Table 5). While in most communities the average number of men and women involved in agriculture was roughly equal, in the Thakuri community more women were involved in agriculture.

Despite similar number of males and females involved in agriculture, the work load on women is heavier. Women are responsible for most of the activities including harvesting, processing, and storage. On any given day in Chhipra, it is typical to find females – young girls to elderly women – involved in agricultural and household work, while boys and men are sitting around playing cards, smoking, and socializing.

The burden on women is exacerbated by gender based discrimination, with *chhaupadi* as a cultural practice that is emblematic of this disparity. In Hindu communities women are considered impure during their menstrual period. They are treated as untouchable and are not allowed to enter kitchens or partake in rituals for three to five days every cycle. Such restrictions are common all over Nepal, even in the cities and in highly educated families. *Chhaupadi* is simply an extreme form of this practice that is common in the Far-Western region Karnali zone. During *chhaupadi*, menstruating girls and women are required to spend three to five days outside the house in *chaugoth* (sheds made for this purpose or simply existing livestock shed). During *chhaupadi* it is taboo for women to touch flowering crops, fruits or eat nutritious diets like milk. In Chhipra VDC, unmarried girls spend seven to nine days and married women spend three to five days in *chaugoth*. During the stay in *chaugoth* women are vulnerable to the attack of wild animals, snakes and insects as well as more exposed to the external elements. Incidents of rape in *chaugoth* have also been reported.

4.1.5 Food Sufficiency Status of Households

The food sufficiency status of households in Chhipra is very low, which causes the VDC as a whole to commonly suffer from food insufficiency (Table 8). Cereal grains are sufficient for 4.67 months, while pulses, represented by the common bean in this site, are sufficient for 3.49 months. Leafy vegetables and other vegetables are sufficient for 3.33 and 2.96 months, respectively. Brahmins and Chhetris have relatively high food sufficiency in comparison to Thakuris and Dalits. Dalits have the lowest food sufficiency, as their produce is sufficient for merely 2 months of the year.

Drought remains a major constraint for crop production in Chhipra and Humla in general. Hence people still rely on food aid supplied by the Nepal Food Corporation or purchase food that is flown in by air thus paying high prices.

Table 8. Food sufficiency status of households in Chhipra in 2014

Food self-sufficiency*	Brahmin	Chhetri	Thakuri	Dalit	Total
Cereal	2.80 ± 0.49	5.67 ± 0.43	4.50 ± 0.76	2.45 ± 0.28	4.67 ± 0.33
Leafy vegetables	6.75 ± 2.29	3.27 ± 0.45	2.88 ± 0.64	2.88 ± 0.84	3.33 ± 0.35
Other vegetables	4.60 ± 2.04	3.00 ± 0.04	2.42 ± 0.40	2.78 ± 0.72	2.96 ± 0.30
Pulses	5.25 ± 1.80	4.23 ± 0.54	2.43 ± 0.42	1.95 ± 0.46	3.49 ± 0.35

** Average months within a year ± SE of mean*

4.2 Cropping Pattern and Crop Calendar

There are two distinct cropping patterns followed in the site: two crops per year in lower altitudes and three crops per two years in higher altitudes (Table 9). In lower altitude areas, cropping patterns are distinct in *khet* (lowland) and *bari* (upland) land. Rice is an important crop in *khet* land even though the area under paddy cultivation is very small in Chhipra. Upland rice (*ghaiya*) is also cultivated in some parts of the district through direct seeding in upland conditions. Finger millet is the number one crop in terms of area in both Humla and Chhipra. Finger millet is grown both by transplanting and direct seeding, but the latter is more common. Farmers reported that naked barley matures earlier than hulled barley, and both of these crops mature earlier than wheat.

Table 9. Cropping pattern in different altitudes and land types in Chhipra

Land types	Lower altitude (2000-2500 masl)	Higher altitude (>2500-3000 masl)	Remarks
Khet land	Rice - wheat/barley/naked barley*	- No *Khet* land available	
Bari land	Maize + beans - barley/naked barley/ wheat	Buckwheat - barley/naked barley/wheat	Buckwheat is a short duration crop, second cropping is possible in a year at high altitudes
	Finger millet/ proso millet + amaranth[2] - barley/naked barley/wheat	Buck wheat – potato	
		Finger millet/ proso millet + amaranth – Fallow	If finger millet is grown at higher altitudes there is no time for a second crop in the winter

"-" denotes different seasons, "+" denotes same season and mixed cropping while "/" denotes the same season and only one of them

[2]*Amaranth is grown as border crop*

Two distinct seasons can be seen in the cropping calendar of Chhipra VDC (Figure 7). Rainy season crops, referred to as *Kartike bali,* are sown from April to June and harvested from September to October. Intercropped beans are the only crops harvested early, from July to August. The harvest season of the intercropped bean differs from that of main season beans because intercrop beans are sown in April while main season beans are sown in June. Winter crops (barley and naked barley) are sown in November and then harvested in late May to early June. Harvesting time of the winter cereals depends on the altitude of the land. The higher the altitude, the later the harvesting date. Figure 7 shows the cropping calendar of Chhipra VDC.

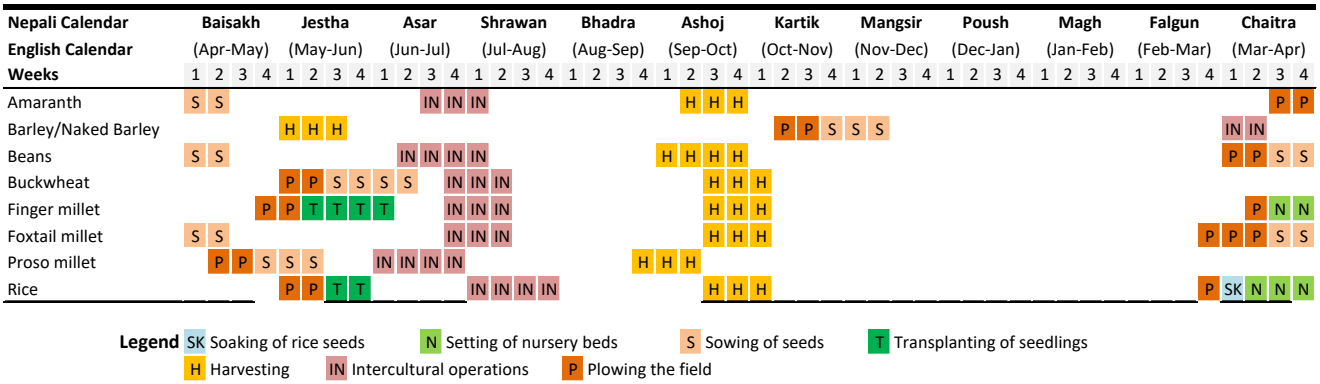

Figure 7. Cropping calendar showing sowing seeds to intercultural operations and harvesting in Chhipra, Humla

4.3 Mandate Crop Diversity

Information on varietal diversity of the mandate crops in the project sites has been collected using focus group discussions (during the 2012 site selection exercise and during the project inception phase in 2014), diversity fair and household survey. Typically, diversity fairs reveal the greatest diversity because farmers seek out and collect even the rarest of varieties for the sake of competition. However, in Chhipra there was not much difference in varietal richness between methods (Table 11). Chhipra and other high mountain villages have limited number of varietal choices due to cold tolerance bottlenecking and limited research for this region. Hence even methods like group discussion were able to capture almost all of the diversity in the system. In a more diverse and populous system, the effectiveness of diversity fairs in finding rare varieties tends to be better than group discussions or household surveys.

Among the mandate crops, only beans show variance in the level of diversity reported based on the methods used. Since beans the crop with the greatest diversity this is not surprising. If a similar exercise was conducted in a location like Begnas in Kaski, where there are over 40 local varieties of rice, we would expect to find great discrepancy in the richness seen at diversity fairs versus in household surveys. However, the same method was not consistently good for all crops (Table 11).

Table 10. Varietal richness of mandate crops in Chhipra as revealed by various methods

Crop	Site selection exercise in 2012	Diversity fair in 2014	FGDs in 2014/15	HH Survey in 2014	Cumulative Total
Amaranth	2 (2)	2 (2)	2 (2)	3 (3)*	3 (3)
Barley	2 (2)	2 (2)	3 (3)*	1 (1)	3 (3)
Bean	7 (7)	10 (10)*	6 (6)	4 (4)	10 (10)
Buckwheat	3 (3)	3 (3)	4 (4)*	2 (2)	4 (4)
Finger millet	6 (6)*	3 (3)	5 (5)	4 (4)	7 (7)
Foxtail millet	3 (3)	2 (2)	2 (2)	4 (4)*	4 (4)
Naked barley	2 (2)	4 (4)*	4 (4)*	4 (4)*	5 (5)
Proso millet	2 (2)	3 (3)*	3 (3)*	3 (3)*	4 (4)
Rice	9 (6)*	6 (4)	2 (2)	4 (3)	14 (11)
Total	36 (33)	36 (34)	31 (31)	29 (29)	55 (52)

Note: Values in parentheses indicate the richness of local varieties
** Indicates the highest richness among the methods used*

Finger millet had the highest average area under cultivation (1.17 ropani), followed by buckwheat and naked barley (each 0.88 ropani), and rice (0.86 ropani). Amaranth had the least average area under cultivation as many households grew amaranth only as a border crop. Common bean had the highest productivity (5.09 tons/ha), barley (4.5 tons/ha), and foxtail millet (4.47 tons/ha). Finger millet was grown by the highest number of households (93%) followed by proso millet (89%), bean (88%), naked barley (86%), and amaranth (83%). These are the major crops grown in the site. The average richness per household was highest for amaranth (2.03), followed by bean (1.76) and foxtail millet (1.55), as all three crops are grown in a mixture by many households. Rice, bean, finger millet, foxtail millet, and naked barley had the highest community richness with four varieties. Barley had only one landrace documented, which caused it to have the lowest evenness (0), followed by proso millet (0.06), for which the *Dudhae* variety was dominant over the *Rato* variety.

The varietal evenness by area of cold tolerant rice (0.68), bean (0.55), finger millet (0.58) and naked barley (0.73) is higher than 0.5, which infers that no variety is dominant over another. However, varietal evenness by area of buckwheat (0.149) and proso millet (0.064) signify that one of the varieties in highly dominant over others (Table 12).

