Valley Conservation and Sustainable Development Plans
Central Karakorum National Park
2016-2026
Gilgit Baltistan
District Skardu

EvK2CNR PAKISTAN

CENTRAL KARAKORAM NATIONAL PARK CKNP

seed Social Economic Environmental Development

Valley Conservation And Sustainable Development Plans
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Central Karakoram National Park
Gilgit Baltistan

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CONTENTS

List Of Exhibits

Abbreviations

°C	Celsius
ABG	Annual Biomass Growth
CAI	Current Annual Growth
CKNP	Central Karakoram National Park
CPEC	China Pakistan Economic Corridor
E	East
EIA	Environmental Impact Assessment
FGD	Focus Group Discussion
GB	Gilgit-Baltistan
GLOF	Glacier lake outburst flood
HH	Households
INGO	International Nongovernmental Organization
Kg	Kilograms
KIU	Karakorum International University
LSO	Local Support Organization
m a.s.l.	Meter above sea level
Mg	Mega grams
MP	Management Plan
N	North
N/A	Not Applicable
NGO	Non-governmental Organization
NTFP	Non-Timber Forest Product
OP	Operational Plan
S	Summer
SEED	Social Economic Environmental Development
UC	Union Council
VCC	Valley Conservation Committee
VCF	Valley Conservation Fund
VCSDP	Valley Conservation and Sustainable Development Plan
VCSP	Valley Conservation Sustainable Plan
VO	Village Organization
W	Winter
WO	Women organization
Yr	Year

1. OVERVIEW OF CKNP

1.1. Localization and access

The Central Karakoram National Park (CKNP), officially gazette as National Park in 1993, is situated within geographical limits of Gilgit-Baltistan. It is the largest national park in Pakistan, placed in category-II. This consists of two main zones, the Buffer Zone and the Core Zone, for a total of 10,557.73 Km^2. According to new administrative divisions, park spans on five of the ten districts of Gilgit-Baltistan[1]. These districts are Gilgit, Skardu, Nagar, Ghanche and Shigar.

CKNP is the largest national park of Pakistan CKNP having an area of 10,557.73 Km^2

CKNP presents variety of landscapes attitudinally ranging from 2000 - 8,000 m asl including world's second highest peak K2 (8,611 m asl), as its center piece and number of largest glaciers outside the polar regions. Land cover map of the area indicates that a major part (66.5%) is covered by snow and glaciers. Bare rocks and bare soils also represent a substantial part (15.4%) of CKNP whereas vegetation base classes represents about more than 14.7% of the area. Besides this, several other high altitude peaks and glaciers, provides world class tourism and mountaineering opportunities for tourists, trekkers and several others.

Exhibit 1: Landscapes of CKNP

1Khan, B. (2011).Field Guide to the Central Karakoram National Park, Pakistan. CESVI, Pakistan, Islamabad, pp. 45

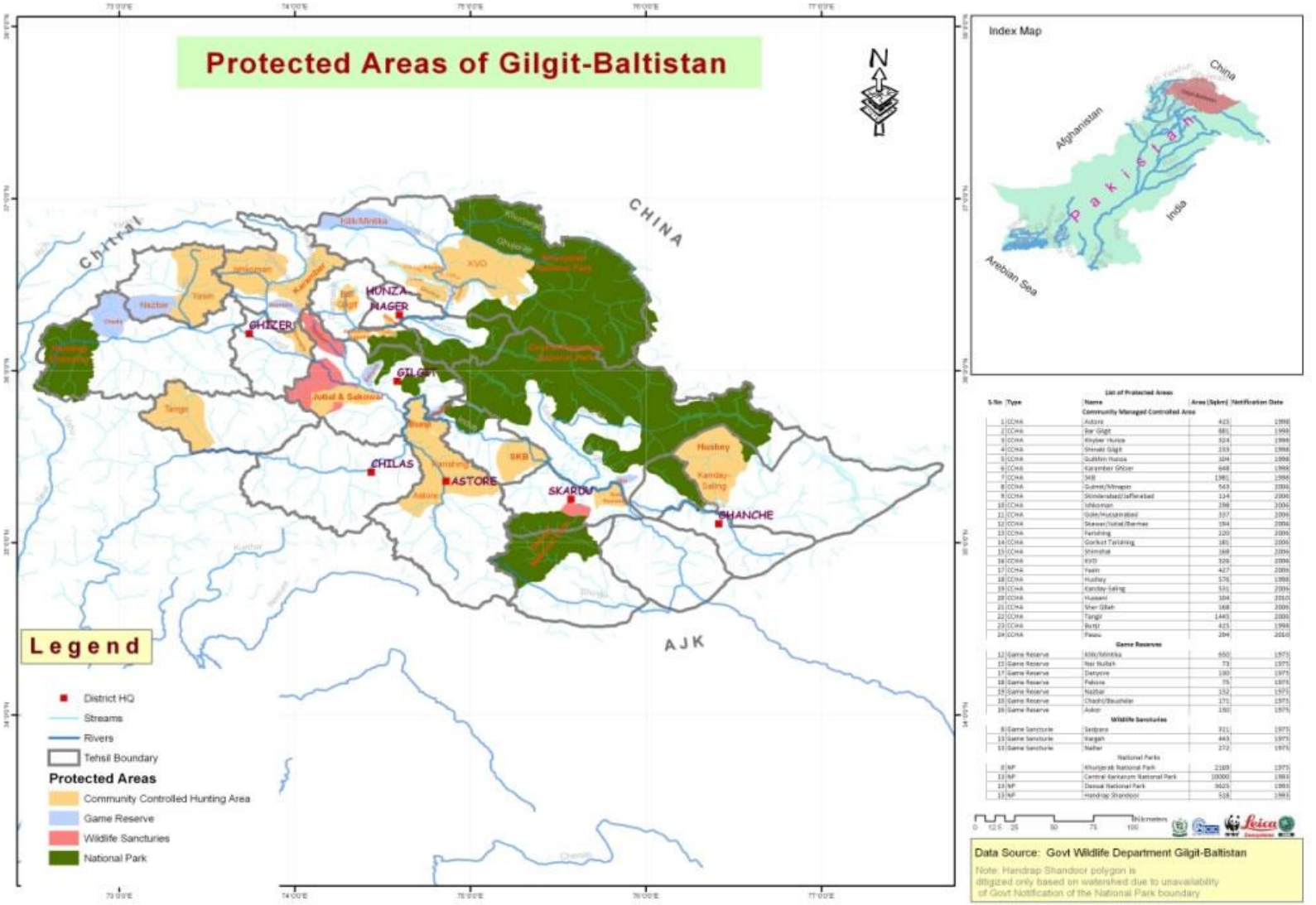


Exhibit 2: Protected areas of Gilgit-Baltistan

1.2. Local Climate

CKNP is part of the "transitional zone" between arid Central Asia and semi-humid subtropics of the South Asia. Local climate is characterized by greater precipitation in winter and spring and by the effects of arid continental climate in summer with sudden onsets of cold weather in early autumn. Average rainfall in the valleys is 100-300mm throughout the year[2].

