ICIMOD Working Paper 2017/12

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Traditional Agricultural and Medicinal Practices in the Kailash Sacred Landscape, Nepal

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ICIMOD gratefully acknowledges the support of its core donors: the Governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom.

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Traditional Agricultural and Medicinal Practices in the Kailash Sacred Landscape, Nepal

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International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal

April 2017

Published by
International Centre for Integrated Mountain Development
GPO Box 3226, Kathmandu, Nepal

ISBN 978 92 9115 491 3 (printed) 978 92 9115 492 0 (electronic)

Production Team
Shradha Ghale (Consultant editor)
Christopher Butler (Editor)
Dharma R Maharjan (Layout and design)
Asha Kaji Thaku (Editorial assistant)

Photos: pp 13,14; Dipesh Pyakurel; all other photos - Kishor Atreya

Printed and bound in Nepal by
Hill Side Press (P) Ltd., Kathmandu, Nepal

Note
This publication is available in electronic form at www.icimod.org/himaldoc

Citation: Atreya, K., Pyakurel, D., Thagunna, K. S., Bhatta, L. D., Uprety, Y., Kotru, R., Oli, B. N., Rimal, S., and Chaudhary, R. P. (2017). *Traditional agricultural and medicinal practices in the Kailash Sacred Langscape, Nepal.* ICIMOD Working Paper 2017/12. Kathmandu: ICIMOD

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Acknowledgements

This study has been undertaken jointly by the Ministry of Forests and Soil Conservation (MoFSC) Nepal, Research Center for Applied Science and Technology (RECAST) under Tribhuvan University, Nepal and the International Center for Integrated Mountain Development (ICIMOD) under the Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI). KSLCDI is a joint effort to promote transboundary cooperation on landscape conservation among China, India and Nepal through the respective governments and partners which is supported by the Ministry for Economic Cooperation and Development (BMZ), Germany, the DFID/UKAid, and core funds of ICIMOD contributed by the governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom. The views and interpretations expressed in this publication, however, are those of the authors and are not to be ascribed to MoFSC, ICIMOD, RECAST or their donors.

The study has benefitted immensely from the guidance, suggestions and support provided by a number of institutions and individuals at its various stages. Our sincere appreciation goes to Social Awareness and Development Association (SADA), a not for profit making organization based in Baitadi district who contributed to all field level work, including primary data collection, focus group discussion, and stakeholders consultative workshop. We acknowledge the support from Wu Ning, Bijaya Raj Paudel, and Maheshwar Dhakal for their support in designing this research work. We also acknowledge the support from Ishwari Paudel, Rom Raj Lamichhane, and Kedar Baral when conducting focus group discussions and field work related activities. Our sincere appreciation goes to all staff member at the District Forest Office Baitadi, officials at the village development committees (VDCs) for their cooperation during the field work and also in community consultative workshop. We wish to set on record our appreciation of the hard work of Narayan Prasad Pant, Parmanand Ojha, Dhauli Kumari Bhatta, and Dammari Bhatta who had to spend a considerable amount of time on difficult terrain when conducting household survey. Finally yet importantly, we are grateful to the participants in the research, sample households in the KSL, without whose cooperation in providing valuable information, this study would not have been possible.

Acronyms and Abbreviations

ABWS	Ash and Bojo for Wheat Seed Storage
BLR	Binary Logistic Regression
CBD	Convention on Biological Diversity
CFUGs	Community Forest User Groups
CST	Choto Seed Production
ICIMOD	International Centre for Integrated Mountain Development
FGD	Focus Group Discussion
GKA	Gwallek Kedar Area
GoN	Government of Nepal
KII	Key Informants Interview
KSL	Kailash Scared Landscape
KSLCDI	Kailash Sacred Landscape Conservation and Development Initiative
LFUGs	Leasehold Forest User Groups
MoFSC	Ministry of Forests and Soil Conservation
RECAST	Research Centre for Applied Science and Technology
SHS	Satuwa to Treat Headache and Stomachache
SMP	Silfode for Milk Production
SPSS	Statistical Package for Social Sciences
TCC	Terrace cutting and compost
TFC	Tite for Fever and Cold and Cough
TK	Traditional knowledge
UNFCO	United Nations Field Coordination Office
UNHR	The Universal Declaration of Human Rights
VDCs	Village Development Committees

Executive Summary

Traditional knowledge (TK) is very important for sustainable development. However, it faces the risk of loss in many parts of the world, including Nepal. There are only a few studies on the determinants of the use and erosion of TK and practices in the Kailash Sacred Landscape. The present study documents traditional practices and the factors determining its erosion in the Gwallek-Kedar Area of Baitadi district, Far Western Nepal. The Gwallek-Kedar Area, which spreads across eight Village Development Committees, is rich in biodiversity and cultural diversity. People who live in the vicinity of Gwallek-Kedar use the resources for medication, livelihood support, and livestock feed. The study documents traditional practices in the area, especially on agriculture and forest-based herbal remedy, and empirically determines the factors behind the erosion of such traditional practices.

Data were collected through different levels of consultation and interaction meetings at the local, district and national level, rapid field assessment, key informant interviews, focus group discussions, confirmation workshop, and household survey.

The study documented 56 types of TK and practices from the study area, which were then classified into three categories, namely agriculture and livestock (20 types), traditional medicine (32 types), and genetic resource conservation (4 types). Out of the total, six types of traditional practices were selected – two from each of the three categories – for detailed evaluation in the household survey. The selected types of traditional practices were terrace cutting and composting; use of Silfode (*Bergenia ciliata*) for milk production; use of Tite (*Swertia chirayita*) to treat fever and cold and cough; use of Satuwa (*Paris polyphylla*) for headache and stomachache; Choto (*Raphanus sativus*) seed production in a traditional way; and the use of ash and Bojo/Timur (*Acorus calamus/Zanthoxylum armatum*) for wheat seed storage.

Among the six types of traditional practices, the one most commonly used was Choto seed production based on the traditional method (72% of the sampled households), followed by the use of Tite for cold and cough (70%), and the use of ash and Bojo for wheat seed storage (58%). The study found gender preferences for intergenerational transfer of traditional knowledge. Individuals prefer 'father to son' or 'mother to daughter' intergenerational transfer of knowledge. The binary logistic regressions showed that the following factors significantly influence the use of traditional practices: age of the respondent, distance to the nearest forest, distance to the nearest motorable road, family members' ill health, and seasonal migration of the family members for jobs. Practices based on traditional knowledge have been decreasing due to increased use of allopathic medicine, decreasing forest cover and habitat fragmentation, overexploitation of resources and habitat destruction, and introduction of 'modern' agricultural practices.

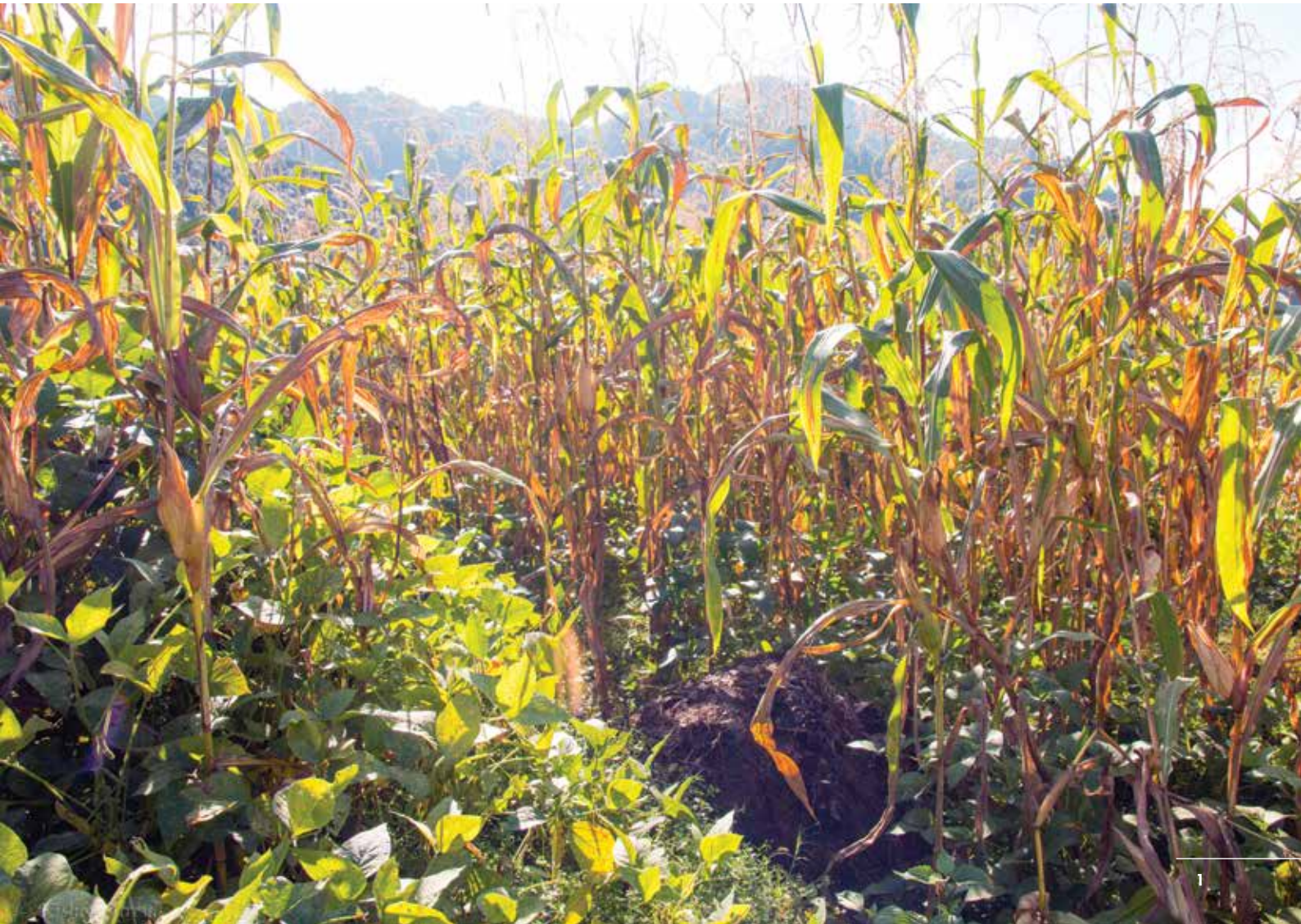
Key words

Traditional knowledge and practices, alternative medicine, Gwallek-Kedar Area, Kailash Sacred Landscape, Nepal

Introduction

Traditional knowledge (TK) is the sum of information that people in a given community, based on their experiences and adaptation to a local culture and environment, have developed over time, and continue to develop (Hansen and Van Fleet, 2003). The term 'traditional', in this context, does not mean 'old' and 'untechnical'; rather it reflects that knowledge is created, preserved and disseminated based on local traditions. The TK includes mental inventories of local biological resources, animal breeds, crops, and local plant species. It also includes practices and innovative technologies, such as seed treatment and storage methods, and tools/methods used for planting and harvesting crops (Hansen and Van Fleet, 2007). Traditional medicine is an important component of TK. Local communities use this knowledge and maintain such resource base for their continued survival. Documentation, preservation, safeguarding and promotion of traditional knowledge, innovations and practices are important not only for local communities but also for scientific communities. It plays a vital role in people's health care, food security, culture, religion, identity, environment, sustainable development, and trade, and is important for planners and policymakers. However, "TK is still underused by science although it is of great value and can contribute significantly to the development of humankind" (Alexander et al., 2011). Huntington (2000) argued that wider application of TK in scientific research remains elusive because of the difficulty in accessing TK, and the need to use social science methods to gather biological data.

Despite its importance, TK and practices are at risk in many parts of the world, including Nepal. First, there is limited documentation of such traditional practices in Nepal, particularly on genetic resources use and conservation. TK is therefore 'hidden', and there is a high possibility that the knowledge is being used and patented by third parties, with minimal sharing of benefits, if at all. This violates globally recognized principles of human rights and benefit sharing. There are a few governance instruments on benefit sharing with respect to biological resources.



