ICIMOD Working Paper 2017/1

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FOR MOUNTAINS AND PEOPLE

# Traditional Practice and Knowledge of Indigenous and Local Communities in Kailash Sacred Landscape, Nepal

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The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.

**Cover photos (clockwise):** *Hippophae salicifolia* bear edible fruits, (i) *Ophiocordyceps sinensis*, a high-value species collected and stored by local communities, (ii) Sheep husbandry and wool collection

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# Traditional Practice and Knowledge of Indigenous and Local Communities in Kailash Sacred Landscape, Nepal

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# Acronyms and Abbreviations

| | |
|---|---|
| CDB | Central Department of Botany |
| CFUGs | Community Forest User Groups |
| IK | Indigenous Knowledge |
| KSL | Kailash Sacred Landscape |
| msl | Mean Sea Level |
| MAPs | Medicinal and Aromatic Plants |
| NTFPs | Non-timber Forest Products |
| NGOs | Non-governmental Organizations |
| TAR | Tibet Autonomous Region |
| TEK | Traditional Environmental Knowledge |
| TK | Traditional Knowledge |
| TU | Tribhuvan University |
| VDC | Village Development Committee |
| WCCB | Wildlife Crime Control Bureau |

# Executive Summary

The Kailash Sacred Landscape (KSL) is a transboundary landscape (area: 31,252 sq.km) around Mount Kailash. KSL is exceptionally rich in cultural and ecological diversity and has its own traditional systems of resource use and management. KSL Nepal comprises approximately 42.5% of the total landscape area, and covers Baitadi, Darchula, Bajhang and Humla districts. This study was conducted in different representative villages of four districts of KSL Nepal with the aim of documenting the traditional practice and knowledge of the indigenous and local communities regarding natural resource use and management.

Resources like agriculture, forest, pastureland and non-timber forest products (NTFPs) have been managed by indigenous and local communities since time immemorial. People have been growing various crops depending on the location, climate and culture. Similarly, they decide the breed and number of livestock to be raised based on their access to pastureland, purpose, religious belief and location. Pasturelands are managed in two ways in KSL Nepal, either as open access or controlled access. Social institutions/communities decide the timing, duration, and area of grazing communally. Management structure of highland pasture is better regulated than that of lowland pasture. Forests in KSL Nepal are managed as government-managed forest, religious forest, community forest and leasehold forest. Local people develop rules and regulations to conserve the forest as a community forest and local authorities decide the time for collecting firewood and punish people involved in violating the rules. In some areas of KSL Nepal, forests are conserved as sacred forest where grazing and collection of timber, fodder, NTFPs, etc. are restricted. NTFPs have become major economic products in the region. The production of NTFPs is gradually decreasing due to unsustainable harvesting practices.

Traditional institutions used to play a decisive role in resource conservation and management in KSL Nepal. Traditional authority systems still have a role in resource governance in Darchula and Humla districts. Property rights over resources are claimed when the economic value of the resources increases; property rights are hence defined accordingly. Traditionally, property rights were defined based on the ecological boundaries of the resources and social relations. Change in the political and administrative set-up led to restricted resources use, but ecological boundaries and social relations continue to take precedence over the political and administrative set-up. Disputes over access to resources sometimes lead to violent clashes, which are resolved by the community or adjudicated by the District Administrative Offices.

Traditional knowledge on the use of plants and animals for diverse purposes is abundant in KSL Nepal. Traditional healers use plants as medicines for different ailments like abdominal disorders, cuts, burns, cough, cold, asthma, etc. Plants are used as wild vegetables, sources of oil, dyes and fibres, and the main source of timber and fodder. Furthermore, people in this region use plants for making agricultural equipment, honey, sour syrup and hay. Locals use wide varieties of plants and plant products in their ritual activities and other cultural practices. Animal resources are less extensively used than plant resources. However, traditional healers, *amchis*, and traders use animal species to obtain items such as fur, wool, bone marrow, meat, gall bladder, feather, etc.

In some places (Bajhang district), temporal and spatial as well as horizontal and vertical transfer of traditional knowledge is constantly taking place through socio-ecological interaction of people of different age groups and areas. In other places (Darchula district), traditional knowledge about the management of resources has not been transferred smoothly to the next generation and faces the risk of loss. Generally, traditional knowledge is transferred through day-to-day activities inside the community or through specialists in particular forms of knowledge. Specialists' knowledge is usually transferred to the family members orally and through practice.

It is necessary to address different issues related to traditional knowledge system for the management of biological resources. Institutionalization and documentation, access to resources, effective policy and legislation are needed to enhance the traditional knowledge system. To avoid unnecessary conflict over resources, access to traditionally used grazing areas and standard norms and rights for collecting resources should be well defined. Activities such as poaching and illegal extraction of forest products should also be resolved to conserve the resources. Bioprospecting of medicinal plants is necessary to encourage indigenous and local communities to continue conserving and using medicinal plants effectively and sustainably. Addressing all the issues demands strong local institutions, effective rules and regulations, and a transboundary approach for conserving resources sustainably.

# Introduction

Kailash Sacred Landscape (KSL), which covers an area of 31,252 sq.km, comprises high-altitude areas around Mount Kailash, including the north-western part of Nepal, south-western portion of the Tibet Autonomous Region (TAR) of China, and a part of north-west India. KSL Nepal makes up 42.5% of the total KSL area and covers Baitadi, Darchula, Bajhang and Humla districts in the north-western Nepal (Figure 1). The region is among the most culturally and ecologically diverse, and includes some of the most fragile areas in the world. It contains a broad range of bioclimatic zones and ecosystems, rich cultural heritage and natural resources, and a wide variety of globally significant diversity of fauna and flora (Zommer and Oli, 2011). The feasibility study conducted in the landscape revealed the existence of a rich trove of traditional knowledge of the indigenous and local communities (CDB/TU, 2010). The indigenous communities possess immense knowledge of their environment based on centuries of interaction with nature, and such traditional knowledge offers valuable insights about landscape conservation at the local and regional level. However, traditional knowledge is likely to decline in the face of the rapid demographic, cultural and socioeconomic changes taking place in the region and across the globe. Thus, as an initial and crucial step towards promoting traditional management of bio-resources and enhancing the livelihoods of the local communities, ICIMOD conducted a study to document various types of traditional knowledge in KSL Nepal.

Traditional knowledge (TK), indigenous knowledge (IK), traditional environmental knowledge (TEK), and local knowledge generally comprise long-standing traditions and practices of indigenous or local communities (Gadgil et al., 1993; Berkes et al., 2000). TK also encompasses the skills, wisdom, and knowledge of the communities. In many cases, TK has been passed orally for generations from person to person. Some forms of TK are expressed through stories, legends, folklore, rituals, songs, and even customary laws, rules and regulations.

Living amidst the richness and variety of complex ecosystems, indigenous peoples have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them sustainably. Rural communities, particularly in developing countries, rely on locally occurring species for food, medicine, fuel, building materials, and other products. TK has become a topic of considerable interest within the research and development arena. The contribution of traditional knowledge to conservation and management is increasingly recognized, and implementation efforts based on this recognition are underway in several countries (Uprety et al., 2012). Equally, indigenous people's knowledge and perceptions of the environment (Ford, 2000), and their relationships with it, are often important elements of cultural identity (Mayor, 1994 cited in Hammersmith, 2007).

This study primarily aims to document traditional knowledge, systems, and practices of the indigenous and local communities of KSL Nepal with particular emphasis on:

- the management of resources (including forests, rangelands, and non-timber forest products (NTFPs), agricultural systems (including cropping, animal husbandry, and apiculture), and property rights
- the use of biological resources (plants, animals and their parts) as various goods and services
- the transfer and acquisition of traditional knowledge within and across the communities
- issues and challenges associated with long-term systematic preservation and ethical use of traditional knowledge and practices

# Methodology

## Study Area

This study was conducted in four districts of western Nepal within the Kailash Sacred Landscape, namely Baitadi, Bajhang, Darchula, and Humla (Figure 1). These districts vary in geographical, ecological, and socioeconomic features. Different settlements within these districts were selected for primary data collection (Table 1). The altitudinal gradient ranges from 390m to 7,132m. Climate of the area is generally characterized by high rainfall and humidity, though a part of the Humla region is drier. The region includes the most recently declared Api Nampa Conservation Area in Darchula; a part of Khaptad National Park falls in the southern part of Bajhang district. Biogeographic, climatic, geological and altitudinal variations as well as topographic complexity contribute to highly concentrated

Figure 1: **Study Location – Kailash Sacred Landscape – Nepal**

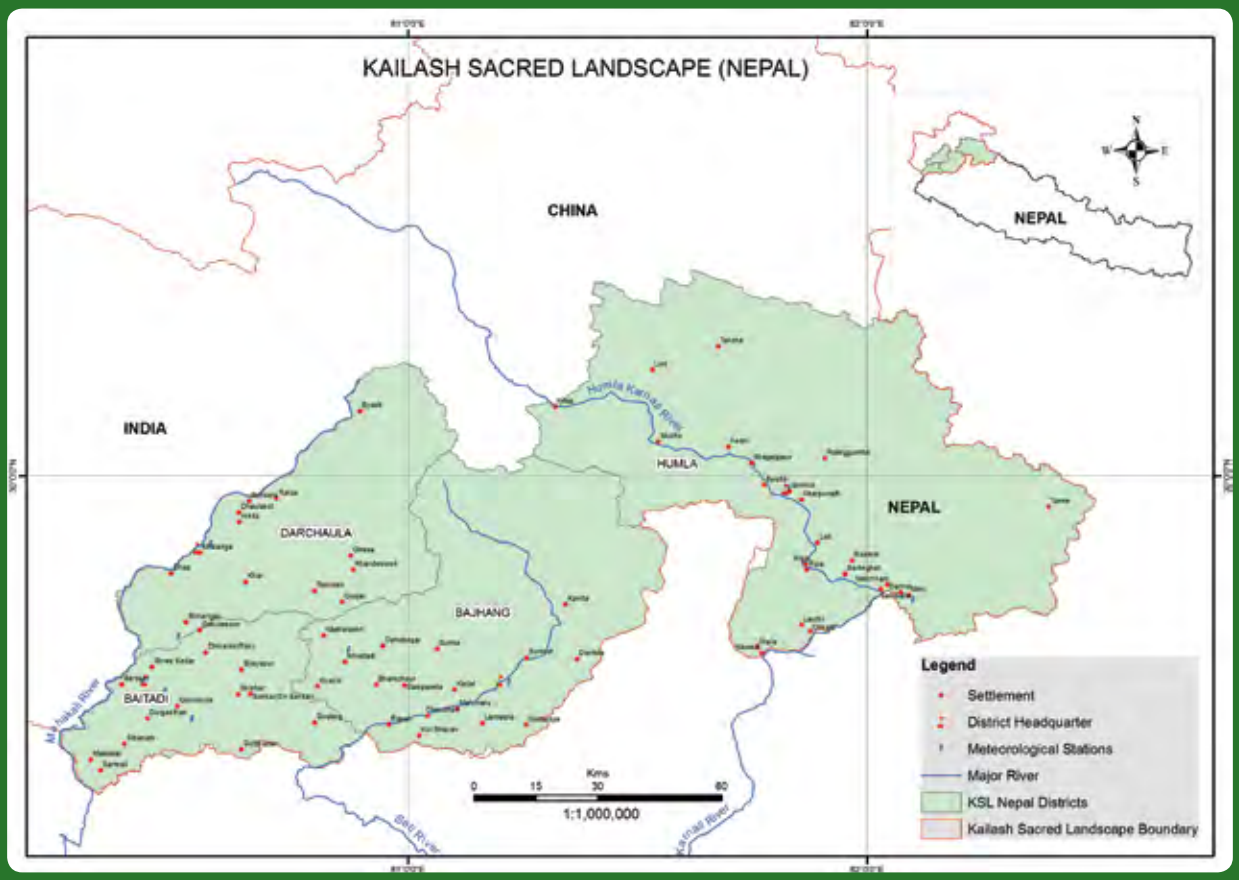



Table 1: **Locations of studied settlements**

| District | VDC | Settlement | Latitude (N) | Longitude (E) | Elevation (msl) |
|---|---|---|---|---|---|
| Darchula | Byas | Chhyangru | 30°7′46″ | 80°53′ | 3,192 |
| | Byas | Tinkar | 30°8′8″ | 80°59′7″ | 3,724 |
| Bajhang | Kanda | Kanda | 29°43′50″ | 81°19′10″ | 2,254 |
| | Kanda | Dhalaun | 29°41′48″ | 81°22′2″ | 2,318 |
| Baitadi | Basantapur | Adtola | 29°26′51″ | 80°30′8″ | 1,293 |
| Humla | Thehe | Thehe | 29°57′16″ | 81°51′47″ | 2,647 |
| | Thehe | Dojam | 30°4′49″ | 82°1′52″ | 3,748 |
| | Limi | Tila | 30°13′18″ | 81°27′9″ | 3,945 |
| | Limi | Halji | 30°13′24″ | 81°30′51″ | 3,744 |
| | Limi | Zhang | 30°14′25″ | 81°35′37″ | 4,002 |

biodiversity in a relatively small area. The landscape thus forms a complex mosaic of ecosystems unique to the mountain system. Land use categories in the study area comprise forest, cultivated land, non-cultivated land, pasture. The existing land use pattern is: forest 24.3%, shrubland 8.6%, grazing land 17.1%, cultivated land 8.6%, and others 41.3%.

The local population comprises various ethnic groups such as Chettri, Brahman Thakuri, Tamang, Bhote, Dalit, and Lama. More than 90% of the population follows Hinduism, and the remainder is primarily Buddhist. Agriculture is the main occupation for over 71% of the population. Population density ranges from 7 persons per km$^2$ in Humla to 154 persons per km$^2$ in Baitadi district. Literacy rates are generally low throughout the four districts.