Exhibit 3: K2, CKNP

1.3. Ecological Profile

Diversity and distribution of natural vegetation and associated fauna is closely linked to climatic and topographic conditions. It declines northwards of the park and increases in south-western regions of CKNP. Owing to the diverse micro-climatic, geographic and environmental conditions. The area is rich in biological diversity and a great source of freshwater and other services of highly aesthetic, ecological and socio-economic significance, for millions of people in Gilgit-Baltistan, as well as for those living downstream of the River Indus in Pakistan, and elsewhere in the world who like to venture through the rugged mountainous and glaciated landscape of Karakoram[3]. The dry alpine vegetation, comprising the species of Artemesia, Juniper, Polygonum and Wild Rose on slopes, whereas, Myricaria and sea buckthorn bushes along riverbanks and streambeds characterize most of the CKNP areas. Broadleaves mainly consist of scattered patches of *Betula utilis* and Salix spp., found in humid places. Conifers, comprising mainly of *Pinus wallichiana*, predominantly occur at lower altitudes in the western ends of the Park including Roundu Skardu, Haramosh, Bagrote and adjacent valleys of Gilgit

Exhibit 4: Vegetation of CKNP

2 Mari, F., Gallo, M.,Vuillermoz, E., Milanesi, D., Dece, L., Burashchi, E., Hassan, R., Central Karakoram National Park Management Plan. Ev-K2-CNR, Pakistan, Islamabad, pp. 323.

3 IUCN, Pakistan. (2009). Central Karakoram Conservation Complex. Draft Management Plan. Sub plan: Species Management, IUCN Pakistan, Karachi. Pages 24.

Exhibit 5: North East face of CKNP

and Hunza and Nagar[4]. Large mammals are a key resource and important conservation focus in CKNP (IUCN, 2009a). The Park is a refuge area not only for threatened species, such as markhor, musk deer, Ladakh urial, Marco Polo sheep (presence to be confirmed in CKNP) and snow leopard, but also for non-threatened but important "flagship" species, such as blue sheep, Siberian ibex, lynx and grey wolf.

2. MANAGEMENT OF CKNP

The management of national park has been governed by its management plan develop in 2014. CKNP is surrounded by 230 villages, inhabited by over 115,000 people living in about 13,000 households, which have access rights upon resources.

Majority of the local communities live an agro-pastoral life depending upon the Parks resources such as rangelands, forests, wildlife, medicinal flora, etc. Moreover, a considerable number of local people are also engaged in tourism and mining industry in and around CKNP. Thus, the local communities around CKNP are major stakeholders and systematic community involvement in Park management is highly desirable to foster a positive relationship between people's needs and Park ecology, which has been emphasized in Integrated Park Management Plan (IPMP) for CKNP[5] for the following major reasons:

One of the National Park's goals is to preserve and promote, in a sustainable way, local cultural heritage which is widely distributed in the valley adjoined CKNP; the CKNP management process is based on a "participatory development and implementation strategy". Considering the large extent of the park and the socio-economic and ecological diversity in the surrounding areas, the resources of the Park management office are limited and will have to rely on a large extent on communities living around CKNP for successful park management. For these reasons the park management office aims at committing community-based organizations to collaboration for management of the park[6]

4 Ferrari, E. (2014). Methodological issues in implementing a Sustainable Forest Management Plan in remote mountain areas: the Karakorum (Pakistan). Ph.D. Thesis. University of Padova, Italy.

5 Integrated Park Management Plan (IPMP) for Central Karakoram National Park. 2014. Developed by Ev-K2-CNR, Islamabad, Pakistan.

6 Flury, B. 2012. Livelihoods and natural resource management in Central Karakoram National Park Areas – Braldo and Basha valleys. Research Report Developed for SEED Project. 46 pp.

However, illegal activities (e.g. wood collection, grazing and tourism) are conducted inside the Park borders. The natural resources in CKNP are subjected to pressure due to traditional rights of the local inhabitants and tourism practices[7]. In addition, other activities not directly related with resource use could affect the Park integrity; and the local communities have some expectations from the Park as a relevant tool to improve their living standards and socio-economic conditions. In CKNP areas, community participation in co-management of natural resources starts from 1990's with establishment of Village and Valley Conservation Committees (VCCs) by INGOs such as IUCN and WWF. The initiative was based on Community-based Natural Resource Management (CBNRM) approach, which was first implemented in Africa and then adapted and applied in some areas of Gilgit-Baltistan, including an adjacent village of CKNP namely Hushey[8]. The initiative primarily aimed at development of community-based trophy hunting program. By 2013 more than 30 community-based organizations namely VCCs, LSOs and other local NGOs were formed by organizations like AKRSP, GBFWED, Ev-K2-CNR and WWF to facilitate CBNRM around CKNP with a view to have protect the Park resources.

Management plan for CKNP has already been developed by EVK2CNR and implemented by CKNP directorate; in response to which certain management gaps have ascended and create difficulty in the park management. To address this issue new and detailed operational plan on the basis of VCSDPS have to be developed for revised management plan of CKNP.

3. NEED OF REVISED OPERATION PLAN/SEED PHASE EXTENSION

The CKNP management plan has already been translated to an operational plan, making it easier for the park staff to understand and implement the plan. The operational plan is based on the data that was available through earlier surveys and reports on the socio-economic and environmental status of selected valleys, just 4 in numbers. Although most of the information, collected earlier were applicable to rest of the park valleys, but there were some obvious gaps that were identified through subsequent evaluation with some as follows:

a) Assessment of Customary Practices
b) Assessment of Climate Change impact on natural resources
c) Valley specific action plan

Besides, this was realized that since the implementation of the CKNP management plan is the basic objective that has been made easier through the formulation of an operational plan but since there were gaps in information from the valleys, reflecting in the management, and subsequently in the operational plan, the consequent implementation of the plan may not yield the desirable results.

7 Panzeri, D & M. Khan. 2009. Livelihoods in Central Karakoram National Park. Socioeconomic baseline data survey. HKKH Technical Report, 77 pp.

8 IPMP for CKNP. 2014. Developed by Ev-K2-CNR, Bergamao, Italy

4. SCOPE OF THE VCSDP

Villages surrounding the buffer area of CKNP have been defined into 15 distinct valleys. These valleys have been defined by same watersheds, considering some geographical analogies, district appurtenance and other proximity relations. For each valley around CKNP a specific Valley Conservation and Sustainable Development Plan (VCSDP) needs to be prepared and implemented to manage core, transition and buffer zone related conservation issues. CKNP VCSDP deals with the integrated conservation and sustainable development matters of its 15 valleys namely Danyore, Haramosh, Upper Braldu, Lower Braldu, Shigar, Astak, Tormik, Thalay, Ghulmat, Nagar, Bagrot, Basha, Hoper-Hispar, Nagar and Hushey that fall within CKNP buffer zone and depends upon park resources for subsistence. Integrated Park Management Plan (IPMP) for CKNP (2014)[9] emphasizes to strengthen the community-based organizations (VCCs and LSOs) around CKNP to make them integrated conservation and development bodies, with a view to:

a) Institutionalize an integrated conservation and development approach at the community level;
b) Increase effectiveness of project implementation
c) Empower women and strength representation of communities into the CKNP management process.

