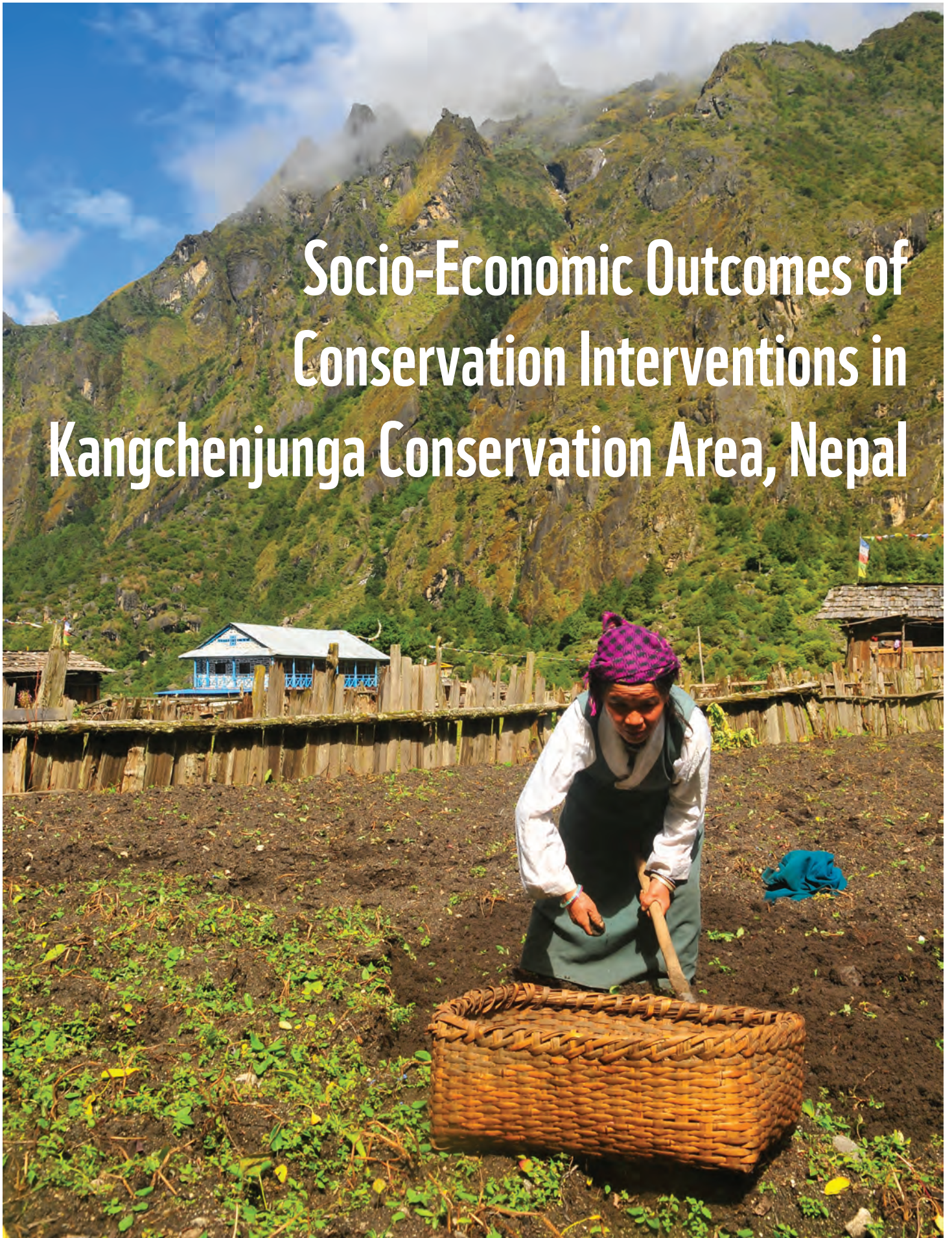


Socio-Economic Outcomes of Conservation Interventions in Kangchenjunga Conservation Area, Nepal



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Socio-Economic Outcomes of Conservation Interventions in Kangchenjunga Conservation Area, Nepal

8 YEARS OF USAID SUPPORT

WWF Nepal 2017



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Authors: Deepak Upadhya, Ananta Ram Bhandari, Tara Prasad Gnyawali, Dhan Prasad Rai and Sheren Shrestha.

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Foreword

Declared “A Gift to the Earth” from the Government of Nepal in 1997, the Kangchenjunga Conservation Area (KCA) in Eastern Nepal covers only 2035 km² of Nepal. It is home to a rich assemblage of biodiversity - including the elusive snow leopard. KCA hosts the world’s third highest mountain, and forms the headwaters of rivers that provide water for millions of people residing downstream.

Yet, despite the ecosystem services it offers to mankind, KCA is highly vulnerable. Increasing temperatures, rapidly melting glaciers, altering river flows and seasonal availability of water means that biodiversity is threatened, subsequently leading to cascading negative effects on people’s livelihoods. Meanwhile, high levels of poverty and vulnerability to climate change have further created conditions that exacerbate human wildlife conflict and biodiversity loss.

Realizing the linkages between climate change, biodiversity and poverty, communities in the KCA region have been at the core of conservation efforts over the last two decades. There has been a relatively high degree of conservation success in the region with over 72,000 hectares of forests protected, increasing populations of flagship species such as the snow leopard, and 127 community institutions leading conservation into the future. However, while conservation outcomes have been rigorously measured, a systematic study of the socio-economic outcomes of WWF Nepal’s conservation interventions among communities is yet to be conducted.

Such studies are imperative in determining the actual impact of conservation interventions, identifying in real numbers the successes and gaps in conservation work. Quantifiable outcomes are therefore essential to bring about real change. This study aims to pave the way for data-driven decision-making, to better help communities; the guardians of our biodiversity.



.....
Dr. Ghana Shyam Gurung
Senior Conservation Program Director
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While ongoing conservation efforts in KCA are being led by local communities, there have been many supporters and partners that have helped these communities achieve their goals. WWF Nepal would like to acknowledge the support of CARE-Nepal, Samriddha Pahad, ICIMOD, and Kadoorie Foundation, DFID (WWF-UK/PIPAL), WWF-US, MacArthur Foundation, WWF-UK (GGPH), UK Embassy in Nepal, Zurick University and other organizations, for the success of conservation efforts in KCA.

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Acronyms and Abbreviations

AHM Project	Conservation and Adaptation in Asia High Mountain Landscapes and Communities Project
CAUC	Conservation Area User Committee
CBAPU	Community Based Anti-Poaching Unit
CBO	Community Based Organization
CF	Community Forest
CFUG	Community Forest User Group
DADO	District Agriculture Development Office
DLSO	District Livestock Service Office
DNPWC	Department of National Parks and Wildlife Conservation
FGD	Focus Group Discussion
GoN	Government of Nepal
HWC	Human Wildlife Conflict
ICS	Improved Cook Stoves
KCA	Kangchenjunga Conservation Area
KCAMC	Kangchenjunga Conservation Area Management Council
KCAP	Kangchenjunga Conservation Area Project
KG	Kilogram
LIS	Livestock Insurance Scheme
MGs	Mother Groups
MHP	Micro Hydro-power
NPR	Nepalese Rupee
NTFP	Non-Timber Forest Product
SCAPES	Sustainable Conservation Approaches in Priority Ecosystems
SD	Standard Deviation
SHL	Sacred Himalayan Landscape
SPSS	Statistical Package for the Social Sciences
SLCC	Snow Leopard Conservation Committee
USAID	United States Agency for International Development
VDCs	Village Development Committees
WWF	World Wildlife Fund

Executive Summary

The Kangchenjunga Conservation Area (KCA) in Eastern Nepal is home to one of Nepal's unique and varied biodiversity, including flagship species such as the snow leopard. The glaciers, ice and snow of these mountains are also the headwaters of the important Tamor, Ghunsa and Simbua rivers and 188 glacial lakes, that provide water to critical ecosystems sustaining the livelihood of millions of people downstream. WWF Nepal has been a critical conservation partner of the government in identifying and supporting the vast biodiversity of KCA and subsequently helping building community capacity to manage it. This has culminated in KCA becoming the first large protected area in the world to be managed wholly by its communities.

With an integrated conservation and development approach, community empowerment has always been at the heart of the 20 years of conservation interventions in KCA that has resulted in 72,000 hectares of thriving forests managed by the community, increased populations of flagship species such as the snow leopard (33% growth, 2009 - 2013), increased capacity of locals with 36 citizen scientists trained and 12 teams of wildlife guardians who monitor and protect wildlife, and 127 community institutions leading conservation into the future. There have also been various interventions aimed at supporting climate adaptation and community livelihoods, with all 1060 households engaged in adaptation pilots in some way.

This study aims to quantify the economic and social benefits to KCA communities resulting from WWF Nepal's interventions from 2009 - 2017 through Kangchenjunga Conservation Area Project (KCAP), a joint initiatives of the Department of National Parks and Wildlife Conservation and WWF-Nepal. Specific focus has been placed on the results of USAID funded projects: the "Sustainable Conservation Approaches in Priority Ecosystems (SCAPES)" and "Conservation and Adaptation in Asia's High Mountain Landscapes and Communities (AHM)" projects. The study also documents the status of other important conservation interventions such as the livestock insurance fund introduced to mitigate human-wildlife conflict, the girls' scholarship program, and an interesting initiative to replace wooden prayer flag poles with metal ones to save trees.

The resulting picture is an encouraging one, showing that all households in KCA have received some benefit from WWF Nepal's interventions. The study also indicates that WWF Nepal's support has brought about notable changes in community livelihoods, the most successful of which is adaptive irrigation, which has benefited 28% of KCA households, increasing agriculture revenue in KCA by NPR 41 million rupees (USD 393,380) annually.

In addition, greenhouse agriculture has been a highly successful adaptation strategy that has increased agricultural production and improved incomes by more than NPR 1.8 million (USD 17,432) annually. Improved metal cook stoves have also reduced pressures on the environment, saving more than 280 truckloads of firewood per year, and an estimated 50% of the population of KCA have benefited from improved pasture management activities, including trail improvements, bridge construction, and improved water supply that has increased the use of disused pastures, and improved pasture health.

The quantification of benefits to KCA households through this study is expected to determine the successes and gaps in interventions, in order to increase support for proven interventions if required, and pilot new data-driven approaches that will improve the livelihoods of the communities that have been tirelessly working on behalf of the global community as the vanguards of KCA's incredible natural resources.





1. Background - Kangchenjunga Conservation Area

The Kangchenjunga Conservation Area (KCA) in Eastern Nepal comprises of only 1.38% of Nepal's geography. This small terrain however, is home to some of the world's most unique and varied biodiversity, and includes flagship species such as the snow leopard. The glaciers, ice and snow of these mountains are also the headwaters of the important Tamor, Ghunsa and Simbua rivers and 188 glacial lakes, that provide water to critical ecosystems sustaining the livelihood of millions of people downstream. The Tamor river sub-basin is one of the most ecologically and economically viable sub-basins of the larger Koshi basin. Meanwhile Ghunsa and Simbua rivers are two of the important tributaries among more than 60 rivers and tributaries of the Tamor river sub-basin.

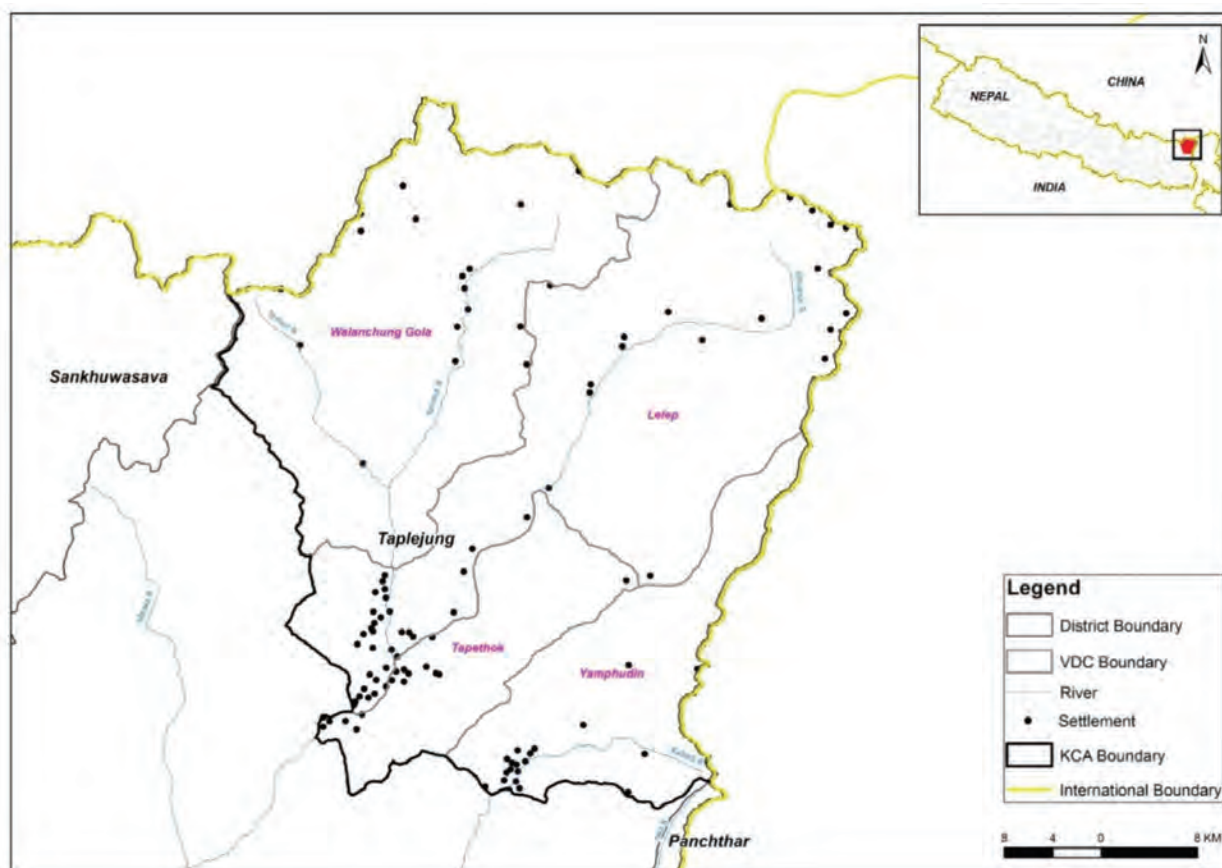
Because of its rich biodiversity, culture and water resources, KCA was declared "A Gift to the Earth" by the Government of Nepal (GoN) to the global community in April 1997. After this declaration, KCA has received greater priority and attention than ever before. In recognition of its beautiful mountain landscapes, rich biodiversity and culture, as well as opportunities for tri-nation transboundary conservation initiatives, the GoN conferred it with a protected area status in July 1997.

1.1. Site Overview

KCA stretches across four villages in the Taplejung district of Nepal i.e. Walanchung Gola, Lelep, Yamphudin and Tapethok, and is located right in the lap of Mount Kangchenjunga; the third highest mountain in the world. Covering an area of 2035 km², KCA is situated between 27°28'48" to 27°56'24"N and 87°39'00" to 88°12'00"E, with an altitudinal variation of 1200 masl to 8586 masl. KCA shares its boundaries with the Tibetan part of China on the North, India on the East and other parts of Nepal on the South and West. The climate is extremely variable with sub-tropical climate prevailing in the foothills and sub alpine to alpine conditions in the high Himalayas.