Study sites and communities were selected based on the richness of biodiversity, composition of indigenous communities, the prevalence of traditional practices, and evidence of traditional knowledge transfer from generation to generation (Cox and Balick, 1994).

### Data Collection Methods

The data and information presented in this study are mostly based on primary information collected during the field visits conducted in May-June 2010 in Humla, September 2010 in Darchula, and July 2011 and October-November 2011 in Darchula and Baitadi. Direct observation and inspection of the significant ecological features at the field, semi-structured interviews with key informants, life histories of both men and women, and group discussions were used for primary data collection. Various groups of people including local community members, village leaders, school teachers, traditional healers, herders, herb collectors, non-governmental organizations (NGOs), civil societies, entrepreneurs, Village Development Committee (VDC) secretaries, and officials at the district levels were consulted. Literature on various resource bases, management practices and cultural systems in the region was reviewed.

## Findings

### Resource Management Systems

Throughout the KSL Nepal region, the local people follow livelihood strategies that integrate several components, namely crop production, animal husbandry, trade, NTFP collection, and off-farm employment. Contribution of individual component to the household and village economy varies across both space and time. Local knowledge on livelihood strategy that uses different resources has evolved through sustained interaction between people and the environment.

#### Traditional institutions of resource management

Before the advent of the Panchayat system in Nepal (pre-1960s), affairs and disputes in the villages were generally resolved by the village heads. These village heads were called *Mukhiya*, *Talukdar*, *Gabbu*, or *Bada*, and were often appointed by the administrative chief of the region, known as *Badahakim*. These village heads maintained the social order in the village, collected land revenue and played a decisive role in the management of resources like forest, pastureland, and irrigation systems. Interestingly, in many northern villages of Humla district, village heads who collected land revenue were appointed from outside the village, mostly *Thakuris* from the southern villages. Any disputes related to the rights over pastureland, water source, or forests that couldn't be settled at the village level were taken to the higher authorities. In addition to the village heads, all the villages had individuals working as watchmen called *Roka* or *Lora*. Usually, these watchmen were responsible for protecting crops from stray animals. Today almost none of the villages have village heads. However, watchmen are still appointed from within or outside the village. In most of the villages, this traditional institutional feature has been replaced by institutions appointed through a larger state mechanism. In some villages like Byas of Darchula, the old system coexists with the new one or has adapted itself to the new arrangements.

Religious institutions have played an important role in the management and conservation of resources in the KSL Nepal region. In many northern communities of Humla district, religious institutions like monasteries, monks, and shamans play a decisive role in how resources are extracted and managed. They have a major role in settling disputes. maintaining social order and conserving resources. However, the scope of their role varies across the region and time periods. Generally it is found that the lesser the market penetration, the greater the role of religious institutions in resource management. Conservation ethos promoted by religious leaders such as monastery abbots is very effective in reducing hunting activities. The role of shamans in resource management, however, has been declining over the years. Religious institutions are key units for addressing the symbolic aspects of resource management, like appeasing various deities of water, rain, good harvest; officiating ceremonies of agricultural activities; and transferring the knowledge and tradition of resource management.

Some institutions like *Bada* (village head system) in Byas, Darchula are more of a social institution. They are more engaged in social activities like marriage and initiation rites and less in natural resource management. These institutions have been instrumental in strengthening social cohesion while indirectly supporting resource management.

In Limi of Humla, the traditional authority system has been subsumed under the larger state system of VDC. Although the VDC authorities have not been elected for a long time throughout the country, people here select authorities for the VDC following traditional selection procedures. As a result, this traditional authority system has been working well for resource governance.

## Property rights

Property rights system defines the way a particular resource is used. This system varies from region to region and across time periods, and is shaped by the availability of resources. Property rights over resources that have been used for a long time, such as forest, pastures, and water, are defined clearly, though such definitions are contested at times. Social institutions that govern these resources have evolved over time.

However, the rights over medicinal and aromatic plants (MAPs) and NTFPs are least clearly defined or understood, and often become the bone of contention. This might be due to the differential values assigned to these resources at different periods of time. In the past, herbs were not considered to be of much economic value and their collection was not a major activity and done mostly by people from the lower socioeconomic strata. Property rights over these resources were not defined; nor were there any clear-cut mechanisms for the management and harvest of these resources. However, over time, the economic value of these resources has increased and some mechanisms for defining property rights over these resources have been developed. For example, Community Forest User Groups (CFUGs) were assigned the rights over herbs harvested from the respective community forests. Well-defined and registered users of the community forest could harvest these resources, or the CFUG could lease out such rights to other members of CFUG, especially Dalit and poor to practice agroforestry within the community forests. Similarly, in the government-managed forests, the state would assign user rights to individuals or firms.

The study showed that usufruct rights and managerial rights are most relevant issues with respect to resource management in the region. For resources like community forests, resource area and users are well defined, and both managerial and usufruct rights are clearly understood. With the establishment of community forests, some of the users who have had traditional access (usufruct rights) to the forests have been denied access. For example, traders from the northern areas who could graze their animals in the forest in the mid-hills during trade caravans and winter season have been denied access to these community forests. But in the case of state-owned forests, users are not strictly barred from using the resources. As the resources are not assigned to a particular community, the forests might have been used as open access resources.

Traditionally, property rights have taken into account ecological boundaries of resources and social relations of production and resource use. For example, herders from the northern VDCs of Humla could graze their animals in the Tibetan portion of the pastureland and herders from the Tibetan side graze their animals on the Nepalese side of border. However, with changes in political and administrative set-ups, herders from these VDCs are no longer allowed to graze their animals on the Tibetan pastureland. But still, there are instances of ecological boundary and social relations overruling the political and administrative setup in exercising the rights over resources. In Byas VDC of Darchula district, local people have decided to allow people from other VDCs in the district to collect *Ophiocordyceps sinensis* in a number of areas, such as Nampa, Budi, Pola, Bolen, Bayali, but have curtailed outsiders' access to Api and Kuntisang area. Meanwhile, people from Garbyang, though located in the Indian territory, are allowed to enter these restricted areas in Api and Kuntisang and collect *Ophiocordyceps sinensis* owing to social ties between Byas and Garbyang villages.

Collectors harvesting 'kira' (*Ophiocordyceps sinensis*) from the Kailsah Sacred Landscape, Nepal

Disputes over access to high-value resources can sometimes lead to violent clashes. For example, restriction on access to Api and Kuntisang area in Byas VDC for collectors from other VDCs initially led to a violent conflict. However, the decision to impose access restrictions was later accepted by all.

In contrast, in Kanda VDC of Bajhang, the District Administration Office decided that such restrictions could not be imposed, as the given area had not been handed over as a community forest. Although Api and Kuntisang were not under community ownership, the locals of Byas VDC were able to restrict outsiders from accessing resources in that area. These two cases show that there is no standard norm to define access rights to resources.

Claims over the resources also have a temporal dimension. As the number and size of herds and flocks has declined drastically over the years owing to the shift from barter to cash economy, claims and disputes over pasturelands have also declined. On the other hand, the value of other resources such as herbs has increased, and claims and disputes over ownership and use of these resources have also increased.

## Agricultural system

### Crop production

Types of crops grown vary from region to region within KSL Nepal. In higher elevation villages like Limi and Thehe VDCs of Humla, major crops are grown only during one season. Major crops grown in this region are naked barley, buckwheat, wheat, potato and radish. Local communities have maintained an irrigation management system for growing crops. In other villages like Byas and Kanda of Darchula and Bajhang respectively, only rain-fed crops are grown.

Naked Barley (*Hordeum vulgare* var. *coleste*) grown in Limi (Humla) and Byas (Darchula), Nepal

In Byas VDC, farmers grow buckwheat, naked barley and wheat as staple food. Potatoes are also grown extensively. Radish, cabbage, cauliflower, beans, peas, pumpkin, carrot, chilli, tomato, etc. are commonly grown in kitchen gardens. Proso millet (*Panicum miliaceum*), amaranth (*Amaranthus* species), and finger millet (*Eleusine coracana*) used to be extremely grown in the past. But once villagers began to obtain rice at cheaper prices from across the border in India, they became less inclined to grow food crops. Most of the time, they are engaged in off-farm employment and trade with Tibet at Taklakot. There is a clear trend of locals abandoning agricultural lands, possibly due to labour shortage.

Kidney Beans (*Phaseolus* species) from Humla District, Nepal

Amaranth (*Amaranthus* species) grown in Darchula District, Nepal

In Kanda VDC of Bajhang district, crops are grown in two seasons. The major crops grown in the summer are potato, finger millet, amaranth, and buckwheat; winter crops include wheat, naked barley, and oats. Other minor crops are proso millet, foxtail millet (*Setaria italica*), and radish. People here follow the rotational fallow system, and the most fertile land is allocated for potato, the most prized crop. In Adtola of Baitadi, some lands are irrigated,

Rice field in Baitadi District, Nepal

though for the most part farmers have to depend on rain. Major crops grown are maize, millet, horse gram, soybean, and rice.

## Animal husbandry

Animal husbandry has been a major livelihood strategy since time immemorial. Contribution of livestock to the local economy varies spatially and temporally. Similarly, the composition of the livestock population within a settlement and a household also varies across time.

Animal husbandry in Limi, Humla District, Nepal

In higher elevation villages like Limi and Thehe VDCs of Humla, and in Dhuli village of Kanda VDC in Bajhang district, yaks are raised. People in Humla and Byas VDC of Darchula used to graze their animals in pastureland across the border in TAR. Herders preferred grazing yaks in winter on the Tibetan side as the chilling wind there would blow away snow from grasses and form a thin coat of ice on the outer furs of yaks, thus protecting the skin underneath. In the summer, after the snow melted, herders moved to the Nepalese pasturelands.

People (especially from the Lama ethnic community) have for generations been practicing cross breeding of yaks with local cattle called *Lulu*. The crossbreeds called *Jhuma* (female) and *Zhopa* (male) are highly valued for their milk and draft animal power respectively. *Jhuma* is also crossed with *Lulu* bulls and the offspring are called *Tolba* and *Tolbini*.

The number and size of goat and sheep flocks have been decreasing in the study areas of Humla and Darchula districts. The main reason for this trend is the lack of grazing area in winter season. The grazing lands that people traditionally used in winter season in the southern parts of the district have been closed to them since they were handed over as community forests. However, the herders from the other southern VDCs in the district can still use the grazing land of Byas in the summer months after paying a nominal fee of Rs. 5 per animal head.

It is reported that the number of goats and sheep in Humla district has been decreasing, especially after the drastic cut in the salt-grain trade. As these animals were primarily used as pack animals, the reduction in the volume of trade concomitantly led to the reduction in the number of sheep and goats. However, in the case of Kanda VDC, the number and size of flocks have increased. Earlier, only the people of Dhuli village, mostly the *Lamas* who have come there from Humla, used to raise these animals; they employed people from the neighbouring villages in the south for this purpose. As these animals provided good income, people from other villages like Kanda and Dhalaun also started to raise them. These animals are used for different purposes such as carrying goods and wool and meat production. But over the last few years, as the collection of *Ophiocordyceps sinensis* has become a major economic activity, the number of sheep and goats in the village has started declining again.

In Byas, four different types of sheep are raised. *Kathe bakhra* is used mainly for hide; *Khunuwa bakhra* for meat; *Dhakaria* as pack animals; and *Biun* is used for wool production and for meat as well. Different breeds of sheep are raised in Humla based on the physiography of the area. People in lower elevations usually rear *Rong-lu* (low country sheep), a breed that provides coarse wool. In upper elevations (Limi valley), people rear *Chiang-lu* (northern sheep), which provides finer wool. Sheep wool is mainly used to make '*Chutka*' – blanket, sleeping mats, and carpets – in Byas and Kanda VDC. Many herders weave *Radi-Pakhi* for their own use or to sell in the market. Tents and carpets are prepared from the fur of sheep called 'Ga' in Byas. Fresh hides are washed with detergent/soap water and then

stretched out and nailed to the ground, the inner side facing up, and left to dry in the sun for 1–2 days. To make the hide soft for producing blankets, it is first soaked in lukewarm water and then hand massaged with oil. Similarly, in higher elevations, people rear *Chyangra* (a type of goat). In Byas and Kanda VDC, goats of the *Lakha* breed, also called *Badhya*, are kept for hauling load and for meat.

Sheep carrying food materials in Bajhang, Humla and Darchula Districts, Nepal

Sheep wool collection in Byas, Darchula, Nepal

Horses grazing in the high pastureland, Nepal

In the higher elevation villages, horses, mules, and cattle form a significant component of the herds. In some villages, the composition of animals is also influenced by religious beliefs. For example, buffaloes are not kept in Kanda village, whereas they are kept in Dhalaun village. In the lower elevation villages, like in Baitadi district, horses and mules are not kept. People closely follow the grazing behaviour of animals. In Byas, sheep are generally grazed first on the new grassland, followed by horses and mules. Although the diets of these animals do not overlap significantly, sheep do not like to graze on grasses already grazed and trampled by other livestock. They do not like grazing on very short grasses either. However, horses and mule graze on lands where sheep have already grazed, including on very tiny grasses. The practice of grazing different animals at different times on the new grassland shows the local people's knowledge about their livestock's grazing preferences and behaviour, and rangeland management.

## Pastureland management

As livestock production has played a major role in sustaining cross-border trade, traditional systems of managing pastures have evolved in different regions. Pastureland is managed in two ways: open access and controlled access. In open access, grasslands are open all year round while in controlled access, the grasslands are conserved so that they can be harvested as winter fodder. Rotational grazing is practised in most of the pasturelands. Similarly, pasturelands at different elevations are accessed in different seasons.