Table 11. Household and community richness and evenness of mandate crops with their average area, productivity, and household richness in Chhipra VDC

Crop	Area** (ropani)	Productivity*** (kg/ropani)	# HHs	Avg Richness****	Community Richness	Evenness (area)
Rice	0.86 ± 0.090	69.99 ± 6.519	40 (56%)	1.10 ± 0.05	4	0.68
Bean	0.479 ± 0.041	101.7 ± 12.813	63 (88%)	1.76 ± 0.09	4	0.55
Amaranth*	0.118 ± 0.021	100.22 ± 30.51	60 (83%)	2.03 ± 0.34	3	0.48
Buckwheat	0.88 ± 0.100	76.69 ± 6.796	43 (60%)	1.14 ± 0.05	2	0.15
Finger Millet	1.17 ± 0.092	73.91 ± 4.804	67 (93%)	1.36 ± 0.07	4	0.58
Barley	0.39 ± 0.09	90 ± 26.967	9 (13%)	1.00 ± 0	1	0
Proso Millet	0.79 ± 0.06	73.83 ± 5.502	64 (89%)	1.06 ± 0.03	3	0.06
Foxtail Millet	0.49 ± 0.051	89.45 ± 13.071	48 (67%)	1.55 ± 0.07	4	0.46
Naked Barley	0.88 ± 0.071	69.39 ± 4.109	62 (86%)	1.24 ± 0.06	4	0.73

Note: Figures in the parenthesis are the HH percentage within total sampled HHs in the baseline survey. FCA results are from RPA 2014/15
**The productivity of Amaranths was found high while cross checking with on station trials due to difficulty in determining area of cultivation by respondents and lack of proper data validation method. Productivity of grain amaranths and leaf amaranths are 50 kg per ropani and 1 tone per ropani respectively (न्यौपाने सन्देश, २०७२)*
*** Average area in Ropani ± SE of the mean, ***Average productivity in kg/Ropani ± SE of mean, **** Average HH level richness ± SE of mean*

4.3.1 Amaranth

Amaranth (*Amaranthus* spp.) is commonly referred to as marshe in Humla, and was grown by 83% of the surveyed households in Chhipra (Table 12). Farmers grow amaranth as a border crop to demarcate their land from others. Hence, its 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 of amaranth is an approximation, at best. Farmers use grain colour and inflorescence attitude to distinguish between varieties. The varieties, area, productivity, distinguishing traits, and percent of households growing each of them are presented in Table 13. Amaranth is consumed both as a grain and as a vegetable. Traditionally, roasted amaranth grains are consumed for breakfast or as a snack. Black grained amaranth is preferred for consumption as a vegetable.

Table 12. Varieties of amaranth, their area, productivity, and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)**	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Kalo marshe	0.05 ± 0.045	76.20 ± 25.40	3%	few HHs in small area	black grain	*Aadilo* (digests slowly and prevents from feeling hungry longer)
Mal marshe	0.09 ± 0.018	244.09 ± 35.56	63%	many HHs in small area	drooping plant, red grain	drought tolerant, mixed cropping
Thado marshe	0.08 ± 0.023	279.40 ± 50.80	43%	many HHs in small area	erect plant, white grain	drought tolerant, high yielding, early maturity, pest tolerant, solo cropping, good eating quality
Mixed	0.06 ± 0.02	202.77 ± 27.09	17%	many HHs in small area	NA	NA

Note: Data for area per HH, productivity, and % HH are from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair

** Percentage of surveyed household that cultivate Amaranth (n=60)*

***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.*

4.3.2 Barley

Barley (*Hordeum vulgare*) is locally called jau and is grown for its grain, which is used for bread production. While barley is grown by almost every household in the second project site in Karnali (Hanku in Jumla), it is rather rare in Chhipra. It was found to be grown only by 13% of the surveyed households in Chhipra (Table 12). Although three local landraces of barley were documented from different studies (Table 14), most households grow a single landrace, Seto Jau, which has a good yield. Barley is consumed in the form of *roti* (flatbread), *sattu* (roasted flour), and *chhyang* (traditional beer).

Table 13. Varieties of barley, their area, productivity and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Kalo jau	NA	NA	11%	few HHs in small area	black panicle	takes long to digest, less husky
Seto jau	0.39 ± 0.09	90.00 ± 26.97	100%	many HHs in small area	white panicle, long awn	high yielding, good milling quality, but more husky
Thangre	NA	NA		few HHs in small area	short straight awns, short plant height	tasty and high yielding

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair

** Percentage of surveyed household that cultivate Barley (n=9)*

4.3.3 Buckwheat

Buckwheat, commonly known as phapar, is grown in fields at higher elevations (lek) in Chhipra. Around 60% of the surveyed households cultivate buckwheat (Table 12). Two species of buckwheat are grown in Chhipra: Mithae or sweet type (*Fagopyrum esculentum*), and Titae or bitter type (*Fagopyrum tartaricum*). Although four landraces have been documented, only Titae and Mithae are grown by many households (Table 15). Titae buckwheat is very popular in Chhipra as it has high yield potential and high milling recovery. This variety is grown in higher altitudes or lek areas of Chhipra as its taste reportedly gets better when grown at higher elevations. Buckwheat is mainly consumed for dinner as *dhindo,* which can be made from the flour of Titae or Mithae phapar or a mixture of both varieties. *Lakkad* (thick pancake) is made from Titae phapar and is eaten with honey as a snack or for lunch. *Dhesu*, a thick and hard bread made of buckwheat flour, is always carried as food during long travels.

Table 14. Varieties of buckwheat, area, productivity and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Khise/ chuche	NA	NA	NA	few HHs in small area	small grain	low milling recovery according to diversity fair, but in subsequent discussions high milling recovery has been stated
Mithe	0.61 ± 0.24	65.00 ± 8.65	10%	many HHs in small area	white flower, plant red, pointed seed	*aadilo*, tasty, early maturity, higher flour recovery, can cause bloating (पेट फुल्ने/पेट ढाडिने) when eaten in excess
Musure	NA	NA	NA	few HHs in small area	blunt seed	high yielding, tasty
Titae	0.81 ± 0.10	79.70 ± 7.01	58%	many HHs in small area	big and black grains, blunt seed	high yielding, high milling recovery, no bitter taste at higher altitudes but becomes bitter at lower altitudes, headache if eaten in large quantities, good against common cold

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Variety names and information on key distinguishing traits and functional traits were gathered from the site selection report, four cell analysis and diversity fair

** Percentage of surveyed household that cultivate Buckwheat (n=43)*

4.3.4 Common Beans

Common bean (*Phaseolus vulgaris*) is a major pulse crop grown by 88% of the households in Chhipra (Table 12) for both household consumption and commercial use. It is primarily cultivated for dry beans, which is consumed as *daal* – an important source of protein and nutrition in a diet that can be low in diversity. In the summer and rainy season, it is also common to harvest and consume beans as fresh vegetable, locally known as *damra* (दाम्रा). Different varieties of beans were documented during the diversity fair, but at the time of the baseline survey, only four varieties were recorded, for which area and productivity was estimated (Table 16). In Chhipra, common bean is the crop with the highest richness. Kalo Jhal Sarne Simi and Kalo Malae Simi are the most popular varieties and are grown by many households. Since beans are commonly grown as a mixture of multiple varieties a majority of the respondents were not able to estimate the area of cultivation for individual varieties. Farmers have stated that mixed varieties of beans have a better taste.

Table 15. Varieties of common beans, their area, productivity, and percent households growing in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Dalle simi	0.17 ± 0.07	0.32 ± 0.16	6%	few HHs in small area	round seed	bushy plant, high yielding, early maturity
Ghiu simi	NA	NA	3%	few HHs in small area	brown and elongated seeds	good eating quality, moderate appearance
Hariyo simi	NA	NA		few HHs in small area	green grain colour	low yielding
Kalo Simi (Humli)	0.29 ± 0.03	0.25 ± 0.05	43%	many HHs in small area	black coloured seeds, smaller than Malae Simi seed, bushy plant	tasty *daal*, local of Humla, even the cooked pulse is black in colour, good appearance, high yielding, early maturity, good appearance
Malae simi	0.32 ± 0.06	0.26 ± 0.04	49%	many HHs in small area	seed colour is black/red with white tints	large pods and high yielding
Pahelo simi	NA	NA	3%	few HHs in small area	yellow coloured seed, good climber	low yielding
Rato simi	NA	NA	NA	few HHs in small area	red coloured seed	good for pulse, moderate appearance
Sano Seto simi	NA	NA	NA	few HHs in small area	white coloured pod	bushy plant and high yielding
Seto male simi	0.20 ± 0.06	0.38 ± 0.21	6%	few HHs in small area	large pod	shattering loss is common and good cooking quality
Seto pahelo	NA	NA	NA	few HHs in small area	large pod	tasty *daal*

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair

** Percentage of surveyed household that cultivate Common Bean (n=63)*

4.3.5 Finger Millet

Finger millet (*Eleusine coracana*), commonly known as kodo, is the major crop grown by 93% of the surveyed households (Table 12). Kalo Kodo is the most popular landrace of finger millet in Chhipra, followed by *Rato* Kodo and Tyase Kodo (Table 17). The religious importance and diverse culinary use of this crop has ensured the maintenance of landraces. Kalo Kodo is grown by many households for its medicinal value and high yield. Finger millet is mainly consumed as *dhindo*. Flatbreads made from finger millet flour are commonly carried during long travel because of their long keeping quality.

Table 16. Varieties of finger millet, their area, productivity, and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Aankule/ aulae	NA	NA	NA	few HHs in small area	black straw, finger like ears	early maturing
Kalo kodo	0.91 ± 0.09	68.02 ± 4.73	68%	many HHs in small area	black straw, large grain	increase blood level, medicinal value, susceptible to diseases
Lapche	NA	NA	NA	few HHs in small area	black straw, ear like ears	tasty, low yield
Latte	NA	NA	NA	few HHs in small area	white straw	late maturing
Pahelo	0.80 ± 0.28	50.00 ± 10.00	3%	few HHs in small area	Yellowish brown grain	NA
Ryaule/Rato kodo	0.87 ± 0.16	87.43 ± 10.31	33%	many HHs in small area	black straw, compact ears	early maturing, tasty, high yielding
Tyase/Seto kodo	0.72 ± 0.11	70.62 ± 9.46	22%	many HHs in small area	white straw	early maturing, tasty, less production, low recovery

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

** Percentage of surveyed household that cultivate Finger Millet (n=67)*

4.3.6 Foxtail Millet

Foxtail millet (*Setaria italica*), known as kaguno, is grown by 67% of the surveyed households in Chhipra making it more common than rice and buckwheat (Table 12). It is grown for its nutritious grains, which are used to prepare *bhaat, chiura* and *jaand*. Kalo Kaguno is the most popular landrace followed by Pahelo Kaguno (Table 18). Both varieties are drought tolerant, but Kalo Kaguno has better yield than Pahelo Kaguno and hence is more preferred.