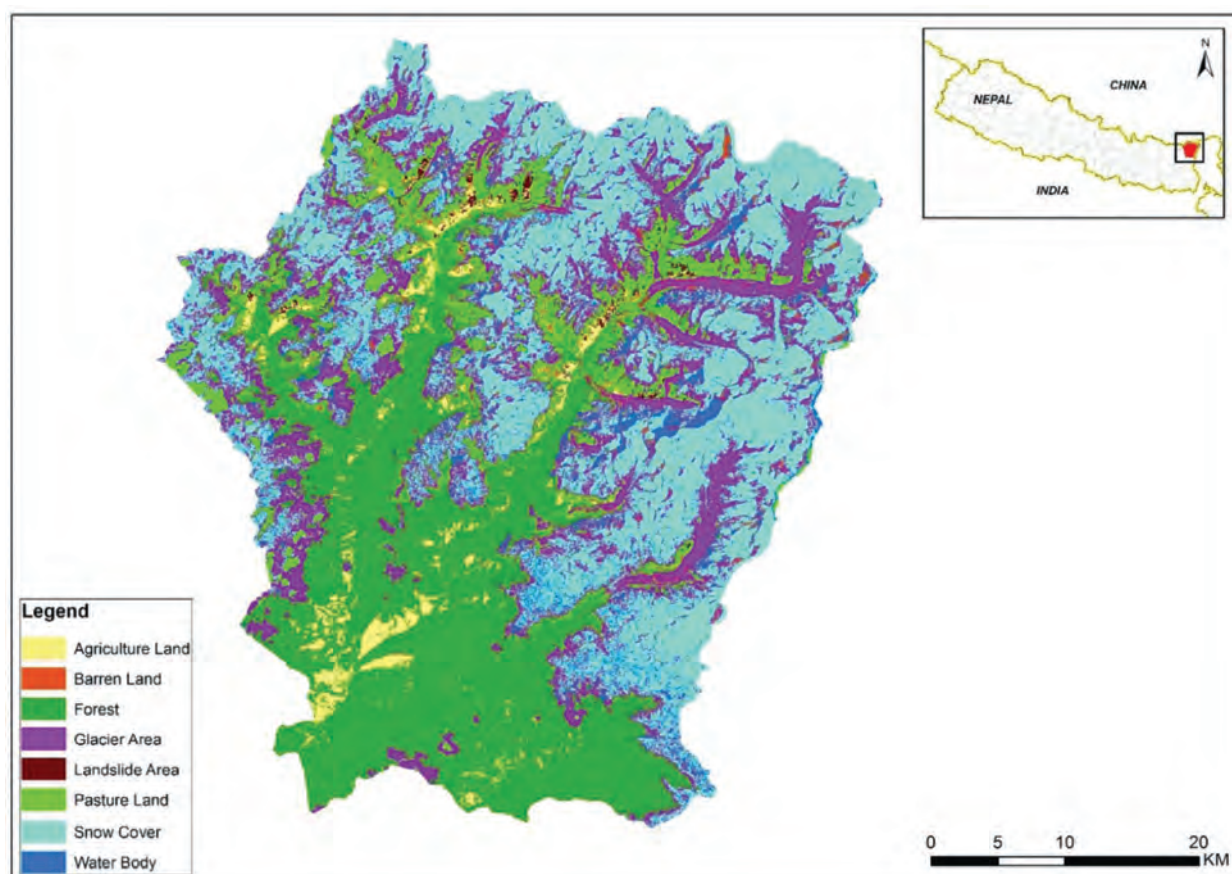
KCA is also home to 253 birds, 62 mammals, 6 herpeto fauna, 5 fish and 844 types of plants, and constitutes 30% of birds, 35% of mammals and 54% of endemic flowering plants nationwide. The population in this region is dominated by Limbu, Rai and Sherpa ethnic groups, while agriculture is the primary source of livelihood for 62% of households in the regions.

Figure 1: Demographic map of KCA villages



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Figure 2: Physiographic map of KCA



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1.2. WWF Nepal Engagement

WWF Nepal's engagement in KCA stems back to 1998, when Kangchenjunga Conservation Area Project (KCAP) was established following the identification of KCA as a priority landscape under WWF's 200 Global Ecoregions. KCAP was launched with the aim of conserving globally threatened wildlife species such as the snow leopard combined with support for local development activities such as promotion of health services, informal education, and income generating activities.

With community leadership identified as the most sustainable approach for conservation of remote landscapes and its biodiversity, KCAP was developed under the Integrated Conservation and Development Program approach aiming to build community capacity and take on the role of stewards of their own environment.

Since its inception, WWF Nepal has invested over NPR 490 million (USD 4.75 million) in KCA from 1998 - 2017, culminating in the handover of the protected area to local communities in 2006. Today, KCA is one of the largest protected areas wholly managed by its communities. While KCAP successfully built capacities of local community groups and facilitated the development of an enabling environment to manage KCA in a transparent and accountable manner, existing community capacities remained insufficient to deal with newer challenges such as climate change. Increasing temperatures and rapidly melting glaciers have altered river flows, resulting in seasonal availability of water, meanwhile KCA's high geological variability, steep slopes, and shallow soils, makes the region highly vulnerable to climate change impacts.

To help KCA communities adapt to these effects, the SCAPES Program was launched in 2009, with USAID support. Building on the lessons learned from USAID supported programs in conservation and development, the program introduced innovative climate change adaptation approaches with a strong trans boundary component. This work was subsequently taken forward by the AHM project; launched in 2012, with the aim of developing an integrated climate-smart approach to conservation and adaptation. Under the AHM project, much of the climate adaptation work started by SCAPES was continued and strengthened, meanwhile also focusing on introducing science based technology for snow leopard conservation; including satellite collaring, species research and community based monitoring.

AHM has also supported scaling up of the lessons of these conservation and adaptation interventions, notably by supporting the first climate-smart snow leopard landscape management plan, titled Snow Leopard and Ecosystem Management Plan - Eastern Himalaya Landscape, which has now, through the Global Snow Leopard and Ecosystem Protection Program, become a model for climate-smart landscape planning for all twelve snow leopard range countries.

A total of NPR 107.90 million (USD 1.04 million) has been invested in KCA during the duration of these projects, NPR 49.77 million (USD 0.48 million) through SCAPES, and NPR 58.03 million (USD 0.56 million) through AHM. This innovative partnership has seeded the opportunity for WWF Nepal teams on the ground as well as communities to build expertise in research and apply adaptive management approaches to ensure sustainability.

Community development remains at the core of these programs which are based on the premise that biodiversity contributes a range of goods and services; from food and livelihood security to family nutrition, climate change adaptation and mitigation, ecological resilience, and environmental sustainability, mainly in diversity-rich but economically deprived regions (*Altieri, 1999; Jarvis et al., 2007; UNEP, 2008; FAO, 2011; Mijatovic et al., 2013; Vanek and Drink Water, 2013; Zimmerer, 2013; Upadhyay et al., 2016*) such as the KCA. This linkage between biodiversity and people's socio-economic status ensures that sound biodiversity conservation initiatives results not only in biodiversity conservation but also in improved lives for people (*Gurung, 2006*). Subsequently, improvement in the socio-economic dimension also leads to the promotion of biodiversity conservation and reduces over exploitation and pressures on biodiversity including forest and wildlife (*Gurung, 2006; Gotame, 2008 and Rai et al., 2008*).

1.3. Objective and Scope of Study

This study is aimed at systematically assessing the socio-economic benefits brought about by WWF Nepal's conservation and adaptation interventions in KCA over the years. Special focus has been placed on the impact of USAID funded programs.

This study is also aimed at determining gaps in WWF Nepal's conservation interventions in KCA with the specific objective of examining socio-economic changes brought about by the USAID funded SCAPES and AHM project initiatives, which collectively operated for a period of eight years; from 2009-2017.

This study, also considers other key WWF Nepal initiatives such as, community strengthening, livestock insurance schemes, and alternative energy. While basic data has been collected on these important interventions, this study does not systematically analyze socio-economic impacts of these interventions.

2. Methodology

This study methodology was developed based on a preliminary literature review and consultative meetings with key stakeholders and experts at WWF Nepal; wherein data gaps were identified and subsequent checklists and questionnaires prepared for the field level surveys.

In the field, a first-level household survey was conducted to get an overview of beneficiary households. This was followed by a detailed second-level household survey followed by Focus Group Discussions (FGDs) to triangulate information collected through the surveys, and generate qualitative information. The data generated from these surveys have been used to quantify the substantive socio-economic outcomes of WWF Nepal's conservation and adaptation interventions.

2.1. Literature Review

Relevant secondary literature was reviewed to understand how conservation interventions contribute to socio-economic dimensions. Technical as well as monitoring and evaluation reports under the AHM project, including the close out report for the SCAPES project were reviewed to develop an inventory of interventions conducted at KCA with USAID funding support. The KCAP project retrospective report was also reviewed to prepare the list of other key activities conducted by WWF Nepal in the KCA region.

2.2. First-level Household Survey

Local enumerators were mobilized to carry out a door-to-door survey across four Village Development Committees (VDCs) in KCA to determine the number of households benefiting from diverse support provided by WWF Nepal. 1060 households were covered between 15 - 19 April 2017, identifying the individual benefits received from various KCAMC interventions supported by WWF Nepal projects, since 1998.

2.3. Second-level Household Survey

Based on the information generated in the first-level household survey, a list of total households and sampling frame (see Box 1) was prepared for the second-level household survey, to evaluate detailed socio-economic outcomes of the conservation interventions implemented by KCAMC with support from WWF Nepal projects.

Box 1: Sample size determination for second-level household survey

The national population census of 2011 indicated a total of 1060 households in four VDCs – Lelep, Walangchung Gola, Yamphudin, and Tapethok lying inside KCA. To study the effect of conservation initiatives, households were selected from each of the four VDCs using widely accepted sample size calculation formula at a confidence level of 90% with a marginal error of $\pm 5\%$ and response distribution of 50%. Altogether, a sample of 230 households from four VDCs (Lelep-102, Tapethok-76, Walangchung Gola-13 and Yamphudin-39) was selected for this study. This study uses the Krejcie and Morgan (1970) sample size calculation formula.

Sample size calculation formula

$$n = \frac{NZ^2P(1-P)}{Nd^2 + Z^2 P(1-P)}$$

Where,

n = Total sample size

N = Total number of households (sampling units)

d = Maximum acceptable error (Value used in this case is 0.05)

Z = Z-value and

P = Probability (Value used is 0.5 to give maximum sample size)

Detailed questionnaires were used to assess the benefits received by the sample 230 households. The survey was administered through in-person interviews, by local enumerators with close monitoring by WWF Nepal staff from 20 April - 20 May 2017.

2.4. Focus Group Discussions

Amidst the second-level surveys, five FGDs were hosted in four VDCs (two in Lelep due to its greater geographical coverage). Both female and male representatives (Appendix 2: List of participants in FGDs across 5 villages), especially key stakeholders in KCAMC activities, as well as beneficiaries from the respective communities were invited to participate in the discussions. A checklist in Nepali was used to systematically guide discussions and document information attained during these FGDs. The FGDs were instrumental in identifying and capturing a broad overview of key interventions in the community and their effect on people's livelihood.



Focus group discussion at Ghunsa. © KCAMC/Susan Rai.



Household survey being conducted by a trained enumerator. © Deepak Upadhyaya/WWF Nepal

2.5. Data Analysis Tools and Techniques

Following the two levels of household surveys and FGDs, data analysis was done using SPSS 16 package, focusing on descriptive statistics such as frequency, mean, percentage, cross tabulation and range. Besides these, multiple-response analysis and paired t-test were also performed to look for important trends, patterns and correlations.

3. Findings

3.1. Sources of livelihood

According to literature reviews and consultative meetings the main sources of livelihoods in KCA has been identified as agriculture, animal husbandry, business, tourism, remittance, wage labor, government employment, skilled labor and sale and trade of non-timber forest products. The sources of livelihood was determined during the second-level household survey of 230 sample households using detailed questionnaire interviews to determine contributions from different sources, currently as well as in the past (up to 10 years ago).

Agriculture is the dominant source of income with over 99% households of study sites engaged in agriculture; with 61.73% of households identifying it as the primary source of livelihood, despite agricultural land being limited to 1.6% (WWF, 2016) of KCA's land area. Agriculture in KCA is mostly traditional and seasonal. In many higher-altitude villages farming is only possible in summer, and is limited to a few crops like potatoes and green vegetables. Livestock rearing is a critical livelihood option for higher altitudes, as well as an option for income diversification in lower villages. Livestock rearing engages 92.17% KCA households in total, with 5.66% relying on it as a primary source. Livestock is an important source of income, as well as milk and milk products, meat, transportation, wool, and manure. Other sources of livelihood are wage labor (41% households), business (35.65% households), government employment (20% households), NTFPs and MAPS (18% households), remittance (10% households) and tourism (8.3% households) respectively at KCA.

This study also analyzes the changes in agriculture farming and livestock rearing in KCA over the last ten years. Results indicate that agriculture is still the main source of livelihood in KCA with very minimal changes over the last 10 years (Table 1).

Table 1: Major sources of livelihood

Livelihood source	Percentage of households engaged		Primary source of livelihood (% households)		Secondary source of livelihood (% households)	
	10 years before	2017	10 years before	2017	10 years before	2017
Agriculture	97.82%	99.13%	61.73%	61.73%	21.30%	20%
Livestock	93.91%	92.17%	13.43%	5.66%	45.83%	32.07%

In comparing the major sources of livelihood to that 10 years ago, results indicate that 1.85% of herding households have left animal husbandry. Similarly, livestock rearing was the primary and secondary source of livelihood for 59.26% KCA households, 10 years ago. At present, this has dropped to 37.73% households. Currently, according to locals a lower number of households are engaged in herding as well as livestock rearing, due to takeover of pasture lands for community forestry or cardamom farming. This has manifold implications on KCA livelihood: as it decreases livestock manure; a major source of crop nutrient in the KCA, which could lower crop productivity resulting in decreased food security and income. Meanwhile, animal husbandry is also the main source of protein for KCA households. Decreased animal husbandry could therefore lead to decreased availability of protein among people in the KCA region.



Agricultural farming at Ghunsa. © KCAMC / Dipesh Sharma

3.2. Key benefits from WWF Nepal supported projects

Results indicate that improved cook stoves, greenhouse agriculture, adaptive irrigation, fruit tree plantation, pasture management, nursery farming, provision of drinking water, bee-keeping, micro-hydro, cultivation of essential oil plants, replacement of metal poles for religious flags, saving and credit in women groups, girls scholarship program, CFUG and Snow Leopard Conservation Committee (SLCC) are the key interventions that have impacted livelihoods of KCA communities. The number of households benefiting from each of these activities are listed in Table 2. Encouragingly, results show that all households at KCA received and enjoyed at least one of the benefits, indicating 100% coverage.