Valley Conservation planning process has been a valuable and important part of the CKNP management in engaging local communities. However, the CKNP Management Plan (2014) while evaluating the existing VCPs around CKNP has identified some gaps to improve this process. Those gaps include several factors such as lack of consistency between various components of the plans, lack of conceptual clarity, and lack of a monitoring mechanism, less clear role, responsibilities, and inappropriate information about resources required to undertake the desirable actions.

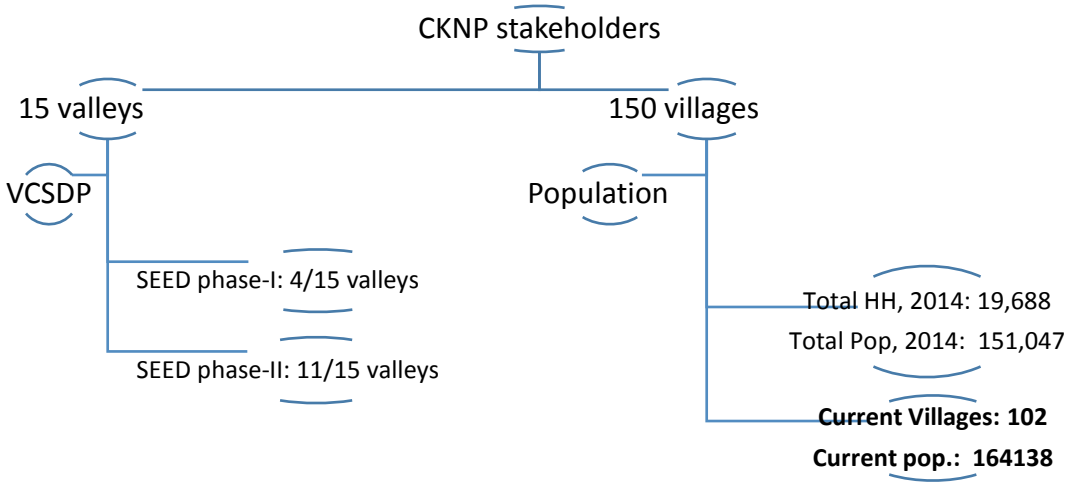
Based on this evaluation, the CKNP Management Plan (2014) has recommended to "revise and amend the VCPs according to a tested and universally acknowledged planning instrument, such as the logical framework approach, for example if they are to fulfill their functions as an instrument for grass-roots planning and implementation within the CKNP management process".

Development and approval of VCPs involve four steps including:

a) Resource Need Assessment (RNA)
b) Participatory Conservation Planning (PCP)
c) Approval of VCP from District Conservation Committees (DCCs)

9Integrated Park Management Plan (IPMP) for CKNP. 2014. Developed by Ev-K2-CNR, Country Office, Islamabad, Pakistan

d) Implementation of VCP through VCCs and other stakeholders.



4.1. Objectives of VCSDPS

One of the steps of CBNRM was to develop Conservation Plans at village or valley level, aimed to provide guidelines for participatory natural resource management. The revised VCPs, keeping in view the integration approach have been termed as Valley Conservation and Sustainable Development Plans (VCSDPs) aimed at the following specific objectives:

a) Promote participatory NRM in CKNP buffer zone villages and valleys to ameliorate environmental conservation of the park.
b) Create synergies among park stakeholder to promote community-based conservation in CKNP buffer zone.

4.2. Structure and Composition of the VCSDP Plan

The plan comprises of the following ten segments:

a) Socio-economic and Ecological profile of valley
b) Assessment of Customary Practices
c) Assessment of Climate Change impact on natural resources
d) Management issues and problems;
e) Proposed management interventions
f) Management actions
g) Indicators of process and progress
h) Implementation mechanisms/Available capacities for the implementation of the Valley Conservation Plans: Social organizations - CKNP Directorate - Facilitating NGOs/CBOs – Others
i) Expected outputs
j) Visible bottlenecks in realizing the expected outputs, and arrangements (available and potential both) to overcome the bottlenecks
k) Monitoring mechanism

4.3. Process of VCSDP Development

The VCSDP development process included following stages.

a) Designing of Questionnaire
b) Training of Enumerators
c) Pre-testing of Questionnaire and pilot survey
d) Sample Size and Interviewee classification
e) Compilation and Analysis of Data
f) Write up of VCSDP

4.3.1 Development procedure of Questionnaire

As a result of CKNP management and operational plan, it became essential to develop the VCSDP's to address the climate change adaptations and assessment of validity of statutory and customary laws in each valley for the conservation of ecosystem. To ensure the successful ecosystem planning community based approach was employed for which development of detailed questionnaire was recommended by the technical experts. Owing to the need of improvement in previously developed questionnaire (developed by WWF and Ev-K2-CNR) and VCSDP's of four valleys (namely Hooper-Hisper, Basha, Hushey, Bagrot) frequent sessions with technical experts from relevant departments, CKNP directorate and representative from local communities were held. The amended questionnaire was semi-structured and involves the research to analyze the attitudes and adaptation practices (customary/statutory) of the local community towards natural resources management in response to changing climate.

Exhibit 6: Meeting with community representatives before Questionnaire Development

4.3.2 Design of Questionnaire

The questionnaire consists of following sections

a. Basic facilities in the village
b. Statutory vs. Customary Laws/Practices
c. Climate Change Impacts on Natural Resources
d. Assessment of current customary practices in response to climate change
e. Management Issues/Problems

Design of all sections is based on analysis of past, current and future time scenarios, based on available projections and excavation of indigenous knowledge.

4.3.3 Pre-testing of Questionnaire and pilot survey

Enumerators have been trained by technical personnel about the interview methodology and information probing through relevant follow up questions from the community. Representatives of the target groups have been identified and a pilot survey was conducted to give the enumerators a real time experience along with the assessment of difficulties that can be encountered during the field survey.

Exhibit 7: Presentation about VCSDP Questionnaire to enumerators

4.3.4 Sample Size and Interviewee classification

The 10% of local community in each valley has been interviewed as sample population which responded with almost same type of answers. This repetition of responses shows that enough sample size has been taken. Interviewees were selected randomly but above the age of 40. The minimum scale for age of the interviewee was 40 years because of the enough acquaintance to the nature based on their life experiences as compared to young generation. To ensure accuracy and resolution of conflict in the information, individual interviews were supplemented with FGDs were conducted. The group comprised of 6-12 persons from local community for each focused discussion. Local community and professionals from relevant departments from both genders has been appointed to interview the semi-structured questionnaires.

Exhibit 8: Meeting with Enumerators

Information for socio-economic and ecological profile of the valley, management issues and problems and proposed interventions were obtained with the help of Focused Group Discussion (FGDs); and interviews with household heads.