In Byas VDC of Darchula district, the communities decide a date in the last week of September (full moon time) for harvesting grasses and herbs. Harvesting restrictions are imposed to ensure that people obtain adequate fodder in times of scarcity (especially in winter season) in a fair and equitable way (Smith and Wishnie, 2000; Negi, 2010). The villagers allot 2–4 days in a particular season for cutting grass in privately owned grasslands and also in the community forests. All family members except children and elderly people participate in grass cutting. Grasses and forbs cut by villagers are left to dry for about 15 minutes, then made into bundles of 4–6 kg each and tied with a rope. These bundles are left hanging from a tree for two weeks to dry. The air-dried grasses and forbs are stored in

Grass harvesting festival in Byas, Darchula, Nepal

a dry place and used for stall-feeding, mostly during winter. Like in many other parts of the country, local people of this region do not use fire to manage the grassland. This is probably linked with the maintaining of forests in good health. The conifer forest, which is the main forest in the area, is very prone to fire and can be devastated easily.

Pastoral migration is one of the important livelihood strategies of local people. Often four to five herders move together in a group; they fix the date for the movement based on information on precipitation, temperature, and the quality and quantity of grasses available in the pasturelands. Sheep generally prefer to graze in the pastures rich in the species of *Kobresia*, *Potentilla*, *Cotoneaster*, etc. During their upward and downward movements, herders avoid the flowering season for the poisonous aconites, which cause illness to their livestock. In order to escape the scarcity of grasses during winter season and the likelihood of miscarriage in sheep, they are moved to a warmer location (lower altitude) by the end of the Ashwin month (September-October).

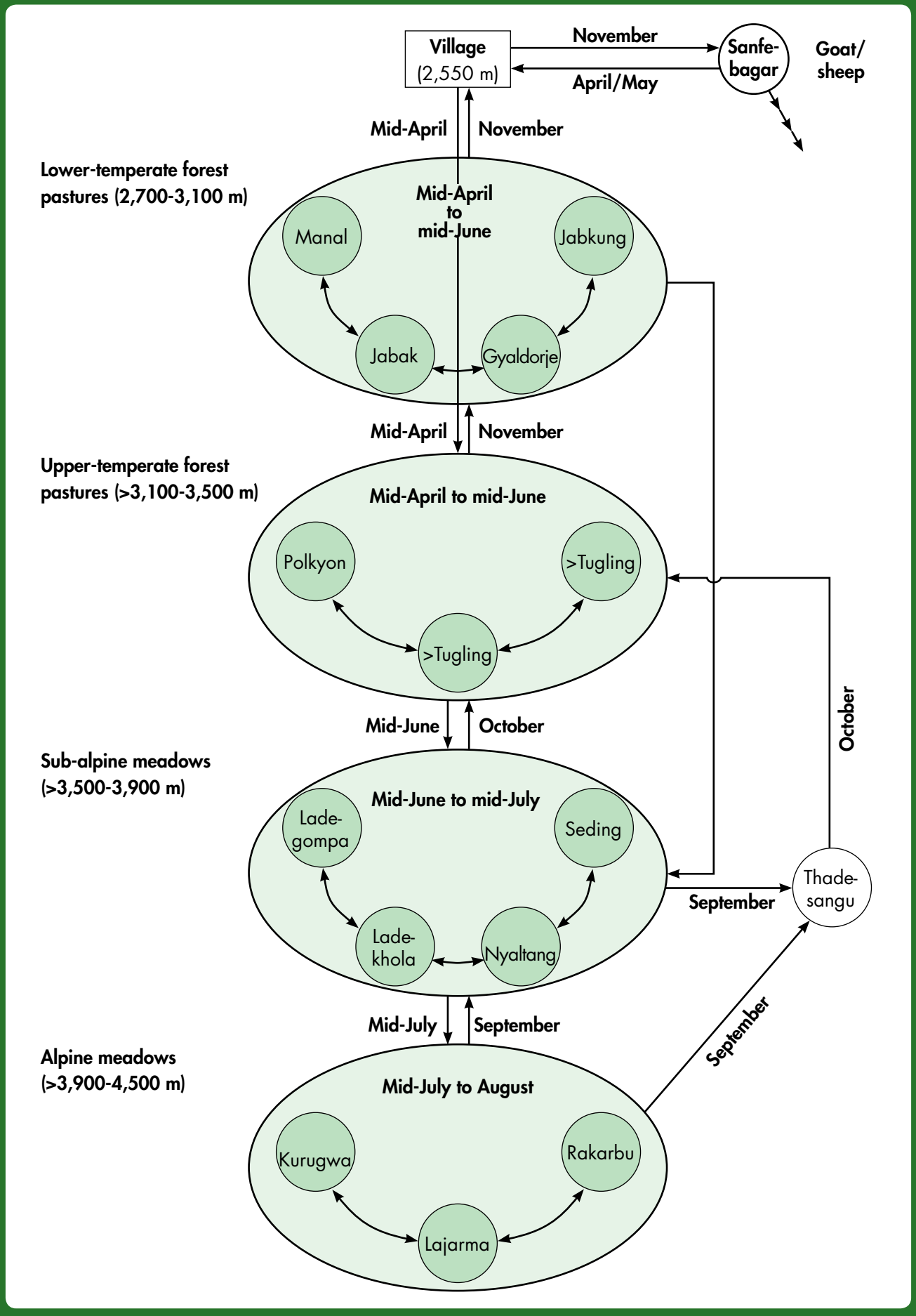
Herders take their livestock to Dongdang (pastureland in Byas VDC of Darchula district near Taklakot) during summer season. During winter season (on the way back from Taklakot), herders take their livestock up to Chhyangru village using the route that passes through India or through Nepal. Usually, the *Bhotiyas* (ethno-linguistically Tibetan people) migrate downwards with their sheep, mules and horses through the Indian route. Sheep are moved all the way down to Dipayal (Doti district), kept there for a month and again moved to higher altitudes, up to Tinkar, by the beginning of Baishakh (April-May). However, due to the dilapidated condition of the trail on the Nepalese side, herders are facing difficulty in moving their livestock from the pastures at Byas to the southern villages of the district. Although *Bhotiyas* get movement permission from India, it is difficult for other herders to get a permit.

In Humla, especially in the northern parts, people practise transhumance (seasonal migration of livestock to different elevations). In the summer and rainy seasons, animals are taken to the high pastures, and in winter season, they are grazed around the main settlements. In some villages, pack animals are not moved and kept at villages while in other villages they are brought back from the high pastures to carry loads if needed. After planting crops in April/May, animals are taken to the summer pasture (higher elevation) called *Soika*. Pasturelands higher up are used during the rainy season and are called *Yarka*. Usually, around August with the onset of Tonka season (autumn), pastoralists start bringing down their animals to the lower pasture. Crops are harvested and animals are moved close to the village by the time *Tonka* season ends and *Ghunka* (winter) season begins. These rotational grazing systems are closely monitored and regulated by the community. If anyone is found grazing animals in *Ghunka* pasture in other seasons, he/she is penalized. To ensure the sustainability of pastureland, the community allots a grazing area within the seasonal pasture. For example, in Limi VDC, people take their animals to Ning Khola, Talung, Artang in *Soika*; to Shakya Khola, Gyau Khola in *Yarka* (summer); Talung, Ning in *Tonka*, and Rak, Ning Khola in *Ghunka* season (Figure 2).

In Bajhang district, herders at Kanda VDC take their animals to Kathan, Gaincha and Godhalne on the Tibetan side from May to July. In July, animals are moved down to Saipal region and then to their villages. Mostly, sheep and goat flocks are moved down to Chainpur in October and finally to Joghbudha area of Dadeldura district or Dipayal of Doti district. After winter, flocks are moved back to the villages. Cattle and yaks are not moved southwards from the village.

Pasturelands in the northern VDCs of Humla district, Byas VDC in Darchula and Kanda VDC of Bajhang are managed and used collectively by local people. Specific areas for grazing are assigned to specific communities at the village level meeting. For example, three villages Tila, Halji, and Zhang of Limi VDC collectively own pasturelands in different areas like Shakya Khola, Ghyau Khola, Ningh Khola, Tolung, etc. and specific areas within each of these pasturelands are assigned each year to a particular village in a village level meeting. In other villages, the grazing area of a particular community is already specified and only the animals of those communities are allowed to graze. In Humla district, there is a provision of allowing the migrating animals to graze for a period of three days during the movement.

Figure 2: **Movement of livestock in different pastures for rotational grazing in Changlakhola valley in Dozam, Thehe VDC, Humla**



Pastureland around the settlement in Limi VDC, Humla, Nepal

Not all households migrate with their animals to the higher pastureland. Households with a few animals hire a herder or request their neighbours/relative to look after their animals. In case of collective herding of milking animals, the dairy products (ghee, dried cheese) are divided among the animal owners in proportion to the number of milking animals and the amount of milk produced by the animals.

Villages in lower elevations have community owned grazing areas where people of the respective communities graze their animals. Generally, the management structure of these grazing lands is not as elaborate as that of highland pastures where the timing, duration and areas of grazing are well regulated.

West Himalaya temperate forest, Humla, Nepal

## Forest management

Forests are managed as government-managed forest, community forest, religious forest, and leasehold forest in the KSL Nepal region. Mostly, local people conserve community forests and have developed their own rules and regulations towards that end. In Limi VDC, the local village officials fix the date for firewood collection (only dry twigs and dead trees) and the village official checks if the decision has been violated. A person found violating the rule is fined up to Rs. 5,000, and any individual possessing a gun is fined up to Rs. 50,000. People also take an oath at the local monastery not to engage in illegal harvest of any green trees. Collection of herbs for trade is prohibited from the forest of this area.

In Chhyangru village of Byas VDC, about 200 years ago, two avalanches occurred one after another. Local communities believed the event signified the wrath of local deities. They decided to establish a temple in the area, prevent further deforestation and degradation, and conserve the forest as a sacred forest. They put prohibition on grazing cattle and collecting grasses, fodder, timber, fuelwood, and medicinal herbs from the area. This forest is called 'Shyanchho', which means rich in biodiversity. Following the conservation of Shyanchho sacred forest, they designated an adjacent area called 'Shyangwayer' for conservation. Although local residents are allowed to graze cattle in Shyangwayer, collection of fuelwood, fodder, grasses, and MAPs is not allowed in this forest. Making fires in the forests is strictly prohibited. Villagers have hired a forest guard to monitor the area and prevent accidental fires.

## Apiculture

Honey production is one of the major auxiliary economic activities in the region. People of all the districts collect/produce honey using both traditional and modern methods. Many farmers keep a large number of hives and a farmer in Thehe VDC of

Beehive 'thour' used in traditional apiculture, Nepal

Humla district was found keeping as many as 90 hives, locally called *thour*.

Hives are hung against a big rock or cliff side with a rope made from the bark of *Desmodium elegans*. Hives are generally hung around May and honey is harvested in October. The rocks against which the hives are hung belong to a particular family, which has owned the spot for generations, and the rights to fix the hives are transferred along the family hierarchy. If a particular household cannot fix the hives in a given season, it may lease the spot out to other families.

'Guchhi chyau' (*Morchella* species) in Humla, Nepal

## NTFP management

Non-timber forest products (NTFPs) have become major economic products in the region. For instance, *Ophiocordyceps sinensis* has become a major economic driver in some of the villages in recent years. Other species of herbs, such as *Fritillaria cirrhosa* (Ban Lasun), *Paris polyphylla* (Satuwa), *Morchella* species (Guchhi chyau) have also gained economic value. Previously, herbs collected from these areas used to be taken to a trading town like Nepalgunj, but in the last few years many traders take the herbs to Taklakot, TAR. The demand for these herbs in Taklakot has rapidly increased its price. In addition to these high-value herbs, people from faraway places (Dailekh, Jajarkot, Nepalgunj, etc.) also come to collect herbs like *Neopicrorhiza scrophulariiflora* (Kutki) in Kanda VDC of Bajhang district.

The high economic value of the herbs has raised the issue of collection rights. In some places only the local communities were allowed to collect herbs whereas in other places such restrictions is not strictly imposed. Almost all the people of this region go to collect *Ophiocordyceps sinensis* for 5–7 weeks in May-June. Contractors get permits from the District Forest Office to collect these herbs and employ/sub-contract other people (especially local community) for collection.

Local people have noticed a gradual decrease in the amount of *Ophiocordyceps sinensis* as more and more people come to collect it and trample the pasture, thus increasing pressure on the resource. Lack of proper supervision and indiscriminate collection threaten the sustainability of this species. The issues of unsustainable harvesting of NTFPs including high value MAPs are common throughout the Himalayan region (Lama et al., 2001; Larsen and Olsen, 2007).

'Kutki' (*Neopicrorhiza scrophulariiflora*), an important non-timber forest product of KSL-Nepal

'Ban Lasun' (*Fritillaria cirrhosa),* Medicinal plant species

## Traditional Knowledge on Use of Biological Resources

Local people of the region have long been interacting with nature and using plant and animal resources for diverse purposes, mostly in a sustainable manner. They use plants or their products mainly as medicines, vegetables, edible oil, dye, timber, fibre, and fodder. Animals or their products (parts) have mainly been used as medicines, furs, skins, source of wool, etc. The major traditional practices that involve the use of various biological resources in the KSL Nepal region are briefly summarized below, and the details of traditional ecological knowledge are given in Annexes I and II.

### Plant resources

The diverse use of plant resources throughout KSL Nepal reflects the rich culture and practices in the region (Annex 1). Some of the categories of traditional use of plant resources are briefly discussed below.