Table 2: Households that benefited from KCAMC interventions supported by WWF Nepal as per the household surveys and focus group discussions

Program	Tapethok	Yamphudin	Lelep	Walanchung Gola	Total (No. of households)
Improved cookstove	103	65	139	53	360
Greenhouse	10	80	142	64	296
Irrigation	88	50	159	0	297
Fruit saplings	15	13	37	0	65
Pastureland Management	150	180	130	64	526
Seedlings production	0	40	50	0	90
*Drinking water	297	132	410	53	892
Bee-hives	0	15	0	0	6***
*Micro-Hydropower	292	149	70	58	569
Essential oil plants	0	Installed	47	0	47
Cultural iron flag pole	0	0	0	64	64
*Saving and credit in women groups	306	165	504	64	1039
Girls scholarship program (Numbers) by women groups	55	41	98	12	206
*Cooperatives	161	110	204	50	525
Community forest user group	470	200	833	66	1569**
SLCC	Not applicable	7	36	18	61
*Toilet (%)	100	100	100	82.81	98.96

* Indicates support from other organizations, in addition to WWF Nepal.

**Some of the households are associated with more than one CFUG.

***Households that were successful.

3.2.1. USAID funded interventions: SCAPES and AHM

3.2.1.1. Greenhouse farming

While agriculture is one of the main sources of livelihood in high altitude villages (3000 - 4200 masl), cold temperatures allow for farming only during summer. Moreover, farming is limited to a few crops such as potatoes or certain high-altitude green leafy vegetables, subsequently limiting the opportunities for high-altitude villages in KCA.

Green house support was therefore provided to support diversification of cropping patterns. A greenhouse controls factors such as temperature, humidity, application of water and ventilation, creating favorable conditions for growing crops. This support has helped KCA households to grow 'medium-thermal requirement plants' such as radish, cauliflower, tomatoes or chillies, in addition to traditional crops.

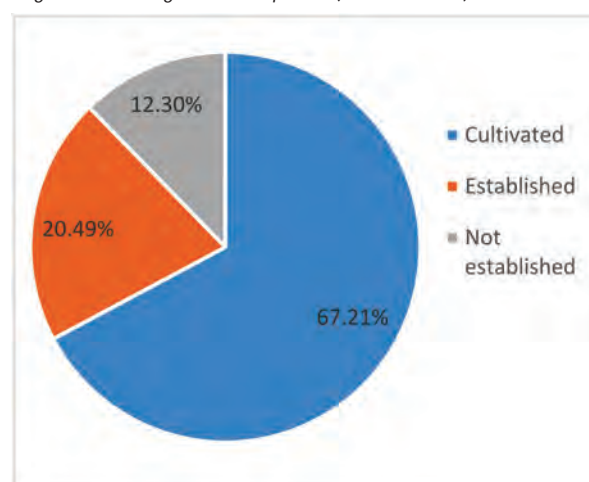


Greenhouse farming at Ghunsa. © WWF Nepal

KCAMC, with financial support of WWF Nepal has helped 296 households establish greenhouses to grow a wider range of vegetables, cash crops and spices between 2012 - 2016 (Table 3). The support included awareness generation as well as distribution of plastic sheets to be placed over a frame to create greenhouses. The transportation cost, local construction materials and labor for construction was covered by individual households.

Of the 230 households sampled in the current survey, 122 were found to have benefited from the greenhouse support (Table 3). Further analysis evaluating the effectiveness of the greenhouse support in enhancing socio-economic situations indicate that 82 households (67.21%) that received greenhouses are growing crops in them (Figure 3). Around 25 households (20.49%) were found to have recently established greenhouses, and were yet to cultivate, while a remaining 15 households (12.30%) used the plastic sheets for non-greenhouse purposes including covering firewood and NTFPs reasoning a lack of technical knowledge on greenhouse installation and use.

Figure 3: Use of greenhouse plastic (% households)



To compare the benefits, individual crop revenue for the 82 households was evaluated with and without greenhouse installation. According to 107 greenhouse farming households average size of greenhouse area is 2.5 aana~79.48 m².

Table 3: Distribution pattern and use of greenhouse plastic in sample households

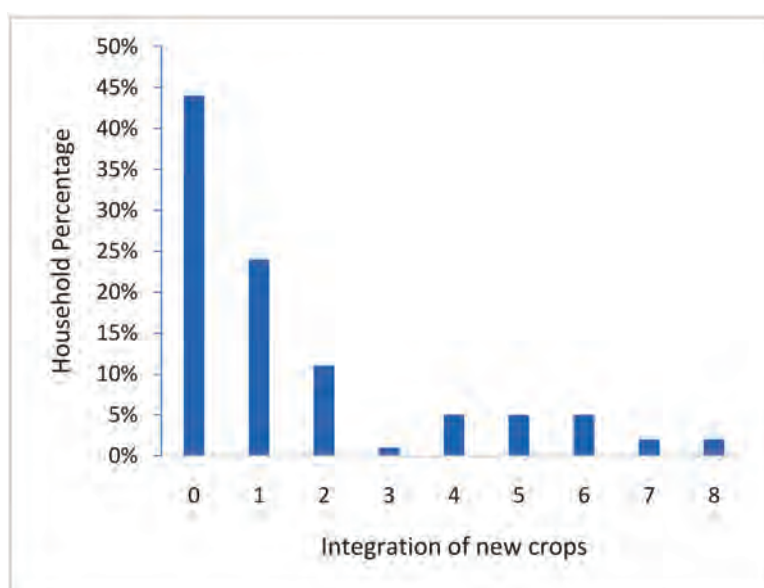
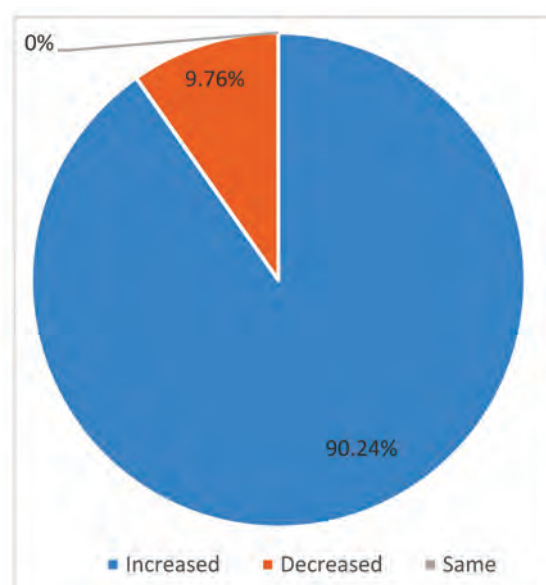
VDC name	Received year					Total	Use		
	2012	2013	2014	2015	2016		Cultivating	Established	Other use
Tapethok	0	0	4	4	2	10	1	0	9
Yamphudin	8	12	11	1	0	32	32	0	0
Lelep	8	17	6	7	29	67	36	25	6
Walanchung Gola	0	2	4	4	3	13	13	0	0
Total	16	31	25	16	34	122	82	25	15
Cultivating	16	30	20	7	9	82	82	0	0
Established	0	0	0	0	25	25	0	25	0
Other use	0	1	5	9	0	15	0	0	15

Among the 82 greenhouse farming households evaluated, most respondents (90.24%) had more successful crops inside greenhouses than outside, with 56% of the greenhouse farming households growing new or additional crops that were previously not possible to grow (Figure 4). Over 20% of household had added one new crop after the introduction of a greenhouse. Meanwhile an addition of up to eight new crops were recorded in 2% of the households.

About 9.76% of the 82 households reported poor crop growth in greenhouses, resulting from lack of know-how in setup and management of the greenhouse.

According to household surveys as well as FGD results greenhouses have made it possible to grow a wider variety of vegetables, increasing agro-biodiversity and earnings, reducing expenditure in purchasing vegetables and spices, and perceivably improving health of locals by diversifying diet through year.

Due to the lack of baseline information on production capacity before greenhouses were installed, the study relies on recall method to estimate production and value of crops grown on the same plot of land, outside and inside greenhouses. Similarly, greenhouse farming households grow different crops in greenhouses, so the value of crops grown inside and outside greenhouses were compared by converting them into the market value.

Figure 4: Household level agro-biodiversity change after greenhouse technology interventions*Figure 5: Change in total value of produced crops (% households) after greenhouse intervention*

The results show an increase in monetary value of crops produced inside the greenhouses, compared to a same size plot without a greenhouse, with 90.24% of households reporting an increase (Figure 5). The increase is due to increased cropping intensity (85.36% of households, Figure 7), shorter growing season inside greenhouses, change to higher value crops, (64.81%, Figure 6) and protection of crops from extreme and erratic weather changes such as a drop in temperatures or frost and heavy rainfall.

Figure 6: % Households shift from low to high value crops

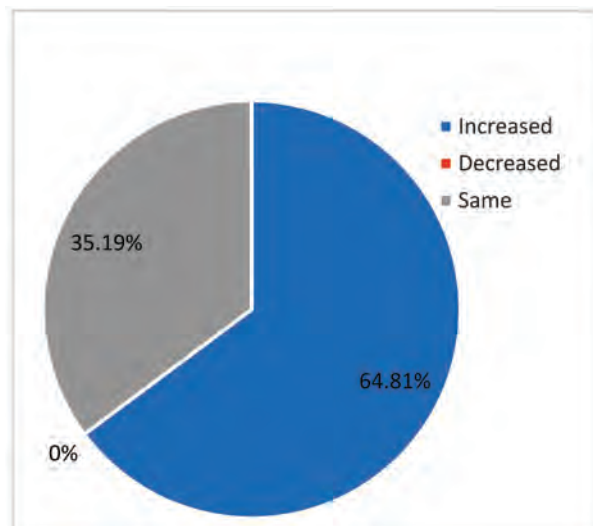
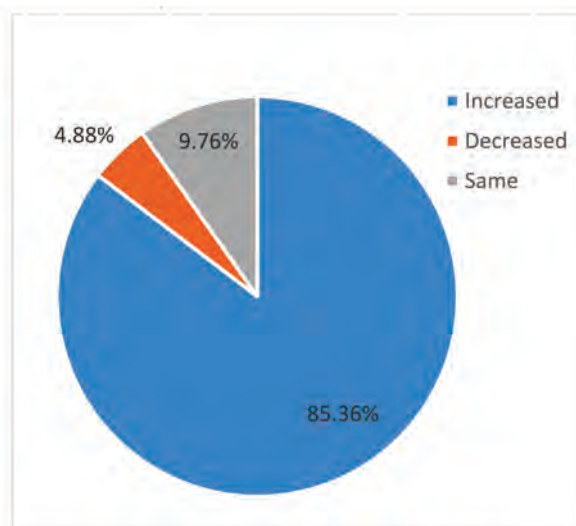


Figure 7: Change in cropping intensity (% of households)



The change in monetary value of crops produced before and after greenhouse technology was reinforced by statistical hypothesis testing. In this comparison, null hypothesis H0: there is no change in monetary value of crops produced with and without greenhouse technology and H1: There is significant change in monetary value of crops produced with and without greenhouse technology, were set and tested.

Table 4: Paired t-test for the difference in value of produced crops with and without greenhouse

Group	N	Mean (NPR) Average size of greenhouse - 2.5 aana~79.48 m ²	SD	99 % confidence interval of the difference		t	df	Sig. (2-tailed)
Without	82	7,158.9	5,918.94	Lower	Upper	7.28	81	0.000
With	82	16,348.11	13,105.08	5,861.91	12,516.91			
Difference		9,189.21						

Table 4 shows that value of crops produced with greenhouse technology was higher (mean NPR 16,348.11 and SD 13,105.08) than for those without greenhouse technology (mean NPR 7,158.9 and SD=7158.9). A t-test measure found the difference of NPR 9,189.21 (USD 89) to be significant, t (81), p<0.001. Thus, it can be inferred that the adoption of greenhouse technology increased annual earning of households by facilitating production of a wider variety of crops including those of greater commercial value within the same piece of land, rejecting the null-hypothesis. Analysis showed that there was an average increase of crop revenue by NPR 9,189.21 (USD 89) per year (per 2.5 aana~79.48 m²) each household with the use of greenhouse technology. This amounts to a 128.36 % increase in household income, after greenhouse installation. The study is 99% confident that the average annual revenue increase with greenhouse technology as compared to non-greenhouse technology is between NPR 5,861.91 (USD 57) to NPR 12,516.91 (USD 122) per household.

Extrapolating this data to the entire KCA, the study estimates success of greenhouse support in a total of 199 households. The total increase of crop revenue of these households is estimated to be NPR 1.82 million/year (USD 17,710).



Greenhouse demonstration for growing vegetables at high altitudes. © KCAMC

Issues and way forward

With installation of greenhouse technology, individual household earnings have more than doubled, by enabling productivity throughout the year and protecting crops from weather anomalies. This allowed for crop diversification, ensuring food security, greater earning, as well as improved health through larger scale implementation.

While greenhouse farming resulted in measurable gains for participating households, 18.29% of the greenhouse beneficiaries reported inadequate know-how of greenhouses, and were unable to gain the anticipated advantages. Households are also not fully equipped to handle problems in greenhouses, such as burning of crop leaf and stem and occurrence of disease and pests. These issues can be tackled by providing training on greenhouse establishment and farming so that households can fully benefit from their greenhouses. KCAMC could coordinate with the Agriculture Service Center and District Agriculture Development Office (DADO) to implement this kind of training.

3.2.1.2. Improved cook stoves

Around 989 households (93.25% of total households) in KCA are dependent on wood, livestock dung and other traditional fuels to meet cooking and heating needs (WWF, 2016). While essential to meet basic needs, unsustainable use has damaged local forests and other environmental resources, meanwhile resulting in indoor pollution which affects the respiratory health of people. Collecting firewood also requires locals to travel long distances, and is time consuming. WWF Nepal has been distributing different kinds of improved (mud and iron) cook stoves (ICS) in KCA since 1999 that consumes less firewood and reduces indoor air pollution. However, identifying greater efficiency and benefits of iron-built stoves, the project has been distributing these improved iron cook stoves since 2009.



Traditional Cook Stove. © WWF Nepal / Susheel Shrestha



Improved Cook Stove. © Deepak Upadhyaya / WWF Nepal

According to the first level household survey 724 households (68.3% of total households) used improved (iron, mud and gas) stoves while the remaining 31.7% used traditional stoves. The former included 360 households (or 33.96%) using improved iron stoves provided with WWF Nepal support.

During the second-level survey, 166 of the 230 sample households were found to use WWF Nepal supported improved iron cook stoves. Representatives of these 166 households were interviewed to quantify reduction in fuel used and time spent collecting firewood as compared to traditional stoves. Of these 166 households, 93.37% (or 158 households) reported regular use of the improved iron cook stoves. The remaining households did not use the improved iron cook stoves and dismantled them, citing risk of burns to young children; with plans to re-install the stoves after the children get older.

Results showed that without ICS, annual average firewood consumption stood at 131.61 bundles or 3,948.42 kg (with each bundle weighing an average of around 30 kg: FGD) per household, with standard deviation of 2091.87 (Table 5). This amounted to an estimated 623,850 kg for 158 households per year. After the intervention of installing improved iron cook stoves, firewood consumption reduced to 89.41 bundles or 2,682.15 kg/household/year, with standard deviation of 1,620.23.

Annual fuel wood consumption of 158 households reduced from 623,850 kg to 423,780 kg, saving over 200,000 kg of fuel wood extraction each year amounting to a 32% decrease in firewood consumption, at 1% significance level, equivalent to an average annual fuel wood consumption decline of 1,266.27 kg/household/year.