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

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Kalo	0.33 ± 0.04	105.77 ± 19.51	49%	many HHs in small area	black panicle	drought tolerant, medicine for fever and diarrhea, high yield, easily digestible
Pahelo	0.36 ± 0.05	75.68 ± 9.60	31%	many HHs in small area	yellow panicle	drought tolerant, higher sterility
Rato (nabo)	NA	NA	3%	few HHs in small area	reddish grains	occurs as weed in the field, not grown for grain, early maturity
Seto	NA	NA	3%	few HHs in small area	pale white panicle	good taste

Note: Data for area per HH, productivity and % HH are from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits were gathered from site selection report, four cell analysis and diversity fair.

** Percentage of surveyed household that cultivate Foxtail Millet (n=48)*

4.3.7 Naked Barley

Naked barley (*Hordeum vulgare* var. *nudum*) is known as uwa in Nepali. It is grown by 86% of households in Chhipra (Table 12) making it the third most commonly grown cereal after finger millet and proso millet. It is hull-less and grown for its grain. Based on awn characteristics, the diversity of naked barley is categorized in to two types. The awned naked barley is referred to as *kunale* or *kun hune* while awnless types are referred to as *takulle* or *phul uwa*. Awned naked barley can be white or red. The red type is rare and has characteristic deep purple nodes as well as colouring in parts of the internodes, panicle, awns, and grains. Flour is used for making flatbread, *thukpa*[2] (noodles) and *sattu* (roasted flour) while grains are used for making *chhyang* (liquor). Five local landraces of naked barley were documented in the site, and four of these were grown by many households. The *Rato* variety seems to be the rarest and is only grown by a few (3%) of households in the community (Table 19). The popularity of *chhyang* and *sattu* has contributed to the abundance of the multiple varieties of this crop.

Table 18. Varieties of naked barley, their area, productivity, and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH	Four cell analysis	Key distinguishing traits	Functional traits
Kunalo	0.60 ± 0.07	79.65 ± 6.75	24%	many HHs in small area	dense awn, white and slightly pointed seed	drought susceptible, tasty, *aadilo* (delays appetite)
Mudulae/ takulae	0.75 ± 0.22	75 ± 10.41	17%	many HHs in small area	less awn, no spine in grains	high yielding, good to make *roti*
Phool phulne/ dhakre	0.85 ± 0.12	57.64 ± 6.52	33%	many HHs in small area	less awn	easy to thresh
Rato Uwa	NA	NA	3%	few HHs in small area	Awned. Purple nodes and colouration in internodes, panicle, awns and grains.	drought resistant, late maturing, takes a long time to digest, medicinal value
Seto Uwa	0.66 ± 0.08	81.41 ± 7.14	24%	many HHs in small area	long awn	early maturing, drought tolerant

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

** Percentage of surveyed household that cultivate Naked Barley (n=62)*

4.3.8 Proso Millet

Proso millet (Panicum milliaceum), known as *chino*, is grown by 89% of the households making it the second most common cereal after finger millet (Table 12). Proso millet grains are used to prepare bhaat, flatbread, *chuila* [3], *moori* (roasted grain consumed after de-husking) and *selroti*. The *Dudhae Chino* is grown by most households (89%) in Chhipra, followed by the *Rato Chino* (Table 20). The reason behind the preference of this crop seems to be its relative drought tolerance with respect to other crops. Although it is difficult to thresh, *Dudhae Chino* is still preferred for its early maturity, high yield, and good taste. Investment in threshers or selecting for easy threshing lines may be worthwhile goals.

2 Noodle (*thukpa*) making is more in the Lama community while in the Brahmin, Chettri and Thakuri community, this recipe is called chumphya (चुम्फ्या). Dough of naked barley flour is rolled out and then cut into strips to make noodles. This is consumed at household level. Although *thukpa* (noodle)soup is a staple of many restaurant around the country, use of naked barley noodles is non existant.

3 *Chuila* is what locals in Chhipra refer to *poori*, i.e., *chapatti* fried in oil or ghee. In Chhipra, *chuila* is also made from wheat, rice, foxtail millet and proso millet. These are prepared during special rites, rituals and festivals.

Table 19. Varieties of proso millet, their area, productivity, and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Dudhae	0.75 ± 0.06	73.70 ± 5.50	89%	many HHs in small area	white panicle, long awn, coarse grain	difficult to thresh, early maturing, tasty, high yielding
Kalo	NA	NA	1%	few HHs in small area	black grains	nutritious, easy to thresh
Kaptade	NA	NA	3%	few HHs in small area	panicle colour white and red, grains are half red half white	nutritious, early maturing, easy to mill
Rato	0.69 ± 0.19	70.00 ± 12.91	6%	few HHs in small area	red panicle, fine grain	nutritious and tasty, hard dehusking operation, late maturing, low yielding

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

** Percentage of surveyed household that cultivate Proso Millet (n=64)*

4.3.9 Rice

Rice (*Oryza sativa*) is grown in the lower altitudes of the VDC in both upland fields (by direct seeding) and lowland fields (by transplanting). Rice has the highest richness out of all the surveyed crops, even more than common beans (Table 11). Although Chhipra has limited area suitable for lowland rice cultivation, 56% of households grow rice (Table 12). This clearly shows the social importance given to this crop in Chhipra. For example, pudding made from local rice is mandatory in festivals. Kalo/Jumli Marsi is the most popular landrace in Humla (including Chhipra) because of its cold tolerance (Table 21). However, the area under cultivation of this landrace has decreased in recent years due to its susceptibility to blast. Chandanath-3 is an improved variety that was introduced to Chhipra recently. The area under cultivation of this variety has been increasing, as it has not been affected by blast as much as local Marsi. Jugiya Dhan is an awned variety of rice that is also known as Jau Dhan because of its similarity in appearance to barley. This local landrace is grown in both upland and lowland fields and has good productivity compared to Marsi variety.

Table 20. Varieties of rice, their area, productivity, and percent households growing them in Chhipra VDC

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Chandanath-3	0.89 ± 0.22	76.00 ± 19.94	10%	many HHs in small area	coarse grains, small round grains	cold tolerant, high yield, late maturing
Chhomrong	NA	NA	NA	few HHs in small area	red grain	late maturing, high yielding, good eating quality
Churena	NA	NA	NA	few HHs in small area	reddish black husk	nutritious
Dhainela	NA	NA	NA	few HHs in small area	round grain, white grain	early maturing, high yielding
Dhokro	NA	NA	NA	few HHs in small area	white seed, panicle long, tall plant height	susceptible to drought
Dudhae Dhan	0.60 ± 0.08	80.83 ± 6.88	8%	many HHs in small area	yellowish red seed	low yielding
Jugiya Dhan (syn. Jau Dhan)	0.94 ± 0.18	45.45 ± 8.38	15%	many HHs in small area	long awn	difficult to thresh, good yield, drought tolerant

Variety	Area per HH (ropani)	Productivity (kg/ropani)	% HH*	Four cell analysis	Key distinguishing traits	Functional traits
Kalo Gahatulo	NA	NA	NA	few HHs in small area	brown seed	tasty
Kalo Lumsero	NA	NA	NA	few HHs in small area	black and white tint	early maturing
Kalo Marsi (syn. Kali Marsi, Kalo Marso, Jumli Marsi)	0.71 ± 0.10	80.50 ± 9.02	29%	many HHs in small area	reddish grain and reddish black seed	Good taste, adhilo (i.e., keeps satiated for longer). Also considered nutritious for postpartum women
Khachya	NA	NA	NA	few HHs in small area	red and brown husk	tasty, drought susceptible
Ratanpure	NA	NA	NA	few HHs in small area	coarse grain, white grain	aromatic, good cooking quality, late maturing, requires more water (upland)
Sunakhare	NA	NA	NA	few HHs in small area	yellow grain	drought tolerant

Note: Data for area per HH, productivity, and % HH is from the baseline survey conducted with 72 households in Chhipra. Information on key distinguishing traits and functional traits was gathered from the site selection report, four cell analysis, and diversity fair.

** Percentage of surveyed household that cultivate Rice (n=40)*

4.4 Seed Source and Seed Management Practices

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 usually applicable for certified seeds of notified varieties, which require 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 as seeds do not require a label. The seed can get to farmers through a variety of avenues with agro-vets and public breeding programmes being more typical for formal seed system while farm saved seeds and farmer to farmer seed exchanges being 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 labels.

The seed system of mandate crops in Chhipra is almost entirely informal. As expected, farm saved seed is the most important seed source. In 2014, all surveyed households relied completely on farm saved seed for barley, beans, foxtail millet and proso millet (Figure 8). A small percentage of households got buckwheat seed from relatives and finger millet seed from neighbours. Neighbours and relatives were both minor sources for amaranth and naked barley seed. NGOs and relatives were the minor seed source for rice, with the NGOs supplying the released variety Chandanath.

In Chhipra there are limited options to farm saved seed. When farm saved seeds are not enough, neighbours and relatives become important sources. Farmers also get seeds of improved varieties of some crops (especially rice) from NGOs and DADO. Every year DADO distributes seed of registered rice varieties through agriculture service centres and farmers from Chhipra can collect seed from the agriculture service centre in Kharpunath, Yangchu. Limited to no registered varieties for mandate crops has also restricted the use of this option. At the time of the survey, there was only one agro-vet store in the entire district, located in Simkot, which mostly sells veterinary medicine and vegetable seeds.