The Universal Declaration of Human Rights (UNHR), 1948, regards intellectual property as a fundamental human right of all people. The Convention on Biological Diversity (CBD), 1992, highlights the important role of TK and local communities in the preservation of biological diversity. Similarly, the Nagoya Protocol on 'Access to Genetic Resources and the Fair and Equitable Sharing of Benefits from their Utilization to the Convention on Biological Diversity' highlights the principle of fair and equitable benefit sharing arising from the utilization of genetic resources as well as subsequent applications and commercialization. Article 5.1 of the Nagoya Protocol states that "*benefits arising from the utilization of genetic resources as well as subsequent applications and commercialization shall be shared in a fair and equitable way with the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention. Such sharing shall be upon mutually agreed terms.*" The protocol also includes a list of potential monetary and non-monetary benefits in its Annex. The Constitution of Nepal 2015 defines intellectual property rights as fundamental rights of the owners of the knowledge holders. Thus, by promoting the use of genetic resources and associated traditional knowledge, and by strengthening the opportunities for fair and equitable sharing of benefits from their use, the Protocol created incentives to conserve biological diversity, sustainably use its components, and further enhanced the contribution of biological diversity to sustainable development and human well-being (CBD, 2011). For this reason, documentation of traditional practices is very important.

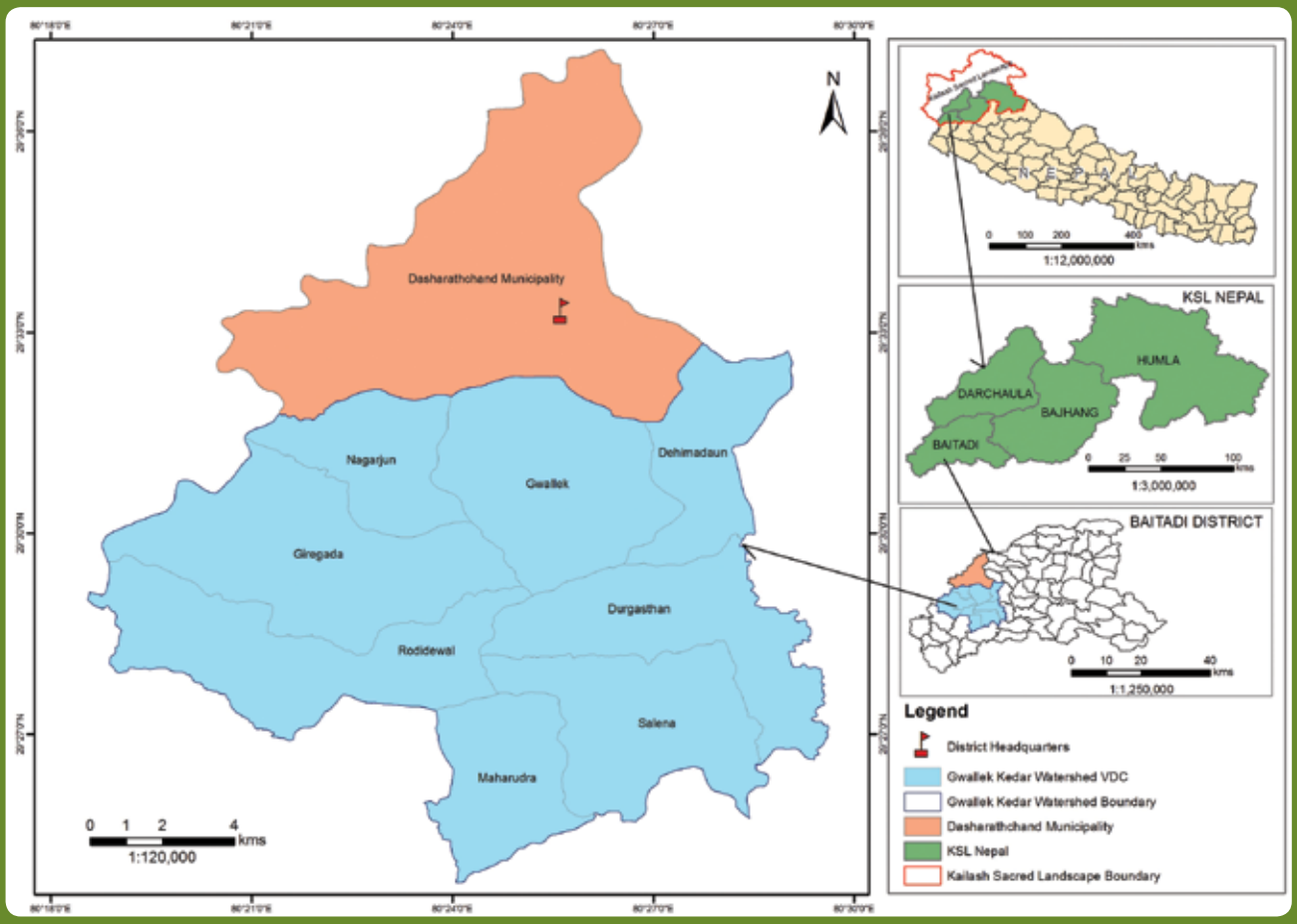
Local communities have developed diversified knowledge, skills and practices on the use of local resources. Such TK has been acquired, preserved and transferred through generations. TK has evolved over time as the communities lived with nature and adapted to changes. It has been modified by local needs, cultures and environment. Recently, this type of knowledge has been acknowledged by the scientific community. Such knowledge is being lost due to ecological degradation associated with the introduction of more 'modern' agricultural practices, displacement of communities by development projects, overexploitation of resources, and the process of liberalization and globalization that has unleashed new market forces, increasing the threat of biopiracy. There are limited studies on the documentation of TK and practices related to the conservation and use of genetic resources including agriculture. The objective of this study was to identify and enlist the types of TK and practices on biodiversity use and conservation and agricultural practices in the Gwallek-Kedar Area of Baitadi district of Kailash Sacred Landscape (KSL), Nepal. The paper also assesses the factors associated with the erosion of traditional practices in the study area.

The Study Area

The Kailash Sacred Landscape lies in the Hindu Kush Himalayan region. It spreads across the remote portions of the Tibet Autonomous Region of China and adjoining areas of Nepal and India, and hosts the world's important ecosystems and contains a variety of environments. The sacred Mount Kailash area is endowed with unique biological diversity, ecosystem goods and services, and a value-based cultural heritage. The area is important for its genetic diversity including its customary systems of natural resource governance and management, which include unique knowledge, skills, and institutions. The knowledge and skills related to genetic resources are inherited by the local people and their sociocultural institutions.

Four districts of mid- and far-western Nepal, namely Humla, Darchula, Baitadi and Bajhang, lie in the KSL area. Baitadi district covers an area of 1,519 km^2 in the Mahakali Zone in the far-western development region of Nepal (Figure 1). The district elevation ranges from 390 to 2,950 metres above sea level. The main occupation of people in Baitadi is agriculture, which is the prime source of household income (UNFCO, 2013). Seasonal labour migration to neighboring India is highly prevalent in Baitadi. Inadequate opportunities for livelihood diversification in the mountains and hills, especially during the agricultural off-season (October to March), and inadequate income outside the agriculture sector push a large number of people to migrate to India. Majority of the households are food deficient. Over 50% of children under age five in Baitadi are stunted due to acute malnutrition (UNFCO, 2013).

Figure 1: **Location of the Gwallek-Kedar Area in Baitadi District**



Around 53% of Baitadi is covered by forests, and the District Forest Office is gradually handing over forested areas to communities by forming community forest user groups (CFUGs) and leasehold forest user groups (LFUGs). Most of the religious places like Gwallek-Kedar Area, Sigas-Kedar Area, and Raula-Kedar Area are surrounded by forests.

The Gwallek-Kedar Area (GKA) of Baitadi district harbors rich diversity of flora and fauna. These biological resources play a major role in the economic, social and cultural life of local communities. The local people in the area have been using plants and animals to meet their daily needs. Most of them use biological resources to prepare conventional medicines, food supplements, and support for farm nutrients and livestock feed.

The Gwallek-Kedar Area is situated in the southeastern part of Khalanga, the district headquarters of Baitadi, and spreads across eight village development committees (VDCs). The eight VDCs cover an area of about 153.4 km^2, of which forest land makes up about 37%, agriculture land about 33%, shrub land about 20%, grassland about 9.6%, and the remaining (0.4%) is covered by other lands. The Gwallek-Kedar Area covers a few wards from each of these eight VDCs.

The rich biodiversity of the area provides a range of ecosystem services while also being culturally important. Gwallek-Kedar is one of the four important shrines in the Kailash Sacred Landscape. At the centre of this landscape is the sacred Gwallek-Kedar Dham worshipped by thousands of Hindu devotees of the district and surrounding areas, including devotees from the Indian side of the border. However, the landscape is environmentally fragile and geologically sensitive.

The GKA faces several challenges for the conservation and protection of its biodiversity, genetic resources, traditional knowledge and ecological systems. Collection of firewood, over harvesting of medicinal plants, inappropriate agricultural practices, and open livestock grazing have caused degradation of natural resources and ecological systems. Land encroachment by people from adjacent areas is also a major challenge. The rapid population growth and unsustainable harvest of natural resources poses an increasing threat to the biological diversity, ecosystem services and cultural heritage of the area.

Methodology

Consultation Workshop

Before the field visit, a half-day consultation workshop was organized at the central level. Sixteen experts from multidisciplinary fields representing different organizations participated in the workshop. The possible research methods were discussed at the workshop and participants critically evaluated each method/activity and selected the most appropriate one. The workshop participants agreed on both qualitative and quantitative tools for data collection, including transect walk, key informant interviews, focus group discussions, and household surveys. Further, sampling methods and sample size for the household interviews were also discussed and agreed on.

Sample Size and Sampling Process

The sampling frame was prepared by enlisting the number of households in the wards that fall in the GKA. It was assumed that these households were directly involved in the collection of forest products and the management and conservation of the area. Of the total 1,714 households in the eight VDCs, 15 % were included in the sampling for interviews. The proportionate sampling resulted in a total of 259 households for interviews (Table 1).

Table 1: **Sample size determination in the study area**

Village Development Committees	Wards within GKA	Total households*	Sample size
Durgasthan	4,5,6,7,8,9	435	67
Gwallek	4,6,7,8	301	45
Giregada	4,6,7,8	247	37
Dehimandu	3,4,5	230	35
Rodidewal	4,5,6	227	34
Salena	6,7	134	19
Maharudra	3	76	12
Nagarjun	9	64	10
	Total	**1,714**	**259**

* Source CBS (2011)

Data Collection Tools

The study adopted rapid field assessment, institutional visits, key informant interviews, focus group discussion, validation workshop and questionnaire survey for data collection. Fieldwork was done during September to November 2015.

Rapid field assessment

As the Gwallek-Kedar Area covers eight VDCs, its boundary delineation was an important component of the research, so the study team began by visiting eight VDCs to get an overall picture of the study area. The team met with the members of the forest user groups and discussed the geographical boundaries, and prepared a list of leader farmers, traditional healers such as Dhami/Jhakri and Vaidya, village elders and social activists. These people were later contacted for focus group discussions and key informant interviews. Also, the rapid field assessment helped the team understand forest ecology, agricultural practices, and the socioeconomic status of the study area.

Institutional visits

The research team visited district line agencies such as District Forest Office, District Agricultural Development Office, District Livestock Services Office, District Development Committee, District Administrative Office, and Dashrathchand Municipality and informed them about the research objectives. A few persons representing these district level offices (if available, office head) were considered as key informants.

Key informant interviews

Discussion with key informants focused on forest types, agricultural and livestock practices, and available traditional knowledge and practices. Further, two elders were invited and asked questions regarding traditional knowledge and practices on agriculture and resource conservation. This initial process of listing the types of traditional practices through key informant interviews allowed the team to get a sense of the potential knowledge available at the study area before starting the actual field-level data collection, which involved focus group discussions and household interviews.