This average figure was extrapolated to the entire 337 households across KCA (as identified in the first-level household survey) that received improved iron cook stoves. Fuel wood extraction in KCA was therefore reduced by around 426,732.99 kg per year, through the improved iron cook stoves supported by WWF Nepal projects, reducing pressure on forests.

Table 5: Paired t-test for the with and without ICS based firewood consumption

Group	N	Sum (Kg)	Mean (Kg)	SD	99 % confidence interval of the difference		t	Df	Sig. (2-tailed)
Without	158	623,850	3948.42	2091.87	Lower	Upper	17.295	157	0.000
With	158	423,780	2682.15	1620.23	1075.35	1457.18			
Difference		200,070	1266.27						
% Difference		32%							

The study also compares the total time spent by KCA households per year on firewood collection before and after the introduction of ICS technology. Before the installation of improved cook stoves, the 158 households spent 37,466.36 hours per year to collect firewood (Table 6), with a mean collection time of 237.13 hours per household and standard deviation of 235.22. This was reduced to 25,141 hours after the introduction of ICS, which translates to a savings of 12,325.36 hours per year, or a 32.89% decrease in the time spent collecting firewood by the sampled households. With ICS technology, the mean time spent collecting firewood was 159.11 hours and standard deviation 168. On duration of firewood collection time, the mean difference on firewood collection time is 78.02 hours/household/year at 1% level of significance. The study is 99% confident that the average time saving for firewood collection in the population with ICS technology as compared to traditional stoves is between 59.43 to 96.31 hours per household.

Table 6: Paired t-test for the with and without ICS based firewood collection time

Group	N	Sum (hours)	Mean (hours)	SD	99 % confidence interval of the difference		t	df	Sig. (2-tailed)
Without	158	37,466.36	237.13	235.22	Lower	Upper	11.12	157	0.000
With	158	25,141	159.11	167.67	59.43	96.31			
Difference		12,325.36	78.02						

Extrapolating this figure to the entire 337 households that installed improved iron cook stoves, an estimated 26,292.74 hours/year is expected to have been saved.

Issues and way forward

At the time of the survey, around 336 (31.7%) of total KCA households were using the traditional cook stoves. Extending beneficiary coverage through this initiative could help save an additional 425,492 kg of fuel wood, and around 26,215 hours per year, providing opportunities to use free time for positive returns to individual households as well as KCA.

Notwithstanding the benefits of saved resources and time, the respondents identified some challenges with respect to improved iron cook stove installation. These included risks of burns for young children, and poor ventilation affecting efficacy. Local adaptations included raising the height of the ICS or cutting out the base and reinstalling the ICS to improve airflow, respectively. These modifications could be systematically documented, evaluated and if useful, taught to other households, increasing the usage and effectiveness of improved cook stoves.

3.2.1.3. Water resources management

Major WWF Nepal interventions for water resources management in KCA are construction, improvement and maintenance of village water tanks; distribution, establishment, improvement and maintenance of water pipes; and introduction of efficient irrigation technologies like sprinkler irrigation. The work on water resources management at KCA can be briefly grouped into two main categories: a) drinking water, and b) adaptive irrigation schemes.



Water resource from the Himalayas. © WWF Nepal



Village water collection tank for drinking water. © WWF

a. Drinking water:

The household surveys and FGDs revealed that KCA households spend a lot of time fetching drinking water, sometimes unclear. Other than KCAMC initiatives supported by WWF Nepal, the Government of Nepal and Kadoorie Foundation have also invested in drinking water management in KCA. As these interventions overlap, it is difficult to separate impact by individual supporting agencies. Therefore, this section views provision of drinking water facility in KCA in its entirety. Currently, 85% of KCA households have potable water supply connected, either to their home, or nearby. This includes 92.11% households of Tapethok, 79.5% in Yamphudin, 80.39% in Lelep and 82.81% in Walanchung Gola (Table 2). The second-level household survey revealed that of the 230 sample households, 188 had benefited from drinking water facility support.

A paired t-test was carried out to evaluate the time saved on collection of water, after provision of drinking water support. The difference in water collection time with and without drinking water program was 994.20 hours/household/year (Table 7), equivalent to 886,826.4 hours/year for the entire 892 KCA households (Table 2). The difference was significant at 1% level, implying that drinking water facilitation programs had significantly saved people's time.

Table 7: Annual time spent by 188 households in collecting drinking water

Group	N	Mean	SD	99 % confidence interval of the difference		t	Df	Sig. (2-tailed)
Without	188	1008.46	938.98	Lower	Upper	14.52	187	0.000
With	188	14.22	50.1	816.22	1172.59			
Total		994.20						

**With and without drinking water facility support*

b. Adaptive irrigation support:

Other than providing drinking water facilities, USAID-supported WWF Nepal projects in KCA has also facilitated installation of climate-smart adaptive irrigation infrastructure aimed at improving livelihood security of small holder farmers in KCA, by countering the effects of erratic rainfall, frost and other adverse weather events.



Cardamom field with irrigation. © Deepak Upadhyaya / WWF Nepal

Under this objective, support was provided to establish and maintain nine water collection tanks, installation of water distribution systems at Tapethok, Lelep and Yamphudin promoting water efficient technologies such as pipes and sprinklers. This section attempts to quantify the livelihood impact of these interventions.

The first-level household survey results identified 297 KCA households (28.02%) currently benefiting from WWF Nepal supported adaptive irrigation (Table 2). The detailed second-level household survey focused on 108 households within the 230 sample households that benefited from this intervention. Information on crops, diseases, infestations, and agriculture revenue, before and after the introduction of adaptive irrigation support, was collected and analyzed.



Cardamom field without irrigation. © KCAMC / Dipesh Sharma

The second-level household survey analyzed the types of crops grown before and after the introduction of irrigation among 108 households. Around 93.51% of 101 households were found to have switched from low-value crops like corn or buckwheat to more profitable cash crops; especially cardamom, or to have increased the expanse of cardamom plantation.

Cardamom plantation has been a popular alternative crop solution adopted in KCA. Although quantifying extent of cardamom farming in KCA was beyond the scope, the study while evaluating the benefits of adaptive irrigation techniques on livelihood improvement identified specific impacts on this crop through reduction of disease and insect infestation. Accordingly, further evaluation was done on contribution of adaptive irrigation support on reducing disease and insect infestation on cardamom farming.

Disease infestation in Cardamom

Chhirke and Furke are two devastating viral diseases affecting cardamom plantations at KCA transmitted by the aphid sp.

Symptoms of Chirke disease:

The disease is seen on the plants as a mosaic with pale streak like spots on the unfolding leaves. These spots slowly turn pale brown resulting in leaf drying and withering of plants (Raychaudhuri and Chatterjee, 1958). Flowering and fruit setting of diseased plants are reduced.

Symptoms of Furke disease:

The symptoms of the disease are characteristic, i.e., pronounced stunting and formation of numerous minute tillers which fail to form inflorescence. The tillers do not grow beyond a few inches in height and appear bushy (Vijayan *et al.*, 2014).

The study found that introduction of adaptive irrigation helped reduce disease infestation in cardamom, thereby augmenting profits. After the introduction of sprinkler irrigation, around 69.4% of the 108 respondent households noticed a decrease in crop disease infestations. Around 19.4% households reported increase in disease infestation, while 11.2% reported no change.

Insect infestation

Around 80.6% of the 108 households (87 households) noticed a decrease in insect infestation after application of adaptive irrigation techniques (Table 8). Around 12% households (13 households) reported no difference, while about 7.4% households (8 households) observed increased insect infestation after irrigation.

Table 8: Reduction of disease and insect infestation with adoption of adaptive irrigation

Level	Disease infestation (With over without irrigation)	Insect infestation (With over without irrigation)
Increased	19.4	7.4
Decreased	69.4	80.6
Same	11.2	12

Based on these responses, the study explored the change in magnitude of crop revenue resulting from adaptive irrigation techniques, through an adapted method of contingent valuation. A paired t-test was then conducted. The analysis found a mean annual household crop revenue increase of 73% (equivalent to NPR 136,769. i.e. USD 1,325) through a shift to high value crops as well as decrease in disease and insect infestation, significant at 1% level (Table 9). The study is 99% confident that average annual revenue increase with irrigation support compared to without irrigation support is between NPR 106,120 (USD 1,028) to NPR 167,419 (USD 1,622) per household.

With 297 households having benefited from adaptive irrigation support, the study estimates an overall annual increase in crop revenue by NPR 40.62 million (USD 393,380) across KCA, as a result of this intervention.

Table 9: Paired t-test estimating annual mean crop revenue with and without adaptive irrigation support

Group	N	Mean (NPR)	SD	99 % confidence interval of the difference		t	df	Sig. (2-tailed)
Without	108	186,965.28	238224.04	Lower	Upper	8.85	107	0.000
With	108	323,734.72	324742.70	106119.79	167419.09			
Difference		136,769.4	136769.44					

Issues and way forward

During the study, the irrigation program reached 297 households i.e. 28.02% of KCA households. The program played a crucial role in improving the livelihoods of these households' by increasing agriculture productivity through reduction of losses caused by disease and insect infestations, and facilitating a shift to higher value crops. Some respondents observed increase in insect and disease infestation following introduction of adaptive irrigation techniques. Albeit beyond the scope of the study, observations indicated possibilities of bacterial disease infestation³ among the causes. This will need to be further studied under the leadership of Plant Pathology division of Nepal Agriculture Research Council.

Adaptive irrigation support, while potentially highly beneficial to increase individual household revenues, have not reached nearly two-thirds (71.98%) of KCA households. As a result, FGD participants therefore observed increasing income disparities. Increasing coverage may therefore benefit more households and enhance equitable earning. Nevertheless, this must additionally be viewed in terms of market availability for cardamom, taking into account possibilities of supply overwhelming demand and exploring opportunities of diversifying to other suitable and beneficial cash crops.

3.2.1.4. Horticulture

The variation in topography, altitude (vegetation zones: 800-4600 masl) and climate within KCA provides opportunities for cultivating a wide variety of fruits; from temperate varieties such as apples, walnuts, peaches, pears and plums, to sub-tropical ones such as oranges, lemons, persimmons and kiwis, as well as the tropical litchi. Fruit-farming was therefore identified as a potentially important source of income for KCA households. Accordingly, KCAMC, supported by WWF Nepal, has been facilitating promotion of fruit farming over the past five years.

Seedlings of apple, walnut, peach, orange and plum were distributed to 65 households in Tapethok, Yamphudin and Lelep VDCs (Table 2). This section reviews distribution, plantation, survival and production rates of these fruit trees (Table 10). Survival of these plants range from 21.7% to 52.17%. The highest survival rate was reported for peach, while the lowest was for apples. A survival rate of around 50% was recorded in the case of walnuts (44.33%), plum (46.51%) and peaches (52.17%), whereas less than one-quarter of apples (21.7%) and oranges (23.47%) survived. Among the trees that survived to maturity, plum and apple trees have produced fruit (Table 10) while walnut trees have not provided any produce yet. Out of 831 orange plants that survived, only 2.77% (23 plants) have borne fruit, as of the time of the study in April - May 2017.

Considering low reach (<10% of KCA households) of this initiative, long-duration maturity of trees and low levels of success at the time of survey, this activity was found to have impacted people's livelihoods, non-significantly. Therefore, revenue calculation was not done for this support.

³ Champoiseau et al (2009) suggests that bacterial infection in plants can occur when bacteria move from roots of infected plants to roots of healthy plants through irrigation practices.



Orange orchard in Lelep. © Mamata Pokhrel / WWF Nepal

Table 10: Fruit seedlings planted, survived and produced.

Fruits Name	Number of beneficiary households*	Number of seedlings		Survival (%)	Production (Kg/year)
		Planted	Survival		
Apple	22	235	51	21.7	676
Walnut	28	194	86	44.33	**
Peach	24	69	36	52.17	1565
Orange	21	3540	831	23.47	705 **
Plum	16	43	20	46.51	1880

*Total number of beneficiary households were 65. Several households received multiple varieties of saplings.

** No fruit production reported at the time of study for all walnut trees, and 808 of the 831 orange trees that survived.

Issues and way forward:

FGDs identified inadequate knowledge of fruit farming and resulting poor cultivation practices, as the reasons behind low survival rate of fruit plants. The study recommends critical long-term review of this income-generating support to identify any other causes for low harvest, including potentially, age of trees.

Considering low investment requirement, enhancing success rate of this initiative could help contribute to income generation of households. However, alongside evaluating suitability of this initiative, establishing market connections need to be considered for this activity to be profitable to individual households.

3.2.1.5. Honey production

Traditionally, sustenance bee-keeping has been practiced in KCA, to produce honey for consumption as well as domestic medicinal purposes. Meanwhile honey is also sold to enhance household earnings, to a smaller extent. Exploring the potential of bee-keeping as an income-generation source, KCAMC with support of WWF Nepal projects assisted facilitation of this initiation at two villages – Samekham and Bhote Gaun, in Yamphudin VDC in 2014.

Fifteen low-income households in Samekham and Bhote Gaun were identified and trained on improved bee-keeping methods, and provided support to procure and install improved bee-hives (Table 2). Out of the 15 beneficiaries, six households of Samekham had continued engagement in the activity. The honey production of these households, and comparison against production through traditional bee-keeping have been provided in Table 11.

Improved bee-hives have led to a 185.36% increase in honey production compared to traditional bee-hives. While total market value of honey produced using traditional beehives stood at NPR 20,500 (USD 199), revenue has increased to NPR 58,500 (USD 567) through improved beehives.



Improved bee-hives at Yamphudin. © Mamata Pokhrel / WWF Nepal

Table 11: Comparison of honey production and equivalent market value*

Type of bee-hives	N	Production (liters)	Market value (NPR)
Traditional	6	20.5	20,500
Improved	6	58.5	58,500
Difference		38	38,000.0

**In traditional and improved bee-hives*

***Market value reflects the cost (of NPR 1000) per liter of honey in local market during the time of survey*

Issues and way forward

While improved bee-hives were successful in *Samekham* village, a nearby village, *Bhote Gaun* reported problems in using the improved bee-hives. According to reports bees in the improved bee-hives fled or died within seven days; with the underlying reason behind this unidentified.

Noting the near-trebling of production and profits, and low investment required for shift to improved bee-keeping methods, this activity shows considerable promise in enhancing livelihoods in KCA. It will be imperative to identify the cause for different outcomes in the two adjacent beneficiary villages of Yamphudin. If the cause is attributed to technical issues with the improved technique, or low understanding and technical knowledge, improving on these areas could strengthen the initiative's outputs.

However, beekeeping worldwide is becoming increasingly challenging, and the reasons for the death or fleeing of bees may be potential ecological or more complex. As such, solutions will need to be explored accordingly.

3.2.1.6. Pasture land management

This study explores the livestock rearing trend in KCA over the last 10 years to determine the livelihood impact of improved pasture land management on KCA households. Of the 230 households surveyed, 92.17% households were engaged in livestock farming throughout this 10-year period. Among them, livestock was the primary source of livelihood for 5.66% of respondents, and a secondary source for 32.07%, indicating that livestock rearing is an important source of livelihood for KCA households. The survey also showed that this livestock (yak, sheep, goats, donkey) were mainly fed through open grazing in pasture lands, making healthy pastures an important part of enhancing KCA livelihoods. Healthy pasture lands also benefit wild mountain ungulates and other prey species that help sustain snow leopard populations in these landscapes.