4.3.5 Data collection, Compilation and Analysis

Both the quantitative and qualitative type of information has been obtained by the questionnaire. The quantitative data in terms of economic benefits has been expressed in relation to customary practices and climate change. The qualitative information will help to design local-level plans or policies may be important in shaping adaptive capacity of vulnerable households and individuals. Regional or district plans and/or sector strategies can give helpful information on priorities of local governments.

Exhibit 9: FGD session at Upper Braldo

By combining local knowledge with scientific data obtained via secondary resources including review articles, this document addresses the people's understanding about climate risks and adaptation strategies and validity of customary rules in consumption of natural resources.

Exhibit 10: Female Enumerator interviewing local representative of Danyore Valley

Best natural resource management practices from other PAs such as KNP in Gilgit-Baltistan and lessons of CBNRM from various valleys of GB were also reviewed for extracting proposed management interventions and actions. A meeting was conducted with CKNP management in Skardu to obtain their opinion on management issues, innervations and appropriate actions.

Exhibit 11: Training of Enumerators for Data Punching

CKNP Management Plan (2014) and SEED Project Technical Report were also consulted for relevant recommendations. Lessons learned by CKNP partners under SEED Project were reviewed from various documents available with WWF-Pakistan. Previously developed VCSDP of Basha, Bagrot and Hisper/Hoper were also reviewed to obtain useful information.

4.3.6 Ethical Consideration

As the interviews, being done was the research for VCSDPs development, therefore ethical issues were considered. Interviewee were informed about the purpose of the interview and the way this information will be used. Moreover, female interviewers were appointed to conduct the interviews from female representative of local communities to respect their culture and conflict resolution.

OVERVIEW OF CKNP VALLEYS

5. OVERVIEW OF CKNP VALLEYS

Indigenous communities are vulnerable to displacement face the difficult task of ensuring that their communities will be able to stay in place for as long as possible. Indigenous communities while interacting and surviving in nature have collected tremendous information on the ways of adaptability and sustainability. This traditional knowledge is complete resource of culture, experiences, natural resources, climate, and sustainable ways to thrive. These are accumulated through experience, relationships, and upheld responsibilities towards themselves and other living beings and places and are passed down generationally through oral histories, stories, ceremonies, and resource use practices. This traditional knowledge is a knack of local communities and come with certain responsibilities, such as determining when and with whom they should be shared.

Presented below is the assessment of customary practices and adaptation to climate change as a tool of sustainable management of CKNP.

Exhibit 12: Socio-Demographic Information of CKNP valleys

Name of Valley	No. of Villages	Total population		Distance to access road	No. of Schools	No. of Health centers	No. of Vet. centers
		Human	Livestock				
Nagar	7	28716	34250	Connected through link roads	16	6	4
Ghulmat	7	16896	19867	Lies along KKH	15	6	3
Danyore	5	41200	51530	-do-	5	4	2
Haramosh	7	9846	98763	Lies along KKH-Skardu road	6	5	2
Astak	16	6827	24808	45 min drive to main Skardu road.	10	3	1
Tormik	15	8533	16522	Located away from main road	11	3	1
Lower Braldo	8	5952	12263	-do-	7	1	1
Upper Braldo	9	3557	28440	-do-	10	4	0
Shigar	16	20295	15099	-do-	15	10	3
Thalay	10	9116	6220	-do-	8	7	2
Daghoni	2	13200	17600	-do-	2	2	0
Total	**102**	**164138**	**325362**	--	**89**	**45**	**15**