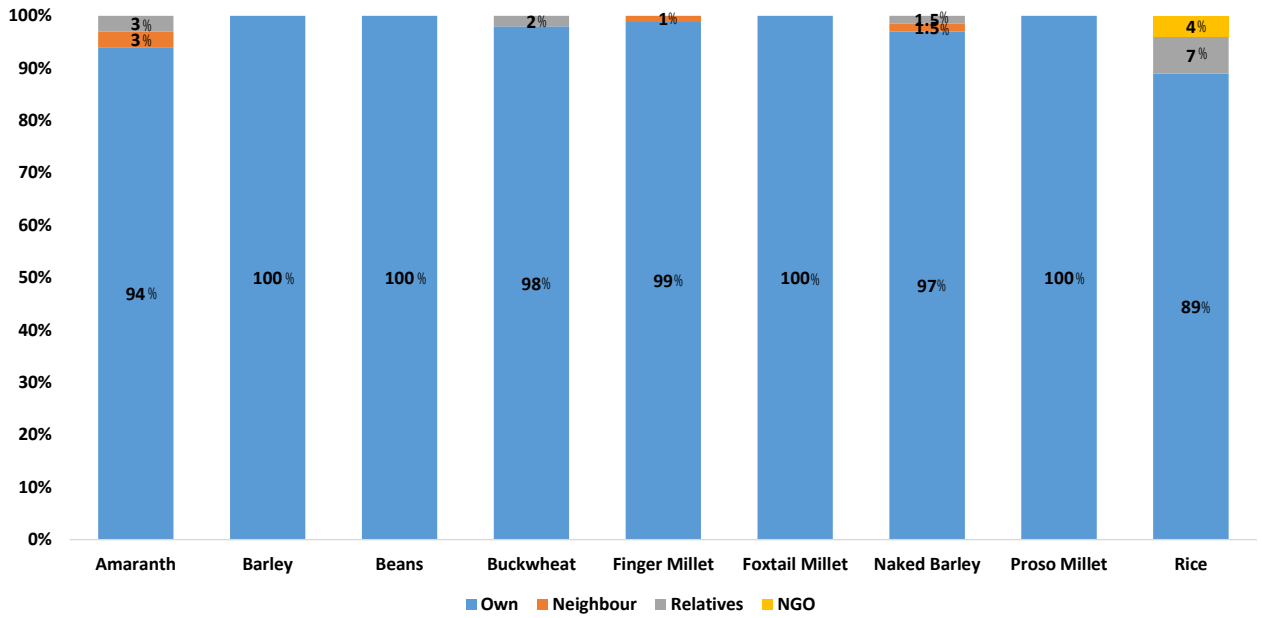

Figure 8. Source of seeds of the mandate crops in Chhipra in 2014

Table 21. Frequency of seed sources used by ethnicity for planting decisions in a year.

Seed Source	Brahmin	Chhetri	Thakuri	Dalit	Total
Own saved	38 (97%)	274 (99%)	138 (98%)	67 (89%)	517 (97%)
Relatives	0	1 (<1%)	1 (1%)	3 (4%)	5 (1%)
Neighbours	0	2 (1%)	0	2 (3%)	4 (1%)
CSB	0	1 (<1%)	1 (1%)	3 (4%)	5 (1%)
NGO	1 (3%)	0	1 (1%)	0	2 (<1%)

Note: Figure in parenthesis is the percentage of the ethnicity's seed need met by the seed sources

Seed sourcing and management practices in Chhipra are traditional (Table 22). Farmers are solely responsible for variety selection, seed plant selection, harvesting, threshing, drying, cleaning and grading, storage and monitoring of the seeds. Seed selection is done at various stages for different crops.

Seeds of rice, finger millet, foxtail millet, and naked barley are selected during the harvesting stage (Table 23). Bold panicles, true to the landrace and with healthy seeds are selected and saved for use as next year's seed. Seeds of buckwheat and beans are selected at the time of threshing and cleaning. Cleaning is done by winnowing; the seeds that remain directly below the winnow stream while cleaning are considered to be robust, bold, and healthy, and are therefore selected for seed saving. Amaranth seeds are selected when the plant is flowering in the field; plants with a thick stem and longer heads are selected as seed plants. No selection is done for proso millet and instead, grains and seeds are stored together.

Farmers do not practice in modern methods of seed management. Harvesting is done manually, and simple local tools like a *raineta*[4] and sickle are used. Threshing is also done manually using *gyabre*[5] and sticks or by trampling by foot. The sun is the sole source of energy for drying. Storage is done in traditional vessels like *dahara*[6], wooden *bhakari*[7], and copper containers. Some crops are stored in sacks and plastic bags. Some crop seeds are hung from ceilings and walls using ropes. Leaves of *khamu* (wild peach) are used to keep rodents and pests away from the stored seeds.

4 *Raineta* is a local farm equipment made up of two sticks, used for harvesting of naked barley, wheat and barley

5 *Gyabre* is a stick, which is bent on one side by heating over fire for easier use. It is used for threshing all types crops

6 *Dahara* is a grain storage vessel, its capacity ranges from 5 kg to 500 kg. It is made up of soil, water, mustard cake and goat's fur. It has small opening in the top, which is covered by a lid.

7 *Bhakari* is also called "khaat". It is a wooden storage material, almost all crop grains are stored in it. Its capacity varies from 20 kg to 500 kg

Table 22. Seed management practices for the traditional mountain crops in Chhipra VDC

Steps	Rice	Amaranth	Buckwheat	Finger millet	Proso millet	Foxtail millet	Beans	Naked barley
Variety Selection Criteria	Yield, taste, and drought tolerance. Chandannath-3 is preferred for yield, Jugiya Dhan is preferred for drought tolerance and yield and Kali Marsi is preferred for taste.	Taste and yield. Seto marse and Mal marse are farmers' preferred varieties.	Yield. Although Mithe Phapar tastes better (sweet), Titae Phapar yields better and hence is preferred.	Yield. Kalo kodo is the farmers' preferred variety.	Early maturity, yield, and taste. *Rato chin*o is chosen for early maturity, Seto *chin*o for yield, Dudhe and Katibade (Kaptade) for taste.	Medicinal properties and yield. Kalo Kaguno is chosen for medicinal purposes, while Seto and Pahelo are chosen for yield.	Drought tolerance, yield, and early maturity. Farmers usually cultivate beans in a mixture to augment taste and secure the crop from failure. *Rato*, Simkote kalo, and Malae are selected for early maturity.	Yield, early maturity, drought tolerance and disease resistance. Varieties with red flowers are preferred, as they are early maturing.
Seed plant selection	When ripe, complete panicles are selected by visiting the farm just before harvesting. Females generally make decision.	Healthy plants with relatively thicker stem and longer heads (*jhaura*) are selected during the flowering stage.	Selection is done after harvesting and during cleaning; seeds are separated from grains by winnowing. The grains that lie directly below the winnower are considered to be robust and are used as seed.	When ripe, perfectly coloured (according to the variety) panicles are selected earlier in the day during harvest.	Not selected separately. Seed and grain stored together.	Completely filled panicles are selected from robust plants at the time of harvest.	Large sized, true to colour grains are selected after threshing from the threshing ground.	Black coloured, thick, and substantially long panicles are selected during the time of harvesting.
Stage of selection	Just before harvesting the grains	Flowering stage of standing crop	During the threshing and cleaning stage	During harvest day just prior to harvesting the grains	No selection is done	At the time of harvesting	During the threshing and cleaning stage	At the time of harvest
Harvesting threshing	Harvesting of seed panicles is done separately during the same day. Threshed separately by trampling with feet. Trampling by oxen is not practiced in Chhipra.	Seed harvesting is done separately during the same day. Threshed by trampling with feet.	Seed is harvested and threshed together with grain plants.	Seed harvesting is done separately during same day. Threshed by trampling with feet.	Harvested and threshed together with grain plants.	Harvesting done separately during same day.	Harvested and threshed together with grain plants.	Harvesting of panicle done separately during the same day. Threshed by trampling with feet.

Steps	Rice	Amaranth	Buckwheat	Finger millet	Proso millet	Foxtail millet	Beans	Naked barley
Drying	Sun drying for 1-2 days.	Sun drying for 2-3 days.	Sun drying for 1 day.	Sun drying of panicles for 2-3 days. Additional drying of seed grains done after threshing.	Sun drying for 3 days.	Panicles are dried for 2 days, and seed grains for 1 day.	Sun drying for 1 day.	Sun drying for 2 days.
Cleaning and Grading	Winnowing	Sieving and winnowing	Winnowing	Winnowing	Winnowing	Winnowing	Winnowing	Winnowing
Storage	Traditionally in an earthen pot called *Dahara*. However plastic vessels and plastic-coated bags are currently gaining popularity.	Glass bottles, *Dahara*, wooden bhakari.	Glass bottles, *Dahara*, wooden bhakari.	Glass bottles, *Dahara*, wooden bhakari, plastic vessels and copper vessels.	Glass bottles, *Dahara*, wooden bhakari, plastic vessels and copper vessels.	Stored by hanging panicles with ropes.	Plastic vessels, plastic sacks and wooden bhakari.	Plastic vessels, plastic sacks and wooden bhakari.
Pest management	Stored along with dried *Khamu* leaves to prevent weevils. Rat traps are used to prevent rats.	Rat traps	Rat traps	Rat traps	Rat traps	Rat traps	No significant pest infestation occurs in storage.	Stored along with dried *Khamu* leaves to prevent weevils. Rat traps are used to prevent rats.
Monitoring while storing	Regular checks on colour and weight of the seeds.	Regular maintenance of earthen storage vessel.	Additional drying of stored seed is done occasionally.	Regularly checked.	Additional drying and cleaning done occasionally.	Regular check for infestation of pests or diseases by observing colour and moisture.	Occasional additional drying.	Regular check for infestation of pests or diseases.
Viability testing during storage	Not done	Not done	Not done	Not done	Not done	Not done	Not done	Not done
Germination testing and pre-sowing treatments	Priming in lowland rice seeds.	Not done	Not done	Not done	Not done	Not done	Not done	Not done

4.5 Post-harvest Handling and Processing of Mandate Crops

In Chhipra, post-harvest handling is traditional and vulnerable to pest infestation. Indigenous knowledge on post-harvest handling and processing is predominant (Table 23). Processing is labourious and a large source of drudgery for women. Milling is done in traditional *okhals*[8] and grinding is done using stones. Some farmers even carry their grain to Simkot to flour in modern mills. Recently, improved watermills have been set up in the Nalla River, which has somewhat reduced the time required to produce flour. There are currently five improved watermills, set up by the Humla Development Initiative Project, which have significantly reduced the drudgery of women. Apart from these, no modern processing tools are available in the VDC.