To ensure healthy and accessible pastures in a changing climate, KCAMC, supported by WWF Nepal, implemented pasture management activities including trail improvement and wooden bridge construction to increase access to little-used or disused pastures, and/or water supply improvement. The idea is to facilitate access and availability of resources in different pasture lands, improving opportunities for rotational grazing and thereby reducing pressure on individual pastures.

FGDs reveal understanding among locals on the significance of pasture land management on their livelihoods. The rotational grazing system decreases pressure on pastures, and promotes quicker re-growth of grasses, contributing to increased pasture health, which can ensure thriving pastures even in a changing climate. Lack of trails, lack of bridges over rivers; causing smaller livestock being washed away, lack of water supply, was also identified as the main reasons limiting use of certain pastures. Addressing these issues could therefore facilitate rotational grazing and improving overall pasture health.

According to the study, over the last five years water supply improvement was carried out at nine important pastures: Luwadada, Murimla, Lonak and Chumgo pastures in Lelep VDC; Ramjer and Tseram pastures in Yamphudin VDC; Maguwa and Thomadesa pastures in Walanchung Gola VDC; and Yangmun pasture in Tapethok VDC. Similarly, trails to the following pastures were improved: Hile and Khomjong in Walanchung Gola VDC; Tseram-Ramjer, Tseram-Ghunsa, Tseram-Okhatang, and Ghatte Khola in Yamphudin VDC; and Chhange Khola in Lelep VDC. In addition, wooden bridge construction and repair was completed at Sambisu, Dongjum, Pavok, Jari and Nup in Walanchung Gola VDC; and Khambachen, Thangcheng, Lungbasangba, Lapuk and Nupchu in Lelep VDC to increase access to little-used or disused pastures. Access was restored to at least two completely disused pastures - Thangcheng and Lumbasamba in Lelep VDC, through construction of bridges over Nupchu and Yamtari rivers in 2013, FGD participants noted.

The FGDs also revealed that 526 households (50% of total households in KCA) could have potentially benefitted from improved pasture management.



Wooden bridge installation to facilitate access as part of pasture land management interventions. © Deepak Upadhyaya / WWF Nepal

Issues and way forward

Animal husbandry is one of the most important livelihood activities in KCA. Pasture management is therefore an intervention that reaches a population dependent on animal rearing. Pasture land management also directly benefits target species such as the snow leopard; by ensuring healthy grazing grounds for their wild prey.

While these interventions address physical limitations affecting rotational grazing, FGD participants noted climate change as the emerging and most challenging issue for sustainable pasture management. According to the FGD results climate change was identified as one of the key factors affecting pasture quantity and quality, with decreasing stock density and length of grasses in pastures, compared to the status 10 years ago. Changes in snowfall time and quantity, shift in snow line, rapid melting of glaciers, drying out of springs, and irregularity in rainfall have been cited as the key reasons behind the decreasing quality and quantity of pastures. Systematically studying these changes in view of the climate predictions for the region, over a long-term, will be useful to further improve understanding.

3.2.1.7. Essential oil plants

The sustainable use of biological diversity is perhaps the most important prerequisite for long-term conservation, alongside strengthening community engagement by providing communities an economic stake in conservation. WWF Nepal, with the help of the community, identified essential oil extraction from *Juniperus* as a potential avenue for sustainable income generation in KCA. In 2008, WWF Nepal provided financial support to the KCAMC to establish an essential oil plant in Ghunsa. After installation, a five-member committee was formed to manage the essential oil program. Each year, the production was contracted out to one of the villagers, for a fee of NPR 5,000 (USD 49), which would then be used for community activities such as installing and repairing *Mane* (prayer wheel), trail improvement etc.



Essential oil plant. © Dipesh Pyakurel

FGDs revealed that an average of 140 liters of essential oil was extracted per year by the contractor. With the market rate of the essential oil at NPR 2,800 (USD 27) per liter, the annual earnings from essential oil plant stood at NPR 392,000 (USD 3,797; inclusive of investments in terms of labor, transport, permits, contract fee and other costs incurred by the contractor). Within eight years of operation, the earnings are estimated to be NPR 3.14 million (USD 30,370).

Issues and way forward

The essential oil plant at Ghunsa indicates potential for increasing community income, through employment generation and sustainable use of local resources. However, the plant has run into governance and management problems, due to which operations have been halted since 2016.

In 2014, WWF Nepal provided financial support to establish another essential oil plant at Yamphudin VDC. By the study period, the essential oil plant had been installed at Tseram, but was yet to begin operation. It will be important to review learnings from the Ghunsa plant, to help improve operations, governance and management of this initiative in both areas, as well as for any planned expansion.

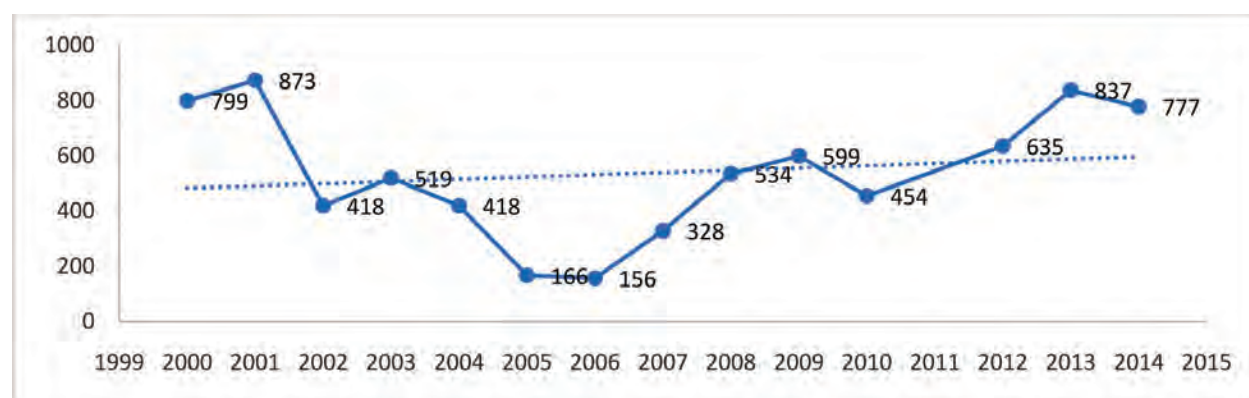
3.2.1.8. Community based tourism

Lying at the foot of Mt. Kangchenjunga (8586 m), the third highest mountain in the world, and renowned as a global hot spot for flora and fauna, as well as the home of the snow leopard, KCA is an important tourist attraction, especially for nature lovers and climbing expeditions. To tap into tourism's potential to bring considerable benefits to the KCA people, KCAMC and DNPWC, supported by WWF Nepal projects as well as other organizations like Kangchenjunga Tourism Promotion Center, Trekking Agencies Association of Nepal, Alliance for Transformation Nepal, the Great Himalaya Trail among others have been promoting tourism in the KCA for the past 18 years.

FGDs reveal that around 100 households in KCA are engaged in tourism. Establishment of sign posts and snow posts, provision of trekking maps and information boards, hotel management and cook training, trail improvement, clean-up campaigns and upgradation of visitor centers are some of the key interventions under community-based tourism promotion at KCA.

In the last five years, to facilitate movement of trekkers, WWF Nepal has also supported the upgradation of trekking trails (estimated to be around 15 - 20 km along Tapethok, Lelep, Gyabla, Phale to Ghunsa), including the repair of two bridges (in Chiruwa and Tapethok). Communities reported increasing tourist numbers over the past 10 years (Figure 8), which aligns with the national data of tourist visit trends at KCA.

Figure 8: Number of tourist visiting KCA



Source: KCAMC management plan and check post record



Trail improvement at Lelep. © KCAMC / Dipesh Sharma



Snow post. © Mamata Pokhrel / WWF Nepal

Issues and way forward

According to FGDs a majority of KCA tourists visit in expeditions, with their own porters, food, kitchen crew and tents. Tourists therefore miss the chance to experience local ways, meanwhile locals miss out on potential income. To ensure more independent tourists, information boards, signs, snow posts and trekking maps of the trails need to be continually upgraded, and facilities along the trail improved.

Along with this, efforts facilitating networking between tourism agencies with connections to international clients and local service providers is necessary to improve coordination and may help increase benefits to local communities. Tourism promotion institutions such as Kangchenjunga Tourism Promotion Center, Trekking Agencies Association of Nepal, etc., could also play a critical role in this.

3.2.2. Other key interventions by WWF Nepal

Apart from analyzing the livelihood outcomes of WWF Nepal's conservation and adaptation interventions supported by USAID funding, this study also captured data on the status of other key WWF Nepal interventions. While detailed analysis of these interventions was beyond the scope of this study, information generated during the FGDs and second level household surveys have been captured and summarized.

3.2.2.1. Human wildlife conflict mitigation

Human wildlife conflict (HWC) is a major threat facing conservation today, globally. In mountain landscapes, predators including the snow leopard, occasionally prey on livestock, bringing them in conflict with the local communities. For local communities, these losses can affect their livelihoods; in extreme cases, resulting in retaliatory killings.



Yalung, the fourth collared snow leopard in Nepal. © WWF Nepal / Sanjog Rai

According to FGD participants, in the pasts now leopards have been killed by KCA herders in retaliation for livestock losses. Since 2005, a Livestock Insurance Scheme (LIS) has helped mitigate people's losses, providing relief to victims of conflicts. The relief, though nominal, has helped in reducing negativity towards the snow leopard, supplemented by other support through the way of snow leopard conservation.

The LIS in KCA began with an endowment of NPR 3.60 million (USD 34,864) provided by WWF Nepal, with support from the Swiss National Centre of Competence in Research North-South through the Department of Geography, University of Zurich, Switzerland. This amount was distributed in December 2005 as LIS seed grant of NPR 1.20 million (USD 16,900) (*Gurung, 2006*) each to Yamphudin, Ghunsa and Walangchung Gola VDCs. Due to its remote location, Yangma village, which is within Walangchung Gola VDC was supported with an amount of NPR 800,000 (USD 7,748) in 2012/13 to establish a separate LIS, which was supplemented in June 2017 with an additional amount of NPR 500,000 (USD 4,842) provided by WWF Nepal's Guarding God's Pet in the Himalayas (WWF-GGPH) project.

Currently, four community-based LIS funds are functional to help ameliorate human-wildlife conflict in the KCA. According to FGD participants, these funds have been supplemented with nominal premium amount paid for by livestock owners to insure their animals. These premium and relief amounts are decided by the respective communities. In Yamphudin, each household deposits NPR 100 (USD 0.97) per livestock as a premium (increased from NPR 55; USD 0.53 per livestock, charged till 2015). In Ghunsa, the premium is NPR 300 (USD 2.91) per livestock, while at Walanchung Gola and Yangma the premium amount is NPR 100 (USD 0.97) per livestock. When the LIS started in 2005, 18 households participated, insuring a total of 493 livestock (Figure 10). However, with increased awareness, in 2016, there were 188 households participating in the scheme, with 1,558 livestock insured (Figure 11).

The funds collected for LIS have also been used to provide micro-loans to local households for income generation. The interest collected from these loans, interest generated from banks, and premium paid for by local households, have added to the LIS endowment. Currently, the total LIS endowment fund has now reached NPR 7.60 million (USD 73,600), an increase of 55% (Figure 9) as compared against 2005.

For the effective disbursement of LIS relief, Snow Leopard Conservation Committees (SLCCs) have been engaged. In 2006, WWF Nepal organized exposure visits for 4 SLCC members to Ladakh, India to learn about the livestock insurance scheme there, to help its implementation in KCA. The role of SLCCs include verification and recommendation of insurance claims.

From 2016, the relief amount allocated in Yamphudin VDC for the loss of a small yak (calf) is NPR 4,500 (USD 44), which increases to NPR 5,000 (USD 48) for an adult yak. Similarly, in Ghunsa, the relief amount allocated for the loss of both small and adult yaks is NPR 8,000 (USD 78). In Walanchung Gola and Yangma, the relief amount allocated per yak lost was NPR 2,500 (USD 24) which has now increased to NPR 3,500 (USD 34) since 2016. Official KCAMC records indicate that relief has been provided for 201 livestock lost till date (Figure 12).