Focus group discussion

A total of 12 focus group discussions (FGDs) were held in the GKA (Table 2). The participants included farmers, traditional healers, and village elders.

Table 2: **Number of focus group discussions held in the study area**

VDC	No. of focus group discussion	Village (Number of total participants/female participants)
Durgasthan	3	Koiraligaun (8/3), Durgasthan Bazaar (12/2), Dhanaun (16/3)
Gwallek	2	Chainpur (6/1), Goichada (27/15)
Giregada	1	Jebalkatya (7/2)
Dehimandu	2	Sundarkhali (5/1), Lawangaun (5/0)
Rodidewal	1	Titabai (13/4)
Salena	1	Kuchigard (6/2)
Maharudra	1	Pelya (13/5)
Nagarjun	1	Dibdya (10/2)

Although the community members use traditional practices in their daily lives, they do not easily recognize its value given the widespread influence of modernization. Respondents might hesitate to reveal their beliefs and practices based on traditional knowledge, fearing they might be considered 'uncivilized' (Ranganathan and Anandkumar, 2006). Therefore, at the start of the FGD, the team carefully explained the purpose of the study to the respondents. The team explained what exactly constitutes traditional knowledge and practices; why the participants were being asked about such knowledge; what benefits they have received; intellectual property rights and other relevant international and national legal instruments (such as Nagoya Protocol). The study team tried to convince them that if a certain type of traditional practice is found to be innovative, valid and commercially valuable, the intellectual property rights over that knowledge of traditional practice will rest with the local community. The team also motivated local communities by briefing them on the access and benefit sharing mechanisms in the Convention on Biological Diversity and Nagoya Protocol; and on the initiatives of Government of Nepal's to fulfill the international obligations on biodiversity conservation and access and benefit sharing of biological resources through the implementation of National Biodiversity Strategy and Action Plan 2014-2020. With this, the participants were more likely to trust the study team and provide valuable information.

The team prepared a checklist of questions to be asked in all FGDs. The checklist was prepared considering four sectors (i) agricultural practices (crop, livestock, and soil fertility); (ii) traditional medicine; (iii) genetic resources, especially crop seed storage and production; and (iv) erosion of traditional practice, if any.

Validation workshop

Due to time constraints, the study team was unable to document the scientific rationale behind the traditional practices during FGDs. Therefore, a TK validation workshop was organized at the district level. A total of 15 individuals including farmers, local leaders, traditional healers and staffs from district government offices were invited. With their help, the team validated the scientific rationality and technical understanding of the farmers regarding the documented traditional practices. While validating the traditional practices, priority was given to crop productivity, availability of seeds/resources, local availability and cultural appropriateness. The team concurrently evaluated the perceived effectiveness of the traditional practices and its scientific base. The TK validation workshop also identified six most promising types of traditional practices (two each from three categories) that were considered for further evaluation in the household survey (Table 3).

Household survey

After the completion of key informant interviews, group discussions and confirmation workshop, a 10-page household survey questionnaire (semi-structured) was developed based on a literature review (Ranganathan and Anandkumar, 2006). The questionnaire was developed for both quantitative (close-ended) and qualitative (open-ended) data collection. The questionnaire was pre-tested and revised accordingly before being finalized. Pre-testing helped us to detect problems with wording issues, misinterpretation of the questions, inability to answer questions, local terminology, and sensitive questions. The questionnaire was translated into Nepali language.

Table 3: **Traditional practices selected for detailed evaluation in the household survey**

Traditional practice	Category	Reason for selection*
Terrace cutting and making compost at upland	Agriculture and livestock	Common practice
Use of Silfode (*Bergenia ciliata*) for buffalo milk production		Rarely practiced
Treating fever and cold and cough with Tite (*Swertia chirayita*)	Traditional medicine	Common practice
Treating headache and stomachache with Satuwa (*Paris polyphylla*)		Rarely practiced
Traditional Choto (*Raphanus sativus*) seed production	Genetic resources	Common practice
Use of ash and Bojo (*Acorus calamus*)/Timur (*Zanthoxylum armatum*) for wheat seed storage		Rarely practiced

* Two variables 'common practice' and 'rarely practiced' were chosen in the validation workshop because the study team assumed that considering two 'extremes' may help to identify household behaviours on the use of traditional practices, and factors affecting their erosion/adoption.

The household survey was conducted by four field-level enumerators who hold bachelor's degrees and have previous survey experience. A two-day training for the enumerators was organized at the field where they learned about survey instruments and questions, dealing with the 'outliers', peer-to-peer practice, filling questionnaires and discussing the possible difficulties. They also received detailed information on the six types of traditional practices and saw relevant photographs, and learned about possible complications that may arise while interviewing

individuals. The study team revised the survey instrument based on their suggestions. Enumerators were then asked to do a household survey in the GKA. Enumerators began the survey in the selected households. The research team monitored them for two days at the field, after which they worked independently. However, the team regularly contacted them by telephone.

The questionnaire was divided into four sections. First section covered household characteristics such as individual age, education, and ethnicity. Second section included questions about income, income sources, ownership of agricultural land and livestock, and access to health care facility. Third section contained questions related to traditional medicines and illness. The final section, also the most important one, contained the following questions about the selected traditional practices

- Did the household use the specified traditional practice over the last two years?
- How was the knowledge on the specified traditional practice transferred to the next generation?
- What was the trend for the use of traditional practice (increasing, decreasing or constant) at the household level over the years?
- What could be the reason behind the trend?
- What were the benefits and problems of the selected traditional practice?
- What problems did it solve?
- What percentage of the community members may have adopted the specified traditional practice?

Data analysis

After the survey, each questionnaire was scrutinized for data consistency. The data were compiled in MS Excel and screened for any omissions or outliers. The Statistical Package for Social Sciences (SPSS ver. 21 for Mac) software was used for data analysis.

Descriptive statistics like mean, median, and mode, and frequency tabulation were provided. Both the chi square test and partial correlation were performed to measure the association between qualitative and quantitative variables respectively.

Binary Logistic Regression (BLR) was used to identify factors affecting the practise of each type of traditional practice. The dependent variables were coded 1 if the household currently practised the traditional practice; 0 otherwise. The team used the 'ENTER' method of BLR considering eleven possible determining factors. The team tested statistical significance at the confidence level of 95%, and if variables were found to be significant; at the 90%, 95%, and 99%, they were denoted by one, two and three asterisks (*) respectively. The names of the variables used in the BLR with their respective hypothesis associated with the traditional practices are provided in Annex I.

Results and Discussion

Documentation of Traditional Knowledge and Practices

A total of 75 types of traditional knowledge and practices were documented in the Gwallek-Kedar area. However, not all of them were considered valid and fruitful. In the validation workshop, the team enlisted 56 types of traditional knowledge and practices in the area, which are provided in Annex II. These 56 types are classified into three categories, namely: (i) agriculture (20 types), (ii) traditional medicine (32 types), and (iii) genetic resource conservation (4 types).

Traditional agricultural practices

A total of 20 traditional practices related to agriculture were identified from the Gwallek-Kedar area. Local peoples still use TK in agriculture, especially for soil fertility management, land management, pest control, postharvest storage of crops, and livestock management. Soil fertility management practices included planting of legume crops in the paddy fields, incorporation of soybean in the maize fields, application of farmyard manure, and terrace slicing and composting. For agricultural pest control, they used livestock urine, *Titepati* (*Artemisia* species), tobacco (*Nicotiana tabacum*), and *Timur/Bojo*. Similarly, people dry and store agricultural produce. Storing and drying maize in a pole outside their home is called Luto; fresh chilli is dried on rooftops; and garlic is dried in the kitchen. For livestock food, people pile up green leaves of maize and store them to use as fodder in the dry season; they feed cattle various locally available plant species such as *Silfode* to increase milk; and they also use plant species as medicines for livestock.

Traditional medicinal practices

A total of 32 traditional medicinal practices were identified. Plant species were mainly used for curing short-term illness such as headache, cold and cough, stomachache, typhoid, and cuts and wounds. Similarly, people used plant species to treat paralysis, poor eyesight, cracked hands, severe cramps, and for orthopedic problems such as fractured limbs.

Traditional seed storage and production practices

Four practices related to seed storage and production were documented. These are (i) traditional Choto seed production, (ii) traditional cucumber seed storage, (iii) drying garlic in the kitchen, and (iv) use of ash mixed with Timur/Bojo for wheat seed storage. There were only a few types of practices under this category due to the availability of improved seeds and storage bins at local markets.

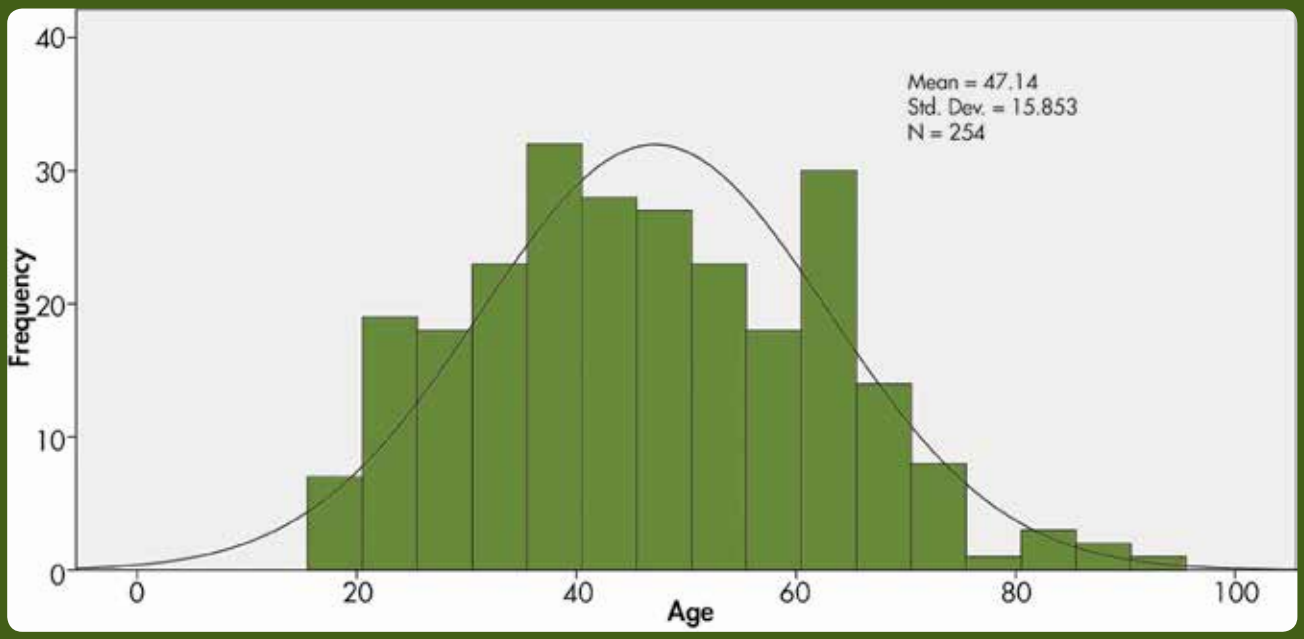
Results of Household Survey

In the TK validation workshop, the study team selected six types of traditional practices. Two examples were provided under each type of knowledge: one represented 'commonly used' and the other 'rarely used' knowledge. The six selected traditional practices were further evaluated in the household survey. This section deals with the results and findings of the household survey.

Respondent characteristics

A total of 259 households were interviewed during household survey. Thirty-four percent respondents were females. The average age of the respondent was 47 years (standard deviation ±16). The age distribution shows that the study had covered both young as well as elder people, however it is slightly positively skewed (Figure 2). The age ranged from 18-90 years with the median 45.5. The first quartile age was 35, the second was 46, the third was 60 and the fourth was above 60.

Figure 2: **Age distribution among the respondents**



The education level of the respondents was found to be low. The average education level was Grade 6. Of the total respondents, 87% hadn't even completed Grade 10; 13% had completed Grade 10; and a few individuals had Bachelor's degrees (4%).