#### Medicine

Using plants or their products as herbal medicine is a common practice among the people of KSL Nepal (also see Kunwar et al., 2006, 2009; Rokaya et al., 2010). Traditional use of medicinal plants is a dominant form of resource use among the rural communities of Nepal (Manandhar, 2002; Shrestha et al., 2004). Mainly traditional healers are involved in the collection and use of such plants for treatment of diseases/ailments. The diseases/ailments that are treated with herbal medicines include abdominal disorders, cuts, burns, cough, cold, asthma, etc. The major medicinal species used in the region are *Aconitum heterophyllum* (Atish), *Aconitum spicatum* (Bish), *Angelica archangelica* (Gananu), *Ophiocordyceps sinensis* (Yarsagunbu), *Dactylorhiza hatagirea* (Hattajadi), *Lomatogonium carinthiacum* (Tikta), *Neopicrorhiza scrophulariiflora* (Kutki), *Paris polyphylla* (Satuwa), *Phyllanthus emblica* (Amla), *Diplazium stoliczkae* (Kalo liundo), etc. Generally, only a particular part of a species is used as medicine, for example, Aconites, *Dactylorhiza hatagirea*, *Neopicrorhiza scrophulariiflora*, *Paris polyphylla*, and *Diplazium stoliczkae* are used for their rhizomes. However, in the case of a few popular medicinal species like *Ophiocordyceps sinensis* and *Lomatogonium carinthiacum*, the whole plant is used. The mode of application depends on the parts to be used and the type of disease to be treated. In most cases, the healer prescribe the paste or powder of a particular part (e.g., *Ophiocordyceps sinensis*, *Dactylorhiza hatagirea*, *Paris polyphylla*, *Diplazium stoliczkae*, *Phyllanthus emblica*, etc.). However, some plants/parts are prescribed in their raw form (rhizomes of aconites, *Bergenia ciliata*, *Paris polyphylla*, etc.) or as a decoction (*Dactylorhiza hatagirea*, *Neopicrorhiza scrophulariiflora*, *Lomatogonium carinthiacum*, etc.). These herbs are either used alone or combined with other plant or animal parts and administered in doses to treat particular diseases (for example, saffron and tiger bone marrow are pounded together with 10–15 pieces of *Ophiocordyceps sinensis* and soaked in brandy (alcohol) for 10–15 days to enhance the aphrodisiac properties of these components).

'Panchaule' or 'Hattajadi' (*Dactylorhiza hatagirea*), an important medicinal plant species

#### Wild vegetables

Plants of the *Arisaema* species (Banko), *Dioscorea* species (Tarul, Bhyakur), *Dryopteris* species (Liundo), *Megacarpaea polyandra* (Rugo), *Paris polyphylla* (Satuwa), *Phytolacca acinosa* (Jarko), *Polygonatum verticillatum* (Kinaudo), etc. are commonly used as vegetables in KSL Nepal. In most of the species (*A. flavum, M. polyandra, P. polyphylla, P. acinosa, P. verticillatum*, and *Dryopteris* species), leaves and/or young stems of the plant are consumed, whereas in some species like *Arisaema griffithii* and *Dioscorea*,

the corms or tubers are consumed. Corms of *A. griffithii* are eaten mainly in Humla and Darchula districts after boiling them in water with ash and salt. Leaves of *Polygonatum* species and *Arisaema* species are dried so that they can be stored for a longer period. To address the scarcity of fresh vegetables during winter season, villagers either dry or ferment green vegetables.

'Banko' (*Arisaema* species) leaves dried and used as vegetable

In Bajhang, and Humla districts, *Tama* made from young shoots of bamboo (*Drepanostachyum falcatum*) is used as a fermented and preserved flavouring vegetable. *Gundruk* made from the fresh leaves of *Brassica* species (cultivated) or leaves of *Arisaema* species, *Megacarpaea polyandra*, *Phytolacca* species, *Polygonatum* species, etc. (wild) are fermented and preserved. Fresh leaves of the above-mentioned species are allowed to wilt in the sun and then beaten to make them into smaller pieces and remove excess water. These beaten leaves are stuffed in an airtight container and placed in the sun for a week. The fermented leaves are then taken out and dried in the sun for several days. The fermented and dried leaves are stored in a dry place for the long term use (Manandhar, 2002).

## Oil extraction

People of KSL Nepal have been using several wild species for oil/fat extraction. Such species include: *Aesandra butyracea* (Chiuri), *Juglans regia* (Okhar), *Prinsepia utilis* (Dhatelo), *Cannabis sativa* (Ganja), and *Prunus persica* (Aaru). Fat extraction from 'Chiuri' is a common practice only in Baitadi district, whereas the rest of the species have been used by the people of Darchula, Humla, and Bajhang districts. The cotyledons of these species are roasted and powdered and thoroughly mixed with boiling water and then compacted into a cotton cloth to extract oil.

'Chiuri' (*Aesandra butyracea*) ghee extracted in Baitadi District is used for household consumption

## Dye extraction

Dye yielding plant species commonly used in the KSL Nepal region are *Arnebia benthamii*, *Maharanga emodi*, *Rheum australe*, *R. moorcroftianum*, and 'Angau' (local name). Roots of 'Angau' are used to extract black dye in Bajhang district, whereas the roots/rhizomes of the *Maharanga* species and *Arnebia* species are used to extract the purple; the rhizomes of *Rheum* sp. are used to extract yellow dye in Bajhang, Humla and Darchula districts. For dye extraction, crushed roots of these species are boiled in water and then the colourful water obtained is used as dye to colour the wool and fibre.

## Fibre extraction

In the KSL Nepal region, species like *Cannabis sativa* (Ganja), *Grewia optiva* (Bheul), *Girardinia diversifolia* (Allo) and *Agave americana* (Ketuki) are now commonly used for fibre extraction. In Bajhang district, the fibre of *Cannabis sativa* was widely used to knit clothes in the past. For fibre extraction, the main stem and branches of *Cannabis sativa* are allowed to dry and then the dried branches are submerged in stagnant water for 5 to 7

'Dhatelo'(*Prinsepia utilis*) use to extract oil for household consumption

'Allo' (*Girardinia diversifolia*) fibre used for making clothes

Women in Khar VDC (Darchula District) spinning fibre using traditional hand spindle 'Katuwa', Nepal

days. The epidermal portion of the branches, which is brownish in colour, is then peeled out carefully, making sure the inner fibre portion remains undamaged. The material just beneath the epidermis is the fibre, which is taken out unscathed. The fibre is dried in the sun and finally piled up and stored.

In Darchula district, local communities have been using the fibre of Allo to make various articles such as ropes, fishing nets, bags, sacks, carpets, jackets, etc. for daily use. The collectors, mostly women, harvest Allo from government forests and community-managed forests. The harvested stem and branch are submerged in water for a day before extracting the bark. Extracted barks are dried, bundled and cooked in wood ash for about 2–3 hours in an iron drum. A wooden hammer is used to soften the cooked bark. The clean bundles of fibre are sun dried and soaked in water with locally available white clay. The traditional hand spindle (Kauwa) is still used for spinning fibre.

### Timber

*Pinus roxburghii* (Sallo), *Pinus wallichiana* (Rani sallo), *Shorea robusta* (Sal), *Abies spectabilis* (Gobre), *Abies pindrow* (Gobre), *Taxus wallichiana* (Lauth), etc. are the tree species that are widely used as timber in the KSL Nepal region. 'Sallo' and 'Sal' are the species mostly used in Baitadi district, whereas the other species are used in the rest of the districts.

### Fodder

A wide variety of plants are used as fodder in KSL Nepal: *Bauhinia variegata* (Koiral), *Grewia optiva* (Bheul), *Celtis australis* (Khadik), *Terminalia alata* (Saaj), *Ficus* species, *Quercus* species, *Litsea monopetala* (Kutmiro). Species of *Grewia*, *Celtis*, *Ficus*, *Quercus*, are used as winter fodder. Some species are considered to be of high economic value; e.g., *Grewia optiva* trees grown in agricultural fields in good conditions are exchanged with ghee/butter seasonally.

### Agricultural equipment

Several plant species (mostly the trees) are used for making various types of agricultural equipment. These species are mostly used for the peculiar characteristics of their wood. Plough is generally made from the wood of *Betula utilis* (Bhojpatra), *Hippophae salicifolia* (dale/tare chuk), and *Desmodium oojeinense* (Sanan), whereas '*Juwa*' used during ploughing is made from the wood of *Morus serrata* (Kimbu) or *Juglans regia* (Okhar). Similarly, pots for storing dairy products are generally made from the wood of 'Sanan' and *Juniperus indica*. Species of *Quercus* are preferred for making the blade (Phalo) of the plough.

### Culturally important species

Locals use a wide variety of plants and plant products in their rituals and other cultural practices. About 22 species and their cultural uses are listed in Annex I. Mostly a specific plant is used for a specific event. However, sometimes two or more plants/products are collectively used for a common purpose; for example, in Humla, Bajhang, and Darchula, rhizomes of *Nardostachys grandiflora*, the whole plant of *Cassiope fastigiata*, the whole plant of

*Tanacetum* species and the leaves of *Rhododendron anthopogon* are collectively used to make incense, which are believed to chase away bad spirits.

### Bamboo

In all districts of KSL Nepal, people make artifacts (locally called 'doko-dalo') from the bark of the culms of *Drepanostachyum falcatum* (Nigalo), *Thamnocalamus spathiflorus subsp. spathiflorus* (Deulo Nigalo). This is a very common practice in the region. People collect culms of desired length, peel the unbroken outer barks, locally called '*Choya*', and use them for weaving different artifacts. The baskets are an important product in cross-border trade, mainly in the Chinese and Indian markets, and are also sold in the domestic market.

Baskets prepared from 'Nigalo' bamboo are sold in the local market across the border

### Other traditional practices

There are several other traditional practices that involve the use of plant resources. Notable among them are: honey production, nectar collection, and sweet (*gud*) preparation from the *Aesandra butyracea* (Chiuri); use of *Sapindus mukorossi* fruits, *Silene species* roots, and *Achyranthes aspera* roots as a substitute of soap; hay collection and storage for winter season, sour syrup preparation from the fruits of *Hippophae* species, *Citrus* species, *Rhus* species, *Punica* species, etc. (Annex 1).

## Animal resources

Animal resources are not used as extensively as plant resources, because most of the animal species are not easily available in the region and most local people do not have knowledge (except knowledge of animal husbandry) about the use of animals/parts. Only traditional healers, *Amchis*, and traders possess adequate knowledge about the use of various animal species for diverse purposes (Annex 2).

Traditional healers of Byas (Darchula), Kanda (Bajhang), and Dojam (Humla) have been using several animal species or their products to cure diseases. Generally, particular parts of the animal are used as medicine, such as the fat of *Marmota bobak* (Himalayan Marmot), bone marrow of *Panthera* species (Tiger), gall of *Ursus thibetanus* (Himalayan black bear), alimentary canal of *Hystrix indica* (Porcupine), gall of *Lophophorus impejanus* (Danphe), etc. These parts are often used in combination with parts of other animals or plant products. Animal products are used to treat major ailments such as asthma, epilepsy, fever, etc. Generally, animal part is prescribed in the form of powder or paste rather than as a decoction or in raw form. In the past, the musk of *Moschus chrysogaster* (Kasturi) was a valuable item for trade and its fur was used to make cushions and beds.

Domestic animals are also used for several purposes. The multipurpose cattle used for farming are sheep (for wool, meat, and transportation), and *Chauris/Jhopas*/cows (for dairy products and agriculture).

A woman in Humla extracting oil from 'Dhatelo' (*Prinsepia utilis*) seeds

## Traditional Knowledge Transfer and Acquisition

Generally, knowledge on the medicinal properties of plant and animal species and their parts falls under two domains: knowledge shared within the community and specialists' knowledge. In the first domain, people in a given village know the medicinal properties of specific plants and animal parts and apply it when needed. Individuals acquire such knowledge through daily interaction with the local socio-ecological systems. This type of knowledge is commonly shared by community members.

On the other hand, specialists who practice traditional medicine and have acquired knowledge about ecology, collection, medicinal properties of plants and animals, and processing and preparation through their parents or family members guard such knowledge as a trade secret. They do not even share such knowledge with fellow practitioners. Such knowledge is passed only to family members orally and through practice. For this reason, specialists' knowledge –such as the knowledge about the preparation of a very specific medicinal compound or identification of rare plant species – faces the risk of loss.

In villages like Chhyangru and Tinkar of Darchula district, most of the children and young people migrate out of the village for education and career opportunities. They hardly get to interact with the local ecosystem and acquire knowledge of the local environment. In the absence of young people in the village, traditional knowledge on the management of biological resources cannot be transferred smoothly and might get lost within the lifetime of a generation. In addition to specific knowledge about the ecology of medicinally valuable species and the preparation of medicines, general knowledge on the traditional production system has also been lost over time. For example, some varieties of potatoes (local *Seto Aalu*, white-tuber potato), millets (*Pahelo Kodo*, yellow-grain variety), and barley (*Junge Jau*, blackish-grain barley with long glumes) have disappeared from the villages.

However, in the villages of Kanda VDC in Bajhang district, no such imminent threat exists as youths live in the villages. Thus, intergenerational transfer of knowledge largely depends on continued interaction between people of different age groups within the local environment. In addition to intergenerational transfer, spatial transfer of knowledge is also taking place through different means. For example, people in Dhuli settlement of Kanda VDC, who emigrated from Humla district, have introduced the knowledge and practice of yak and sheep herding and cross breeding of yak with cattle of local breed in this region. Other communities of Kanda VDC have adopted these practices.