Figure 9: LIS Endowment fund 2005 and 2016

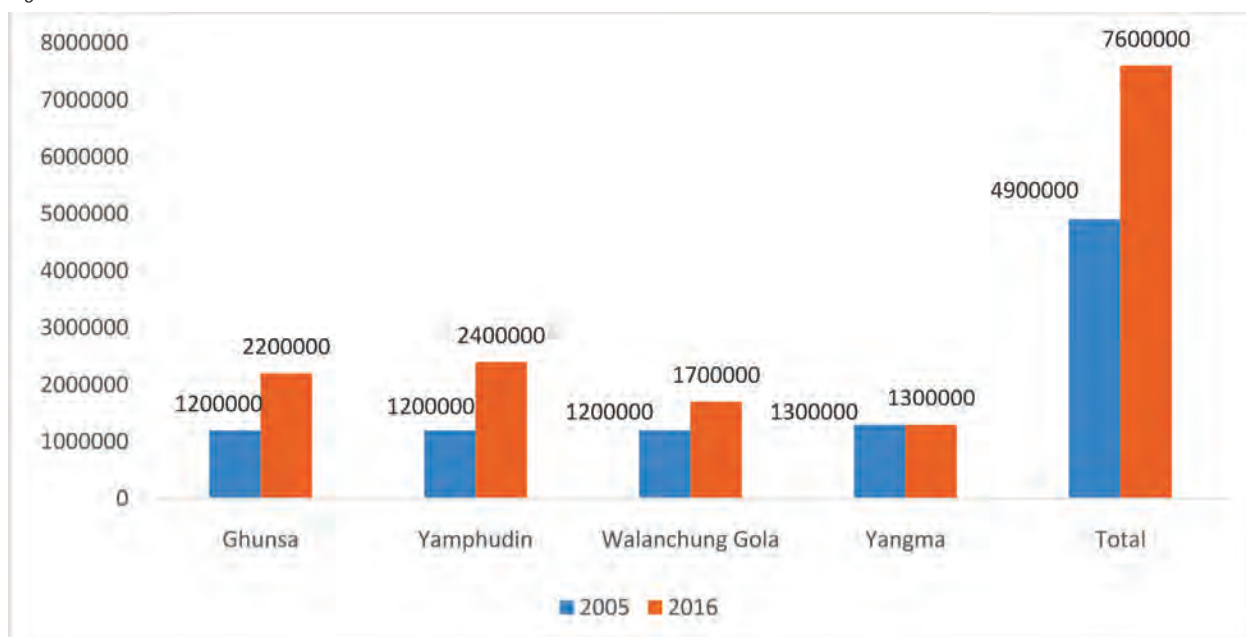


Figure 11: Number of livestock under LIS scheme

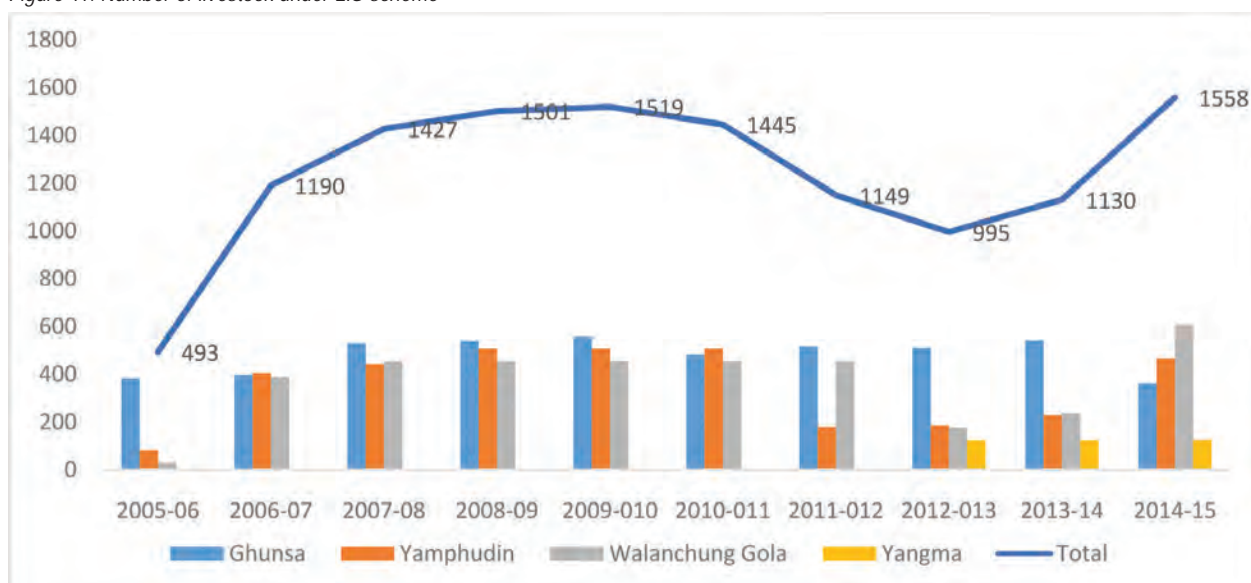
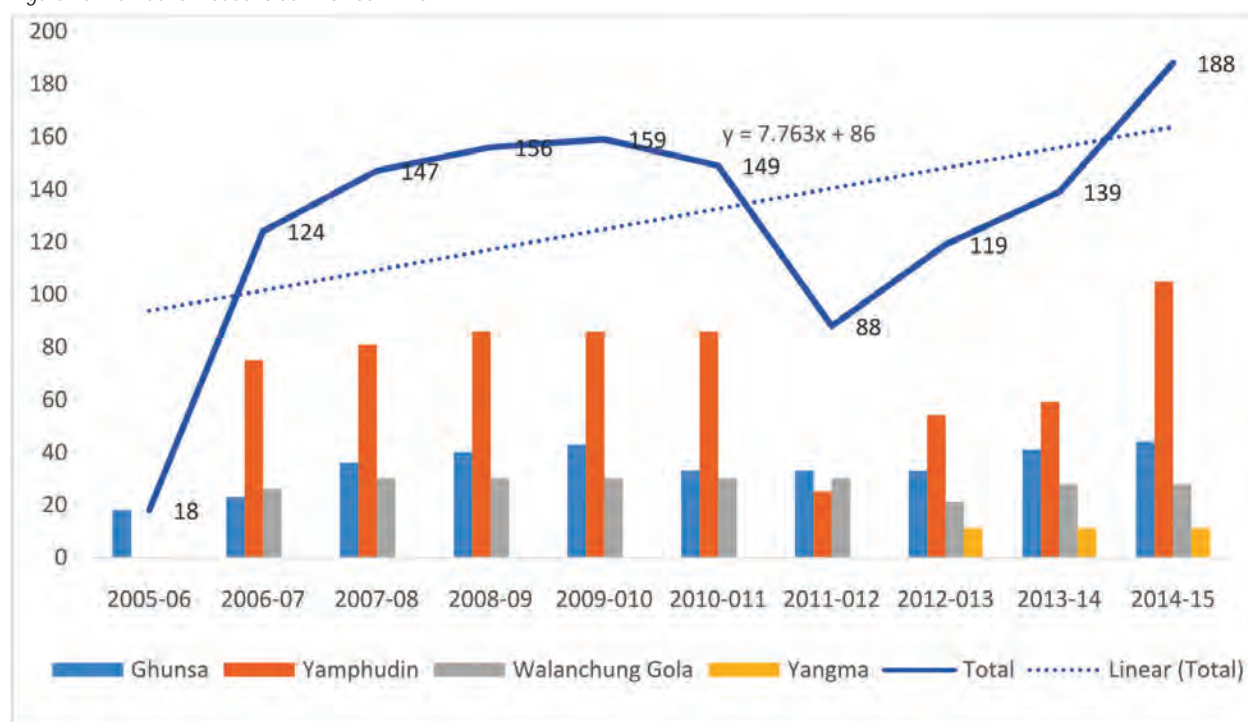


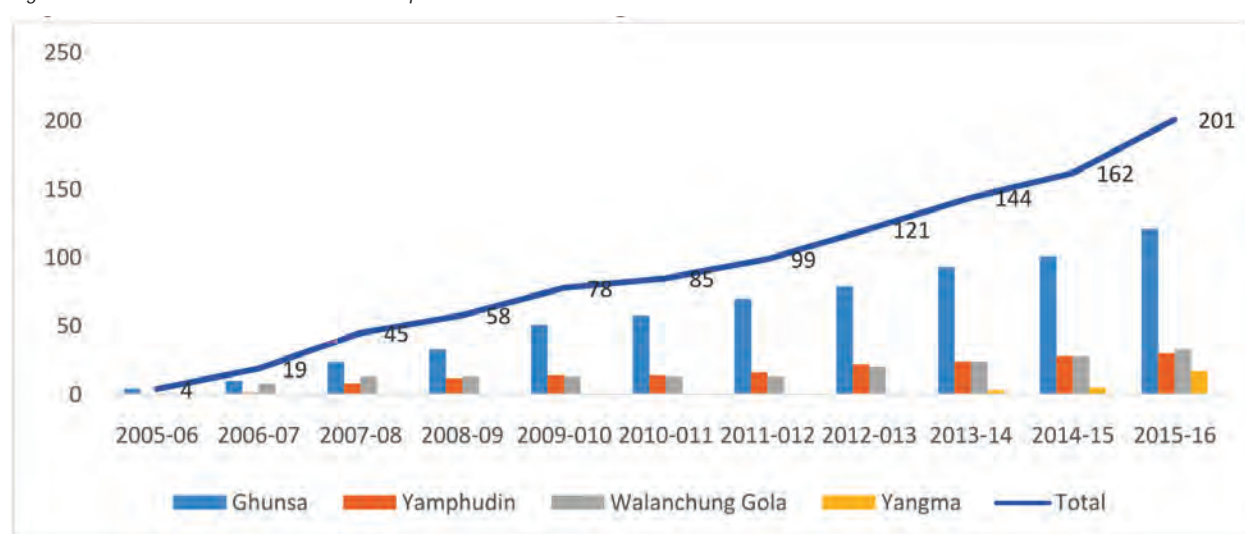
Figure 10: Number of households involved in LIS



FGD participants noted that with the establishment and mobilization of LIS, community attitude towards snow leopards has changed for the good. They noted increase in people's tolerance towards the snow leopard as well as enhanced support for its conservation, as a result of LIS. FGD participants perceived that population growth of snow leopard and prey were a direct outcome of LIS mechanism, among other interventions.

Other than LIS, crop damage relief fund was established with an endowment contribution of NPR 2.2 million (USD 21,305) in 2010. The FGD identified that this amount has currently reached NPR 4.72 million (USD 46,275) (Yamphudin – NPR 1.13 million (USD 10,943); Walanchung Gola – NPR 190,000 (USD 1,840); Lelep – NPR 1.80 million (USD 17,431 and Tapethok – NPR 1.60 million (USD 15,494), through interests raised from savings and credits, and bank interests.

Figure 12: Number of livestock kill claims compensated



Overall, during the second-level household survey, 73.91% of the 230 sample households reported losses to crop raiding by wildlife in 2016. The magnitude of crop losses varied with wild animals (Table 12); macaques were the most common cause (50.70%) of crop losses at KCA followed by deer (18.65%), civet (14.2%) and porcupine (9.34%).

Table 12: Crop losses (in NPR) due to raiding by wildlife in 2016

Wild animal	Total economic losses (NPR)	Share in total (%)
Bear	195,230	2.59
Civet	1,069,700	14.20
Deer	1,404,815	18.65
Goral	99,830	1.33
Macaque	3,818,500	50.70
Mouse	202,325	2.69
Porcupine	703,720	9.34
Squirrel	21,000	0.28
Wild Boar	13,000	0.17
Blue sheep	3,750	0.05
Grand Total	7,531,870	100

While certain mitigation measures have been tried, the FGD participants noted that these have not been very successful. Additionally, unlike community-based LIS, crop damage relief fund mobilization needs stream-lining.

Issues and way forward

While the LIS appears to have successfully mitigated retaliations against snow leopard, the FGD participants noted increased livestock killing by Tibetan wolves. For instance, according to the Yangma FGD 10-12 yaks were killed in 2014, 15-20 in 2015 and 24-36 in 2016. Concerns were also raised about killings caused by common leopards. These predators are still viewed negatively by local communities. Moreover, the relief amount provided under the LIS has not been able to keep up with the rapidly increasing market value of livestock.

Government of Nepal, through its Wildlife Damage Relief Guidelines, offers relief in case of losses incurred due to protected wildlife. The relief amount provided under this guideline is greater than the community-based LIS relief in practice in KCA. Additionally, other than snow leopard, these guidelines cover damage caused by common leopards as well as wolves. Going ahead, there may be a need to explore integrating and synergizing the LIS with the GoN's Wildlife Damage Relief Guidelines, for more effective relief processing.

बताए। ४ हजार मिटरमाथिको क्षेत्रमा हिउँचिनुवाले पनि त्यत्तिकै दुःख दिने गरेको छ। हिउँचिनुवाको धार्ति कम गर्ने विश्व बन्सजन्तु कोष नेपालको सहयोगमा पशु विमा कार्यक्रम लागू गरिएको छ। अहिले त्यही कोषबाट एउटा चौरा मोर ८ हजार रूपैयाँ दिने गरिएको छ। तरे त्यति राहतले केही नपुग्ने किसानको गुनासो छ। एउटा चौरा मर्दा हामीलाई एक लाखसम्म धार्ति हुन्छ, पशु विमा कार्यक्रमबाट ८ हजार पाइन्छ,' कञ्चनजंघा संरक्षण क्षेत्र व्यवस्थापन परिषद्का पूर्वअध्यक्षसमेत रहेका छेत्रिनाले भने, 'विमा नाम मात्रैको छ।' सोलुखुम्बुमा पनि उस्तै खुम्बु-पासाङ ल्हामु गाउँपालिकाका दाछिरी शेर्पा र बोझुङ शेर्पाका पाँच/पाँचवटा चौरा ब्याँसोले गोठमै मारिदियो। बाँकी पृष्ठ ४ ➡

जनावरको संख्या र अवस्थाका विषयमा नेपालमा अध्ययन भएको छैन ।
 एसिया, युरोप र अमेरिकामा पाइने यसको संसारभरको संख्या एक लाख रहेमा अनुमान छ । ७ देखि ८ मिटर उचाइमा बस्ने यो जनावर बासस्थान बिनाशजस्ता कारण संकटापन्न रहेको साइटस सूचीमा उल्लेख छ । यसले घरपालुवा जनावरलाई पछाडिको भागबाट आक्रमण गर्ने र मारेर छाड्ने गर्छ ।
 कञ्चनजंघा क्षेत्रमा लामो समय नदेखिएको यो जनावर हिउँचिनुवालाई स्याटेलाइट लगाउन पासो थाप्ने क्रममा चार वर्षअघि क्यामेरा ट्र्यापको तस्बिरमा कैद भएको थियो । विविध बन्धजन्तु कोष नेपालका तत्कालीन अनुसन्धान अधिकृत कमल थापाले हिउँचिनुवासमेत खान सक्ने र घरपालुवा जनावर सखाप पार्ने यो जन्तुवारे तत्काल अध्ययन गर्नुपर्ने औन्याएको थिए ।

3.2.2.2. Substituting Iron Poles for Prayer Flags

FGDs indicate that each household in Walanchung Gola VDC in KCA cut down an average of 10 trees every year to use as flagpoles before 2006. 300 trees were felled every year on average, as flagpoles decay and have to be replaced every year. In 2006, WWF Nepal distributed two iron poles for each house to mount their prayer flags, as a permanent solution, to stop tree-felling. While previously 300 trees were cut down each year to prepare the cultural flag, this has decreased following the intervention, contributing towards increased forest cover that ultimately contributes to the whole ecosystem.



Iron Pole used for prayer flags. © WWF

3.2.2.3. Establishment and empowerment of community based institutions

Community based institutions have been at the core of KCA's community-owned, long-term approach to conservation. Since the inception of its work at KCA in 22 March 1998, WWF Nepal has invested considerable resources to establish and strengthen local institutions at KCA. Today, there are 7 Conservation Area User Committee (CAUCs; Table 13), 42 User Groups (UGs), 35 Mothers Groups, 4 Cooperatives, 4 Snow Leopard Conservation Committees (SLCCs), 12 Community based Anti-Poaching Units (CBAPU), and 27 Community Forest User Groups (CFUGs) in KCA, formed with the joint efforts of DNPWC, KCAMC, and supported by WWF Nepal projects. This section captured basic information on these groups, their funds, as well as notable activities carried out by them.

Table 13: Organizational framework of Conservation Area User Committee of KCAMC

VDC	Ilaka	Coverage (wards)	Name of CAUC
Lelep	Lelep	1-6	Laligurans
	Ghunsa	7-9	Sekathum Ghunsa
Wlangchung Gola	Gola	1-9	Ghanglung
Yamphudin	Yamphudin	1-3	Pathibhara
		4-9	Kangchenjunga
Tapethok	Tapethok	1-6	Bihani
		7-9	Simbuwa Khola

a. Community forest user groups

Various government and non-government actors have been implementing community forestry as an effective strategy to curb, and even reverse forest degradation in Nepal for decades now. Evidence has shown that when local communities are empowered, provided legal rights for the management of government-owned forests, and can reap the benefits sustainably, they will restore, protect and manage forests responsibly.

WWF Nepal adopted the community forestry approach as a principal forest management strategy and helped establish 27 community forests in the KCA, totaling over 72,000 ha, as well as trained over 400 members of Community Forest User's Groups (CFUGs); independent entities having rights over forest resource use as per Forest Act 2049 (1993 AD), to manage these forests sustainably. The training covered subjects ranging from forest operations, sustainable management practices, governing regulations, laws and policies to principles of good governance, gender and social inclusion.

The number of CFUGs at Tapethok, Yamphudin, Lelep and Walanchung Gola VDCs are 6, 4, 15 and 2 respectively. The total households engaged in CFUGs were 1,569 (Table 14); this number is more than the actual households of KCA, and reflects membership of individual households in multiple CFUGs. Assessment of ethnic composition of CFUGs members show that owing to presence of higher percentage of *Janjatis* in the population, they were also dominantly represented in the CFUGs.