The household demography is provided in Table 4. The average household size was 8 members; among them 50% were males. On average, each household had 3 children (<18 years old) and more than 1 elder (> 60 years old). Out of the sampled population, 117 households (45%) had members working in India, and only 15 households (6%) had members working in the third country (besides India).

Table 4: **Household characteristics**

Characteristics	N	Minimum	Maximum	Mean	Std. deviation
Family size	259	1	22	7.70	3.183
Number of male members in the household	258	1	10	3.83	1.664
Number of children under 18 years	241	1	8	2.98	1.625
Number of elders above 60 years	127	1	3	1.29	0.473
Number of members working in India	117	1	4	1.52	0.794
Number of members working in third country	15	1	3	1.20	0.561

Land types and land area are provided in Table 5. Almost all households had *pakho* (upland, non-irrigated agricultural land), with an average of 18 *Nali* per household. Similarly, 90% of the households had private grassland. However, *khet* (lowland, irrigated agricultural field) was limited to only 28% of the sampled population. A few households also had private forest. People cultivate maize and soybean in the upland, and rice and wheat in the lowland. The study team observed the following cropping pattern: maize + soybean – wheat/barley in the upland; and rice – wheat/maize in the lowland. Their staple food was maize and wheat. They practise mixed cropping by incorporating legumes, both in the upland and lowland. Incorporating soybean in the maize field in the upland was a widespread traditional practice. Much of the study area had local land races of soybean (black, white and red soybean).

Table 5: **Land types and land area (*Nali*)*/household**

Land types	N	Minimum	Maximum	Mean	Std. deviation
Pakho	254	1	100	17.80	13.838
Grassland	233	1	150	19.47	16.236
Khet	73	2	40	11.38	7.910
Forest	64	1	35	10.61	7.341

* *Nali* is the area measurement unit at the local level.
1 *Nali* ≈ 1/4 *Ropani* ≈ 127m^2

Easy access to forest resources, health care facilities, and local healer services are important because it determines the 'quality of life' of the villagers, as well as the 'business' potential of the community. It also signals the 'development' status of the study area. Table 6 provides the average walking distance to these resources and services. The survey data showed that, on average, villagers walked for 50 minutes to reach the nearest forest, 20 minutes to reach the nearest 'Vaidya' home (Ayurveda medicine), and 16 minutes to reach the nearest healer (Dhami/Jhakri). Government health care facilities were quite far; it took villagers an average of 53 minutes to reach the nearest one. However, private health care facilities (pharmacy shops) were relatively closer, the nearest one being an average of 44 minutes' walk away. Villagers have to walk for more than an hour to reach the nearest motorable road.

Table 6: **One-way walking distance to the nearest facility (minutes)**

Nearest Facility	N	Minimum	Maximum	Mean	Std. deviation
Forest	258	5	160	50.35	38.597
Vaidya home	207	0	120	20.20	19.856
Traditional healers	230	0	120	16.02	16.939
Government health post	257	5	150	52.67	29.561
Private medical pharmacy	257	5	150	43.53	26.360
Motorable road	255	1	180	63.78	51.288

The GKA is a remote rural area with limited health care facilities. Traditional healers and Vaidya are available at the village level, but other health facilities are far away. When people fall sick, they are likely to prefer visiting traditional healers/Vaidya at first because they are more accessible.

Household incomes

Income distribution of the households surveyed was positively skewed. Lower values were more frequent. There was significant variability in incomes among households, which was expected. An interesting finding is that off-farm income significantly contributed to the total income, and agriculture was the least important source of income. It should be noted that income from livestock was included in agricultural cash income. The average agricultural income was less than 8% of the off-farm income as well as total income! Estimated agricultural income, however, did not take account of home consumption. It was the surplus value of agricultural products.

The low contribution of agriculture to income may result in a loss of traditional knowledge on agricultural practices. People in the GKA engage in subsistence agriculture. As the production is not enough for survival, they migrate to India or other countries for earnings. About 83% of the sampled households did not produce enough food to last them for a year. On average, such households only produce enough to feed themselves for up to five months. Nearly half of the sampled household had at least one member working abroad. Most of them worked (seasonal migration) in India (117 households) and a few worked in other countries (15 households).

As the contribution of off-farm income was found to be significant, it was necessary to break it down. Therefore, the team documented incomes from the various off-farm sources (Table 7). Incomes from remittance was significant, followed by jobs and small businesses like tea shop, small hotels, retailers, and so on. In the sampled households, the study found nine people working as traditional healers, *Dhami/Jhakri* and *Pandit*. They earned an average of NPR 28,000 per annum.

Table 7: **Off-farm income of the households (NPR/Year)**

Income types	N	Minimum	Maximum	Mean	Median	Std. deviation
Remittance	102	2000	1,000,000	1,44,324	1,00,000	1,61,390
Job	61	5000	6,24,000	1,63,508	1,50,000	96,235
Small Business	41	3000	5,00,000	88,951	50,000	1,23,023
Daily Wages	92	5000	3,00,000	45,902	25,000	50,251
Pension	78	6000	1,90,000	33,782	8,000	49,239
Other (*Dhami/Jhakri*, traditional healers)	9	2000	60,000	28,000	25,000	17,313

As mentioned earlier, agricultural income contributed much less to the total income, because most of the agricultural produce is consumed within the households. Also, most households were food insufficient. People sell what they produce if they produce a surplus. The team found an insignificant number of households selling agricultural produce. For example, only 20 households sold vegetables, 17 households sold cereals, and 8 households sold fruits. However, a significant number of households (37% of the sampled households) sold livestock and its products.

Sickness and treatment facility

Respondents were asked if any member of the household felt sick over the past 12 months. It was found that in 85% of the sampled households, at least one member had been sick over the past year. The most common short-term illnesses were cold and cough, fever, headache, stomachache, skin allergy, and digestive problems like gastritis and diarrhea. Similarly, long-term illnesses reported were asthma, hypertension, rheumatics, heart problem, and neurological problems. Asked where they treated those illnesses, 45% of the respondents said "at home"; 5% said "at the traditional healer/*Dhami/Jhakri*", and the remaining 50% said "at medical facilities like pharmacy and district hospital".

During the focus group discussions, the study team asked the respondents to specify the illnesses that required 'home' treatment, those that required *Dhami/Jhakri* treatment, and those that required hospital treatment. Most participants said that for generic and short-term illnesses such as cold and cough, stomachache, digestion problems, and skin allergy, they preferred 'home' treatment. Here, 'home' treatment is not limited to locally available traditional medicine, but also includes common medicines like painkiller, paracetamol. For acute and chronic illnesses like asthma, they preferred 'modern' facilities. People preferred *Dhami/Jhakri* or traditional healers for illnesses that could not be cured after 'home' treatment. In addition, it was observed that people consult (even repeatedly for a single problem) *Dhami/Jhakri* for psychological or psychiatric problems believed to result from the ill effects of 'evil eye' or 'bad star/medical astrology'. People consult traditional healers for serious cases like snake bites, jaundice, severe gastritis, and paralysis. There were a few successful cases reported for snake bites and paralysis. Many local people believed that traditional healers can cure snake bites, paralysis, and neurological disorder. The study team also found that a few people combined modern medicine with traditional 'home' treatment or *Dhami/Jhakri* as a series of alternatives for a single problem, e.g., severe gastritis.

Description of the six traditional practices

Terrace cutting and compost

Terrace cutting and compost making (TCC) along the toe side of the upland terrace is a common type of traditional knowledge on agriculture. This practice maintains soil fertility and protects crops from pests and rodents (Plate 1). During Bhadra/Asoj (August/ September), farmers thinly slice terrace slopes with a spade to remove weeds and grass. The weeds and grasses are mixed with soil and buried under the soil surface to make compost. Farmers believe that compost improves soil fertility and crop productivity. This practice protects crops from pest infestation as the pest habitat is removed during slicing and the pest is killed when buried under soil. This practice is also common in other parts of Nepal, especially in the hills. Carson (1992), Poudel and Thapa (2001), and Pilbeam et al. (2005) have described the slicing of terraces as a strategy for soil fertility improvement and a land management technique in the hills of Nepal. But the difference in the study area was that farmers prepare compost from the slices along the toe side of each terrace, and incorporate the compost in the succeeding crops; whereas in other hill areas, farmers take out weeds and grass and throw these away. Also in the study area, farmers do not cultivate crops along the toe of the terrace (small strip), so they even sacrifice crops for TCC. And they carry out this practice every 2–3 years to make the terrace stable.

Plate 1: Terrace cutting and compost making for soil fertility management was common in the study area.

Silfode for milk production

Silfode (*Bergenia ciliata*) for milk production (SMP) is practised by Gwallek communities (Plate 2) who live in the vicinity of forests. A handful dried *Silfode* rhizome (that weighs about 50 grams) is crushed and mixed with 500 grams of wheat or corn flour, and a pinch of salt, and cooked for 15 to 20 minutes. The mixture is fed to lactating livestock (especially buffalo) daily for about 25 days after parturition. Local communities thought that the quantity of milk increased after feeding the mixture.

There are no studies on the relationship between *Silfode* and milk production, but its uses in curing human health problems have been reported. Chauhan (1999) mentioned that its rhizomes is mixed with boiled milk and consumed to treat backache. Kunwar et al. (2013) reported its use for the treatment of kidney stone in far-west Nepal. Malla et al. (2015) also reported that a decoction of its rhizomes is used for curing kidney stone in Parbat district of Nepal. In Pakistan, its rhizome and bark are used for treating diseases like ulcer, back pain, piles, dysentery, and external or internal wounds (Abbasi et al., 2013).

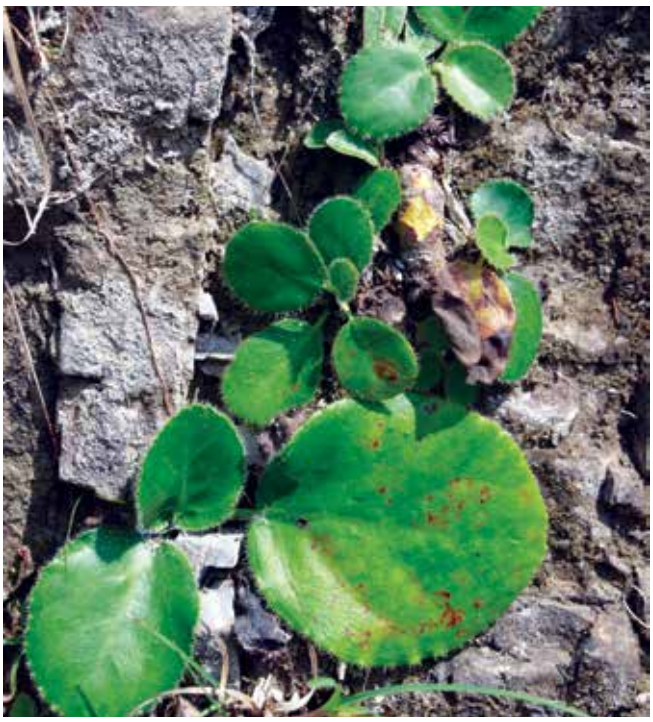


Plate 2: Use of *Silfode* (*Bergenia ciliata*) has been reported to increase the quantity of livestock milk. Very few households use this knowledge.

Tite for fever and cold and cough

Tite (*Swertia chirayita*) for fever and cold and cough (TFC) is used in two different ways (Plate 3). Two to three small pieces of *Tite* are soaked overnight in a glass of water and consumed to treat fever, which is the conventional method adopted throughout the hilly regions of Nepal. However, local communities of the Gwallek-Kedar area use it in a different way.

A handful (about fifty grams) of *Tite* is cooked in 200 to 250 ml of water till the volume of water becomes one third, i.e., about 80 ml. Once the solution is cooled, it is applied on the forehead, throat, chest, abdominal area and back of kids aged between 6 months to 2 years to treat cold, cough and fever, because *Tite* is intensely bitter in taste for oral intake for children. Manandhar (2002), Ghimire et al. (2008) and Gurung and Pyakurel (2012) also mentioned the use of Tite to cure fever, cold and cough for adults, but the mode of application was found to be different among the Gwallek communities.