Table 23. Post harvesting and processing methods of mandate crops

Crop	Post-harvest handling and processing methods
Buckwheat	After cutting, the crop is dried in the sun for 2-3 days and is then threshed by beating with a stick on rugs called *Leeu*[9]. Grinding is done using a stone. Improved watermills are presently being used to grind this crop into flour.
Proso millet	Panicles are cut and then heaped for 1-2 days (except panicles to be used as seed). This allows any unripe and green panicles to ripen and heat up, which makes further processing easier. After the heaping, the panicles are sun dried for 3 days before threshing. The process of heaping before drying and threshing allows the unripe grains to ripen and improves the taste of bhaat prepared from proso millet. Milling is done with *okhals*.
Naked barley and barley	Panicles are harvested with two small sticks known as *ruinetha*[10] and then threshed with an instrument known as a *gyabree*[11] . This is very time consuming and labour intensive work. Flour is made by grinding in the improved watermills.
Finger millet	Panicles are cut with a sickle, and then kept in a heap for a few days. They are threshed by beating with a *gyabree*. Flour is made by grinding in the improved water mills.
Foxtail millet	Panicles are harvested by hand. For large quantities, threshing is done by beating with a stick/ *gyabree*. For small quantities, the grain is trampled by feet for threshing. Threshed grains are milled in *okhals*.
Cold tolerant rice	Panicles are cut along with the straw, leaving straw just 1 inch above the soil. They are dried for 2-3 days. Threshing is done by beating with *gyabree* or by trampling. Paddy is milled in an okhal to make rice. An average woman grinds 10-15 kg of a paddy in a day. For the purpose of making *sel roti*, rice is grinded in improved watermills. Both coarse and fine flour can be made in these mills.
Amaranth/Marshae	Threshing is done by trampling or by beating with sticks. Seto/Thado marse does not easily come off by trampling, and so is beaten with a stick.
Beans	Mature plants are uprooted and dried in the sun for 1 month and then threshed with a *gyabree*.

Source: Focus Group Discussion, transect walk and key informant interview 2014

8 Mortars used for husking and milling the grains

9 *Leeu* is a home woven carpet. The thread used to weave this carpet is made up of either goat fur or Sheep fur. It is used as a threshing floor among many other uses.

10 *Ruinetha* is a tool made up of two sticks of about 1.5 ft length joined close to one end. This tool is used to harvest the panicle of millets by pluck ing as the sticks are pulled towards the user.

11 *Gyabree* is a tool used for threshing different crops. It is made up of a long handle (long stick about 2.5m long) and a flat head (made of a set of 5-7 small sticks about 1 m length) attached on an axle to allow 360° rotation at the end of the long handle. The small sticks in the flat head are bound together with strips of animal hide and increases the surface area when striking the panicles laid on the floor.

4.6 Major Production and Post-production Constraints of Mandate Crops

Chhipra lies in the high Himalayan range, and is currently under a great threat by a changing climate and adverse weather conditions. The rising temperature has increased the effects of pests and diseases. Drought has been a limiting factor for agricultural production. Wild animals have hampered production in fields near forests. The major post-production constraints are threshing, milling, and grinding. Women are mostly responsible for these activities, and as a result they experience high levels of drudgery. The crop-specific production and post-production constraints are presented in Table 24.

Farmers use gyabree to thresh millets. Photo: Achyut Raj Adhikari/LI-BIRD

Table 24. Major production and post-production constraints in mandate crops

Crop	Production Problems/ Constraints	Post-Production Constraints
Buckwheat	• Damage from wild animals (bears, monkeys, porcupines) • Leaf curling insects • Cutworms • Empty panicles (no seed inside), faded leaves (known as *chilsa lagnae* in local language), leaves and grains shatter • Decreasing area under cultivation. This has occurred because of the ban on shifting cultivation (slash and burn) • Aphids, which lie on the underside of leaves and feed on the tender and young leaves • Downy mildew (common)	• Threshing and grinding
Proso millet	• *Palate* (empty panicle without seed inside) • Blight in leaves • Effects from different animals (bears, monkeys, porcupines, birds) • Superstitious belief that if anyone enters the proso millet field during the flowering stage it will fail to produce grain (known as '*Hai*' in local language) • Loose smut is prevalent • Stem borers affect the crop during all stages, and in maturity the plants become dead and dry, and have immaturely dried grains	• Difficult to thresh and mill. Only *Dudhae* variety is easily milled when trampled over.
Barley and naked barley	• *Kalo Poke* (loose smut) • Rust (*sindurae*) • Blight in patches of the field • Drought reduces the potential yield of the crop	• Lack of proper processing technologies
Finger millet	• Empty panicle without grain inside (known as *Kainae* disease locally) • Blast • Leaf spot • Stem rot • Leaf Blight • Cutworm (*phed katnae kira*) • Drought (major constraint)	• Threshing cannot be done unless it is dried in sun for 2-3 days and difficult to thresh by women.

Foxtail millet	• Panicle is eaten by squirrels • Loose smut • Cutworm • Stem borer • Affected by drought at lower altitudes due to low soil moisture content and dry air • Uncontrolled grazing. Plants that are grazed by animals fail to produce grain	• No proper processing technologies
Cold tolerant rice	• Leaf blight in patches of field • Leaf blast and neck blast • Sheath rot • Drought reduces the potential yield	
Amaranth/ Marshae	• Leaves get faded, empty panicle without seed inside	
Beans	• Anthracnose • Rust • Drought dries the plants before maturity and reduces the yield • *Gathe Kira* (stem borer) feeds on the stem and dries the plant	

Source: Focus Group Discussion, transect walk and key informant interview 2014

4.7 Training on Neglected and Underutilized Species

There have been limited amount of training on agricultural practices across the board in Chhipra and training on neglected and underutilized species (NUS) is virtually nonexistent. Only 4% of respondents have received training related to the project's mandate crops and all trainings were on rice, a socially and academically preferred crop in Nepal. Farmers have not received any training on cultivation practices or disease and pest management techniques except in rice.

4.8 Use of Amaranth and Buckwheat as Vegetables

A large proportion of respondent households consumed buckwheat (96%) and green amaranth (72%) as green vegetables (Figure 9). Only 1% of respondents reported that they buy green amaranth for consumption. All respondents reported that they do not buy or sell buckwheat as a green leafy vegetable.

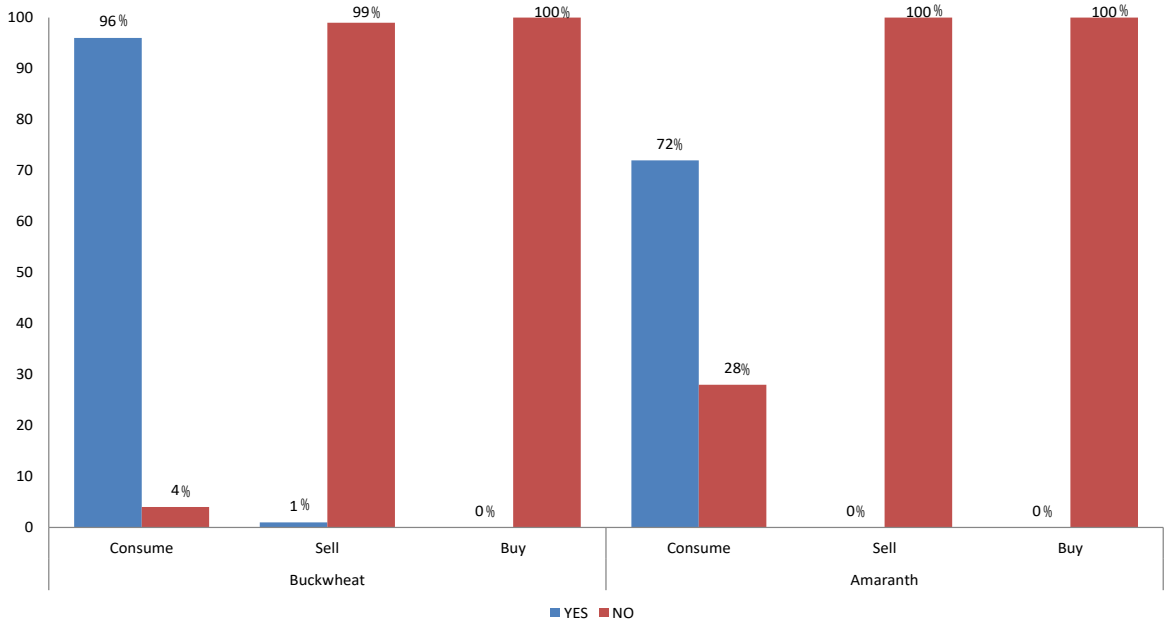

Figure 9. Respondents consuming green amaranths and buckwheat

4.9 Awareness of NFC, FFS and CSB

Most farmers (92%) are unaware that the Nepal Food Corporation (NFC) purchases local crops, especially those produced in the Karnali region, representing an untapped opportunity for commercialization of mandate crops in the area (Figure 10). Likewise, most farmers have not had farmer field school (FFS) training and are unaware of community seed banks (CSBs).

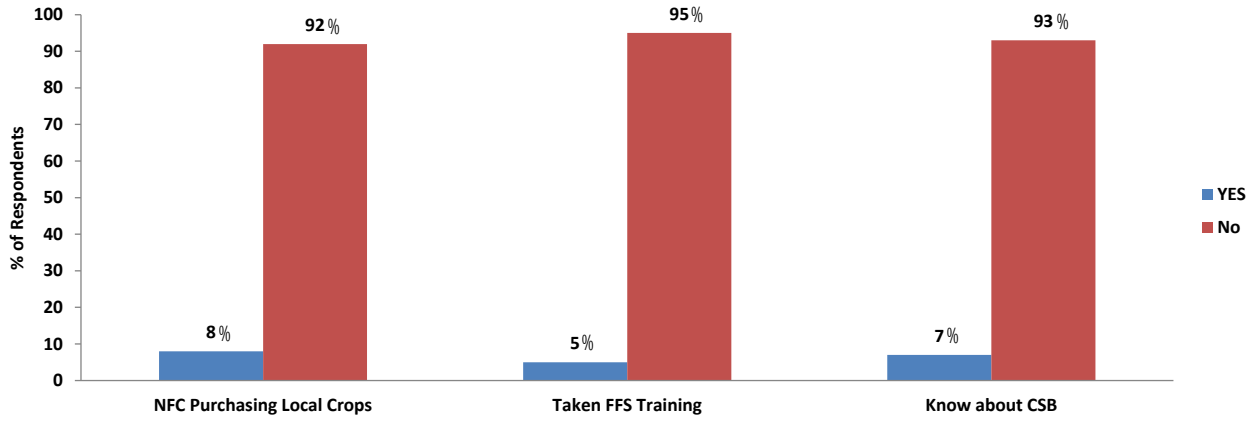

Figure 10. Level of market awareness, farmer field schools and community seed banks

4.10 Purchase of Mandate Crops

Majority of surveyed households (76%) rice for consumption as it is an important and preferred staple food of the Nepalese people (Table 26). Finger millet is the second most commonly purchased crop with 50% of the households buying around 96 kg of finger millet annually.