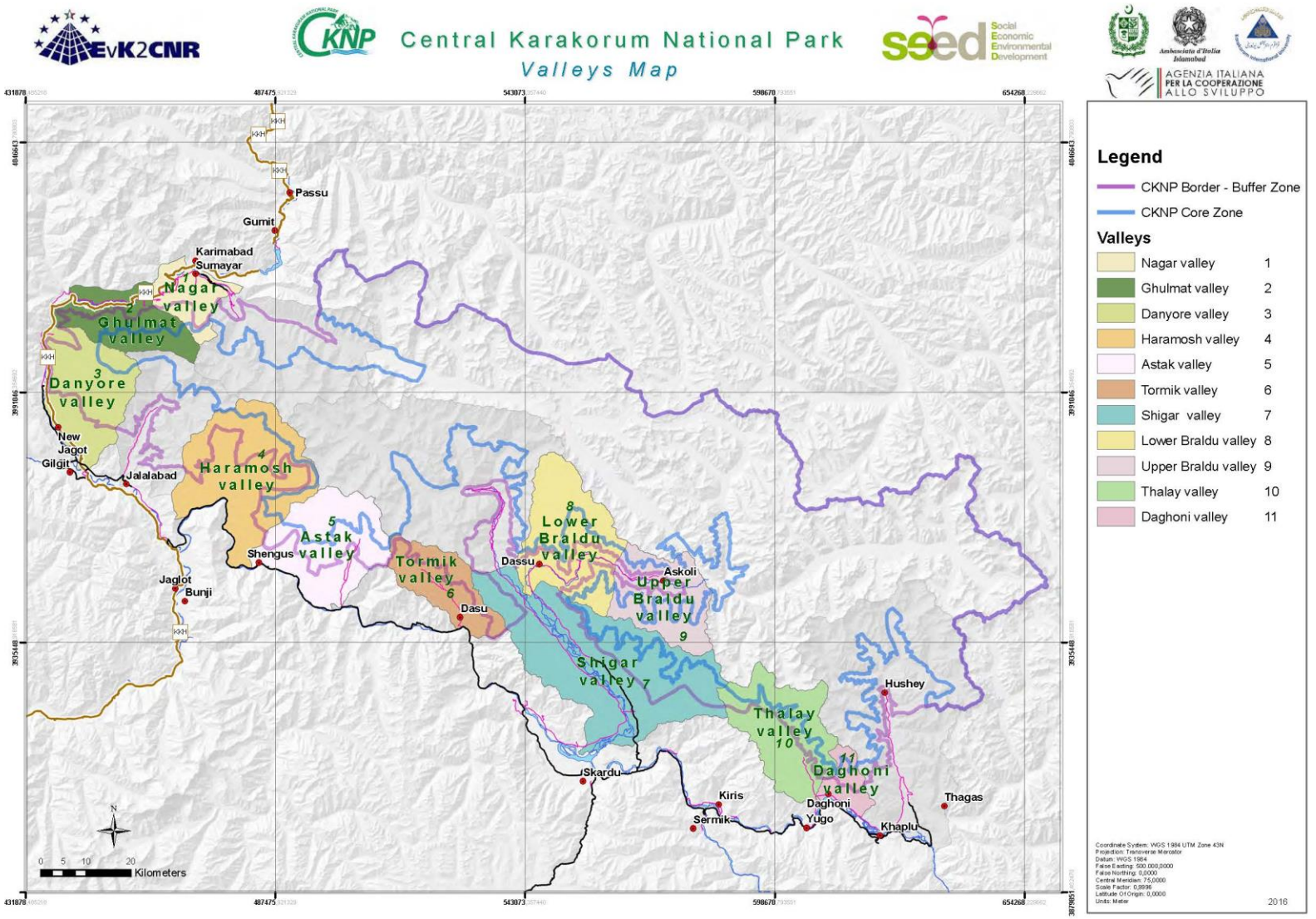


Exhibit 13: Valleys of CKNP

Exhibit 14: Status of Natural Resource Harvest in CKNP valleys

Name of Valley	Water				Forest				Pastures				Medicinal Plants				Wildlife Hunting			
	Sustainable	Unsustainable			Sustainable	Unsustainable			Sustainable	Unsustainable			Sustainable	Unsustainable			Sustainable	Unsustainable		
		L	M	H		L	M	H		L	M	H		L	M	H		L	M	H
Nagar	✓	-	-	-	-	✓	-	-	-	-	✓	-	✓	-	-	-	✓	-	-	-
Ghulmat	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓	-	-	-	-	-	✓	-
Danyore	-	✓	-	-	-	-	✓	-	-	-	✓	-	✓	-	-	-	-	-	✓	-
Haramosh	-	✓	-	-	-	-	✓	-	-	-	✓	-		-	-	-	-	-	✓	-
Astak	✓	-	-	-	-	-	-	✓	-	-	-	✓	✓	-	-	-	-	✓	-	-
Tormik	✓	-	-	-	-	-	✓		-	-	-	✓	✓	-	-	-	-	-	✓	-
Lower Braldo	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓	-	-	-	-	-	✓	-
Upper Braldo	✓	-	-	-	-	-	-	✓	-	-	-	✓	✓	-	-	-	-	-	✓	-
Shigar	✓	-	-	-	-	-	-	✓	-	-	-	✓	✓	-	-	-	-	✓	-	-
Thalay	✓	-	-	-	-	-	-	✓	-	-	-	✓	✓	-	-	-	-		✓	-
Daghoni	✓	-	-	-	-	✓	-	-	-	-	✓	-	✓	-	-	-	-	✓	-	-

- Nil, L=Low, M= Medium, H=High

Exhibit 15: Assessment of validity of customary and statutory rules in CKNP valleys for Park resources

S. No.	Consumptive uses of Park Resources.	Community practices	CKNP MP/OP rules	Recommendation
1.	Harvest of Forest and other natural vegetation	Juniper trees are cut and used as fuel wood and timber	Harvest of Juniper is banned; if harvest is necessary than only only braches should be removed instead of whole tree	Awareness of community is required
		Riparian vegetation e.g. Sea-buckthorn and Willows, community usually remove the whole plant/tree from soil	Cut single basal shoots from each plant to preserve in its root system. By doing so, new shoots can re-grow rapidly producing new biomass to be harvested	-do-
		Community harvests wood at unsustainable level both from buffer and core zone	Wood and shrub collection is allowed only in the buffer zone up to sustainable level	Afforestation, alternative fuel options and sustainable forest management areas are need to be designated. Along with this harvest rate compatible to annual growth of forest should be determined
2.	Medicinal Plants	Community harvests local medicinal herbs and aromatic plants from park for household purpose	Harvest is completely banned in core zone and allowed at sustainable level from buffer areas under license.	Community must be awarded the license and concerned department restrict the harvest without license.
3.	Livestock Grazing	Herd grazing is allowed only in buffer zone and tourism focused zones of the park.	Community graze their livestock in packs along with dogs inside core zone. Dogs and packs are not allowed inside parks	Improvement in watch and ward mechanism along with community awareness is necessary at urgency
		Equines (horses, mules, donkey) occasionally found in core zone of the park	Equines are allowed only in tourism focused zone	--

S. No.	Consumptive uses of Park Resources.	Community practices	CKNP MP/OP rules	Recommendation
		Yaks and its hybrids freely graze in the park	Grazing of traditional free roaming yaks and yak-cow breeds is buffer and core zone is acceptable	--
		Herders graze livestock in pasture and core zones dispose plastic bags, bottles in nearby streams and also use burn wood from forest	Use of plastic bottles, glass bottles, plastic bags and match box is not allowed inside parks.	Movement must be restricted for the grazers.
4.	Pastures	Community graze livestock in the pastures, which are located in and around buffer zones.	Grazing is allowed only in buffer zone	--
		Indigenous system of grazing was sustainable. During previous times herders ensured to take livestock into the pastures, when vegetation becomes knee-length. Currently, herders have abandoned this practice and take their livestock to pastures even before its sprouting.	Indigenous grazing system should be revived	Awareness and training of herders is important
5.	Wildlife hunting	Community take advantage of inaccurate population counts of wildlife and poach/ hunt wildlife at family gatherings, holy occasions and on other such events	Reliable wildlife count by DNA analysis is recommended and also to track poaching for core zone management. Hunting except for "trophy hunting" is banned both for buffer zone and core zone.	Community awareness can serve the purpose. Moreover genetic approach should be employed for accurate population counts and tracking of poaching

Exhibit 16: Impact of Climate Change on Local Community

Valley	Status	Visible Changes	Adaptations to CC by local community
Nagar	Changing	Recession of Glaciers	Dyke buildings of water channels
Ghulmat	-do-	Increased pest infection on crops	No adaptation
Danyore	-do-	Drought during late summer and early winter	-do-
Haramosh	-do-	Emerging Livestock diseases	-do-
Astak	-do-	Drying pastures	Dig creeks to hold snow and rain water in pastures
Tormik	-do-	Occurrence of medicinal herbs is declined	Community prefer allopathic ways
Lower Braldo	-do-	Extreme winter temperature	Harvest increaed quantity of fuel wood
Upper Braldo	-do-	Rapid Snow melt	No adaptation
Shigar	-do-	Increased Floods	-do-
Thalay	-do-	Landslides	-do-
Daghoni	-do-	Low agriculture productivity	Abandoning agriculture

CONSERVATION MANAGEMENT ISSUES & PROBLEMS OF CKNP VALLEY

6. MANAGEMENT ISSUES AND PROBLEMS

Current surveys of CKNP valleys for VCSDP development has reflected several conservation issues in customary practices halting their development and making them more vulnerable to climate change. Therefore, in order to develop an effective strategy for adaptation, it is necessary to identify issues and develop capacity of local community to develop in a way that reduces their dependency on natural resources. These adaptation approaches must then be disseminated to the communities and relevant laws up-gradation.

6.1. Agriculture

Arable lands are mostly small piece of land terraced by reclamation and cultivated by traditional methods. However, villages which lies close to road employ modern machinery for farming. Agriculture productivity is low and highlights food insecurity. Farmers usually accomplish required food from markets. Following issues are being reported by the local community. These issues although belongs to several sectors but all are aiding in decline of agriculture production.