Table 14: Community forest in KCA and their member households

SN	Name of Community Forest	VDC	Member households			
			<i>Dalit</i>	<i>Janajati</i>	<i>Brahman/Chhetri</i>	Others
1	Tiptala Bhanjyan CF	Walanchung Gola	0	54	0	0
2	Ujeli Pakha CF	Lelep	0	25	2	0
3	Banpala CF	Lelep	0	29	0	0
4	Patale CF	Tapethok	1	176	0	0
5	Guranse CF	Lelep	0	102	0	0
6	Satpatre Rani Mahila CF	Tapethok	1	52	0	0
7	Dorong Gyabu CF	Lelep	1	77	0	0
8	Lungthung CF	Lelep	1	37	0	0
9	Kapolung CF	Tapethok	0	47	0	0
10	Dobate CF	Lelep	0	253	0	0
11	Lapsibote CF	Lelep	0	54	0	0
12	Thakpa Khola CF	Lelep	0	18	0	0
13	Nagthan CF	Lelep	1	30	0	0
14	Lawajin CF	Lelep	0	27	0	0
14	Namphuwa CF	Tapethok	0	76	0	0
16	Nigijum Fulbari CF	Tapethok	1	85	0	0
17	Sumdo hans pokhari CF	Lelep	0	21	0	0
18	Bigbari CF	Lelep	0	13	0	0
19	Kumvakarna CF	Lelep	0	64	0	0
20	Lukumba Fulbari CF	Tapethok	0	31	0	0
21	Kanchanjunga CF	Yamphudin	1	61	0	0
22	Pathivara CF	Yamphudin	0	22	0	0
23	Timbung Phokhari CF	Yamphudin	0	56	0	0
24	Deurali CF	Yamphudin	0	59	1	0
25	Omighangri	Walanchung Gola	0	12	0	0
26	Kisongma Deurali	Lelep	0	12	0	0
27	Sacred Natural Forest	Lelep	0	66	0	0

The study also gathered information on the total endowment support provided by WWF Nepal, and current fund of each CFUGs as shown in Table 15. In total, WWF Nepal projects had provided NPR 2 million (USD 19,369) to 27 CFUGs. CFUGs fund is mobilized for saving and credit among members, agriculture, cardamom farming in the community forest and paying salary to the forest watchers (*ban heralu*). Currently, the amount has increased to over NPR 3 million (USD 29,159).

Table 15: Financial dimension of CFUGs

VDC	Endowment fund (NPR)	Current fund (NPR)
Tapethok	480,000	1,000,000
Lelep	1,040,000	1,300,000
Walanchung Gola	160,000	320,000
Yamphudin	320,000	391,000
Total	2,000,000	3,011,000

Cardamom farming in the community forest:

Each year the CFUGs identify poor, small land-holder members interested in cardamom farming in the community forest with the dual objective of supporting the livelihood of poor communities and increasing the CFUG fund. These members are supported with a plot, cardamom planting supplies as well as irrigation from CFUG. When the harvested cardamom is sold, the community member has to deposit 50% of income to the respective CFUG so benefits are shared.

b. Mother groups

In KCA, as in most parts of Nepal, household activities, roles and responsibilities are differentiated by gender. Child raising, family caring and subsistence type of household works are mostly allocated to women. This includes cooking, cleaning, caring for family members, collecting firewood and water, intra-household financial mobilization, household decision making and farming.

Since KCA women spend more time than men on activities that may have impact on forests, it is important to involve women more effectively in natural resource management and livelihood improvement. KCAMC supported by WWF Nepal projects accordingly helped establish and strengthen mother groups at KCA, providing opportunities for women to develop their leadership skills, especially in natural resources management and household dynamics. This is further expected to capacitate women for influence and representation in KCAMC governing structure, from CAUG to KCAMC.

The mother's group has also become a foundation for transforming traditional women's role from household to community management. A total of 35 mother groups have been formed in KCA (Table 16), with women from 98.02% of all KCA households as members. Membership is essential for eligibility for saving and credit benefits from mother group. Altogether, WWF Nepal supported these mother's groups with endowment funds of NPR 2.1 million (USD 20,337), which has now reached NPR 4.9 million (USD 48,276).

Table 16: Status of Mother Group at KCA

VDC	Group (No.)	Beneficiary households (%)	Fund	
			Endowment fund (NPR)	Current fund (NPR)
Lelep	14	99.2	840,000	3,095,000
Walanchung Gola	3	100	180,000	230,000
Yamphudin	7	100	420,000	560,000
Tapethok	11	95	660,000	1,100,000
Total	35	98.02	2,100,000	4,985,000

Saving and credit:

Before community savings and credit programs, rich people were only the loan source for KCA households. With the lack of formal financial institutions, communities were forced to pay higher interest rates. A major community benefit of the mother's group is the savings and credit program that has established a saving habit in KCA households, with 98.02% of them found saving in a mother's group. Mother's groups saving and credit program is based on the principle that a household's savings might be small but the group's savings can be used rotationally to serve the majority's needs. The study also found that about 609 households (57.39%) at KCA have benefited from loans from mother's group in 2015-2016, saving them from paying higher interest rates.

Community development:

All mother's groups are increasing their funds through membership fees, savings, and borrowers' interest. These groups spend their money on different community development work such as trail improvement, clean-up campaigns, and education stipends for girls, tree plantation, and construction of *Chautara* (public rest area). Mother's groups organize village clean-up campaigns once a month, and have helped install household systems to collect waste and subsequently dispose it. For lack of alternatives, the waste collected is either buried or burned.

Women are key to the household's economic growth, yet have less access than men to productive resources and opportunities. In KCA as well, this gap is further widened by low education among women. With the aim of improving gender equality in education, especially in terms of increasing girls' enrollment and retention in school, mother groups with the financial support of WWF Nepal, started to provide stipends to disadvantaged but meritorious female students. Between 2001 - 2017, a total of 206 students received this stipend. 98 students from Lelep, 12 from Walangchung Gola, 41 from Yamphudin and 55 from Tapethok, have benefited from this initiative.

Analysis was carried out to understand the gender composition of students at KCA. The results show that there were 1067 students altogether in KCA village schools where the number of female students (563) were slightly higher than male (504) students (Table 17). Comparing male to female ratio at village school in totality was 1:1.12. Furthermore, based on level of education, male to female ratio was 1:1.03 for pre-primary school level, 1:1.11 for primary, 1:1.04 for lower secondary and 1:1.3 for secondary level respectively (Table 18).

While baseline figures are unavailable to measure trend, anecdotal evidence indicates this as an important achievement on efforts supported by the WWF Nepal projects to promote girl-child education, through partners such as CARE Nepal.

Table 17: Number of students in village school

Gender	VDC	Pre-primary	Primary	Lower Secondary	Secondary	Total
Male	Lelep	23	112	52	0	187
	Walanchung Gola	3	3	0	0	6
	Yamphudin	6	21	0	104	131
	Tapethok	0	35	145	0	180
Sub-total		32	171	197	104	504
Female	Lelep	25	112	51	0	188
	Walanchung Gola	3	0	0	0	3
	Yamphudin	5	32	0	135	172
	Tapethok	0	46	154	0	200
Sub-total		33	190	205	135	563
Total		65	361	402	239	1067

Table 18: Female to male student ratio in village school

Grades	Boy	Girl	Boy : Girl
Primary (1-5)	203	223	1 : 1.1
Lower Second. (6-8)	197	205	1 : 1.04
Secondary (9-10)	104	135	1 : 1.3
Total	504	563	1 : 1.12

c. Cooperatives

Since the establishment of cooperatives, mother's groups, CFUGs and CAUC have been consistently acting as a source of finance for KCA households. These organizations have made substantial progress in increasing their financial capital through membership fees, interest earned from lending, penalties and support from various organizations including WWF Nepal (refer to earlier sections).

With this growth, the need for a formal institution to deposit and manage these community funds more efficiently was felt. Subsequently, four cooperatives, one in each VDC, were formed to oversee these transactions (Table 19) by KCAMC supported by WWF Nepal projects and technical support of the district cooperative association. Capacity was built among members of cooperatives to maintain transparent and accurate financial management systems, accounts and record keeping. Discussions to bring committee funds into the cooperative have started. Building and improving these cooperatives have also been supported by Samriddha Pahad.

Table 19: Cooperative details

VDC	Cooperative	Established year	Members (No)
Yamphudin	Yanglungkang Multi-purpose cooperative	2072 (2016)	110
Walanchung Gola	Walung saving and credit cooperative	2072 (2016)	50
Tapethok	Tagera saving and credit cooperative	2070 (2014)	161
Lelep	Conservation saving and credit cooperative	2070 (2014)	204
Total			525

The community institutions have been established at KCA through dedicated, long term efforts of communities, KCAMC and DNPWC with support of organizations including WWF Nepal. These groups and institutions have now become much stronger, effective, efficient, self-sustaining and self-reliant than when they were at establishment. Despite these, our study found that these institutions are highly reliant on external support. Subsequently it may be useful to increase their reach and coordination with local government agencies and institutions.

d. Micro and Pico hydropower

The glacierized, ice and snow-capped areas of KCA are an important source of water for hydropower generation. According to FGDs 6 micro and 1 pico hydro were established at KCA with support from DNPWC, VDCs, WWF Nepal, community contributions and Namsaling Community Development Center-Ilam. These completed energy projects are producing 150 kilowatt of electricity and benefitting 569 KCA (53.68%) households (Table 20).



Micro hydro power plant in Tapethok. © WWF

Table 20: Hydropower information of the KCA

Name and address	Capacity [kW]	Beneficiary households
Walanchung Gola MHP*, Gola	10	58
Yamatari MHP*, Ghunsa	35	70
Rate Khola Pico HP**, Yamphudin	4	33
Tammawa MHP*, Tapethok	68	222
Mengthum MHP*, Tapethok	10	70
Tumiya Khola MHP*, Yamphudin	8	66
Kabeli Khola MHP*, Yamphudin	15	50

* and ** indicate production capacity of below 5, and 5 to 100 kw respectively.

e. Sanitation programs

Sanitation in the context of this study includes the availability of toilet and proper waste management, as the scale and impact of drinking water interventions have already been analyzed (refer to section 3.2.1.3 (a), page 18). Waste management activities at KCA included village clean-up campaigns, with each household establishing bamboo trash cans and trash disposal tanks. Mothers groups have also been conducting waste management campaigns once a month. Household waste is further disposed of at a village dumping pit.

Several organizations including WWF Nepal have also provided support to establish toilets in the KCA. A majority (98.96%) of households have toilets at home (Table 21). All households at Tapethok, Lelep and Yamphudin VDCs have toilets at home, with Walanchung Gola VDC, in particular Yangma village, being the exception. The establishment of toilets and training on its proper use has been conducted in support of the government campaign to declare KCA VDCs as open defecation free zone.

Table 21: Toilet reach out at KCA households

VDC	Toilet households(%)	Open defecation free
Tapethok	100	Yes
Yamphudin	100	Yes
Walanchung Gola	82.81	Yes*
Lelep	100	Yes
Total	98.96	

**excluding Yangma village.*

f. Capacity building

More than half (58.26%, 134) of the 230 study households have received skill training from WWF Nepal (Table 22). The main objectives of the training were to enhance and diversify livelihood options of KCA households through livelihood improvement, and increase access to and control over natural resources. Training participants were asked whether they were implementing their training in practice, and responses are illustrated in Table 22 below.

Table 22: Type of training received by the study households

S.N.	Name of training	Trained people	Practiced households
1	Carpet weaving and knitting	13	13
2	Natural resource management and biodiversity conservation	18	18
3	Hotel Management	28	24
4	Account Keeping	16	16
5	NTFP training	26	22
6	Social mobilization and leadership	66	60
7	Forest fire control	26	22
8	Insect pest control	6	5
9	Compost making	8	7
10	Citizen scientist	11	10
11	Governance	12	12
12	Carpenter	10	10
13	Eco-tourism	1	1
14	Home stay	3	3
15	Pig rearing	6	6
16	Anti-poaching	5	5
17	Beekeeping	5	5
18	Equipment preparation	3	3
19	Micro-hydro	1	1
20	Potter	1	1
21	Farming	13	12
22	Improved mud stove making	1	1
23	Education	7	5
24	Suspension bridge construction and maintenance	1	1
25	Local resource person	1	1
26	Women health worker	3	3
Total	291*	267	

**The total number of households is higher than the study households because some of the households received more than one training.*

4. Challenges

As part of the second-level household surveys and FGDs, sample households were asked to identify the major challenges that limit livelihood enhancement in KCA. Listed below are some of the key challenges identified:

Increasing productivity

The major sources of livelihood of KCA households are agriculture and animal husbandry. However, these practices are primarily still conducted in a traditional manner - growing land races, rearing local-bred livestock, applying locally available resources and measures to control diseases on crops. This limits productivity, which is further lowered by increasing impacts of climate change. Increasing productivity through better management and improved varieties, techniques and technology, can ensure reduced pressure on natural resources.

Market assurance

Cardamom plantation is an important income source for households in lower KCA villages. However, market price fluctuation is a major concern. With many households having made huge investments in cardamom anticipating good returns, recent fall in prices are a cause of worry.

Technical Support

Study households reported absence of veterinary and agriculture technicians at the village level. Without these experts, communities were unable to deal with technical problems such as greenhouse setup, or crop and livestock diseases, hindering productivity.

Climate change

Study households reported that current WWF Nepal interventions has resulted in an increase in awareness on climate change, and helped them adapt to climate change impacts to a certain extent. Study households in Ghunsa compared the current situation to just five years ago, and noted decrease in number of rainy days, increase in rainfall intensity, unpredictable precipitation with snow instead of rain, and vice versa. They also observed changes like mosquitoes and leeches in higher altitudes, yellowing of potato plants, early rotting of stored potatoes, and drying of springs; including one that used to feed a large pond. Likewise, peaks next to Ghunsa snow-capped up to 6-7 years ago, have now become completely exposed and rocky. Climate change impacts on pasture land includes shorter grasses, and drying water sources, which affect pasture and thus livestock health.



The dried spring. Until 2014, water used to pass through the white mark on the stones. © WWF

Lack of checkpoints to monitor illegal harvesting of herbs

The remote Tseram and Ramjer areas of Yamphudin VDC are home to important herbal plants such as *Bikhma*. In the absence of check posts and presence of authorities' in these remote areas, especially at Tseram, there is a high possibility of people across the border illegally harvesting valuable herbs according to locals.

Higher crop raiding by macaques

Extensive crop damages have been reported in Lelep, Yamphudin and Tapethok by macaques. Locals also informed that they had not received any relief.

Installation of long lasting bridges

While wooden bridges constructed in KCA have helped herders access little-used or disused pastures, benefiting both herder households and ecosystems, FGD participants noted low durability of these bridges. In most places, every year such bridges are washed away by the river during rainy seasons.

Regular monitoring by CBAPU

CBAPUs are formed to conduct anti-poaching patrols in designated areas to find and remove snares, and curb poaching and hunting activities. However, these units are relatively ill-equipped, with limited supplies and necessities such as tents for camping, compared to poachers who come from across the border. They are subsequently also discouraged by low allowances.

Increased training, adequate safety equipment including satellite phones or walkie talkies while accessing remote areas, and insurance schemes for community members engaged in these risky endeavors is essential to strengthen capacities and boost morale of CBAPUs to ensure effective anti-poaching operations.