Plate 3: Use of *Satuwa* (*Paris polyphylla*) and *Tite* (*Swertia chirayita*) to treat short-term illnesses was common in the area.

Satuwa for headache and stomachache

The use of *Satuwa* (*Paris polyphylla*) to treat headache and stomachache (SHS) is a traditional practice among the Gwallek communities (Plate 3). Rhizomes of *Satuwa* are dried, powdered and about 1-2 teaspoon (about 2–3 grams) of the powder is mixed with a glass (about 100 ml) of water and stirred. The mixture is then boiled for 10 minutes and the juice, after cooling, is given to a person suffering from a headache or stomachache. Other studies also reported the use of *Satuwa* to cure fever, as anthelmintic, and for stomachache (DMP, 1970; CSIR, 1986; Pohle, 1990; Manandhar, 2002; IUCN, 2004).

Choto seed production in a traditional way

In the traditional method of Choto (*Raphanus sativus*) seed production (CST), farmers select one or two healthy Choto plants in the field. They uproot the selected plants before they begin to flower. They cut the root tips from the base and trim off the top, leaving one-third of it behind. A mixture of soil and cow dung is placed around the Choto root. Finally, farmers transplant the root close to their house in fertile soil and water for at least 3-4 days. When the fruits (siliquae) become light yellow, they are harvested. Farmers believe that seed produced using this technique is highly potent, productive and pest free.

Ash and Bojo for wheat seed storage

For the use of ash and Bojo for wheat seed storage (ABWS), farmers collect dry dung from the jungle and burn it. The ash produced from burning is mixed with small rhizomes of *Bojo* (*Acorus calamus*) and/or fruits of *Timur* (*Zanthoxylum armatum*) (Plate 4), and the mixture is applied to wheat seed and stored at home in an airtight container. Here, the ash absorbs seed moisture, and the smell produced by the plant species repels/kills storage grain pests.

Plate 4: Use of *Timur* (*Zanthoxylum armatum*) and/or *Bojo* (*Acorus calamus*) along with ash to manage storage pests was common in the area.

Detailed evaluation of the six traditional practices

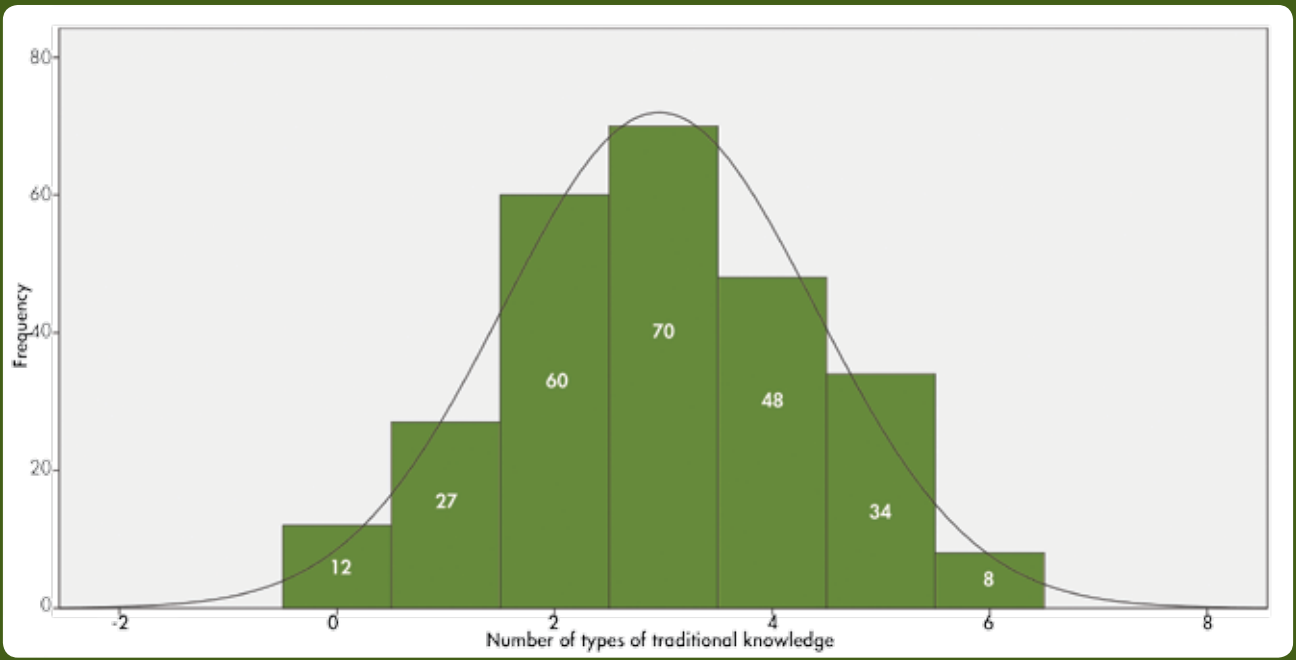
The study team evaluated the selected types of traditional practices against their adoption, inter-generational transfer of knowledge, use trends over the years, their benefits and problems.

Existing traditional knowledge practise

The most commonly practised traditional practices among the six was CST (72% of the sampled households), followed by TFC (70%), and ABWS (58%). The least practised was SMP; only one in five households used it (Table 8).

The households practised multiple traditional practices. However, 12 households (4.6%) did not practise even a single among the six practices (Figure 3).

Figure 3: **Household practise multiple traditional practices**



Intergenerational transfer of traditional knowledge

Sources of information and dissemination mechanisms are a basic means of acquiring knowledge. The study team analysed intergenerational transfer of knowledge related to the six traditional practices. For this, three specific questions were asked during the household interviews. The first question the team asked the respondents who used traditional practice was "From where did you acquire the knowledge for this particular type of traditional practice?" They were asked to select the most appropriate answer from a list of five options. The objective was to find out their source of information on different types of traditional practices. The results (Table 9) revealed that individuals acquired traditional knowledge from their father (52%) and mother (26%) and through direct observation and verbal communication. On the whole, traditional knowledge is being transferred within the family in the GKA; the least

Table 8: **Practise of six types of traditional knowledge**

Traditional practice	Household [Number (%)]	
Terrace cutting & compost (TCC)	125	(48)
Silfode for milk production (SMP)	54	(21)
Tite for fever, cold and cough (TFC)	181	(70)
Satuwa for headache and stomachache (SHS)	71	(27)
Choto seed - traditional (CST)	187	(72)
Ash and Bojo for wheat seed storage (ABWS)	149	(58)

Table 9: **Respondent's sources of traditional knowledge**

Traditional practice	From where did you acquire the knowledge for this particular type of traditional practice? (% of individual saying "Yes")				
	Grandfather	Grandmother	Father	Mother	Neighbour
Terrace cutting & compost (TCC)	16.8	8.8	48.8	16	9.6
Silfode for milk production (SMP)	6.4	14.9	63.8	14.9	0
Tite for fever, cold and cough (TFC)	6.1	16.6	40.9	30.4	6.1
Satuwa for headache and stomachache (SHS)	9.9	1.4	64.8	21.1	2.8
Choto seed - traditional (CST)	3.2	14.6	53.5	27	1.6
Ash and Bojo for wheat seed storage (ABWS)	2.7	8.2	38.8	47.6	2.7
Average	7.5	10.8	51.8	26.2	3.8

number of respondents have acquired TK from their neighbours (only 4%). For the TCC, SMP, TFC, SHS, and CST, most people depend on their father, but for the ABWS most people depend on their mother for learning.

The second question the team asked the respondents was "How old were you when you first acquired knowledge on this particular type of traditional practice?" The objective was to find out the mechanism through which traditional knowledge was transmitted to the next generation, and when the respondent acquired such knowledge. It was found that the respondents had acquired traditional knowledge related to the selected traditional practices from their parents when they were very young (by age 15). (Table 10).

The study team learned that respondents received TK from his/her parents in childhood, but it was still unclear how the respondents intended to transfer that knowledge to their children. Therefore, the next question the study team asked them was "How is the traditional knowledge on the selected traditional practices being transferred to the next generation in your household?" Respondents were asked to select from among five possible options in response to the question. Their answers revealed that 'father to son' was the preferred method of transferring TK, followed by 'mother to daughter/in-law'. It is interesting to note that, within a household, the father tends to transfer his knowledge to the son and the mother to the daughter.

Regarding knowledge transfer for different traditional practices, 'father to son' was most favoured mechanism for TCC (Table 11). Similarly, 'mother to daughter/in-law' was the most favoured mechanism for CST and ABWS. Both 'father to son' and 'mother to daughter/in-law' are used equally for SMP knowledge transfer.

Table 10: **Age of respondents when they first acquired traditional knowledge**

Traditional practice	How old were you when you first acquired knowledge on this particular type of traditional practices?		
	Mean	Median	Mode
Terrace cutting and compost (TCC)	14.8	15	15
Silfode for milk production (SMP)	12.9	12	10
Tite for fever, cold and cough (TFC)	15.6	16	15
Satuwa for headache and stomachache (SHS)	14.1	15	10
Choto seed - traditional (CST)	14.5	15	10
Ash and Bojo for wheat seed storage (ABWS)	15.4	15	15
Average	14.6	14.7	12.5

Table 11: **Intergenerational transfer of traditional knowledge**

Traditional practice	How is the knowledge of the particular traditional practices being transferred to the next generation in your household? (% of individuals saying "Yes")				
	Father to son	Father to daughter/ in-law	Mother to son	Mother to daughter/ in-law	Other
Terrace cutting & compost (TCC)	59.2	6.4	9.6	16	8.8
Silfode for milk production (SMP)	36.2	17	10.6	36.2	0
Tite for fever, cold and cough (TFC)	41.8	10.4	12.6	32.4	2.7
Satuwa for headache and stomachache (SHS)	42.3	16.9	21.1	18.3	1.4
Choto seed - traditional (CST)	36.2	12.4	5.4	44.3	1.6
Ash and Bojo for wheat seed storage (ABWS)	23.8	9.5	17	46.9	2.7
Average	39.9	12.1	12.7	32.4	2.9

Use of traditional practice over the past ten years

It is frequently reported that traditional practice is declining; therefore, respondents were asked about the use of promising types of practices over the past 10 years within their households. Majority of the respondents said that they have been practising the promising types of traditional practices for a long time. Among those households that still practise such traditional practices, 77% reported 'no changes' in the use of traditional practices over the past 10 years (Table 12). Only 21% of the households mentioned a 'decreasing trend' during the same period. However, many respondents who reported a 'similar trend' and/or 'decreasing trend' said, "although we have been using the same traditional practices for a long time, the frequency of its use has been reduced due to the decreasing forest area, and more demand of labour/effort to use the same traditional practices." A more detailed study is required to explore the reasons behind the loss of traditional knowledge and practices in the region. Efforts should be made to identify factors affecting traditional knowledge and practices, its modification and improvement – in terms of resource use frequency and perceived effectiveness. The present study used the 'Yes/No' format for data collection. However, it is recommended that future studies include questions about the modification of traditional practices, preparation methods of health care ointment and doses required to cure particular diseases.

Table 12: **Use trend of traditional practices over the past 10 years (% of individuals saying 'Yes')**

Traditional practice	Increasing	Decreasing	Similar
Terrace cutting & compost (TCC)	2.4	16.0	81.6
Silfode for milk production (SMP)	4.3	25.5	70.2
Tite for fever, cold and cough (TFC)	1.1	30.0	68.9
Satuwa for headache and stomachache (SHS)	0	30.0	70.0
Choto seed - traditional (CST)	3.8	7.6	88.6
Ash and Bojo for wheat seed storage (ABWS)	0	17.2	82.8
Average	1.9	21.1	77.0

Factors Associated with the Use of Traditional Practices

Kunwar and Duwadee (2003) stated that knowledge on ethnobotany was decreasing because of increased use of homeopathy, deforestation, habitat fragmentation, over exploitation of resources, and habitat destruction. This is also reflected in our study area. It is a fact that not all surveyed households were practising the promising traditional practices at the time of study. The percentage of households that used such knowledge ranged from as low as 21% (in case of SHS) to as high as 72% (CST). What factors determined the continuation of certain types of traditional practices? Are there any social or economic factors that may have caused the loss of the traditional practices? These questions can be answered by regression analysis and field discussion. Therefore, the study team first used household survey data to better understand the factors associated with the use of traditional practices; and second, the team listed other factors associated with the erosion of TK and practices which were identified during the FGD, KII, and direct field observation.