1. **Land holding size:** Average land holding of farmers around CKNP valleys is 0.2 hectare per household seems to shrink further in size due to increasing population and conversion of arable land to more houses and settlements.
2. **Irrigation and Water Rights:** Water is frequently supplied by snow fed springs, river and its tributaries but supply is blocked during mid-summer and winter because of water shortage. Water become a problem in disaster prone areas, which damages the irrigation channels, and cause water blockage. Moreover, customary rights about water sharing between villages and among the households is not documented anywhere. This generates confusion and rivalry among the landholders for water during peak season.
3. **Traditional practices and non-certified seed varieties:** Local farmers rely upon the traditional farming and cultivation methods. Farmers prefer this practice due to several reasons, which includes certainty of quality, convenience, timeliness/availability, and cost. They also prefer this practice because farmers don't want to take risk on their productions. However, with the progress of time keeping though cultivar performance remained same but productivity declined which demands the practices of modern farming techniques and new seed varieties.
4. **Weeds and Pest:** Organic farming is an important aspect that is valued all over the world for healthy food. Local farmers are lucky enough to manage the crops and fruit production without using pesticides, insecticides and inorganic fertilizers. Animal manure and ash is used to enrich the soil with minerals. Despite of these, farmers are facing difficulties now a days due to several insect and pest species which feed on the grains, fruits and other such products. Indigenous people and their knowledge is blaming climate change for increasing pest infection on fresh as well as dry seeds and fruits.
5. **Climate Change:** Climate change is exacerbating the challenges faced by the agriculture sector, negatively affecting both crop and livestock systems in CKNP valleys. Intensity and

rapidly varied climatic events have added pressure on the local agriculture system – which is already struggling to thrive in rising pathogenic infections. The changing climate is also contributing to resource problems beyond food security, such as water scarcity, pollution and soil degradation. As resource scarcity and environmental quality problems emerge, so does the urgency of addressing these challenges. During FGDs farmers depicted inability to mitigate such issues and thinking to abandon the cultivation of cereal crops and altering them with cash crops.

6.2. Pasture

Majority of the pastures of CKNP valley are degrading at rapid rates. Pastures have pressure from excessive livestock, medicinal plants extraction, landslides and floods. Another prevailing issue since last ten years is infrequent and declined rate of snow fall leading to drying pastures.

1. **Baseline of flora and Phenological Shift:** There is no documented baseline data or inventory about the floral species of the pastures, their status and use. So it is the need of time to develop such basic dataset which prioritize the species for conservation actions to mitigate the socioeconomic and environmental pressures. Only medicinal plants are explored and listed but there is no information on the predicted impacts of climate change over these medicinal plants and their adaptations. It is therefore especially recommended on priority basis to monitor and conserve the floral species and medicinal plants affecting by climate change and showing phenological shifts.
2. **Gaps in customary practices:** Livestock grazing is an ecosystem service provided by the pastures**.** Pastures of CKNP valleys are showing decline in productivity due to unsustainable livestock grazing practices. There are no established rules about the maximum number of livestock heads in the customary rules. Carrying capacity of these pastures have never been estimated and that's why unsustainable pressures are fueling the degradation. Diseased animals are advised to keep away from the pastures but their water points are shared which can induce the infection in whole herds and there is a chance of disease transmissions.
3. **Grazing Timing:** Lasting pastures can be improved only when herders understand plants' recovery needs and practice good grazing land husbandry to maintain plant health. The local community around CKNP reported the problems like weed invasion, less productivity and weakened soil health. All these issues are indicators of impatient grazing by the herders i.e. they start to graze their animals before pastures are fully grown. Herders do so to provide animals with a high-quality diet but they are unaware that short plant growth reduces bite size and the nutrient intake. Moreover, it contributes to decline in pasture productivity, which is lose-lose situation only.
4. **Livestock insurance scheme:** Livestock insurance scheme is an incentive equal to the loss for the herders if their livestock get killed or attacked by the wildlife. The scheme was introduced in CKNP valley but currently it is non-functional. Though very few livestock kills by predators were reported during the survey and no retaliatory killing reported by the community, but in the absence of insurance scheme retaliatory killing of wildlife is expected.

5. **Lack of Zonation:** Pastures are degrading continuously but the customary laws don't have any hint of abandoning such pasture areas which hastens its decline. It is essential that grazing on pastures in the buffer area of CKNP should be controlled to maintain adequate vegetative cover that reduces erosion and permits adequate regrowth after each grazing period to ensure the health of grazed plants.
6. **Harvest of Medicinal plants:** CKNP valleys pastures and forest areas the rich sources of these medicinal herbs. Local community uses them for disease cure. These drugs have anti-pyretic, analgesic, anti-cancerous, anti-diabetic and several other uses. Local community is fully aware of their uses but they don't have any understanding of ways of its extraction without damaging the whole herb. Training of local community for collection, drying and usage is important.

6.3. Water

Water is the key ingredient and symbol of life. All the changes in climate pattern are directly and indirectly playing with water quantity and quality. Altered precipitation patterns, warm temperatures and frequent air currents actually disturbed the water quality and quantity both. The local community in CKNP valley depends directly upon the rain and indirectly upon annual snowfall. Due to delayed rain timings and less annual snowfall local community is frequently facing the drought and water shortage due to increasing glacier melting and flood causing blockage of irrigation system. Moreover, torrential rains are now more frequent which on one hand increases water quantity but also cause floods and landslides in disaster prone areas thereby creating socio-ecological stress. Water pollution is increasing due to lack of sanitation /drainage system and animal sheds nearby water channels and drinking water sources. Grey water from the local community is also getting mixed in to fresh water and degrading its quality.

1. **Drinking Water:** Local community depends on fresh water supplies from glaciers and springs for drinking purposes. Sediments are continuously increasing in the water supply due to weathering of rocks and mixing of soil and grit in the area. High mineral content can induce disease in local community and their livestock. The water testing facility already established at Karakoram International University provides the free testing but local community is not very interested in the procedure due to lack of awareness.
2. **Irrigation Deficit:** Local community reported poor structure of irrigation channels or insufficient irrigation channels is the prime reason for irrigation deficit. "Either lot of water or no water" in the water sources, the communities cannot fully utilize it for irrigation purpose. The communities in the villages have constructed irrigation channels but with increasing land fragmentation and demand for water those irrigation channels have proven insufficient. The communities cannot construction of more irrigation channels due to lack of financial resources.
3. **Water pollution mitigation:** To ensure the water quality local community should be compelled to make separate pathways for grey water ensuring that it do not mix into the fresh water streams. Hotel owners should be trained to dump the trash elsewhere instead of water while adopting ecosystem friendly approaches.

4. **Disaster Management:** Climate change is deeply reshaping the landscape of disaster risk. Weather extremes such as drought, flood and landslides cause the huge economic depressions in all sectors ranging from transport to land farms. No protocols are developed yet for the villages in the surrounding of CKNP. It is very necessary to take action because dependence of poor people on natural resources increases dramatically.

6.4. Forest and NTFP Issues

These sectors are as vulnerable from climate change as any other is and therefore, there is strong need to assess and enhance the adaptive capacity of the forest and biodiversity.