Socio-ecological knowledge on the ecology of species is transferred or gained when the species gain a high economic value within a short period of time. In Kanda VDC, Yarsagunbu (*Ophiocordyceps sinensis*) was not considered highly important until the people of Byas VDC of Darchula shared the ecological and economic importance of the species. Within a few years, the soaring economic value and demand for the species motivated the local people to learn about its availability and collection method from other communities. People learned that availability of moisture at the critical growth stage would ensure the abundance of this species in the following season.

Gender dimension also plays an important role in traditional knowledge acquisition. It was found that women were better versed in the extraction of oil from walnut and peaches in Kanda VDC of Bajhang and from *Prinsepia utilis* in Thehe VDC of Humla. However, men were mostly involved in collecting herbs like Kutki.

## Issues

Some of the major issues related to traditional knowledge system in the management of biological resources in the region are listed below:

### Issues related to healers and traditional medicinal practice

The Himalayas and the Tibetan mountain ranges are among the few remaining areas where traditional medicinal practices are still going on. The majority of the people in these remote areas depend on traditional remedies not only due to poverty, but also because traditional systems are more culturally acceptable (Brown, 1994; Lama et al., 2001; Bhattarai et al., 2006; Uprety et al., 2010). The knowledge of the local healers who use traditional methods and local plant and animal resources has helped cater to the health needs of the local populace.

Despite their contribution in providing health services in rural areas, traditional healers in Nepal have not gained the recognition they deserve. They have received little or no material support for their professional growth. In China, by contrast, healers have been given national recognition and their profession has been institutionalized.

### Issues related to transhumance

Over the years, the number and size of flocks has declined in most parts of the region except in Kanda VDC. This has affected the livelihoods of many herders. One of the main reasons for the declining population of sheep and

goats is the restriction on access to traditionally used grazing areas. As most of these grazing areas have now been designated as community forests, herders have no access to such forests. With the establishment of Api Nampa Conservation Area, herders from Byas fear that the government will impose further grazing restrictions. Moreover, in Darchula district, the road used for sheep movement is so dilapidated that herders are obliged to get permission from the Indian authorities and pay a higher fee to use the Indian road.

## Issues related to illegal hunting

Hunters from different parts of India and Nepal often come to Byas VDC to hunt musk deer and blue sheep. Skins and bones of tiger/leopard, skins and pods of musk deer, biles of bear are illegally traded and smuggled to Tibet. Sometimes, even rhino horns are smuggled through Darchula. Although the government has adopted some control measures to enforce laws in the remote areas of Darchula, illegal trafficking of wildlife products seems to be a flourishing business. Institutional mechanisms such as the Wildlife Crime Control Bureau (WCCB) and Management Council have not been very effective. Lack of proper supervision in border areas like Hilsa of Humla and Urai Bhanjyang in Bajhang contributes to illegal hunting and wildlife trade.

## Issues related to timber export

Despite the conservation activities in the community forests, illegal felling and smuggling of trees are common in border areas like Byas VDC of Darchula district and Muchu of Humla district. Such illegal activities are driven by the increasing demand for timber in the bordering towns. Illegal felling of trees is particularly rampant in Darchula. Owing to higher prices of timber in India and China, smugglers are motivated to export timber from Nepal (Chaudhary et al., 2015).

Timber supplied to Taklakot through Hilsa from Humla District (© Yogi Shakya)

## Issues related to loss of knowledge

The healers generally pass on their skills and knowledge to their offspring or apprentices. However, only few people are interested in traditional medicinal practice. Aware that their knowledge and profession is on the wane, healers want to document the existing knowledge so that future generations can use it. The loss of knowledge can be attributed to the following root causes:

'Vaidya' Ratan Singh Bohra, a local healer from Darchula District, Nepal

**Lack of access to resources:** Lack of adequate resources among healers hinders the practice of traditional medicine. The Government of Nepal has provided legal protection to 19 plant species and 2 forest products under the Forest Regulations, 1995 (amended 2001). These include medicinal plants that have great significance for traditional medicinal practice, such as *Dactylorhiza hatagirea*, *Nardostachys grandiflora*, *Neopicrorhiza scrophulariiflora*, and *Ophiocordyceps sinensis*. These legal restrictions have created confusion as to whether the healers' practice of collecting these plants to make medicines is legal or illegal. Such restrictions on the collection of culturally and socially valuable

species protected by the Government of Nepal are in contrast to the rights provided by the Biological Diversity Act of India, 2002, to local people and communities, including *vaids* [healers] and *hakims* [village leaders] who have been practicing traditional medicinal practices.

**Lack of infrastructure:** Access to resources alone cannot ensure a smooth practice of traditional medicinal practice. The local healers need basic infrastructure like instruments for extraction, storing equipment, electricity, etc. for long-term and efficient use of medicinal plants.

**Monetary problems:** The economic value of medicinal plants is rising by the day, so the local people prefer to export those resources rather than selling them to local healers. Local healers can hardly afford to buy these expensive resources. The fee they receive from their patients is not enough for preserving their traditional knowledge for the long term.

**Inadequate policy and legislation:** There are no ethical guidelines on collaborative bioprospecting. One of the weakest aspects of Nepal's legislation relating to biodiversity is the lack of clarity about access to genetic resources. Rules to regulate the activities of local and foreign companies engaged in bioprospecting are urgently required and conditions for local communities to access to genetic resources should be addressed seriously. At present, people face no restrictions while taking genetic resources out of the country (Chaudhary, 2000).

**Difficulty in knowledge transfer:** It is difficult to document and store knowledge of traditional medicinal practice due to the lack of institutional support for this form of knowledge and practice. Transferring traditional knowledge to the younger generation and motivating them to learn traditional medicinal practice has become a big challenge.

### Issues related to governance of NTFPs/MAPs

Governance of resources like NTFPs/MAPs and other natural resources is not systematized. Disputes over the collection rights for high-value resources like *Ophiocordycpes sinensis* have led to violent conflicts, though in Darchula a few staff members from the District Forest Office visit the collection sites for monitoring. No standard norms have been developed to define who has access to these resources. As discussed before, the District Administration Office in Bajhang intervened in Kanda and allowed collectors from outside the VDC to collect *Ophiocordyceps sinensis* on condition that the area does not fall within the community forests. However, in Darchula district, local residents could deny outsiders access to some of the collection sites although they did not fall within the community forests. Similarly, collection of other herbs is also not well monitored and regulated.

### Issues related to bio-prospecting

Biodiversity prospecting, or bioprospecting, is the exploration, extraction and screening of biodiversity and indigenous knowledge of commercially and socially valuable genetic and biochemical resources. Bioprospecting provides economic value to ensure the long-term conservation of natural biodiversity in countries rich in biological and cultural diversity (Chaudhary, 1998).

In Nepal, the medicinal plants that are being used to treat common ailments and diseases such as dysentery and diarrhea, diabetes, malaria and respiratory problems all need to be authenticated and their efficacy and dosage standardized with the help of pharmacognostic analyses in the laboratory. Such information is aimed at encouraging the local community to continue using the effective medicinal plants.

## Conclusion

This study documented the rich traditional practice and knowledge of indigenous and local communities of KSL Nepal on the use of biological resources. The traditional system of resources governance is an ancient art that has evolved over the generations. The available knowledge on the use and management of plant and animal resources is an asset of the communities. The tables, though not exhaustive, list the various uses and local practices to manage and/or utilize these resources. The specialists' knowledge on the preparation and use of these resources has been acquired and passed through generations.

Indigenous and local communities have developed systems that would help in managing and conserving the resources. The rotational grazing system, transhumance, and locally developed resource governance system (in Limi valley) are some of the examples of how people have developed a resources management system that would help sustain the resource base while also meeting the demand of the local communities. Traditional resources governance systems have been found to be well developed and effective, and have for centuries played an important role in resource conservation. However, such social arrangements have not evolved rapidly enough to address emerging issues related to the resources that have gained economic importance in recent years. The institutional vacuum in the management of resources that have recently gained a high value makes resources management all the more challenging.

People in the bordering region have for generations utilized and conserved the resources from different ecosystems and regions. In the process the resource base gradually acquired its own social and ecological boundaries. However, with the political and administrative issues overruling such socio-ecological boundaries of the resources, people's livelihoods and the sustainability of the resource base itself will become a challenge. To address such issues, it is important to understand and promote traditional socio-ecological systems across the transboundary landscapes.

Over the years, with the change in the overall economic system of the whole region, the subsystems and social relations of production have also changed, seriously affecting the food security and livelihoods of people. The deep-rooted culture of trading across the transboundary landscapes has survived though the trading items have changed. Grains, which were a major commodity during the period of salt-grain barter trade, have now been replaced by herbs. The dynamics of herb trade, especially high-value herbs like *Ophiocordyceps sinensis*, have deep ramifications for the overall socioeconomic situation of rural communities.

## Further Suggestions

The study shows that regulatory institutions for natural resource management should have effective presence in KSL Nepal, especially in the remote areas like Byas, Limi, Hilsa, and Kanda VDCs. Lack of government authorities in these areas would lead to rapid deterioration of the resource base. An in-depth study of traditional management practice is needed.

It would also be essential to strengthen local institutions like Bada of Byas VDC and traditional institutions of Limi VDC and make them knowledgeable about, capable of, and responsible for conservation of natural resources at the landscape level. The NTFPs/MAPs and animal resources are at risk due to overexploitation and illegal collection. A transboundary approach by Nepal, China and India would help to conserve the resources sustainably.

The practice of traditional medicine has been declining. Lack of knowledge transfer is an important issue. Giving national recognition to traditional healers may encourage the younger generation to gain traditional knowledge.

Establishment of a nursery of important NTFPs/MAPs would help raise conservation awareness and promote the species and their products for sustaining the livelihoods of the local people. Local healers wish to cultivate important NTFPs/MAPs and are seeking support from the government and development partners.

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## Annes 1: **Traditional knowledge on plant resources used by local communities in KSL Nepal**

| Scientific name (Family) | Local vernacular name(s), Part(s) used | Remarks |
|---|---|---|
| **Medicine and vegetable** | | |
| *Aconitum heterophyllum* Wall. ex Royle (Ranunculaceae) | Atish, Rhizome | In Darchula district, local people can distinguish 'atish' (an antidote) from 'bikh' (poison) based on the colour of the rhizome. Rhizome of 'atish' is white, whereas the rhizome of 'bikh' is reddish in colour. Atish possesses anti-toxic property, and is widely used against snakebites and toxic effects of other aconites and poison. It is also used to cure high fever and abdominal pain. A piece (about 5–10 g) of rhizome is chewed to cure these diseases. |
| *Aconitum spicatum* (Bruhl) Stapf (Ranunculaceae) | Bikh, Rhizome | |
| *Aegle marmelos* (L.) Correa (Rutaceae) | Bel, Mature fruit | In Baitadi and Bajhang districts, pulp of the mature fruits of the species is used to cure chronic headache and diarrhoea. Leaves are used during religious activities, mainly during the worship of lord Shiva. |
| *Angelica archangelica* L (Apiaceae) | Gananu, Rhizome | Vaidhya Krishna Bohora (Bajhang) recognizes two types of this species; 'Patnu', which is found at higher elevations and possesses fewer medicinal properties, and 'Aulya', which is found at lower elevations but possess more medicinal properties. Rhizome of this species is fragrant, and a piece of dried rhizome is chewed directly or a paste/decoction is given to cure stomachache, ulcer, etc. A small quantity of very fine paste of the rhizome is mixed with fresh butter and is applied to the eyes before going to sleep at night. This will remove any kind of extraneous material trapped in the eye. |
| *Arisaema flavum* (Forssk.) Schott (Araceae) | Banko or Dhoka, Leaves | The plant possesses irritating (kokayune) and allergic properties and is poisonous if eaten without proper processing. Leaves of *A. flavum* are eaten both as fresh vegetables and in dried form. The dried leaves are washed in hot water and fried properly. Corms of *A. griffithii* are eaten as vegetables. The corms are boiled properly by mixing ash and salt, made into paste, mixed with buckwheat flour, and eaten normally with soup prepared from chilly, salt, Himalayan pepper (timur). |
| *Arisaema griffithii* Schott (Araceae) | Banko or Dhoka, Corms | |
| *Bergenia ciliata* (Haw.) Sternb. (Saxifragaceae) | Pakhanved or Shribad or Silphode, Root stock | The plant has a thick rootstock and grows in moist rocky places at elevations between 1,300 and 3,000 m. In Darchula and Bajhang, powder or paste of rootstock is used to cure kidney stones and urinary problems. The rootstock can also be chewed to cure stomachache and gall stone. |
| D*actylorhiza hatagirea* (D. Don) Soo (Orchidaceae) | Hattajadi or Panchaule, Rhizome | Rhizome of *D. hatagirea* possesses strong antiseptic property. In Darchula and Bajhang districts, paste of rhizome is applied externally on the cuts for quick healing. A decoction of rhizome is also used to cure gonorrhoea and syphilis. The rhizomes, when eaten raw, are known to act as an energizer tonic. |
| *Dioscorea bulbifera* L. (Dioscoreaceae) | Githa, Tuber | A bitter variety of *D. bulbifera* is found in the region, called 'Tito Githa'. Tubers of both the species are dug out of the ground during winter season and eaten directly or as curry, after boiling. However, the rhizome tubers of *D. bulbifera* are boiled for 2 to 3 times in water with ash to remove its bitter taste, and then consumed. Powder of the tubers of *D. bulbifera* is also used to cure malarial fever and to remove excess heat from the body. |
| *Dioscorea hamiltonii* Hook. f. (Dioscoreaceae) | Ban Taud, Tuber | |
| *Diplazium stoliczkae* Bedd. (Woodsiaceae) | Kalo liundo, Rhizome | In Bajhang district, the spiny rhizomes of this plant are dried and pounded. The powder is mixed with rapeseed oil to make a paste, and the paste is applied on burns for quick healing. |
| *Dryopteris* sp. (Dryopteridaceae) | Liundo, Young leaves | In Bajhang, Humla and Darchula districts, fresh young leaves are used as vegetable. |