Table 25. Purchasing details of mandate crops for household consumption

Crop	No. of HHs (% HH) purchasing	Quantity Purchased (Kg)		
		Average	Min	Max
Buckwheat	16 (22%)	57.8	10	120
Rice	55 (76%)	104.7	5	300
Finger millet	36 (50%)	95.7	5	500
Proso millet	26 (36%)	57.8	3	150
Foxtail millet	3 (4%)	31.7	15	60
Naked barley	21 (29%)	35.2	4	120
Barley	3 (4%)	12	6	20
Beans	21 (29%)	43.5	4	200

The trend of purchasing of all mandate crops for household consumption is increasing. The increasing rate is highest for rice, followed by finger millet, as these are both staple crops. Rice is mainly purchased from the NFC, which provides it at a subsidized price.

4.11 Promotion and Conservation of Local Crops

Sixty-five percent of the surveyed households think it is necessary to promote local crops grown in their area. Some people think that the traditional crops have different value than other crops, while others think that crops other than mandate crops may not be suitable in their location. People think that their local crops have a different value in this community as they are typical to Karnali

(compared to other regions in the country) and are essential for some religious rituals. For example, foxtail millet is necessary in the Hindu community when performing a ritual called "*Das Daan Baitrani*".

However, not all mandate crops were given same level of importance for conservation. A large proportion of respondents reported a need to conserve proso millet, finger millet, beans and cold tolerant rice in Chhipra (Figure 13), while none mentioned the need to conserve foxtail millet or amaranth. The low conservation priority for foxtail millet may be due to respondents not having many food recipes for this crop. In the case of amaranth, it may not be given much importance due to lack of awareness about its nutritional benefits. Existing recipes of amaranth grains are as snack food and hence may receive less priority than crops that can be used in the main meals.

The highest percentage of households (65%) reported an interest in the conservation of proso millet, followed by finger millet (62%). The farmers' stated need for the conservation of naked barley and barley was found to be very low, as wheat is preferred over these crops. The difficulty associated with harvesting and post-harvesting practices for buckwheat is a main cause for this preference.

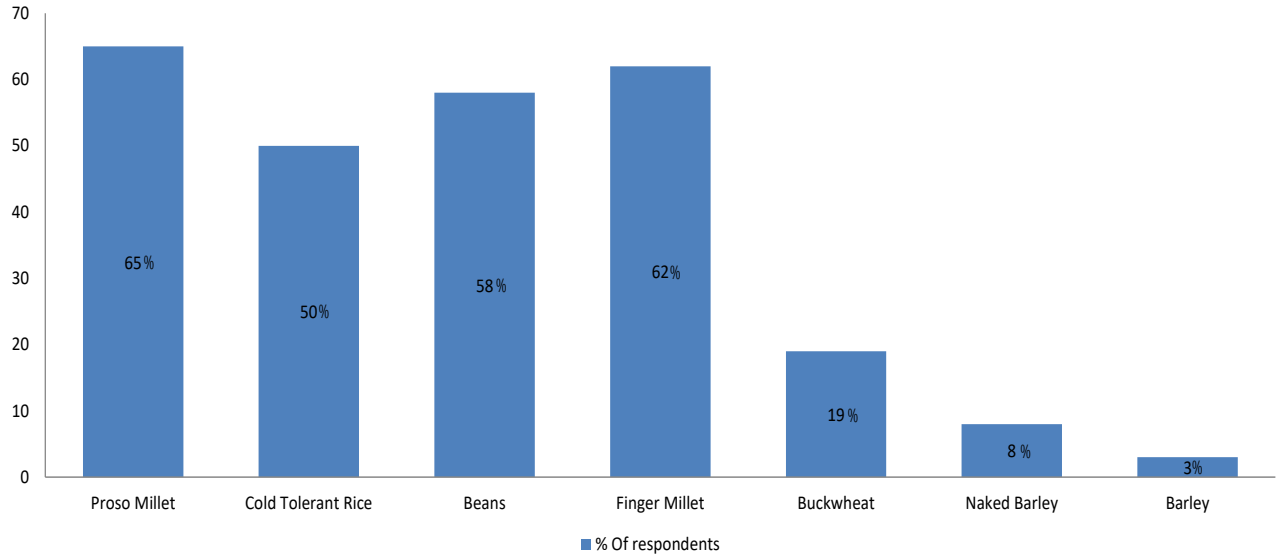

Figure 11. Percentage of respondents who feel it is necessary to conserve local crops

4.12 Local Institutions and Organisations Working in Chhipra

NGOs and INGOs are implementing various development projects and programmes in Chhipra (Table 26). These programmes are either working with existing or establishing new user groups, farmer groups or cooperatives (Table 27).

Although four cooperatives have been established in Chhipra since 2007, only two remain active. Both perform multipurpose activities, including input supply, and saving and credit. The Dudhkunda Women's Multipurpose Cooperative Limited in the Lekha village was established in 2007 by the Women and Children Development Office of Humla. It currently has 212 members. The Karnali Agriculture Cooperative Limited in the Nalla village is second cooperative in the cooperative with 123 members at the time of the survey, which has since grown to 150 members. It was established with the support of the Humla Development Initiative project implemented by LI-BIRD. Karnali Agriculture Cooperative Limited is more active and successful with investments in different forms, including loans, irrigation, seeds and other materials. However, they lack adequate community awareness and the capacity to effectively mobilize for on-farm conservation and promotion of traditional mountain crops.

The village has farmers groups facilitated by the DADO with whom the Agriculture and Food Security Project (AFSP) is implementing activities. There are many farmers' groups in different wards. There is a Community Seed Bank supported by the NCCSP (LAPA), but it is not functioning. The NCCSP (LAPA) has also supported processing mills with flouring and oil extraction functions. The mill has not been used to its full potential.

Because the VDC is situated close to the district headquarters, news and information reaches it quickly, thus increasing the awareness of the people. Various organisations with programmes in different sectors continuously organize training and awareness campaigns. This has escalated the level of awareness among the people on various issues. However, the awareness on conservation and use of local crops and social capital building for collective action to promote community seed banks and community based natural resource management remains limited, as there are no organisations working specifically on these issues.

Table 26. Developmental organisations and programmes currently active in Chhipra

Organisation /Programmes	Major Activities
Western Upland Poverty Alleviation Programme (WUPAP)	Provide revolving funds for income generation activities and support for building community infrastructures
Agriculture and Food Security Project (FAO/ DADO)	Promote improved varieties and technology for agriculture and nutrition through FFS and provide small grant support to farmers groups/ Cooperatives
Himali Navin Samaj	Works for the welfare of women and children nutrition, social justice, and education
Nepal Climate Change Support Programme (NCCSP)	Support for building community infrastructures and income generation activities
Poverty Alleviation Fund (PAF)	Support for pro poor income generation activities and provides revolving funds
Women Welfare Service (WWS)	Helps in skill oriented and income generation training for at-risk or victimized women. Provides adult literacy classes
Rural Village Water Resources Management project (RVWRMP)	Supports rural communities for provisioning safe drinking waters resources
Karnali Integrated Rural Development and Research Centre (KIRDARC)	Work to improve health and sanitation conditions
World Food Programme (WFP)	Food for work programmes
Women Development Office	Empower women thorough saving and credit scheme and promoting income generation activities

Source: Focus Group Discussion and key informant interview 2014

Table 27. Status of community based organisations (Cooperatives and groups) in Chhipra, Humla

Name	History	Working Area	Current Status
Cooperatives			
Karnali Agriculture Cooperatives Limited	Established in 2013 by the Humla Development Initiative project of LI-BIRD	Saving and credit, Community based seed production, distribution, and Community based vegetable production	Active
Dudhkunda women's Multipurpose Cooperatives Limited	Established in 2007 by the effort of Women and Children Development Office, Humla. There are 212 members in this cooperative.	Saving and credit cooperative to support income generation and advocacy for women empowerment	Active
Shree Pragatisheel Cooperative Limited	Established in 2009 by local effort. It has 25 members with one female and it is based on Chhipra-8, Nalla	Saving and credit cooperative	Not Active
Shree Upaakar Women Consumers Cooperatives	Established in 2009 by local effort. It has 34 members and it is based on Chhipra-8, Lekha	Saving and credit organisation and to carry out women empowerment programmes in society	Not Active
Groups			

Name	History	Working Area	Current Status
Chandannath Community Forest Users Group	Established in 1997 in wards 1, 2, 3, 4 and 8	To distribute benefits from forest equitably and conserve forest by community efforts.	Active
Hilsa Community Forest Users Group	Established in 1998 in wards 5, 6, 7 and 9	To distribute benefits from forest equitably and conserve forest by community efforts.	Active
Kuldeuta Krishak Samuha	Established in 2000 in ward 3	Grain crops and seed production	Not Active
Chandannath Krishak Samuha	Established in 2001 in ward 8	Grain crops and seed production	Not Active
Ful*bari* Krishak Samuha	Established in 2007 in ward 3 and 4	Vegetable farming	Not Active
Durgam Himali Lekali Krishak Samuha	Established in 2007 in ward 9	Cereal grain production	Not Active

Source: Focus Group Discussion and key informant interview 2014

5. DISCUSSION

5.1 Socioeconomic and Demographic Context

Humla is among the most marginalized and economically disadvantaged districts in Nepal. Out of 75 districts, Humla ranks 73rd in terms of adult literacy rates and 75th in terms of human poverty index and undernourishment of children under 5 (Nepal Human Development Report 2014).