Regression analysis

The objective of the BLR is to identify significant factors associated with the existing practise of traditional practices. The results obtained are provided in Table 13. Five independent variables (gender, education, area of land owned, food sufficiency, and income) were excluded because their associations with the dependent variable (for all traditional practices) were found to be statistically insignificant. Only significant variables are described below.

Age of the respondent

The age of the respondent (AGE) was found to be significant for CST and is negative at the 95% confidence level. This indicates that the age of local people negatively determines current use of CST. Older people are less likely to use the CST. Choto seed production in a traditional way demands labour and time, which could be a possible reason why older people do not practise the CST. Or they might have modified the seed production method. During field visit and FGDs, many people mentioned that they have modified the traditional method of seed production.

Table 13: **Results of binary logistic regressions**

Independent variable	Traditional knowledge (dependent variables)					
	Terrace cutting & compost (TCC)	Silfode for milk production (SMP)	Tite for fever, cold and cough (TFC)	Satuwa for headache and stomachache (SHS)	Choto *(Raphanus sativus)* seed - traditional (CST)	Ash and Bojo for wheat seed storage (ABWS)
Age					(-)**	
HHsize			*			(-)*
Distforest	(-)***		(-)**			
Distroad			**	*	**	(-)**
Sick		**	***	**	***	
Migration	**				**	
Constant				***		

Note: *, **, and *** denote significant at the probability 0.10, 0.05, and 0.01

Nowadays, people prefer to keep the Choto plant in the same production field instead of uprooting it and transplanting it to another place.

Number of family members

The number of family members in the household (HHSIZE) was found to be significant for TFC and ABWS at the 90% confidence level. Its relationship with TFC was positive, but found to be negative for ABWS. This indicates that households with more family members are likely to use TFC, but it may minimize the practise of ABWS.

Distance to forest

Time to reach the nearest forest (DISTFOREST) was found to be significant for TCC and TFC. It affects negatively. This means that the greater the distance to the forest, the less likely people were to practise TCC and TFC. Alternatively, the closer the forest, the more likely they were to practise TCC and TFC.

In the GKA, households close to the forest tend to have larger upland area compared to the households away from the forest. We observed negative correlation between DISTFOREST and upland area ($r=-0.18$, $p<0.001$). This means households far from the forest owned less upland area; this further means that they are less likely to practise TCC to fulfil the demand for grass for livestock, because grasses available at the terrace riser are lost during TCC. In FGDs, most of the participants agreed that people do not practise TCC if they do not have enough grasses in their own land. Thus, it can be concluded that households near the forest have comparatively more upland area, and practise TCC because they can replace grasses lost during TCC with fodder from the nearby forest.

It was also observed that households near the forest practise TFC more frequently. This is understandable because these households may have more knowledge about the medicinal use of Tite and when they get sick they can collect/get the Tite from the nearby forest. This might explain why households close to the forest reported more frequent use of TFC.

Distance to motorable road

Time to reach the nearest motorable road (DISTROAD) was found to be positively affecting TFC and CST, but it was negative for ABWS at the 5% significance level. This indicates that access to the road significantly affects practices based on TK, but its effects may be positive or negative depending on the traditional practices. Households away from the motorable road are less likely to get 'modern amenities' such as medicines, improved seeds, fertilizers and chemical pesticides. High availability of modern medicines to cure fever and cold and cough nearby road might have led to the erosion of TFC along the road corridor . Similarly, due to higher availability of improved seeds of vegetables and other crop varieties near the motorable road, people who live near the road may have shifted/ modified their cropping patterns; and thus, they were less likely to continue CST. However, households nearby road were more likely to continue the traditional method of wheat storage (ABWS). This is interesting, though

understandable. The availability of Bojo and Timur in the study area has been decreasing. Moreover, open livestock grazing in the area has also decreased, thus reducing the amount of dry dung. In contrast, households near the road could buy both Bojo and Timur from the nearby market (as these plant species have other health benefits, people use them as alternative medicines; Timur in particular is used as a spice). It is thus likely that households near the road use Bojo/Timur for wheat seed storage more frequently because these species are available in the market.

Sickness of family members

The sickness of family members was found to be positively affecting SMP, TFC, SHS, and CST. This indicates that when a family member falls sick, the households in the study area were more likely to practise traditional practices. This can be explained as follows.

When family members fell sick, they first adopt home-based treatments like TFC and SHS. If the sickness prevails for a long time, they may visit a local 'Vaidya' or a modern healthcare facility such as a local pharmacy or district level facilities. It was evident that nearly half of the respondents first preferred to treat short-term illnesses at home. The survey showed that people in the study area were most likely use local medicines at home when a family member fell sick.

Second, more frequent use of SMP may be due to the complementary effects of TFC and SHS. The SMP was the least practised among the six traditional practices. A person who was aware of the TFC and SHS in the sick-household may have gained knowledge about the use of SMP, and therefore, collected Silfode when he/she visited the forest and used it as livestock feed for milk production. For this study, the results of Chi-square tests showed positive association between SMP and TFC ($p<0.05$), and SHS ($p<0.01$).

Third, the reason behind the more frequent use of CST in the sick household is unclear and needs further exploration.

Labour outmigration

Labour outmigration was found to be positive for TCC and CST at the 95% confidence level. This means that labour outmigration is likely to increase the practise of TCC and CST. This is against our hypothesis (see Annex I). It was hypothesized that labour outmigration might have induced farm labour shortage during a critical phase of farming. However, the regression analysis for TCC and CST revealed otherwise, and this can be explained. In the study area, households with a bigger family size were found to have a higher rate of labour outmigration. The

average family size of the migrant-sending households was nine, whereas it was seven for households without migrants. This suggests that labour shortage may not have prevented migrant-sending households from practising TCC and CST, because migration was in general short-term and seasonal. However, the study team found increased application of TCC and CST in migrant-sending households. More frequent application of TCC and CST among the migrant-sending households is likely because these households get extra income and can hire paid labour for those traditional practices.

Other factors

The study also documented factors behind the minimal use of traditional practices during focus group discussion, key informant interviews, and other field observation (Table 14). Overall, unavailability of plant species in local areas; more use of modern medicine; readily available modern agricultural technology such as seeds and storage bins, and lack of awareness about traditional practices were the common factors behind the minimal use of those traditional practices. Also, people gave less priority to agriculture and searched for alternative source of income such as seasonal migration. Traditional healers did not like to disclose the TK and 'mantras' (sacred ritual phrases) because they believe doing so would make their healing power less effective. Therefore, they do not disclose their knowledge to the public; they only share it with their selected family members, preferably biological son. So, if the healer dies, then his/her TK will be eroded.

Broadly, the study team observed a decline in traditional knowledge and practices due to increased use of allopathic medicine; decreasing forest cover and its habitat fragmentation; over exploitation of resources and habitat destruction; and introduction of more 'modern' agricultural practices by development projects at the local level. Kunwar et al. (2013) identified a number of medicinal herbs (55% of the documented 238 plant species) used as the main ingredients of traditional medicines in the far-western region of Nepal (Dadeldhura, Baitadi and Darchula districts), and concluded that medicinal plants are inseparable from their livelihoods, but such knowledge is now eroding due to changing lifestyles, perceptions, and social transformation. Iniesta-Arandia et al. (2014) also identified outmigration as a significant contributor of TK erosion in a Mediterranean watershed, Spain. A multi-locational study (Paniagua-Zambrana et al., 2014) showed that use of TK is highly localized, and thus conservation strategies should be prioritized at the local level.

Table 14: **Factors associated with the loss of traditional knowledge and practices with respect to the six traditional practices**

Traditional practice	Factors
Terrace cutting and compost (TCC)	Unavailability of labour force due to seasonal outmigration; land fragmentation caused decrease in land per capita; intense rainfall damaged terraces; use of stone in improved terraces; grasses unavailable for livestock; increased soil erosion; and lack of scientific understanding of traditional practices. A few farmers believed that TCC does not increase soil fertility and crop productivity and also demands much labour and time.
Silfode for milk production (SMP)	Unavailability of Silfode in the nearby forest area; decreasing number of milking livestock; lack of technical knowhow on SMP among the new generation; and lack of knowledge about this traditional practice.
Tite for fever, cold and cough (TFC)	Use of modern medicine; unavailability of Tite in the nearby forest (forest degradation and over exploitation); lack of awareness about this traditional practice.
Satuwa for headache and stomachache (SHS)	Use of modern medicine; unavailability of Satuwa in the nearby forest (forest degradation and over exploitation); lack of awareness about this traditional practice.
Choto seed – traditional (CST)	Availability of improved seeds of vegetables in local markets; modified seed production methods (produce seed from the same plant in the same place where it is grown); cumbersome so a few farmers borrow seeds from neighbours; and low quality of land.
Ash and Bojo for wheat seed storage (ABWS)	Increased use of Celphos (*Aluminum phosphide*); availability of seed storage bins at local markets; cumbersome; unavailability of 'guitha' (dung) in the jungle (reduced grazing in the jungle area because of strict rules and regulations); and its modification (use of ash produced at home, and use of chilli).

Limitations of the Study

Traditional healers such as Dhami/Jhakri and Vaidya often resist sharing the details of their TK. In some areas, group participants cautioned traditional healers (who were also participants in the FGD) not to provide their TK to the research team, because they believed that the healers' knowledge might become ineffective if they shared it with anyone other than their biological sons.

Conclusion

Local people of the Gwallek-Kedar Area use TK on agricultural practices, especially for soil fertility management, land management, pest control, post-harvest storage of crops, and livestock management. People also possess various types of traditional knowledge on medicinal plants, which are used to treat different health problems. However, we observed only a few types of TK on seed storage and production because of the availability of modern agricultural technology.

The survey revealed that traditional healers and 'Vaidya' are available at the village level, but other health facilities are farther away. When a person falls sick, family members are more likely to visit traditional healers/Vaidya at first because these were the nearest health care facility at the time of the survey.

People acquired traditional knowledge from their parents in childhood (by age 15); and most of them preferred 'father to son' or 'mother to daughter' intergenerational transfer of TK. The study found gender preferences in the intergenerational transfer of TK. Father tends to transfer his TK to the son, and mother to the daughter.

The regression results showed that (i) age of the respondent (ii) number of family members in a household (iii) distance to the nearest forest area (iv) distance to the nearest motorable road (v) sickness of the family members, and (vi) seasonal migration of the household member for earnings significantly affect current use of traditional practices. Further, we observed a decreasing trend in the use of traditional knowledge and practices because of increased use of allopathic medicine; decreasing forest cover and its habitat fragmentation; over exploitation of resources and habitat destruction; and introduction of more 'modern' agricultural practices by development projects.

Use of traditional practice is determined by various other factors that were not covered by the study. A more detailed study is needed to explore the reasons behind the loss of traditional knowledge and practices in the region. Further studies should consider factors associated with the modification of traditional practices and the preparation methods and doses of herbal medicine.