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| *Fagopyrum esculentum* Moench (Polygonaceae) | Phapar, Young leaves and seeds | Three different local varieties of buckwheat are cultivated in the Chhyangru area of Darchula. Local people distinguish these varieties on the basis of seed characteristics. These varieties are 'Khabe' (elongated seed) mostly found around Tinkar area (higher elevations); 'Syangwe' (spherical seed); and 'Tichey' (oblong seed) mostly found around Chhyangru. The Syangwe variety has the highest productivity and is bitter buckwheat. In Bajhang district, two varieties, 'Tite phapar' with a bitter taste of flour, and 'Mithe phapar' without the bitter taste of flour, are under cultivation. Young leaves of the species are used as vegetable whereas the flour of the seeds is used to make breads. |
| *Fritillaria cirrhosa* D. Don (Liliaceae) | Podya or Ban lasun, Tuber | In Humla and Darchula districts, local healers use the paste of rhizome of *Fritillaria cirrhosa* (ban lasun) mixed with either rapeseed oil (sarsoo oil) or fat of Himalayan marmot (phyau musa, *Marmota bobak*) to treat swelling and pain in the legs and arms. The paste prepared is applied externally over the affected surface twice a day for one month. |
| *Hippophae salicifolia* D. Don (Elaeagnaceae) | Dale chuk, Ripe fruits | Local people of Darchula use the fruits of 'Dale chuk' in various ways. Fruits of the species ripen during September-October. During collection, the collectors wear plastic gloves and macerate the ripe fruits on intact branches so that the juice can be directly collected in the pot of precise size kept beneath the branches. This ensures that the branches are undamaged and can bear fruits in the next season. Then the collected juice is filtered with the help of a cotton cloth and processed to make sour syrup that can be stored for a long time. During sour preparation, the juice is boiled till its volume is reduced by five to seven times. It turns black and viscous. A small amount of salt and fried red chilli are also often added to the fluid. The fluid is then allowed to cool and stored properly in a jar. The material prepared in this way can be stored for several years and used for several purposes. Ripe fruits are eaten raw, also consumed to cure stomachache, cough and cholera, and as anthelmintic, as well as used to make fresh pickle. |
| *Hippophae tibetana* Schlecht. (Elaeagnaceae) | Dale chuk, Ripe fruits | |
| *Lomatogonium carinthiacum* (Wulfen) Rchb. (Gentianaceae) | Chiraito or Tikta, Whole plant | This herb is more effective than the *Swertia* species for curing fever, according to the traditional healer of Darchula. Plant mass is boiled in water and the decoction is administered to treat fever, cough and cold. The species has anthelmintic properties and is also used against ulcer. |
| *Megacarpaea polyandra Benth*. (Brassicaceae) | Rugo, Leaves | In Humla, Bajhang, and Darchula districts, fresh leaves are used as vegetable. |
| *Nardostachys grandiflora* DC. (Valerianaceae) | Bhutkesh or Jatamansi, Rhizomes | The healer from Darchula district uses the decoction of its rhizome to cure cough. The rhizomes are also used as incense; they are burnt together with the dried leaves of Junipers, *Tanacetum* species, and *Artemisia* species. It is believed that the incense smoke wards off ghosts and evil spirits. |
| *Neopicrorhiza scrophulariiflora* (Pennell) D.Y. Hong (Scrophulariaceae) | Kutki, Rhizomes | In Bajhang and Darchula districts, it is used to cure fever, cough, asthma and high-altitude sickness. The plant is crushed and boiled in water. The hot water containing the plant decoction is served as medicine. It is collected during August-September. |
| *Nicandra physalodes* (L.) Gaertn. (Solanaceae)) | Ishworgola, Seeds | The seeds are used by local people in Bajhang district. They mix the seeds in water or milk, add sugar, and offer it to the patient to treat urinary problems, typhoid, malaria, etc. |
| *Ophiocordyceps sinensis* (Berk.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora (Ophiocordycipitaceae) | Yarsagumba or Yarcha or Kiro, Whole fungus with caterpillar | It is the most popular 'high-value, low-volume' product of the Himalayas. Besides its popular aphrodisiac properties, it is used to cure asthma and other respiratory problems. Different constituents are mixed for different diseases, according to the local healer of Darchula district. Saffron and bone marrow of tiger and 10–15 pieces of *Ophiocordyceps sinensis* species are pounded together and soaked in brandy (alcohol) for 10–15 days for a better effect. *Ophiocordyceps sinensis* harvested during April-June is of best quality and is golden-yellowish in colour. The collected caterpillar is cleaned with a brush to remove soil and mycelia and stored in a well-aerated cotton bag to make it dry. *Ophiocordyceps sinensis* should be used within 1–1.5 years of harvest. |
| *Paris polyphylla* Sm. (Trilliaceae) | Satuwa, Root and young leaves | It has a creeping rhizomatous root, which is used as medicine. According to local healers of Bajhang and Darchula districts, it is "a plant with seven leaflets, and the seven nodes on the rhizome possess the best medicinal properties, and are used to cure seven different diseases". Vaidhya Krishna Bohora (Bajhang) recognizes two varieties of satuwa: 'Auli', which is found at lower altitudes and possesses better medicinal properties; and 'Lekali', that is found at higher elevations but possesses fewer medicinal properties. In Bajhang and Darchula districts, it is used to cure dizziness, boil, tumor, gall stones, cuts, paralysis and gastritis. It can be chewed directly or consumed as a decoction. In Bajhang district, young leaves of 'Satuwa' are used as vegetable. |
| *Phaseolus* sp. (Fabaceae) | Guraush/Simi Seeds | It is one of the very common pulses of the Bajhang and Baitadi region, and also possesses medicinal properties. Soup of the grains of this species is given twice or thrice a day to the patient of 'chickenpox' (Theula). |

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| *Phyllanthus emblica* L. (Euphorbiaceae) | Walo, Fruits and bark of the stem | Fruits of the species are edible and possess medicinal properties. In Baitadi district, people chew mature fruits to quench their thirst during their walks in the hilly areas. Besides, pulp of the fruits is used to make pickle, or is beaten and used during hair wash to remove dandruff and control hair fall. The fruits are dried, powdered, and mixed with the powder of the fruits of *Terminalia chebula* Retz. (Combretaceae) ('harro'), and *Terminalia bellerica* (Gaertn.) Roxb. (Combretaceae) ('barro') in equal proportions to make 'Trifala' powder. The powder is used to cure gastritis, ulcer, stomachache, etc. Decoction of the barks is applied externally on the body parts affected by paralysis. Leaves and fruits of the species are used during religious activities. |
| *Phytolacca acinosa* Roxb. (Phytolaccaceae) | Jarko or Jaringo, Leaves | In Humla and Bajhang districts, young fresh leaves are used as vegetable. |
| *Polygonatum verticillatum* (L.) All. (Convallariaceae) | Nigali saag or Khinaudo, young Leaves and stems | In Humla, Bajhang, and Darchula districts, fresh as well as dried young leaves and stem are used as vegetable. |
| *Rhus javanica* Miller (Anacardiaceae) | Bhake Amilo, Fruits | In Bajhang, ripe fruits are dried, beaten in 'okhal' and filtered to remove the residue. Then the powder is stored and used as sour in pickle and lentil (daal) soup. The powder is also mixed with honey and consumed to cure fever and cough. |
| *Selinum wallichianum* (DC.) Raizada & Saxena (Apiceae) | Sogre kayar, Rhizome | According to the healers of the Bajhang district, rhizomes of this species are pounded and the sap is mixed with honey or sugar. These rhizomes can be harvested in any season. One full spoon of such mixture is given to the patient twice or thrice a day to treat asthma. |
| Katare (Local name) | Roots | The healers of Bajhang district identify the plant from its three rootstocks that are yellowish in colour. These roots are pounded into paste. About 10 gram of the paste is mixed with a spoonful of water and given to children suffering from diarrhea. Diarrhea will be controlled within 2-3 days. |
| Thakale (Local name) | Roots | According to the healers of Bajhang district, roots of the species are dried and pounded to make powder. At the time of administration, a little water is added to the powder to make a paste. The paste is applied on cuts; it heals wounds quickly. |
| Ulto jado (Local name) | Roots | According to the healers of Bajhang district, fresh roots of this plant are pounded and the sap is extracted from it. The sap is mixed with an equal amount of water and then two spoons of such product are given to the cholera patient, once in the morning and once at night. The treatment will cure the disease within two to three days |
| Bishmaar (Local name) | Roots | Vaidhya Ratan Singh Bohra of Darchula district uses the roots of this plant. The roots are powdered and soaked in water and then filtered with a cotton mesh. The liquid thus obtained is applied in the eyes (two drops in each eye) to cure blindness. |
| Shir (Local name) | Rhizome | Vaidhya Ratan Singh Bohra of Darchula uses the rhizomes of this plant to cure muscle pain and swelling. |
| Sindani (Local name) | Whole plant | Vaidhya Ratan Singh of Darchula uses the plant as a very effective cooling agent; when added to water, it converts water to ice within a few minutes. |
| **Oil** | | |
| *Aesandra butyracea* (Roxb.) Baehni (Sapotaceae) | Chiuro, Cotyledons | In Baitadi district, seeds of mature fruits, called 'Khulla', are used for this purpose. These seeds are roasted and their seed coats are peeled off. Then the cotyledons are ground and roasted. The ground cotyledons are mixed in water and the mixture is then transferred to the traditional grinder (mill), called 'Kolu', in which the mixture is compacted to extract the fat. The fat is edible as well as medicinal, used externally for curing muscle and joint pain, headache, skin eruptions, etc. |
| *Juglans regia* L. (Juglandaceae) | Okhar, Cotyledons | In Bajhang and Humla districts, nut collected from the trees growing in the wild is submerged in water for 3–4 days or boiled for 2–3 times to soften the kernel (locally called 'ghanja'). The 'ghanja' is pounded in a traditional stone mortar called 'okhal'. The powder is roasted, mixed with water to make slurry, wrapped with a thin cotton cloth, and pressed hard to extract oil. The oil extracted through this method is fragrant, considered to be of high quality, and used in cooking. About 5 kg kernel yields 1 litre of oil. Use of this oil was common in the past. |

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| *Prinsepia utilis* Royle (Rosaceae) | Dhatelo, Seed | In Bajhang and Humla districts, mature fruits of P. utilis are collected, dried in the sun and the outer pulp is peeled out. Then the cotyledons are pounded in 'okhal'. The powder thus obtained is roasted and a little hot water is added to it to make it slurry. The mixture is then stirred thoroughly and poured into a thin cotton cloth. It is compacted and pressed to extract oil. Oil extracted in this way is edible; 1 litre of oil can be extracted from 4–5 kg of cotyledons. |
| *Cannabis sativa* subsp. *indica* L. (Cannabaceae) | Ganja, Seed | In Bajhang district, seeds of Cannabis sativa are collected, ground in a traditional stone grinder called 'Jato' and the outer seeds coat is removed. The ground cotyledons are roasted, pounded, thoroughly mixed with hot water, placed on a thin cotton cloth and pressed hard. Oil thus extracted is edible as well as medicinal; however, only a small amount of oil can be extracted from a large quantity of seeds. Such oil is applied externally to cure swellings and pain in muscles and joints. |
| *Prunus persica* (L.) Batsch. (Rosaceae) | Aaru, Cotyledons | In Humla and Bajhang districts, cotyledons of P. persica are beaten to make powder. The powder is roasted, mixed in hot water and stirred well. The mixture is then placed on a thin piece of cotton and pressed hard so that drops of oil can be collected in a pot. Oil extracted from the seeds of P. persica is edible and also possesses medicinal properties. It is applied externally to cure pain in muscles, joints, etc. and also used to cure stomachache, gastritis, acidity, etc. |
| **Dye** | | |
| *Rheum australe* D. Don (Polygonaceae) | Padamchalnu, Rhizomes | In Humla and Bajhang districts, rhizomes of 'Padamchalnu' are crushed and boiled in water to extract yellow dye, which is mostly used to colour wool. |
| *Rheum moorcroftianum* Royle (Polygonaceae) | Padamchalnu, Rhizomes | |
| *Maharanga emodi* (Wall.) A. DC. (Boraginaceae) | Marangi, Roots | In Humla and Bajhang districts, roots of 'Marangi' are crushed and boiled in water to extract red-purple dye. This dye is used to colour wool and fibres. |
| *Arnebia benthamii* (Wall. ex G. Don) I. M. Johnst. (Boraginaceae) | | |
| Angau (Local name) | Roots | In Bajhang district, crushed roots of 'Angau' are boiled in water to extract black dye, which is used to colour wool and fibres. |
| **Fibre** | | |
| *Girardinia diversifolia* (Link) Friis (Urticaceae) | Allo, Fibre | In Darchula district, local communities have been using the fibre of 'allo' for making various articles such as ropes, fishing nets, bags, sacks, carpets, jackets, etc. for daily use. The collectors are mostly women who harvest 'allo' from forests. Fibre is obtained from the bark. The clean bundles of fibre are sun dried and soaked in water, mixing with locally available white clay. Traditional hand spindle (kauwa) is used for spinning of fibre. |
| *Cannabis sativa* subsp. *indica* L. (Cannabaceae) | Bhango, Stem bark | Fibre extraction from hemp is very popular throughout Bajhang district. The fibre was used to knit clothes in the past; however, these days a large quantity of hemp fibre is exported to Dhangadhi, Mahendranagar, and Kathmandu. For fibre extraction, main stem and branches of the plant are allowed to dry and then the dried branches are submerged in stagnant water for 5 to 7 days. Then the epidermal portion, which is brownish in colour, is carefully peeled from the branches so that inner fibre portion remains undamaged. The material just beneath the epidermis is the fibre, which is taken out unscathed from the remaining cortical portion of the stem. The fibre is dried in the sun and finally piled up for storage. |
| *Grewia optiva* J. R. Drumm. ex Burret (Tiliaceae) | Bheul, Bark of branchlets | The branchlets left after feeding the leaves to cattle are collected and dried for several days. These branchlets are submerged in stagnant water for 5 to 7 days. After 7 days, these are taken out and at first the brownish epidermal portion is carefully peeled off. The remaining portion of bark, which is yellowish-white in colour, is the fibre and it is taken out singly from the cortical portion of the branchlets. The fibre is piled up, washed with soapnut (*Sapindus mukorossi*), dried, and used to make different artifacts. The remaining woody portion called 'Bheulyat' is dried and used as an excellent source of lighting as well as firewood. |