Khas or Chhetri are the major residents of Chhipra followed by Thakuri, Dalit and Brahmin. In this already marginalized community, Dalits and women face further hardships from social and gender based discrimination. Dalits tend to have lower landholding, fewer livestock and food sufficiency compared to other groups. Gender-based discrimination negatively affects the health, well-being and empowerment of women and is epitomized by *chhaupadi*.

The average household size in Chhipra is 6 and migration of family members for work is rare. This is in stark contrast to other project sites like Jungu in Dolakha and Ghanpokhara in Lamjung. Agriculture is the main source of income for most households, while Dalit households rely more on working on other people's farm for income. Food self-sufficiency is low with average self-sufficiency around 3-5 months a year in all food categories.

Only 9,708 ha of Humla's 565,500 ha area is arable (Intensive Study and Research Centre, 2013) The average land ownership in Chhipra is 3.64 ropani or 0.18 ha per household, which is far lower than the national average of 0.70 ha per household (CBS 2013). The low average land holding size of the households is due to the partitioning of land in inheritance to sons every generation. The average landholding in Chhetri households is a ropani above the village average, while the average landholding in Thakuri and Brahmin households are a ropani below the village average. The average landholding of Dalit households is two ropani below the village average. Farmers with larger land holding usually maintain more landraces of the mandate crops. This is because the land owned by the farmers are distributed across different altitudes and environments that need different varieties.

Livestock is an integral component of livelihoods in Chhipra. Livestock are reared for manure, milk, and draught purposes. In Chhipra and in Humla, livestock are raised in a transhumance system because of the cold temperature during winter. Some of household rear local cattle with very low milk production potentiality. There is a lack of proper care and management of the farm animals. Livestock is more common and multiple species are kept in Chhetri and Thakuri households, while Dalit and Brahmin households tend to have fewer livestock. Similar pattern is seen in terms of fruit tree holdings.

Agricultural decisions are made jointly by men and women in most households (83%). Households mostly rely on family members for agriculture labour with 1.48 females and 1.37 males per household contributing on average. The work load is much heavier for women who are also more involved in agricultural activities than men. An in-depth understanding of the role of gender in diversity maintenance and genetic resource conservation is essential for designing local crop conservation strategies.

All the families in Chhipra are residing in their place of origin and the residents have been growing the mandate crops for as long as they can remember. Farmers in Chhipra and in Humla value crops like buckwheat, finger millet, proso millet, foxtail millet and *Marshi* rice as these crops are historically intertwined with their food culture. Crops like finger millet and beans are grown in mixtures, especially by farmers with smaller land parcels. There are certain recipes transferred down to generations which have these mandate crops as their major ingredient. Reliance of farmers on traditional knowledge and practices is another factor that has helped maintain diverse landraces of mandate crops. Beans for an example are traditionally grown in mixtures.

Farmers do not produce local crops in marketable scale due to lack of adequate land to grow, post-harvest handling and processing technologies. Farmers rely on informal seed system characterized by exchange of seeds between households during need. Farmers do not have access to good quality and diverse planting materials. Chhipra has no formal seed and inputs supplier. Humla itself has only two agro-vets in the district headquarters at Simkot. Awareness in farmers is very limited in pest and disease management. All of these have resulted in lower production despite of huge labour investment.

Local institutions have only recently emerged and lack strong leadership abilities. Policies that favor conservation and promotion of local crop genetic diversity are lacking. These constraints have hindered conservation and promotion of local crops. Local Crop Project can play a vital role in addressing these issues.

5.2 Status of Mandate Crop Diversity

All mandate crops[11] are grown by majority of households showing that these crops are neglected only from the perspective of research and development. Even preliminary research on these crops could lead to great benefits for these high mountain farming communities.

Chhipra has four settlement clusters or villages: Lekha, Nalla, Chhipra and Majha. These clusters differ from each other in terms of elevation and local micro-environment. Farmers have fragmented land parcels scattered at varying altitudes, slope aspect and distances. Farmers tend to grow landraces suitable to the micro-environment of their land parcel and hence, the diversity of crop landraces is encouraging. For instance, Nalla has irrigated lowlands where farmers grow diversity of cold tolerant rice.

Household level management by farmers also shape the genetic diversity of local crops. Resource rich farmers have opportunity to select and maintain several landraces in their field. On the contrary, farmers with limited resources do not have such opportunity and put less effort to select and maintain landraces.

Abiotic stresses such as chilling temperatures, drought, and infertile soil, are prevalent. Traditional landraces have evolved special characteristics that make them well adapted to these marginal environments. Incorporating these traits and their underlying genetics through breeding programmes and developing and promoting farmer-preferred varieties is one way to contribute to ensuring food security in Humla and other mountain districts. In addition, religious, cultural, and medicinal values of the crops are playing a crucial role in conservation of some landraces of local crops.

5.2.1 Richness and Evenness

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). Hence, the very first step in accessing and characterizing local diversity with tools available such as diversity fairs, diversity block. During the process, farmer involvement is necessary as they can distinguish between varieties based on particular phenotypic characteristics and documenting this can be helpful in identifying the variety.

Gene bank collections and studies have revealed that Nepal has a wide range of landraces of finger millet and rice. Rice has higher diversity as it is highly sensitive to climate and field level micro-climate. Joshi (2005) and Gupta et al. (1996) identified nearly 2500 rice landraces in Nepal. Fewer landraces have been identified for other mandate crops like foxtail millet, buckwheat, and barley. In case of Chhipra as well, rice has the highest community richness (14) followed by beans (10), finger millet (7) and naked barley (5). Some of the varieties that we recorded during the diversity fair and PRA activities but missed during the baseline survey indicate most households grow few varieties and rare ones grown by very few households were not captured by the survey.

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. Higher evenness signifies greater stability and adaptability of the community. Evenness by area of the mandate crops in Chhipra suggest that in case of crops like cold tolerant rice, naked barley, beans and finger millet, no single variety is dominant over others. Whereas, in case of proso millet and buckwheat, single varieties are dominant over the others resulting low evenness value.

5.2.2 Traditional Management Practices

Humla only has air transport and narrow foot trails connecting it to the rest of the country. Hence, there has been little influx of outside technology in farming. Farmers in Chhipra have rich traditional knowledge on mandate crop cultivation and management, which is yet to be well documented.

All aspects of production, including land preparation, cultivation, harvesting, processing and storage are done in a traditional manner. Cropping in mixtures cereals and legumes is more common than in other parts of the country, while special handheld tools are used for the purposes of threshing rather than livestock. Plastic and glass bottles and as well as traditional vessels are used for storing seed. Mandate crops also have uses and recipes not common elsewhere.

11 Hulled barley is one exception as farmers have preferred to grow naked barley over it.

Despite its important role, traditional knowledge on the management of pests and diseases has not been sufficient. Anecdotally, appears that the issue of pest and disease damage used to be lower in the past but has been worsening with climate change in recent years. It is important to document the traditional practices and rationales before they become lost, while at the same time augmenting the traditional practices with new approaches.

5.2.3 Seed Systems

In developing countries, 60-100% of the seed sources are farmer managed, depending on the crop (Almekinders and Louwaars, 2002). 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 (FAO 1996).

Among the mandate crops, 97% of mandate crops planted are from farm saved seeds. Dalits households are the only group that get more than 10% of their seed from relatives, neighbours and other sources. Great reliance on farm saved seed is mostly out of necessity as there is limited or no access to formal seed actors.

With almost every household making independent seed saving and hence selection decisions on the crops they plant, there is continuing evolution of the crops being grown. However, conscious seed selection and storage is not practiced for all crops by all households. Combined with small land parcels and hence small populations these crops are grown in at the household level, there is the risk of genetic drift and hence the loss of useful traits even in traditional varieties.

This highlights the germplasm collection of mandate crops conducted by the project as it will become an important foundation for further work. Approaches like grassroots breeding can identify better materials within the existing diversity. Improving access to these materials to farmers will help improve productivity, while access to breeders will bring greater success in subsequent plant breeding efforts.

5.2.4 Key Production and Conservation Constraints

Apart from rice, the production and use of all other project mandate crops is decreasing. Farmers are increasingly purchasing more of the mandate crops. This is an indication that farmers are less attracted to farming as an occupation in the recent years. The two major factors influencing this trend are: availability of imported rice distributed by the Nepal Food Corporation at a subsidized rate, as well as increased and multiple risks in farming due to changing and unpredictable climate.

Despite all these factors, mandate crops are crucial in social and cultural lives of the farmers as they are embedded in their food habit. Furthermore, there are limited alternative income and employment opportunities available locally other than farming. Hence, farmers already spend, even if reluctantly, a lot of time in farming. Access to better varieties and processing technologies would give more return on the efforts they already put in.

Major constraints to conserve and use of traditional crop varieties are lack of sufficient crop genetic diversity, inaccessibility of crop genetic diversity to farmers, undervalued and underused traditional crops and inability to derive benefits from use of traditional crops (Jarvis et. al., 2011). In Humla, farmers have limited capacity building opportunities in terms of improving farming practices and principles.

Inaccessibility of technology for cultivation, processing and storage and limited awareness on the values and benefits of local crops are other limiting factors. Due to the rugged topography and difficulty in transporting modern equipment, mechanization in agriculture is very difficult. Land preparation is done manually and harvesting is done using simple handheld tools.

There are five improved watermills set up along the Nalla River, all of which are supported by the Humla Development Initiative project. Apart from these, no modern processing tools are available in Chhipra. A lack of processing technology is a common constraint on all mandate crops and specifically increases drudgery on women.

With only two agro-vet suppliers in the district and none in the VDC, farmers have practically no access to inputs like chemical fertilizers, pesticides, and insecticides. District Agriculture Development Office imports organic fertilizer but the amount is very limited and is difficult to access.

In geographically inaccessible places like Humla, improving the understanding of farming principles may be important as this can

enable farmers to take a more scientific problem-solving approach rather than adopting technologies that are hard to find or ill-suited for their conditions and scale.

Chhipra is drought prone region with very cold winter. It has short season for summer crops as temperature begin to fall soon after September. Early maturity and drought tolerance are the desired traits in the mandate crops. Chhipra lies in a mountain ecosystem and is more vulnerable to the effects of climate change. Changing temperatures and rainfall patterns will inevitably erode the genetic resources of the VDC. Heavy snowfalls, droughts and rising temperatures are the biggest issues the community has faced in recent years. Increasing rates of disease and pest occurrence have already posed a threat to traditional landraces like *Kali Marshi* rice.