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Annex I: Independent variables for the binary logistic regression and their hypothesis

SN	Variables	Explanation	Terrace cutting & compost (TCC)	Silfode for milk production (SMP)	Tite for fever, cold and cough (TFC)	Satuwa for headache and stomachic (SHS)	Choto seed - traditional (CST)	Ash and Bojo for wheat seed storage (ABWS)
1	GENDER	Sex of the respondent (1 Male; otherwise 0)	+	+	+	+	+	+
2	AGE	Age of the respondent (Years)	+	+	+	+	+	+
3	EDU	Highest level of education	?	?	?	?	?	?
4	HHSIZE	Number of family members	+	+	+	+	+	+
5	BARI	Area of the Bari land (Nali)	?	?	?	?	?	?
6	FOODSUF	Household food sufficiency (1 Food sufficient; otherwise 0)	?	?	?	?	?	?
7	DISTFOREST	One-way walking distance to the nearest forest (Minutes)	–	–	–	–	–	-
8	DISTROAD	One way walking distance to the nearest motorable road (Minutes)	–	–	–	–	–	-
9	SICK	Whether any members in the household fell sick over 12 months (1 Yes; otherwise 0)	–	?	+	+	–	-
10	INCOME	Square root of the gross household income (A thousand Nepalese Rupees)	+	+	+	+	+	+
11	MIGRATION	Whether any member in the household was absent and had gone to India or elsewhere for earnings (1 Yes; otherwise 0)	–	?	?	?	–	?

Note '+', '-' and '?' indicate 'positive', 'negative' and 'positive or negative' relationship of the independent variables with the dependent variable respectively.

Annex II: Traditional knowledge documentation in the Gwallek-Kedar area, Kailash Sacred Landscape-Nepal

Category 1 - Traditional knowledge related to agricultural practices

S N	Name	Description	Benefits	Modernization and changes	Current trend
1	Farmyard manure application for increasing soil fertility	The livestock dung and crop remains are used to make manure – the '*Parso*'. Livestock dung, urine and the remaining feeding crumbs are mixed with grass and pilled-up in a specific location. For 3 to 6 months, water is added (during the dry period) to prepare manure throughout the year and applied to the crop fields before planting.	It increases the fertility of soil. The use of organic manure is also good for human health. It helps to build organic soil. The use of organic manure increases the shelf life of crops.	Compost making has been started for kitchen garden and vegetable farming. Unused grass, weeds and crop remains are used to make the compost.	Manure preparation is decreasing with the decreasing trend of animal husbandry, whereas farmyard compost is increasing.
2	Application/use of urine for pest control	Outbreak of diseases and pests in agricultural crops is controlled by using '*Ganhut*' (urine of cow and buffalo) during the rainy season. Almost three litres of water is mixed with one litre of urine and sprinkled on the leaves and shoot system of the crops.	It helps to control agricultural pests and diseases. In addition, plants get nitrogen from the urine and grow well.	Washing soap, and plants like *Ketuki* (*Agave americana*) and *Titepati* (*Artemisia dubia*) are cut into small pieces and ground, and finally mixed with urine to make organic pesticides.	Application of urine and organic pesticides is increasing in vegetable farming.
3	Storage of maize cobs as Luto	When maize cobs have dried and it is time for harvest, the cobs are handpicked. One or two outer husks of the maize cobs are opened and tied together in bunches of 4 to 6 cobs and sun-dried for 3-5 days. A wooden pole of around 7–8 metres long is erected in a sunny area close to home, and with the help of a rope, the maize bunches are tied around the pole and covered with rice straw or plastics at the top of the pole to protect them from rain. Likewise, leaves of the pine tree are kept at the base to prevent them from rodents. This storage system is locally called 'Luto'. The 'Luto' system is dismantled during winter season and grains are threshed by hand and stored inside the house.	Maize cobs are well dried, and the incidence of insects, diseases, and rodents is minimal. In the winter season, when the system is dismantled, husks of cobs are used as livestock feed; and the hard-inner cobs are used as firewood.	No change	Similar
4	Storage of maize plants as fodder for winter season	After harvesting cobs, maize plants are piled/staked up at the field and dried naturally to feed the livestock during winter season.	There are alternative fodder species available during the rainy season; therefore, maize plants are stored to feed livestock during winter season.	No change	Similar

S N	Name	Description	Benefits	Modernization and changes	Current trend
5	Soaking rice seeds for early germination	During the months of Baishakh (April-May) and Jestha (May-June), 60 days before rice planting, a small wet nursery is prepared for rice seedlings. Seeds are soaked in water for 2 days in a copper container, then put in baskets and covered with jute sacks for early germination. Once the seeds germinate, they are sprinkled with water. In 40 to 60 days, rice seedlings are ready for transplanting.	Seedlings prepared in this way grow early and have better rate of germination because of increased temperature in the baskets.	Due to lack of labour and water sources, dry nurseries (instead of wet) are being raised in some places.	Use of this traditional practice is declining.
6	Soaking maize seeds before sowing	Maize seeds are soaked in water for two days. The wet seeds are sown along the plow line at about 30cm.	Soaked seeds germinate early at a higher germination rate.	No change	Similar
7	Mixed maize cropping with soybean	Soybean and maize are sown in the field at the same time.	Soybean (*Glycine max*) plants fix nitrogen, which increases soil fertility, which in turn helps to grow healthy maize plants. This method enhances the production of maize and soybean as well as the productivity of agricultural land. It also improves the resilience of maize production system.	Traditional varieties of soybean have been replaced by improved varieties.	Increasing trend
8	Legume cultivation in the terrace riser in the rice field	Legumes, especially soybean and black gram (*Vigna mungo*), are planted at a spacing of about 30cm in the terrace riser of rice field.	Legumes are also produced along with rice. The roots of legumes help strengthen the terrace for the waterlogged condition. Also, when the terrace is cut and soil is incorporated into the rice field, it increases soil fertility.	No change	Due to labour shortage, this practice has been declining.
9	Terrace cutting and compost	Terrace cutting and compost along the toe side of the upland terrace is a common practice. During September/ October, farmers thinly slice terrace slopes using a spade to remove weeds and grass. The weeds and grass are mixed with soil and buried under the soil surface to make compost.	The method is used to maintain soil fertility and protect crops from pests and rodents. This improves soil fertility and crop productivity. It also helps to protect crops from pest infestation, because slicing removes the pest habitat and the pest is killed when buried under soil.	No change	Decreasing trend due to labour shortage
10	Use of meat or eggs to heal broken/ dislocated limbs.	Dislocated or broken part of the limb is straightened and bandaged with the support of bamboo or wooden plank. Raw eggs or pulped cooked goat meat is then used as ointment over the bandaged area.	No beneficial evidence has been documented so far; however, local people believe that this practice had helped early recovery.	NA	This practice has disappeared completely.
11	Horse gram lentil balls (Dubka) as a food item	Horse gram (*Macrotyloma uniflorum*) seeds are soaked for a day. It is then ground to a paste with a stone and mixed with salt and spices. Then it is made into small balls (Dubka). The balls are mixed in cooked soup to improve the taste.	Horse gram is considered to be highly nutritious. It is believed to be able to dissolve stones formed in the gastrointestinal tract (stomach). Local healers use it for stone patients.	Local stones are being replaced with modern grinders.	This practice is increasing. A few restaurants practise this method.

S N	Name	Description	Benefits	Modernization and changes	Current trend
12	Black gram *Batuk* as a food item (dehydrated balls of black gram)	Black grams are cleaned and soaked for a day. The skin of the soaked black grams is removed. It is then ground to a paste and salt and spices are added. Then it is made into small balls. The balls are fried and people eat them, especially during rituals and festivals.	Black lentil is also considered to be nutritious. It is a source of protein, vitamins and calories.	Local stones are being replaced with modern grinders.	Similar
13	Use of Bhimal (*Grewia optiva*) bark as hair cleanser	Bark from the branches of Bhimal trees are removed and soaked in water. When it turns soft, it is ground to a pulp and used for hair washing.	It cleans hair and controls hair fall and greying.	Soap and shampoo are being used.	The use of soap and shampoo has replaced the practice completely.
14	Use of ash for cleaning hair	Fine powder of ash is used to clean hair.	It cleans hair and controls hair fall and greying.	Soap and shampoo are being used.	The use of soap and shampoo has replaced the practice completely.
15	Use of maize smut (*Kalino*) for burns treatment	*Kalino*, the black maize smut, a fungus galls, is collected to make a fine paste. It is used 3 to 4 times a day as an ointment to heal burns.	It helps to heal burns.	No change	This practice is declining due to the availability of modern medicines.
16	Use of stinging nettle (*Urtica dioca*) leaves to heal wounds	Stinging nettle leaves are ground to make a paste. This paste is used as an ointment to heal cuts, burns and wounds.	Helps to heal cuts and wounds.	No change	This practice is declining due to the availability of modern medicines.
17	Black gram, banana (*Musa* spp.), and wheat (*Triticum aestivum*) flour for milking cattle	If the livestock stops giving milk for any reason for about a month, the mixture of black gram, banana and wheat flour is cooked and fed to the livestock. The cooked mixture is fed to the livestock for a week, after which the livestock starts to lactate.	This helps the livestock produce milk. This also makes the livestock healthy and reduces the chances of infection by other diseases.	No change	The practice is being used widely.
18	Use of *Chiuri* (*Diploknema butyracea*) oil to treat hand cracks.	In May-June, after Chiuri fruits ripen, they are plucked and their seeds are dried, ground and dried in the sun. It is again ground to a fine powder and made into balls, which are squeezed between the hands to produce oil.	The oil is used to heal cracks in hands and feet during winter season.		This practice is on the verge of extinction. Due to the availability of moisturizing lotion, its use has been declining.
19	Use of Buckwheat plant for paralysis treatment	During the months of June-July, buckwheat plants can be eaten as a vegetable. Traditional healers feed buckwheat plant to people suffering from paralysis.	Due to the high content of vitamins, dietary minerals, this plant is beneficial for the patients. Found abundantly in nature, this plant helps improve blood circulation in paralyzed patients.	No change	This practice is still used; the use trend remains constant.
20	Beekeeping with hollowed logs	Logs are cuts into about 60 cm long pieces and hollowed out. Doors are set up at both ends and then it is placed outside the house and used for beekeeping.	Thousands of years ago, people hollowed out wood and hung them on cliffs for beekeeping.	Modern beekeeping hives and methods are being used.	This practice is declining due to the unavailability of good quality wood and the availability of modern hives.

Category 2 - Traditional knowledge on the medicinal practices

S. No.	Name	Description	Benefits	Modernization and changes	Current trend
1	Use of Silphode (*Bergenia ciliata*) to increase cattle/ buffalo milk	The people of Gwallek feed Silphode to post-delivery livestock to increase milk production. Roots and fruits of Silphode plants are collected from the forest, cleaned and then ground. It is then mixed with half kg maize or wheat flour and a pinch of salt and cooked for 20 minutes and fed to the post-delivery livestock for a minimum of three weeks.	This helps to increase milk production and keeps livestock healthy.	No change	Similar
2	Dislocated limb treatment	Common salt, dubo (*Cynodon dactylon*) leaves, and fresh turmeric (*Curcuma longa*) are mixed with lemon (*Citrus aurantifolia*) juice. This mixture is used as an ointment and applied on dislocated limbs or sprains and bandaged, and fresh cow dung is applied every day.	This method helps to reduce swelling and remove blood clots.	This method is still used for sprains but not for broken limbs.	Decreasing
3	Use of Silphode for constipation	Adults chew a small piece about 1–2 cm long (1–2 gram) of Silphode and for children mix 0.5 grams of silphode with milk or water and feed the mixture twice or thrice a day.	It can be used for constipation, abdominal pain and diarrhea.	No change	Decreasing due to increased use of medical treatments.
4	Use of Tite (*Swertia chirayita*) for cold, cough, fever, high blood pressure*	During the month of Kartik (October-November), whole plants of Tite are collected, dried and stored safely. Tite is boiled in hot water or soaked in cold water overnight and fed to patients suffering from colds, flu, fever and high blood pressure. In case of young children, Tite is cooked in water until the liquid is thick. It is then applied on children's forehead, chest and neck to get rid of cold, flu and fever.	Very useful for cold, flu and fever. Helps to reduce high blood pressure.	No change	It is used for general treatment but in case of prolonged sickness, people prefer modern medicines.
5	Various use of holy basil (as spices, tea, toothache, ears pain and gastric)	Dried Basil (*Ocimum sanctum*) leaves are boiled with tea leaves or used as a spice. Green leaves of Basil are ground and the juice is used to cure toothache or ear pain. The leaves are boiled in water and given to gastritis patients.	It also works as an antibiotic. It relieves gastritis.	No change	Similar
6	Use of Satuwa (*Paris polyphylla*) for headache and stomachache	Dried rhizome powder is boiled in water, Satuwa is mixed with water and put on the child's navel to get rid of abdominal pain and constipation.	Local treatment for abdominal pain, constipation problems and treatment for pain in the limbs.	No change	Since it is hard to find Satuwa in the forest, the use has decreased.
7	Use of Lunde / Liudo (*Amaranthus viridis*) improves eyesight	Green Lunde can be cooked and eaten as a vegetable.	Use of Lunde as a vegetable helps control night blindness and also increases blood cell count.	No change	Use has remained the same
8	Silajit (*mineral pitch*) for injury wound and stomachache	Silajit is mixed with water and applied on external wounds. About a teaspoonful of Silajit is mixed with 1 glass of milk to relieve stomachache.	It heals wounds, stomach pain and joint pain. Silajit mixed with milk helps to clean the stomach and acts as a blood purifier.	No change	Since it is hard to find Silajit in the forest, the use has decreased.