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| **Timber** | | |
| *Pinus roxburghii* Sarg. (Pinaceae) | Sallo, Wood, needles, seed, resin | In Baitadi district, pine needles called 'pirol' are used as bedding material for cattle and compost manure is prepared from them. The species is also a chief source of timber and fuelwood. People have been involved in the collection of resin, which is sold to Turpentine Company at the rate of NPR 120 per container, and of which NPR 3 per container is paid to the community forests. One container of resin can be collected from about 30 trees and each container weighs about 16 kg. The hard wood of pine, called 'Jhuro', is used as an excellent source of lighting as well as burning material. Hard wood at the nodes and the resin are also used medicinally (applied externally on the wound) against scorpion bite. |
| *Shorea robusta* Gaertn. (Dipterocarpaceae) | Sal, Wood, leaves, resin | This species is used by the local people of Bajhang and Baitadi districts for multiple purposes. Leaves are used during religious activities (to make dinner plates 'duna-tapari', and during worship) and as fodder. Timber of the species is very durable and used to make frames of doors and windows. Resin (sap) extracted from the species, called 'saal ko raal', possesses medicinal properties. Resin mixed with hot water and honey is given to women during childbirth for quick expulsion of the remnants of placenta. It is also used to treat stomachache. In Bajhang district, leaves of *Shorea robusta*, or *Cucurbita pepo* L. are cooked and the decoction is given to women immediately after childbirth for quick expulsion of the remnants of placenta. Alternatively, locally manufactured jaggery, 'gud, wrapped in the leaves of *Shorea robusta* is given to women after child delivery. |
| **Fodder** | | |
| *Bauhinia variegata* L. (Fabaceae) | Koiralo, Leaves | The plant is widely used as fodder in Baitadi district. |
| *Grewia optiva* J. R. Drumm. ex Burret (Tiliaceae) | Bheul, Leaves | In Baitadi and Bajhang districts, the species is used as cow and buffalo feed to improve the quality of milk. It is said to increase the fat content of milk. |
| *Celtis australis* L. (Ulmaceae) | Khadik, Leaves | In Baitadi, the plant is lopped for fodder. |
| Other fodder species of lower altitudes include: *Terminalia alata* Heyne ex Roth (Combretaceae), *Ficus semicordata* Buch.-Ham. ex Sm. (Moraceae), *Quercus lanata* Sm. (Fagaceae), *Quercus glauca* Thunb. (Fagaceae), *Quercus semecarpifolia* Sm. (Fagaceae), *Litsea monopetala* (Roxb.) Pers. (Lauraceae), *Ficus neriifolia* Sm. (Moraceae), etc. Similarly, the common fodder species of high elevation areas are *Rosa sericea* Lindl. (Rosaceae), *Caragana* species (Rosaceae), *Hippophae tibetana* Schlecht. (Elaeagnaceae), etc. | | |
| **Plant species used to make agricultural tools** | | |
| *Acer cappadocicum* Gled. (Aceraceae) | Tilailo, Wood | In Bajhang, Humla, and Darchula districts, the stem of this species is used to make the handles of agricultural tools, walking sticks, etc., because the wood of this species is hard and possesses tensile strength. |
| Angau (Local name) | Wood | Wood of 'Angau' is also used for making plough and handles of agricultural tools in Bajhang district; it is used because of its durability, tensile strength and resistance to stem borer and wood rot fungi. |
| *Betula utilis* D. Don (Betulaceae) | Bhuj, Wood | In Humla and Darchula, plough and handles of agricultural tools are also prepared from the wood of *Betula utilis*; it is chosen for its toughness and durability. |
| *Cotoneaster affinis* Lindl. (Rosaceae) | Ruish, Wood | In Humla and Bajhang districts, handles of agricultural tools are prepared from the branches of 'ruish', because the wood of such species is hard and possesses tensile strength. |
| *Cotoneaster frigidus* Wall. ex Lindl. (Rosaceae) | Rains, Wood | |
| *Desmodium oojeinense* (Roxb.) H. Ohashi (Fabaceae) | Sanan, Timber | In Baitadi, plough and pot for storing dairy products are made of 'Sanan' because the wood is hard, durable and cannot easily be infected by stem borers and fungi. |
| *Hippophae salicifolia* D. Don (Elaeagnaceae) | Tare chuk, Wood | In Bajhang, plough is also prepared from the wood of 'Tare Chuk' because it is durable. |
| *Juglans regia* L. (Juglandaceae) | Okhar, Wood | In Bajhang, Darchula and Humla districts, timber of *Juglans regia* (okhar) is used to make 'juwa' because the wood is light and durable. |
| *Juniperus indica* Bertol. (Cupressaceae) | Sukpa, Wood | In Humla, wood of 'Sukpa' is used to make two types of vessels: (i) a big vessel or churn (locally known as '*twadam*' ) for keeping curd, in which curd is stirred vigorously to produce butter; and (b) a small vessel locally known as '*pari*' for milking. |
| *Morus serrata* Roxb. (Moraceae) | Kimu, Wood | In Baitadi, 'Juwa' used during ploughing is generally prepared from *Morus serrata* (Kimbu) because the wood is light and has tensile strength. |

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| *Pyracantha crenulata* (D. Don) M. Roem. (Rosaceae) | Ghangaru, Wood | In Baitadi, Bajhang, and Darchula districts, walking sticks and the handles of agricultural tools are prepared from 'Ghangaru' as the wood of this plant is hard, heavy, and resistant to borers and wood rot fungi. |
| *Quercus glauca* Thunb. (Fagaceae) | Phalat, Wood | In Baitadi and Bajhang districts, agricultural tools are made from the wood of this species. The wood is hard, durable, and resistant to termites. |
| *Quercus lanata* Sm. (Fagaceae) | Banjh, Wood | In Baitadi, handles of agricultural tools, and digger of the plough, 'halano', are prepared from the wood of 'Banjh' because it is hard and heavy, has great tensile strength and is not easily affected by water and borers.<br>In Bajhang, plough is prepared from the wood of 'Phalat' and 'Kharsoo' because it is hard, heavy, and durable. |
| *Quercus semecarpifolia* Sm. (Fagaceae) | Kharsoo, Wood | |
| *Taxus wallichiana* Zucc. (Taxaceae) | Lauth, Wood | In Humla, Darchula, and Bajhang districts, beating rod (pestle of the traditional mortar) for cereals, 'okhal', is generally prepared from T*axus wallichiana* (Lauth sallo) because its timber is light, tough, and durable. |
| *Ulmus wallichiana* Planch. (Ulmaceae) | Tyaksing, Wood and bark | In Humla, bark is used to make the cord ('*halludo*' or '*jhutak*') that is attached to the yoke of a plough pole. Wood is highly durable and used to make the handles of agricultural tools. |
| *Zanthoxylum armatum* DC. (Rutaceae) | Timur, Wood | In Baitadi, the stirrer used during whey preparation (*madani*) is generally made from the wood of *Zanthoxylum armatum*, because of its durability and peculiar scent that prevents dairy products (whey and butter) from retaining the unpleasant smell. The unpleasant smell in dairy products is caused by infection of microorganisms. If a 'madani' of *Zanthoxylum* sp. is used during whey preparation, the fungus cannot immediately infect the product, because the species possesses antimicrobial properties. |
| **Culturally important species** | | |
| *Abies pindrow* Royle (Pinaceae) | Gobrya, Wood | In Humla and Darchula districts, tree trunks are used as flag poles (Doburchhe). |
| *Abies spectabilis* (D. Don) Mirb. (Pinaceae) | Gobrya, Wood | |
| *Acer caesium* Wall. ex Brandis (Aceraceae) | Dalaba or Tilailo, Wood | In Humla, knotty burs of trunk are used for making drinking cups (Phuru). |
| *Acer cappadocicum* Gled. (Aceraceae) | Cahjat or Tilailo, Wood | |
| *Artemisia dubia* Wall. ex Besser (Asteraceae) | Kurjo or pati, Leaves | In Baitadi, and Bajhang, leaves of this species are used to make incense for religious purposes. |
| *Aegle marmelos* (L.) Correa (Rutaceae) | Bel, Leaves | In Baitadi district, leaves of 'Bel' are used during religious ceremonies, particularly for worshipping lord Shiva. |
| *Brassica rapa* L. (Brassicaceae) | Tori, Seeds | In Baitadi and Bajhang, seeds of 'Tori' and 'Mas' are used during religious ceremonies, as they are believed to get rid of ghosts. |
| *Vigna mungo* (L.) Hepper (Fabaceae) | Mas, Seeds | |
| *Cedrus deodara* (Roxb. ex D. Don) G. Don (Pinaceae) | Dyar, Whole plant | In Humla, Darchula, and Baitadi districts, the plant is considered sacred and planted on temple premises. |
| *Ficus benghalensis* L. (Moraceae) | Peepal, Leaf/ whole plant | In Baitadi and Bajhang, leaves of 'Peepal' are regarded as sacred and used during religious ceremonies. |
| *Hordeum vulgare* L. (Poaceae) | Jau, seeds | In Bajhang, Baitadi, and Darchula, seeds of 'Jau' are used as a sacred offering to god. |
| *Inula cappa* (Buch.-Ham. ex D. Don) DC. (Asteraceae) | Naksupa, whole plant | Plant is used by shamans to treat spiritual/mental illnesses. |
| *Juglans regia* L. (Juglandaceae) | Okhar, Wood and bark | In Bajhang district, wood and bark of the plant are used during death rites. |
| *Picea smithiana* (Wall.) Boiss. (Pinaceae) | Jam, Wood | In Humla, trunk of the tree is used to make flag poles. |

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| *Pinus wallichiana* A. B. Jacks. (Pinaceae) | Thesing or sallo, Wood | In Humla, trunk of the tree is used to make flag poles. |
| *Prunus cerasoides* D. Don (Rosaceae) | Paiyun, Wood | In Bajhang and Baitadi districts, wood of the plant is used during death rites, as it is believed to get rid of ghosts. |
| *Nardostachys grandiflora* DC. (Valerianaceae) | Bhulte or Bhutkesh, Rhizome | In Humla, Bajhang and Darchula, rhizome of 'Bhulte' is mixed with the leaves of Juniper, 'Balu' and *Cassiope fastigiata* for making incense that is believed to get rid of ghosts. |
| *Cassiope fastigiata* (Wall.) D. Don (Ericaceae) | Pasuk, whole plant | |
| *Rhododendron anthopogon* D. Don (Ericaceae) | Balu, Leaf | |
| *Juniperus indica* Bertol. (Cupressaceae) | Sukpa or Dhupi, leaves | |
| *Tsuga dumosa* (D. Don) Eichler (Pinaceae) | Aggar, Wood | In Humla, the plant is regarded as highly sacred; a small piece of wood is needed during different occasions, such as marriage, funeral rites, obsequies rites, fire offering etc.; the wood is especially valued for making 'doli', a kind of palanquin consisting of a covered seat for the bride. People believe that burning the dead on a pyre made of this wood is auspicious. Wood paste is applied on the forehead as 'chandan'. |
| *Zanthoxylum armatum* DC. (Rutaceae) | Timur, Wood | In Baitadi, wood of 'Timur' is kept in houses to get rid of ghosts. |
| **Bamboo (Nigalo)** | | |
| *Drepanostachyum falcatum* (Nees) Keng f. (Poaceae) | Nigalo, Culm | Preparation of different artifacts (locally called 'doko-dalo') is a very common practice throughout Bajhang district, particularly in Kanda VDC. Rattan has long been a major trade item in the district. Rattan items (baskets, mats, cages, smoking pipes, etc.) are made from the bark of the culms of *Drepanostachyum falcatum* (Nigalo). For this purpose, the culms of desired length are collected, all the branchlets and leaves are removed, and the unbroken outer bark, locally called 'Choya', are peeled out. The remaining inner (hypodermal) portion is called 'Gudo'. Both 'Choya' and 'Gudo' are used for making basketry articles; however, those prepared from 'Choya' have more tensile strength and more durable than those prepared from 'Gudo'. After the epidermal and hypodermal portion is peeled off, these peels are piled up and submerged in water for 6 to 7 days, after which they become more flexible and can be bent in any direction during weaving. These peels are then used for weaving different artifacts. |
| **Other traditional practices** | | |
| *Aesandra butyracea* (Roxb.) Baehni (Sapotaceae) | Chiuro, Nectar | *Aesandra butyracea*, locally called 'Chiuro' is a multipurpose plant. Ripe fruits are consumed for its sweet juice, and the remaining seeds, after the consumption of juice, are used for fat extraction. Flowering season of the plant is October-November. Honey produced from such regions during this period is considered to be of high quality and popularly known as 'Kartike Maha'. Nectar from the flowers of this plant is used by honey bees to produce high-quality honey. The honey is believed to have medicinal properties and used to treat cuts, burns, boils, stomachache, paralysis, pain in muscles and joints, etc. The nectar is also collected by farmers to make high grade 'gud', which is very expensive even in local markets.<br>Jaggery 'sweet (gud)' preparation: During the flowering season, nectar is collected from the plant, which is a tedious job. For this purpose, a bowl tied on top of a long stick is placed under the clusters of flowers and the nectar fallen from the clusters gets collected in the bowl. At one time, nectar is collected from 5 to 10 clusters. Then the nectar is transferred to a larger pot tied to the waist of a person or a nearby branch. The process is repeated for other bunches of flowers and the activity is continued for several days till the flowers give small fruits. In this way, about 6 kg of nectar is collected from 5 to 6 mature trees and 3 kg of jaggery 'gud' can be prepared from it. During gud preparation, the nectar is boiled three times so that its volume is reduced to half and it turns viscous. The fluid is allowed to cool and solidify. This gud costs NPR 500 to 700 per kg in the local market, and is used to treat the above-mentioned diseases. |
| *Achyranthes aspera* L. (Amaranthaceae) | Kurro, Root | In Bajhang district, fresh roots of 'Kurro' are beaten and the paste is used as a substitute of soap. |