5.3 Awareness of Initiatives, Services, and Conservation

Because Chhipra is situated close to the district headquarters, news and information reaches the VDC quickly, thus increasing the awareness of the people compared to other parts of Humla. Various training and awareness campaigns in different sectors are regularly held in Chhipra, thus increasing the level of awareness on various issues. However, the awareness on conservation and use of local crops and social capital building for collective action agricultural biodiversity management remains limited, as there are few organisations that work on this.

In general farmers have a favourable view on conservation of local crops of Karnali. Almost a third of respondents think it is necessary to promote local crops being grown in their area. The historical, social, and religious importance may be the reasons behind this sentiment. Among the mandate crops, amaranth and foxtail millet were not considered to be as important for conservation by the respondents.

Very few respondents are aware of the government's initiative to buy local crops from Karnali and sell in urban markets as an incentive for continued cultivation of local crops. Hence, the implementation of this initiative has not been successful so far. While, the local government bodies, like the District Agriculture Development Office, Humla, have been involved in the overall improvement of agriculture production in the district, there is no focused programme to promote mandate crops *per se*.

Due to the limited communication and transportation infrastructure, DADO does not have enough human resources to serve all the farmers especially in remote areas of the district. It is also not easy for farmers to visit the DADO and Agriculture Service Centres due to the need for long hikes.

Most community members were not aware of Farmers' Field School (FFS) training or the use and importance of community seed banks. Radio is the primary source of information for farmers. There are two FM stations that air programmes from Simkot. Television is not popular in Chhipra. As a result, the awareness level of the community is very low and is limited to the information from radio and organisations working in the VDC.

Our surveys found that only four percent of farmers had received training, and in all cases it focused on rice cultivation. This implies that farmers' access to training and technologies in mandate crops is very low. Though the site is not so far from the district headquarter geographically, it is far behind in access to improved tools and technologies that could make harvesting and processing of the mandate crops easier. This is because the only form of transportation is walking down the hills.

Chhipra has two cooperatives directly involved in local community welfare. There are also several farmers' groups in different wards. There is a Community Seed Bank supported by the NCCSP (LAPA), but it is not functioning. The NCCSP (LAPA) has also supported processing mills with flouring and oil extraction functions. The mill has not been used to its full potential.

5.4 Potential Opportunities

Promotion of local crops has tremendous potential in Humla, especially considering the limited work done on these crops so far. Increasing production, improving processing techniques and enhancing marketing through value addition of the local crops creates opportunities for the farmers. Some promising avenues are highlighted below.

- Mandate crops have a major role in food security in Chhipra. Improving access to better selections as well as new varieties using simple approaches as grassroots breeding and participatory variety selection can contribute to increasing productivity.

- Documentation and dissemination of local recipes and food culture as well as new recipes can demonstrate the potential uses of these crops. Increasing the nutritional awareness of these crops can emphasize their health benefits. Together, these initiatives can contribute to improving the food habit of people which at present is being more inclined to consumption of subsidized rice.
- Market outlets of the local products are being prioritized by the government as well. A synergistic approach in developing such outlets can link rural farmers with the market motivating to grow and sell surplus for small income.
- Humla is the gateway to Mansarovar pilgrimage. Thousands of tourists from Nepal and India travel to Mansarovar through Humla. Promoting local recipes and products linking with local hotels have a huge potential of increasing benefits to the community.

6. SUMMARY

Agriculture is the main source of income for most households in Chhipra, followed by agriculture labour and business. Although agriculture and agricultural labour are the main occupations of the people in Chhipra, the food sufficiency status is very poor, with sufficiency values of cereals, leafy vegetables, other vegetables, and pulses being less than 4 months. Dailt households and women are especially worse off.

Chhipra is characterized by rugged topography and a dry climate. The difficult terrain has hindered the technological advancement in crop production, processing, and value addition. Rice, wheat, naked barley, finger millet, proso millet, beans, potato, and buckwheat are the major crops grown in the VDC. The farming system is rain-fed and has low external inputs yielding low production insufficient to meet the food demand of the VDC.

The site does harbor reasonable diversity of mandate crops with 55 varieties of 8 mandate crops. Of these, most (52 out of 55) are local landraces, emphasizing the potential of great productivity gains even with preliminary research. Taste, yield, and socio-economic factors are the major reasons that drive farmers to cultivate and conserve local landraces. The mandate crops have their own social, cultural, economic, and religious importance in the VDC. However, distribution of subsidized white rice by the Nepal Food Corporation in the recent years has reduced the incentive for farmers to grow their own food.

Changing climate experienced in terms of increasing temperature and unpredictable weather patterns has been a threat. Drought in recent years has caused crop failure. Occurrence of diseases and pests in recent times has been increasing.

Isolation of Humla has led to preservation of traditional knowledge on production and management of mandate crops out of necessity. However, existing traditional knowledge on crop protection is insufficient especially when it comes to disease management. There is a need to complement useful traditional knowledge with new scientific knowledge for improving productivity and reducing drudgery.

Seed management is traditional and the seed system is informal. Farmers preserve the mandate crop seeds themselves and exchange with their neighbours and relatives in need. The major constraint in production and marketing of mandate crops is the lack of appropriate post-harvest processing tools. Processing of the mandate crops is a major source of drudgery for women. Although the community awareness is increasing on issues of gender equity, sanitation, health and education, there is still a long way to go.

The promotion and conservation of local crops has also been limited due to the absence of agencies working for this purpose. The presence of multiple traditional crop landraces for all mandate crops indicates the potential for promotion and conservation of those crops through the Local Crop Project. The importance given by farmers to these crops due to social, cultural, and religious causes is another positive remark.

The village also has local institutions (cooperatives, NGOs, farmers' groups) involved to some extent in agriculture, but they are not adequately trained to undertake conservation and promotion efforts for the traditional mountain crops. Local Crop Project can play significant role in strengthening the capacity of these local institutions and networking with DADO, and other stakeholders in the district. The major areas of intervention will be improving production, processing, and marketing opportunities of the local crops.

6.1 Way Forward

Understanding the production constraints of traditional crop diversity is the key to developing suitable interventions at the local level (Jarvis et al., 2011). This baseline study has attempted to understand the on-farm diversity of mandate crops, farmers access to information and seeds, traditional management and processing practices and the socioeconomic context. This baseline study has teased out the possible constraints for the production and conservation of local crops and the following areas of interventions are identified:

- **Documentation and selection within existing diversity:** The portfolio of diversity of mandate crops readily available to the farmers in Chhipra is limited. Very few varieties were found for buckwheat, naked barley, foxtail millet and amaranth. Diversity fairs and varietal catalogs with photographs can document traditional knowledge and raise awareness of available diversity. Participatory Seed Exchange (PSE) can also be a low-cost approach to facilitate seed and knowledge exchange for existing rare varieties. Grassroot breeding can help identify and popularize best lines from the existing population and serve as the basis for future plant breeding for the region.
- **Introduction of new diversity:** Promising varieties from outside the local community including accessions from the genebank can be tested in diversity blocks and popularized using diversity kits, informal research, and development (IRD) kits or participatory variety selection.
- **Addressing agronomic constraints:** This baseline study shows that the existing level of traditional knowledge and processing technologies are not adequate to address the needs of the community. Augmentation of scientific principles of agronomic practices and new technologies (varieties, processing, etc.) are needed to improve yield and reduce drudgery. Thus, identifying the agronomic constraints, developing technologies to overcome them and demonstrating them for wider adaptation is a potential area of intervention. Mechanization using small tools and ma*chin*eries are the need at present in the context of decreasing labour for agriculture.
- **Using diversity for disease management:** Disease pest occurrence is a major problem in Chhipra. For an example, *Marshi* rice is very popular among the farmers but continuously suffers huge losses to blast. In isolated sites like Humla the economic threshold for farmers accepting pest damage in their crops is higher as the cost of protection techniques is high or not available. Hence use of intraspecific diversity of mandate crops could be a promising and cost-effective way for managing pests and diseases.
- **Value chain study and capacity building:** Availability of subsidized rice has reduced the incentive for farmers to grow crops for self-sufficiency of food. Hence a study on improving market linkages for crops produced in Karnali is needed to restore economic incentives for farming. Value addition processes like cleaning, grading, processing, and branding can help promote the local crops by making them attractive in the market. Nutritional analysis of the local crops which can clearly demonstrate their nutritional importance can be a way forward. Local crop project can enhance the capacity of the farming communities in regard of value chain concept and value addition techniques. Awareness raising and capacity building of farmers and local communities is needed.
- **Social capital building:** Social capital building and mobilization of local institutions through awareness raising, capacity building and community led activity implementation should be a key approach throughout the project. Diversity Field School (DFS) can be the forum to build capacity of the farming communities on importance of biodiversity, techniques of insect pest management and technology for improved production and processing. Community Seed Bank can be another major social capital which can help them conserve their local crops and make income from them as well.
- **Resource leveraging and local stakeholder engagement:** To mainstream the successful practices of the project, engaging the local stakeholders including DADO, DDC and other relevant NGOs and INGOs is crucial. Resource leveraging can help scale up the successful practices for wider impact. Forums such as the District Agriculture Development Committee (DADC) meeting can be utilized for sharing progress of the project with wider stakeholders. Similarly, we can involve the local agricultural suppliers and link them with the Community Seed Bank and the seed producers' groups. Involving local school students and JT/JTA levels in relevant project activities can also help disseminate the knowledge.

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ANNEXES

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 गरिदै 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 अवस्था 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***.....वर्ष

८. थर/ जात :***Ethnicity***.....

९. सम्पर्क 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 बगैँचा *Fruit Orchard*						
खरबारी *Pasture*						
निजी वन *Own Forest*						
अन्य *If others then specify* -खुलाउनुहोस्)						

१९. पशुको विवरण*(Detail about Livestock)*

क्र. 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?

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

==========

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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 II: PHOTO GALLERY

Chhipra village, Chhipra

Women carrying NFC distributed rice

Man weaving local carpet leeu. It is one of the important source of livelihood and income.

Manjha village and surrounding

women carrying fertilizer in field

Mixed farming of foxtail and finger millet

FGD

Women transplanting finger millet

Local Crop Project Mandate Crops

Amaranth

Finger Millet

Naked Barley

Foxtail Millet

Beans

Proso Millet

Buckwheat

Cold Tolerant Rice

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