S. No.	Name	Description	Benefits	Modernization and changes	Current trend
9	Treatment of various diseases with Timur (*Zanthoxylum armatum*)	Timur is used to cure toothache, gastritis, typhoid and flu. For toothache, put a pinch (less than 0.5 gram) of Timur powder in a thin cloth and place it where it hurts. For gastritis, eat 0.5 teaspoonful of Timur powder mixed with equal quantity of black salt on an empty stomach. For cough and typhoid, mix it with water and drink it.	It is beneficial for toothache, typhoid, and cough relief. When mixed with vegetables and pickles, it has health benefits.	People have started cultivating it. The market demand is also good.	Due to increased market demand and home use, its cultivation is increasing, hence increasing.
10	Dalchini and Tejpat (*Cinnamomum tamala*) as spices.	Cinnamon leaves and bark are used as a flavouring agent in pulses, vegetables, tea and meat.	It is used to increase the blood cell count, prevent cold and add flavour to food.	As it is difficult to find in the forest, people have started cultivating it because of the high market demand.	Increasing due to increased market demand and home use
11	Kurilo (*Asparagus* species) and Satuwa to increase cattle/buffalo milk production	About 5 to 10 pieces of Kurilo tuberous root and Satuwa root are fed once a day to the nursing livestock. It is fed for only 11 to 25 days after delivery. On the 11th day, livestock are made to smell the smoke of burning Kurilo, Titepati and Dhuto (paddy husks).	The roots of Kurilo and Titepati are fed to the livestock, as it helps increase milk production and prevents diseases.	Since it is difficult to find in the forest, people have started cultivating it.	Similar
12	Titepati as organic pesticides	Titepati is placed near the food storage area to prevent pest infestation. Titepati, Surti (*Nicotiana tabacum*), Asuro (*Justicia adhatoda*) and cow urine are mixed together and stored for a few months. The liquid is used as a pesticide.	Used to prevent pest infestation when storing crops. Used to make organic pesticides, and for livestock blood purification.	No change	Modernization has diminished its use.
13	Use of Panchaaule (*Dactylorhiza hatagirea*) as medicine	Mix ground Panchaaule with a glass of milk or hot water and feed it to the lactating mother twice a day.	It helps increase milk in nursing mothers. It helps keep babies healthy and disease free. It is believed to prevent and control even cancer.	No change	Its practise is decreasing because of the unavailability of the plant species.
14	Jimbu (*Allium hypsistum*) for increasing food taste	Dried leaves are used as taste enhancer. It is fried in oil and mixed in curry or pulses.	It helps to purify blood and improves the taste of food.	Raw leaves were used in the past; however dry leaves are used now.	Increased use
15	Allo (*Girardinia diversifolia*) as vegetables and medicine	Allo is plucked during the winter season; the leaves are ground and cooked and fed to livestock. The leaves are dried and powered, then boiled in water and eaten.	It provides vitamins and nutrition. It is also used as medicine for gastritis. It is nutritious for cows and buffaloes and increases milk production.	No change	Similar

S. No.	Name	Description	Benefits	Modernization and changes	Current trend
16	Koirala (*Bauhnia variegata*) as food and medicine	Koirala flowers during winter. The flowers are used to make pickle. It is also used as animal feed.	It is used as Ayurvedic medicine for dysentery treatment. It is used as a vegetable and pickled. It is also fed to cows to increase milk production.	No change	Similar
17	Rittha (*Sapindus mukorossi*) as cleanser	Rittha are dried and made into powder and stored. It is used to wash clothes, hair and livestock.	Used to wash hair, clean animals and used as chemical free cleanser.	It is grown because of the market demand	Due to the availability of soap and shampoo, the practice is declining.
18	Amala (*Phyllanthus emblica*) as a source of Vitamin C	Amala are plucked, seeds are removed, mixed with spices and oil and then dried in sun for a few days. It is later consumed alone or as pickle.	Amala are pickled and eaten throughout the year. It is a good source of Vitamin C.	It is grown because of the high market demand	Similar
19	Mushroom as a source of food	Selected wild mushrooms grown during the rainy season are eaten. Once identified as edible, it is picked, cleaned and cooked.	Wild mushrooms grow naturally and are delicious.	Only some people used to eat them before; now most people are familiar with it and eat it.	Increasing
20	Use of Ghiu kumari (*Aloe vera*) for home remedy	Jelly obtained from the leaf is used to treat cuts and burns. It is also eaten by people suffering from high blood pressure and gastritis.	It reduces pain from cuts and burns. It also cures blood pressure and stomach related diseases.	No change	Its use is widespread because of its publicity through different media.
21	Pudina (*Mentha spicata*) use as a spice	Use of Pudina to make a variety of pickles, juice, etc. It is also used as a taste enhancer.	It helps to cool our body and to cure gastritis.	No change	Similar
22	Use of tobacco (*Nicotiana tabacum*) to kill pest and bacteria	Tobacco juice mixed with water is used to get rid of lice and flea in livestock. This is also used as pesticide in vegetable gardens. The mix of sugarcane juice and dried tobacco leaves is used to smoke as hookah.	Kills lice and flea in livestock. Repels insects and pests in vegetables.	No change	Decreasing because of its unavailability and the increasing availability of chemical pesticides
23	Akasabelo (*Cuscuta reflexa*) to cure Jaundice	Drink half a spoon of Akasabelo juice mixed with water for one month to cure jaundice.	It is good for controlling jaundice, high blood pressure and abdominal pain	No change	Increasing use by jaundice patients

S. No.	Name	Description	Benefits	Modernization and changes	Current trend
24	Bedulo/Beru (*Ficus sarmentosa*) as vegetable	Collected beru grain are ground in mortar and pestle and mixed with flour to make flat breads or used in vegetable curry.	Used as a vegetable during shortage of food.	No change	Decreasing as the availability of other vegetables increased
25	Use of Nirmasi (*Delphinium denudatum*) as antidote	Rhizome of Nirmasi are mixed with water to make a paste and used for detoxification. Likewise, rhizome is used to treat 'amalapitta' (acidity), fever, ulcers and cough. Rhizome paste is also used for cuts, wounds and boils.	Mainly used for detoxifying poison		Replaced by modern medicines
26	Use of moss to enhance the flavor	Moss is collected from the forest and dried. It can then be used as a spice in pickle and vegetable curry.	It adds flavour to pickles and vegetables.		Moss has been substituted by other spices.
27	Use of Gubo / Bucci (*Gnaphalium and Anaphalis* species) and pine resins to light a fire.	Dried leaves of Gubo/Bucci flower are collected and kept wrapped in cloth until it's time to use them. Stone and iron are used to make sparks to start a fire using Bucci flower dust and pine resin.	Used to start a fire.		This has completely disappeared.
28	Use of Pyauli (*Reinwardtia indica*) for rashes	Paste of Pyauli leaves is applied on rashes	Helps cure rashes		This has completely disappeared.
29	Use of Siltimur (*Lindera neesiana*) for stomach pain and gastritis.	Siltimur are used as spices. People drink the mixture of Siltimur powder and water to relieve abdominal pain and gastritis.	Helps relieve stomach pain and gastritis.	No change	Increasing use
30	Kurjo /Titepati for sinusitis and nose bleeding	Whole plants or leaves of Titepati (*Artemisia* species) are ground and two drops of the juice are put in nostrils.	Helps control sinusitis, nausea, stomach problems and nose bleeding.		Modern medicine has replaced the practice.
31	Bel (*Aegle marmelos*) for pneumonia, blood dysentery	Ripe & unripe fruits are collected and ground and the dissolved in water. The mixture is taken twice or thrice daily.	Bel helps control pneumonia, blood dysentery, cholera, nausea, and convulsion	No change	Decreasing use as the availability of Bel is decreasing.
32	Use of leather and Nigalo (*Drepanostachyum falcatum*) in basket making	Leather is used to make the base of the doko (basket) to make it strong.	Strengthens the basket	Leather has been replaced by plastic	Decreasing

Category 3 – Traditional knowledge related to genetic resource conservation

S. No.	Name	Description	Benefits	Modernization and changes	Current trend
1	Cucumber seeds preparation and storage	Cucumber fully matures during September-October. When the cucumber turns yellow, the inner flesh of the cucumber and seeds are taken out and mixed with rice husks or wood mulch. It is kept on door/window frames where there is plenty of sunlight. The rice husks/wood mulch help absorb seed moisture and also protect the seeds from birds and insects.	Wood mulch helps the seeds absorb moisture and prevents fungus build up. Sun-dried seeds are of better quality.	Cucumber seeds are separated and dried in a cloth.	It is declining due to the unavailability of rice husks or wooden mulch, and the availability of improved seeds in the market.
2	Use of ash and *Bojo/Timur* for wheat seed storage	Farmers collect dry dung from the forest and burn it. The ash produced thus is mixed with Bojo (*Acorus calamus*) rhizomes and/or Timur (*Zanthoxylum armatum*) fruit and then mixed thoroughly with wheat seeds. The mixture is stored at home in a tight container. Seeds are stored in May-June and used in October – November. Here, the ash absorbs seed moisture, and the smell of the plant species repels/kills storage pests.	The outbreak of seed borne diseases is minimized, and seeds are healthier as ash helps the seeds absorb moisture and kills insects. The smell of the mixture is not bearable to the insects; therefore, insect infestation and diseases are prevented. This helps improve the quality of seeds.	Wood ash has replaced cow dung. Instead of Bojo/Timur, chilli is mixed these days. People have also started using chemical fumigant tablets such as Celphos.	This practice has declined due to the availability of chemical fumigant.
3	Choto (Radish) seed production in a traditional way	Farmers select one or two healthy Chotos (*Raphanus sativus*) in the field. They uproot the selected plant before it starts flowering (November/December). They cut the root tips from the base and leave behind one-third of the crown after trimming off the top. A mixture of soil and dung is placed around the Choto tuber. Finally, farmers transplant the tuber in fertile soil near their house and provide water for at least 3–4 days. Within 4 months, the pods become light yellow, and they are harvested.	Farmers believe that seed produced from this technique is highly potent, productive, bigger in size, and pest free.	Due to time constraints, uprooting is seldom practised; only leaves are cut and left at the original field.	Decreasing trend because of labour shortage and the availability of improved seeds in the local market.
4	Drying garlic bulb over the oven or fire.	Twenty to twenty-five in a bunch of garlic bulbs are hung over the fireplace in the kitchen to reduce its moisture and maintain its fertility.	This dries the moisture in the garlic and stops it from germinating and from getting spoilt during the rainy season.	Due to increase in the production of garlic, it is not possible to dry them in the kitchen, and therefore people sun-dry them instead.	It is decreasing.

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ISBN 978 92 9115 491 3