Engagement of private sectors

The private sector can play an important role in the economic development of KCA, through sustainable green investments. However, due to remoteness and lack of road facilities, private sector presence is very limited.

5. Conclusion

Wildlife conservation and well-being of local communities are closely interlinked. Conservationists around the world are increasingly working towards establishing and strengthening these links to ensure sustainability in conservation. Working with this principle, KCAMC supported by WWF Nepal projects including USAID-funded SCAPES and AHM, have focused substantial resources on improving socio-economic status of KCA communities.

This study aimed to evaluate socio-economic benefits accrued by the KCA communities as part of conservation investments carried out under the USAID-funded SCAPES and AHM projects. While the study has limitations in terms of determining the impact of individual contributions considering involvement of multiple partners, effort has been made to prioritize USAID supported WWF Nepal projects, followed by other WWF Nepal projects.

Overall, the resulting picture is an encouraging one, showing that all households in KCA have received some form of benefit from WWF Nepal interventions, and the support has brought about notable changes in community livelihoods. Major positive changes brought about by these interventions include an increase in household income, higher diversity in vegetables available across the year, significant time savings, saving of trees, control of open defecation, and group savings for revolving loans, among others.

Of the myriad interventions, the study identified that efforts to increase the climate resilience of agriculture, including adaptive irrigation and greenhouse vegetable farming have helped improve people's livelihoods the most. Direct livelihood interventions, such as improved beekeeping and new micro enterprises have the potential to benefit households, but may require detailed investigations to increase success rate. While livestock insurance schemes and savings in community based institutions are also expected to have major positive impacts on the livelihoods of KCA communities, systematic assessment of these were outside the scope of this study. Such assessment, including relief for crop damage by wildlife, could help improve the efficacy of the relief system. There also remains an opportunity to explore integration of the GoN's relief mechanism to ensure sustainability of the community-based relief systems in place.

Despite these challenges, these interventions and resulting socio-economic benefits have been recognized to have brought about positive changes in people's attitude towards wildlife, particularly snow leopards. The authors anticipate that this study will provide for documentation of successes, challenges and opportunities in enhancing livelihoods and sustaining conservation of wildlife in KCA.

6. Lessons Learned and Recommendations

Based on this study, certain learnings and opportunities have been identified that could benefit the communities further, and enhance conservation successes. These are listed below:

Increase coverage of adaptive agriculture interventions:

Agriculture is the main stay of the local communities of KCA. However agricultural productivity is retarded by conventional factors of small size cultivable land, seasonal, weather dependent and traditional ways of farming, as well as climate change impacts such as reduced water availability, or occurrence of new diseases and infestations. Beneficiaries of adaptive agriculture techniques like greenhouse agriculture and adaptive irrigation have notably already enhanced their productivity, profitability and food security. The study identified that these interventions have yet to reach over 70% of KCA households, reflecting an opportunity to increase prosperity via agriculture. However, such a scale-up should be accompanied by a clear focus on building farmer knowledge of improved agricultural techniques and disease and insect control measures, as well as taking into account market accessibility and assurances for local produce. Engaging with the experts of Nepal Agriculture Research Council, District Agriculture Development Office, Agribusiness Promotion and Marketing Development, Department of Agriculture, and mobilizing GoN's support systems, while keeping potential negative impacts on nature in check, will be helpful in improving sustainable success for livelihood enhancement and conservation.

Increase access to clean energy sources:

The study shows that alternative energy initiatives like improved cook stoves, solar, and micro and pico hydropower have all been effective in reducing deforestation, saving time and improving the health of KCA communities by reducing the indoor air pollution. However, clean cook stoves haven't reached 31.7% of households, and 46.32% household are devoid of electricity facility. Alternative energy, and energy efficient technologies need to be extended to cover all KCA households to ensure maximum impact. As technologies and accessibility enhances, more efficient energy sources could be explored and rolled-out in long-term, as, although improved cook stoves reduce consumption, it does not completely eradicate need for fuel wood.

Replicate livestock insurance schemes:

Community-based Livestock Insurance Scheme has been identified by the communities as an important intervention that has helped shaped people's positive attitude towards snow leopards. Learning from this system could be useful in other mountain regions of the country for human-wildlife conflict mitigation. The key factors in the success of LIS in KCA appear to be the participatory process used to set up and establish the LIS, its governance structure and operational framework.

While it was suggested that the compensation amount needs to be periodically revised to reflect market prices, it would help to integrate the system with the provisions of the GoN's Wildlife Damage Relief Guidelines. This will enhance relief amount as well as extend coverage due to losses caused by other predators including the common leopard and wolves. There also exists opportunities to explore utilization of GoN's crop and livestock insurance policies, and engage with insurance companies, for sustainability. A detailed assessment of the challenges and opportunities, including understanding on correlation between livestock lost to wildlife and relief provided, will help direct future actions.

Introduce measures to reduce the livelihood impact of crop losses:

Wildlife damage to agricultural crops (especially by macaques and deer) was recorded in about 73.91% KCA houses in 2016. This serious problem with severe livelihood impacts for KCA communities currently has no effective solution. While not life-threatening, these issues generate negativity of communities towards wildlife, and jeopardize positive gains made through other

interventions. A comprehensive spatial and temporal assessment of crop losses will provide a baseline to explore for potential preventive and mitigative solutions. In the meanwhile, efforts need to be made to mobilize the crop damage relief fund to provide relief, in addition to the current use as a source for revolving fund. As with LIS, integration with GoN's schemes may be helpful in the long-run.

Promote tourism:

KCA is a land of immense natural beauty, that has the potential to cater to a wide range of travel enthusiasts. However, due to various reasons including accessibility, enhancing earning through tourism remains an untapped opportunity. Other than necessary marketing link-ups with institutions and private partners that may increase tourist flow to KCA, management will need to consider providing fair-priced and informed systems ensuring earnings for local communities and comfortable stay for visitors.

Take a different approach to enterprises:

Natural resources based small scale enterprises can demonstrate the economic benefits of conservation and promote sustainable use. A number of small scale enterprises such as seabuckthorn juice processing, incense making, essential oil plants, and potato chips preparation have been introduced. Despite their importance and the effort expended, these enterprises have been only partly successful. Reasons include high cost of production, lack of packaging and marketing knowhow, and political differences, among others. It will be useful to document the learnings systematically, identify gaps and explore solutions to strategize and execute this income-generating and capacitating initiative.

Examine implications of decrease in livestock rearing:

A lower number of households are herders, and households have also decreased their amount of livestock, mainly due to the takeover of pasture land for community forest or cardamom farming. This has manifold implications on KCA livelihood: livestock manure is the major source of crop nutrient in KCA, and reduced livestock and subsequently manure could result in lower crop productivity, decreased food security and consequently income. Animal husbandry is also the main source of protein for KCA households.

While livestock present challenges to wildlife, considering long-term association of local communities with herding, it will be imperative to identify and implement approaches that improve practices that benefit both people and wildlife.

Seek sustainable funding:

Women groups, CFUGs, CAUC, SLCC, CBAPO and KCAMC have been established at KCA. These groups and institutions have now become increasingly more capable, effective, efficient, self-sustaining and self-reliant. Further strengthening their capacity to raise and mobilize funds through multiple sources and manage a variety of conservation and livelihood finance mechanisms, will help capitalize on these institutions better.

Incorporate good practices and learning in government's program:

This study documents some of the successful interventions in addition to challenges and opportunities, from interventions supported by WWF Nepal. These learnings can be incorporated in the government's programs as applicable, or used as baseline to design initiatives, that benefit both wildlife and people of KCA.

7. References

- Altieri, M. A. (1999). The ecological role of biodiversity in agroecosystems. *Agriculture, ecosystems & environment*, 74 (1), 19-31.
- Champoiseau, P. G., Jones, J. B., & Allen, C. (2009). *Ralstonia solanacearum* race 3 biovar 2 causes tropical losses and temperate anxieties. *Plant Health Progress*, 10, 1-10.
- FAO. (2011). Biodiversity for food and Agriculture: Contributing to food security and sustainability in a changing world. The Food and Agriculture Organization (FAO) of the United Nations and the Platform for Agro biodiversity Research. Outcomes of an expert workshop held by FAO and the Platform on Agro biodiversity Research from 14-16 April 2010 in Rome, Italy.
- Gotame, B. (2008). Economics of Biodiversity Conservation in Nepal. *The Initiation* 2(1): 55-61.
- Gurung, G. S. (2006). Reconciling Biodiversity Conservation Priorities with Livelihood Needs in Kangchenjunga Conservation Area, Nepal (Vol. 23). *Department of Geography, Division of Human Geography, University of Zurich,, Zurich, Switzerland*.
- Jarvis, D.I., Padoch, C., & Cooper, H.D. (2007). Biodiversity, agriculture and ecosystem services. In Jarvis DI, Padoch C and Cooper D (eds). *Managing Biodiversity in Agricultural Ecosystems*, Columbia University, New York, USA, pp.1-12.
- KCAMC. (2013). Kangchenjunga Conservation Area Management plan 2070/071-2074/075. Kangchenjunga Conservation Area Management Council (KCAMC), Lelep-3, Taplejung (*In Nepali*).
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, 30 (3), 607-610.
- Mijatović, D., Van Oudenhoven, F., Eyzaguirre, P., & Hodgkin, T. (2013). The role of agricultural biodiversity in strengthening resilience to climate change: towards an analytical framework. *International journal of agricultural sustainability*, 11(2), 95-107.
- Rai, D.S., Tshering, K., Gyeltshen, K., Norbu, N., Sherub., Ngawang, R., & Wangchuk, S. (2008). Biodiversity of Toorsa Strict Nature Reserve-Jigme Dorji National Park Proposed Conservation Corridor, Western Bhutan. In Chettri Nakul, Shakya Bandana and Sharma Eklabya. *Biodiversity Conservation in the Kangchenjunga Landscape*. Hill side Press (P.) Ltd. Kathmandu. Pp 39-55.
- Raychaudhuri, S. P., & Chatterjee, S. N. (1958). A preliminary note on the occurrence of a new virus disease of large cardamom (*Amomum subulatum* Roxb.) in Darjeeling District. In *Proceedings of Mycological Research Worker's Conference, ICAR, held at Shimla from the 20th to* (Vol. 23, pp. 174-176).
- UNEP. (2008). Farmers and the future of agro-biodiversity. United National Environment Programme (UNEP) COP 9 MOP 4 Bonn Germany 2008. Retrieved on 13 October, 2017 at <http://www.unep.org/chinese/iyb/pdf/Agrobiodivbriefs.pdf>.
- Upadhyaya, D., Dhakal, R., Khadka, K., Rana, S., Acharya, P., Rana, R., & Chaudhary, P. (2016). Local Knowledge on Climate-induced Traits in Rice for Improving Crop Yield, Food Security and Climate Resilience. *International Journal of Agriculture Innovations and Research* 5 (3), 385-396.

Vanek, S. J., & Drinkwater L. E. (2013). Environmental, social, and management drivers of soil nutrient mass balances in an extensive Andean cropping system. *Ecosystems* 16:1517-1535. <http://dx.doi.org/10.1007/s10021-013-9699-3>

Vijayan, A. K., Gudade, B. A., Deka, T. N., & Chouseholdsetri, P. (2014). Status of viral diseases of large cardamom (*Amomum subulatum* Roxb.) and its management in Sikkim and Darjeeling, West Bengal. *J Mycol Pl Pathol*, 44(4), 438-441.

WWF. (2016). Kangchenjunga Conservation Area. Status report. Findings of the baseline survey. WWF Nepal Baluwatar, Kathmandu. In process of publication.

Zimmerer, K. S. (2013). The compatibility of agricultural intensification in a global hotspot of smallholder agrobiodiversity (Bolivia). *Proceedings of the National Academy of Sciences of the United States of America* 110(8):2769-2774. <http://dx.doi.org/10.1073/pnas.1216294110>.

8. Appendices

8.1. Appendix 1: List of data enumerators

S.No.	Name
1	Shova Rai
2	Nima Futi
3	Bhim B Rai
4	Dipesh Sharma
5	Tshring Sherpa
6	Nirusha Rai
7	Bisnu Bhutiya
8	Sarjit Rai
9	Gwajo Lama
10	Bisnu Bhotey
11	Chhiring Ghorpa
12	Susan Rai
13	Pema Tasi Sherpa
14	Kalpana Limbu
15	Premika Limbu
16	Subha Darshan Limbu
17	Nupu Sherpa
18	Sanjay Limbu
19	Doma Sherpa
20	Dawa Chiring Sherpa
21	Tasi Sherpa
22	Tensing Sherpa
23	Onggya Sherpa
24	Manika Rai
25	Dilip Limbu
26	Durga Limbu
27	Santosh Limbu
28	Sukraraj Limbu
29	Ninanta Limbu
30	Chaturman Limbu
31	Deepak Limbu
32	Gyajo Lama

8.2. Appendix 2: List of participants in FGDs across 5 villages

S.No.	Name of Participants	Address
1	Chetan Dandu Sherpa	Ghunsa
2	Dandu Sherpa	Ghunsa
3	Himali Chungda Sherpa	Ghunsa
4	Nima Sherpa	Ghunsa
5	Uttuk Sherpa	Ghunsa
6	Pema Dongwel Sherpa	Ghunsa
7	Shreemati Lasu Sherpa	Ghunsa
8	Dharke Sherpa	Ghunsa
9	Pema Sherpa	Ghunsa
10	Tashi Tenjing Sherpa	Ghunsa
11	Lakpa Shiring Sherpa	Lelep
12	Pemba Futi Sherpa	Lelep
13	Pasang Bhote	Lelep
14	Sita B.K.	Lelep
15	Pemba Choki Sherpa	Lelep
16	Pabitra Sherpa	Lelep
17	Gyanu Sherpa	Lelep
18	Keshing Limbu	Lelep
19	Cherren Sherpa	Lelep
20	Pema Tashi Sherpa	Lelep
21	Susan Rai	Lelep
22	Kalpana Limbu	Lelep
23	Dawa Shiring Sherpa	Lelep
24	Abhirman Rai	Yamphudin
25	Man Kumari Rai	Yamphudin
26	Ram Kumari Rai	Yamphudin
27	Dawa Chiring Sherpa	Yamphudin
28	Gyajo Lama	Yamphudin
29	Bhim Bahadur Rai	Yamphudin
30	Surya Man Rai	Yamphudin
31	Lochan Kumar Limbu	Tapethok
32	Dhan Hyang Limbu	Tapethok
33	Hem Bahadur Limbu	Tapethok
34	Samichyya Limbu	Tapethok
35	Sancha Kumari Limbu	Tapethok

36	Ramesh Limbu	Tapethok
37	Birahad Lal Limbu	Tapethok
38	Dipak Limbu	Tapethok
39	Nupu Sherpa	Walanchung Gola
40	Chetan Sherpa	Walanchung Gola
41	Guru Lakyam Sherpa	Walanchung Gola
42	Henden Sherpa	Walanchung Gola
43	Tashi Sherpa	Walanchung Gola
44	Fupu Chungda Sherpa	Walanchung Gola
45	Yangi Sherpa	Walanchung Gola
46	Pasangi Sherpa	Walanchung Gola
47	Pema Tashi Sherpa	Walanchung Gola
48	Nupu Tshiring Sherpa	Walanchung Gola



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