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| *Sapindus mukorossi* Gaertn. (Sapindaceae) | Ritha, Fruit | In Baitadi district, 'ritha' is a common tree. '*Ritha*' cultivation is a common practice in the region. Local people have been using the fruit of this species as a substitute of soap. For this purpose, they beat the pulp of the mature fruit to make it powdery. Then the powder is soaked in water for hours and then the mixture is used to wash clothes and hair. However, 'Ritha' is not frequently used these days for washing purposes. It is a commonly traded item. |
| *Silene* sp. (Caryophyllaceae) | Naro, root | In Humla and Darchula districts, the roots of 'naro' are powdered and used as a substitute of soap. |
| **Hay (forage) collection and storage** | | |
| People of Bajhang and Baitadi store forage for winter season when there is a scarcity of forage and fodder. For this purpose, each household has a separate piece of land, locally known as 'Gajal' or 'Melo'. These are generally dry patches of land on steep slopes where it's not possible to grow crops. The land is used for growing grasses, which are locally known as 'Gajjo' or 'Khar'. Those who do not have a separate 'Gajal' go to the government forest for 'Gajjo' collection. 'Gajjo' is collected in October-November; people cut the grass and leave it for 4 to 5 days to let it dry. Then they piled up the grass and store it on the trees of 'Gajal' or bring it home and store it on the poles of pine or some other trees. The stored 'Gajjo' is called 'luto'. This method of storage has two advantages: First, biomass of the grasses in the 'Gajal' is maximum during October-November. Therefore, if the grass is harvested during this season, it will address the need for forage during winter. Secondly, 'Gajjo' mainly includes the species of Poa, Brachiaria, Stipa, Arogrostis, Paspalum, Cyperus, etc. Species of Poa, Stipa, Cyperus, etc. contain some metabolites (alkaloides), and therefore, if they are given to cattle as fresh feed, may harm the cattle. But dried and stored grasses probably do not contain such alkaloides.<br><br>In Darchula, grasses are available in the grasslands as well as agricultural fields that have been abandoned for a decade. Abandoned fields are not cultivated now due to labour shortage. People are allowed to collect forage from common grassland and private-owned grasslands. For forage collection, the villagers fix a day after a few days after the full moon. Grasses are cut, piled in the long bunches, and then stored on the nearby trees for further drying up and then used to feed the cattle during winter season. Main forage species collected from the grasslands are *Pedicularis* sp., *Potentilla* sp., *Nepeta* sp., *Impatiens* sp., *Poa* sp., *Stipa* sp., *Kobresia* sp., *Swertia* sp. etc. | |
| **Sour preparation** | | |
| *Citrus aurantifolia* (Christ.) *Swingle* (Rutaceae) | Jyamir, Fruit | Sour is prepared from the fruits of several species and stored. However, main species used are the species of Citrus (C. medica, C. auriculata, etc.), and Punica granatum, and Rhus javanica. Ripe fruits of the species are macerated and raw juice is extracted. Then the juice is thoroughly boiled in a metallic (iron) pot until it is reduced by 10 to 15 times; sour prepared in an iron pot is considered to be good for health. Then the sour becomes black and viscous. A few pods of fried red chili and sometimes salt crystals are also mixed with it before it is stored for the long term. |
| *Citrus limon* (L.) Burm. f. (Rutaceae) | Kagti, Fruit | |
| *Citrus medica* L. (Rutaceae) | Chuk or Amilo, Fruit | |
| *Punica granatum* L. (Punicaceae) | Dadim, Seeds | |
| *Rhus javanica* Miller (Anacardiaceae) | Bhakamilo, Fruits | |
| Traditional method of food storage during winter | | People of Byas migrate to lower altitudes, mostly to Khalanga, the district headquarters of Darchula, during winter season. They have to store food grains and vegetables at home during this period. For this purpose they dig a big pit of about 6ft depth and cover the pit wall with papery bark of *Betula utilis* (Birch), which is supported by the frame of *Salix* species branches, locally known as Kundli. They put grains and vegetables in the pit and cover it with layers of birch bark, slate-like stones and soil. Local people claim that the taste of vegetables stored in this manner does not deteriorate even after about half a year. |

## Annex 2: **Traditional knowledge on animal resources used by local communities in KSL Nepal**

| Scientific name (family) | Local vernacular name(s), and part(s) used | Remarks |
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| *Moschus chrysogaster* L. (Moschidae) | Kasturi, Fur | Local peoples of Darchula use the fur of musk deer to make cushions and bedding. According to them, to make a bed of 6-feet length, 3-feet breadth, and 2-inch thickness, they require fur of about seven deer. Cushions made thus are tougher and less comfortable to sleep on compared to cotton and wool cushions, but possess high medicinal value and known to cure pain in the muscles, joints and head. Such cushions are very expensive, worth about 5,000–7,000 (Indian Currency) in the international market. People also consume the meat of musk deer. |
| *Marmota bobak* Muller (Sciuridae) | Phyau Musa, Fat | Local healers use the paste of rhizome of *Fritillaria cirrhosa* (ban lasun) mixed with either rapeseed oil (sarsoo oil) or fat of Himalayan marmot (phyau musa, *Marmota bobak*). The paste is applied externally over the affected surface twice a day for the period of one month. |
| *Panthera* species (Felidae) | Baagh, Bone marrow | Vaidhya Ratan Singh of Darchula prepares dosages of aphrodisiac medicine by mixing tiger bone barrow with equal proportions of *Ophiocordyceps sinensis* and saffron. According to him, regularly using this medicine for at least 15 doses gives the best effect. |
| *Ursus thibetanus* G. Cuvier (Ursidae) | Bhalu, Gall | According to vaidhya Krishna Bohara of Bajhang, about 5 grams of dried gall is mixed with the powder of *Piper longum* (pipla), *Zanthoxylum armatum* (timur), *Coriandrum sativum* (dhaniya), *Gingiber officinale* (aduwa), nutmeg (jaiphal & jaipatri) (20 grams). About 5 grams of such mixture is given to the patient of asthma, malaria, or epilepsy at the time of severe attack by the disease. Application of 5 to 6 doses of such mixture will help cure the disease. |
| *Falco tinnunculus* L. (Falconidae) | 'Bagchadi' or 'Baundai', Meat | According to Vaidhya Krishna Bohara of Bajhang, meat of the common falcon, locally called 'Bagchadi' or 'Baundai', possesses medicinal properties that cure epilepsy. For this purpose, vaidhyas generally prescribe the dried meat of the falcon because they believed it possesses better medicinal properties than the fresh one. |
| *Hystrix indica* L. (Hystricidae) | Swado or Dumsi, Alimentary canal | According to Vaidhya Krishna Bohara of Bajhang, the whole alimentary canal of the porcupine, along with its inside content, is dried and about 15 grams of such material is given to the patient of asthma (twice a day). |
| *Naemorhedus goral* Hardwicke (Bovidae) | Jharal, Alimentary canal | According to Vaidhya Krishna Bohara of Bajhang, 'Jharal' possesses medicinal properties for curing malarial fever. For this purpose, gall or alimentary canal of the deer is dried and about 5 grams of it is given to the patient once or twice a day.<br>Dried gall of 'Danphe' and gall of fish from the warmer regions (aulo machha) are also used to cure the same disease in a similar way. |
| *Lophophorus impejanus* Latham (Phasianidae) | Danphe, Dried gall | |
| *Urocissa erythrorhyncha* Boddaert (Corvidae) | Lampuchhre Chado, Feather | Local healers of Bajhang use the bird to cure chronic headache. For this purpose, the feather of the bird is rubbed on stone and the paste obtained thus is rubbed on the head; about 5 gram of it is placed on the tongue. |
| Male chado (Local name) | Dried meat | According to the local healers of Bajhang district, dried meat of this bird is given to asthma patients. |
| **Wool extraction and processing** | | In Darchula, Humla, and Bajhang districts, sheep are sheared for wool twice a year – once during April-May when the sheep are ready to move upwards to Tibet and once during September-October when the sheep returning from Tibet reach their villages. Temperature, rainfall, and wind are thus the main determining factors for wool harvesting. One sheep gives about 1.5 kg of wool in a year and 1 kg of local wool is worth NPR 60–70 in the local market.<br>In Bajhang district, wool is harvested form 'Khalwa' as well as 'Bheda/ Patha' (breeders). The wool obtained from local varieties is used to make blankets, pumilo, etc. In Darchula district, there are two local varieties of sheep that produce different qualities of wool – 'Khasro', and 'Uniya'. However, they are called 'palti patha' if they are only used as breeds and not to carry goods, and 'dhakariya patha' if they are used to carry goods. Wool from the 'Uniya' variety is softer, durable and heavier, and is therefore considered to be of better quality than wool obtained from the 'Khasro' variety. However, wool obtained from both these varieties of sheep are of lower quality compared to wool obtained from the Tibetan variety sheep 'Raboo' and 'Bhanker'. Therefore, wool obtained from local varieties is used to make blankets, pumilo, etc. for local use only, whereas high quality pashmina is only prepared from the wool of the Tibetan sheep.<br>After wool harvesting, the wool is first beaten thoroughly with a wooden bat and washed with '*Sapindus*', '*Achyranthes*' or '*Silene*' root. The wool is then dyed using a dye obtained from '*Maharanga*', '*Rheum*' or '*Angau*' (local names) species or commercial dye available in the Indian market. |

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| **Herdsmen's knowledge about the grazing behaviour of different animals** | | In Darchula, and Bajhang, local herdsmen practise livestock husbandry, which comprise sheep, chyangra, horses and mules. They have identified the grazing preferences of these animals. They generally do not bring horses/mules and sheep to the grassland at the same time. They first move the sheep to the new grassland, and the horses and mules follow after a few days. Although the diets of these animals do not overlap significantly, sheep prefer not to graze on grasses already grazed on and trampled by other livestock. Besides, they do not like to graze on very short grasses. However, horses and mules graze on lands already grazed on by sheep and can also graze on very tiny grasses. The practice of grazing different animals at different times on the new grassland shows the local people's knowledge about the livestock's grazing preferences and behaviour, and rangeland management. |
| **Musk collection** | | Professional hunters search for the habitat of the musk deer during daytime. Then they surround the habitat at night when the deer return to their habitat. The hunters do not aim to kill the deer but try just to injure and capture it and take out the musk before its death. Musk taken out before the death of the deer is of the best quality and fetches the highest price in international markets. Such musk is yellowish in colour. The musk taken from the deer after its death is of second grade quality and slightly brownish or blackish in colour. After taking the musk from the pouch, hunters fill the pouch with the blood of the deer and allow it to dry. The blood also possesses the same smell as the musk and the traders sell it as duplicate musk. |
| **Falcon collection** | | According to the local people of Chhyangru village and the range post staff, falcon collection was common in the past but now the population has decreased drastically. To capture falcons, the collectors keep chickens or other birds at different spots in the mountains. When the falcon pounces on the bird, it gets trapped in a net called 'pasho'. The collected falcons were traded illegally to Tibet. According to the informants, traders from Tibet and elsewhere used the falcons to prey on other economically important birds such as 'Rajhans', which is believed to keep pearls in its stomach. |
| **Method of storing woollen clothes** | | Woollen items like blankets, pashminas, etc. are stored after their use during special occasions. They also have to be stored before they are put on sale or after the sale is over. Local people have their own traditional storage method that allows them to safely store valuable woollen items for years. They take their woollen clothes to be stored in their villages at higher elevations (cooler places), i.e., Chhyangru and Tinkar. They dig a pit several feet deep and as long and wide as the items to be stored. The pit is layered with wooden frames, and the frames are covered with the papery bark of birch. The woollen items are stuffed in the pit and the pit is covered with the bark of birch, then with a wooden frame, and finally with soil. |
| **Yak raising in Byas village** | | According to Mr. Dan Singh Tinkari (former president of Ward 7 of Byas VDC) of Chhyangru village, there were two yaks in the village, which were only used as breed. However, one yak died recently, leaving behind only a single yak near the Tinkar village. They only used to keep their yaks in the 'Goth' near Tinkar village because the climate and topography below Tinkar are not favourable for yaks. It is interesting to have very little number of yaks in the Byas VDC. According to local people, the reasons why there are such few yaks are: yaks are only used as breeds with no any alternative uses; higher temperature and precipitation but lower wind current in the village in comparison to Tibet; lack of caretakers for the yaks in the villages, because most of the villagers move to lower altitudes (at or near Darchula district headquarters) during winter months, leaving their yaks in Tinkar; Byashis don't use the leather, meat or bones of yaks and Jhopas. |



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