1. **Mortality:** Drought has increased tree mortality, resulted degradation, and reduced distribution of entire forest ecosystem. It increased the wood harvesting opportunity for the local community for subsistence purposes at the cost of degenerating forest.
2. **Harvest Pressure:** Heavy collection of timber and non-timber products from the forests allows the community to fulfill their needs. With continuously increasing population dependence of local community is also increasing on these natural resources. Fuel wood harvest of CKNP valleys has showed an unsustainable approach. This harvesting is not limited to here only but includes the removal of foliage, branches and plants cutting for livestock forage as well. Unsustainable practices and unguided approaches towards harvesting leads the ecosystem imbalance.
3. **Forest Regeneration:** Climate change has shown differential approaches for the propagation dependent upon the species ecology. Warmer temperatures and increased CO_2 increased the rate of photosynthesis and thus growth but increased the pest attack is seriously stressing the forest regeneration.

6.5. Eco-tourism

Ecotourism is nature based tourism that fosters environmental appreciation and awareness. Gilgit-Baltistan, which is considered as the hub of eco-tourism, incorporates a considerable number of tourists every year to generate the huge amount of revenues and alternative livelihood opportunities.

The local community is reporting following issues.

1. **Tourist Accommodation:** Limited accommodation facilities compel the tourists to opt for camping in open areas. This option become unsuitable during the adverse weather.
2. **Visitor facilities:** Site maps, information boards, sign board and other facilities are not available for tourists. However, open camping areas are the only option for the tourists stay in the valley due to lack of hotels.
3. **Climate Change:** Climate is a key resource for tourism and the sector is highly sensitive to the impacts of climate change and global warming, many elements of which are already being felt. Climate change is having adverse impacts on the number of tourists especially for the treks, which CKNP valleys offer.

6.6. Mining

In and around CKNP in the sedimentary rocks of the mountains, huge reservoirs of gemstones and precious rocks are deposited. Local level mining is being carried out in and around CKNP. Mining area can be identified by having the holes in its mountains just like bee web.

"About 30,000 people associated with the mining sector are carrying out activities inside the Central Karakoram National park territory, adding that the act may result in the loss of habitat for various species" (Express tribune: June 27th, 2012).

This mining provides some of the valleys around CKNP with a good opportunity to earn livelihood. In CKNP valleys, mining opportunities are available but a small portion of the entire population is associated with it. On other hand people associated with mining cannot get maximum benefit out of it due to the following reason.

"Lack of alternative livelihood opportunities for communities and uncontrolled mining in mountains are some of the issues that require attention" (Express tribune: June 27th, 2012).

1. **Lack of Modern tools and Practices:** Local miners are not trained for mining. They use iron rods for excavation and mostly end up in the damaging the stones. It leads to loss of revenue not only on personal level but also on the regional and ultimately at national level.
2. **Lack of training:** Local miners have learned the methods of mining by hit and trial approach and succeeded somewhat. Nevertheless, due to lack of training they are unable to extract pure and high quality rock. They accidently break these gemstones and thus lose the amount of profit.
3. **Value addition of Gemstones:** Gemstones are sold in raw form by the local community to the dealers on low cost due to improper cutting and polishing. Therefore, local miners lose their chance to earn huge revenues and only get a minor share.

6.7. Wildlife and Protected areas

Institutional structures to manage wildlife and protected areas experience lot of issues due to increasing urbanization, degrading forest and natural areas. The biodiversity of CKNP and its buffer zones has the species, which are of international and national importance. Wildlife plays an important role in both ecosystem sustainability and community economics. Although trophy hunting is a controversial subject, yet it enabled the community to earn millions of dollars since its start and contributed to conservation as well.

1. **Population trends:** The investigation of issues related to wildlife and protected areas normally consider the number of heads of animals irrespective of their health, annul recruitment. The overall trend of two trophy species; i.e. Markhor and Ibex seems to increase in their population according to the relevant government departments but there is no assessment on the reproductive output. There is chance of reproductive deficit in mountain ungulates such as Ibex and other species due to the history of population surge.

2. **Population Surge:** During the recent years of conservation, wild species has increased considerably. The sudden increase from small population are often culprits of inbreeding depression, which is most expected in the case of mountain ungulates and birds which are decreasing continuously.
3. **Unidentified Species:** GB hosts the diversity of wild fauna and flora most of which are unidentified and even un-discovered yet. The rapid environmental degradation is causing the extermination and extinction of the specialist species. It shows that biodiversity of the species is declining without recognizing their ecological and economic roles.
4. **Habitat degradation and Isolation:** Population is continuously increasing in CKNP and encroaching into the natural areas for settlements and agriculture. This land use change affected wildlife both positively and negatively depending upon the species ecology. Habitat degradation has also pushed the species to isolated and low quality habitats that caused additive stress on the wildlife heath, reproductive potential and genetic health and so on. There is no assessment for the impact of habitat degradation on genetic health of wildlife species.
5. **Genetic reserves of wildlife species:** Most wildlife surveys are based on the numerical assessment of the animals and do not account for their genetic viability. Designated areas such as national parks and sanctuaries are notified irrespective of the idea that particular area is either genetic bank of the particular species or not. Genetic reserves of forests and wild species are not identified and protected yet.

PROPOSED MANAGEMENT INTERVENTIONS FOR CKNP VALLEYS

7. PROPOSED MANAGEMENT INTERVENTIONS

7.1 Agriculture

In particular, there are different adaptation options in agriculture according to the involvement of different agents (producers, industries, governments); the intent, timing and duration of employment of the adaptation; the form and type of the adaptive measure; and the relationship to processes already in place to cope with risks associated with climate stresses finally the development of provincial climate change policy.

The adaptation options required for the local community needs four tiers. (i) Technological developments, (ii) government programs and insurance (iii) farm production practices, (iv) farm financial management.

1. **Population expansions:** Similar to other areas of GB, with increasing population construction is rapidly increasing and mostly houses, cattle shed and other required constructions are being built around the settlement and agriculture area, which is continuously shrinking arable land. To avoid these issue new settlements must be built on barren or abandoned parts of the land. This will keep the arable land available for cultivation.
2. **Certified seed varieties and crop insurance:** Certified seed is the only input that can get farmer more than just higher yields. Such varieties are resistant to climate related and pesticide issues. To introduce the concept and usage of certified seed varieties, relevant stakeholders must provide them on subsidized rates and premium insurance packages. Along with this one time, training of farmers of each village around CKNP is recommended to increase the agriculture production per unit area.
3. **Integrated farming and agriculture products:** Farmers are traditionally inclined to mono-cropping systems and earn the revenues from raw products. In CKNP valleys the farmers do not sale both fresh and dried fruits due lack of awareness on post harvesting techniques, processing techniques and proper storage facilities. The little economic innovation lies in the sale of potato only, while million rupees worth of fruit is being wasted annually due to lack of awareness, and skill for value addition and facilities for storage. Many end-users require specifically processed products such as Marmalades, Jams, Vinegar and Honey. Farmers need guidance on the value addition of products in order to be economically stable.
4. **Soil Analysis:** It was unanimously reported by all the communities that land they are cultivating is never tested in the laboratory and scientifically they don't know which crop and fruit varieties are best for their soil type. Each crop is sensitive to soil type and productivity heavily depends upon the suitable soil. Practically there is requirement of soil testing facility within each agriculture information cell. This facility will provide information about several structures especially addressing the common question of farmers such as suitable seed varieties, microbiota of soil and it's capacity of crop growth and several others.

5. **Secure water availability:** Water is central to agriculture productivity. Adaptation of climate-smart inputs and shifting to irrigation that is more efficient methods will help local farmers to maintain productivity levels. Water tanks for the storage purpose of agriculture are required to reduce the drought effects at some village.
6. **Training on climate friendly agriculture practices:** Farmers should be trained with the emphasis on targeted ingenuities such as outcome-based farmer incentives and knowledge transfer systems – that enhance farmer capacity to achieve sustainable productivity growth through mitigating and adaptive practices keeping the pace with climate change. These climate friendly and climate proof practices particular to each valley must be incorporated into the operational plan. As there are no previously approved practices so, they are needed to be designed by methodically modelling the practices with climate change models.
7. **Introduction of climate resistant seed varieties:** Farm decision-making is seen as an on-going process, whereby producers/farmers are continually making short-term and long-term decisions to manage risks emanating from a variety of climatic and non-climatic sources. In this sense, adaptation is the result of individual decisions influenced by forces internal to the farm household (i.e. risk of income loss, environmental perception) will become reasonable and let them earn revenue to decrease pressure of local community on natural resources. To resist or at least minimize the pressure of ever changing climate patterns and issues in relation to climate change, there is a need to develop an agriculture information cell for the farmers in each village. This information cell will raise the job opportunities for local community and will guide them about the climate resistant breeds, ways of cultivation, harvesting in detail. This information cell must have the tested varieties of climate resistant seeds and seedlings. Seed storage for potato in the harsh climatic condition is a challenge in the CKNP area, therefore input store for seed must be provided at least among every three villages.
8. **Spread of infestation to the wildlife:** Buffer area of CKNP harbor 230 villages. All of these villages have agriculture crops and tress, which are getting infected manifolds since last decade. These pest species have the chance of transmission towards the wild medicinal herbs, forests, nests of birds and ultimately enter in fauna. This pathogenic transmission can induce infections in the flora and fauna and has a considerable potential to depress the specialist species. However, this issue has not yet been explored and needs a well prepared monitoring procedure to estimate the estimate the annual economic laws.
9. **Research Projects:** Without research, adaptation to climate change is generally problematic for agricultural production and for agricultural economies and communities; but with adaptation, vulnerability can be reduced and there are numerous opportunities to be realized. Adaptation must be supported by the research of relevant components. Productivity is declining at a rapid pace due to some known and unknown reasons. Apparently, climate change seems responsible for this decline aided with ever-increasing pest attacks during last 10 years. The recent changes in the climate are so unpredictable that it is becoming impossible for the farmers to work in agriculture farms for profit. Customary practices for agriculture sustainability are losing their functionality. These practices must be updated by designating specific studies of seed variety, soil analysis, crop suitability analysis,

bio-control of pests, projected impact of climate change on the crop's productivity and transport, optimum economic benefits from every suitable crop and several other inter-related components. As it is evident that the impacts of climate change on agriculture will vary depending on precipitation changes, soil conditions, and land use, therefore these impacts are required to be evaluated independently for each valley in the buffer zone of CKNP. This vast research is possible if included in the operational plan of the CKNP to provide support for updated management plan of CKNP.

10. **Key Policy Reforms:** Key policy reforms across three pillars are needed to strengthen farmer incentives to achieve productivity growth sustainably, and without sacrificing climate change mitigation and adaptation objectives. These three pillars are i) Farmer level, ii) Agriculture sector level, iii) Provincial level. The agriculture policy needs an up gradation to mitigate the effects of changing climate and devising the climate friendly strategies at an urgency to minimize the agriculture induced impacts on climate ultimately to protect the protected areas of GB, particularly its largest park the CKNP. The management plan, which is already established, has a huge gap about the laws of employing climate friendly approaches in villages residing in buffer areas for agriculture. Moreover, the climate is not only changing but it is also on stationary, which means old knowledge can't be the thing to rely upon. Therefore, gap of climate friendly approaches must be assessed via operation plan for CKNP and then addressed in to the revised version of CKNP management plan.

7.2 Pasture

1. **Upgradation of customary laws:** Customary practices should be amended in such a way that ensures sustainable use of pastures.
2. Diseased animals must be kept away from the pastures to avoid the zoonosis and must be vaccinated.
3. Extraction/cultivation of medicinal plants by the local community must account only for household purpose and should be cultivated in the amount equal to its removal.
4. Encourage stall feeding/minimize grazing till the improvement of pastures.
5. These strategies must be field tested and then included in the customary and statutory laws and CKNP revised management plan.
8. **Grazing Management:** To enhance pasture productivity timing of grazing and grazing sites in each pasture are need to be designated to develop holistic grazing strategies with farmers/herders that include rotational grazing or intensively managed grazing as a regular grazing routine.
9. **Fodder Cultivation:** Regionally adapted and high nutrition value fodder crops should be cultivated for fodder instead of traditional species. This will remove the stress of early grazing from the pastures and allow them to grow.
10. **Training of herders:** Herders have no information about the sustainable practices of livestock grazing. They just sent their livestock with guards to feed upon the pastures. Timing of grazing is integral for livestock. Several other factors need to be cared for the sustainable livestock grazing.

11. **Seeding of local flora and training of Farmers:** Local flora should be collected and cultivated on the barren patches among the pastures. This will increase the pasture areas and productivity. Research on cultivating these species is required. After it dissemination of knowledge through training sessions, manuals and brochures will convince the farmers about the re-seeding of pastures.
12. **Local botanical garden to ensure existence of local flora:** Adaptable plants should be identified among the plants. These plants should be kept in botanical gardens to provide backup in case of avalanches, landslides, floods and barren land cultivations.
13. **Encourage the pasture extension services by other line departments:** Many forestry and livestock enterprises run by private farmers and the government depend on efficient, economical, and environmentally beneficial pasture use. Farmers need technically competent advisors to help them accomplish their objectives. Unfortunately, no advisory services for the pastures exist in the villages because of lack of pasture specialist technical advisor. Therefore, there is strong need to train the forest relevant personnel from each village or valley as a pasture specialist. CKNP biodiversity directorate staff can be a potential candidate for this training as they are both aware of natural resource use in and around CKNP.
14. **Cultivation and marketing of medicinal herbs:** Cultivation of these herbs should be promoted as an alternative economic resource with appropriate site assessment and training on its cultivation, harvesting marketing and utilization. Economic uplift of the community will actually decrease their dependence on CKNP resources and allow them to grow.
15. **Ethno-botanical Database:** Development of consumer linked ethno-botanical databases of each village will not only enhance the market for the local farmer but also fosters the direct link to the consumer.
16. **Pasture awareness programs:** Hands-on training and field experience are two of the best, most rapid ways to increase farmer's/shepherd's awareness and local university students about the optimum pasture use for healthy livestock. Outcomes will be best when technically competent professionals who can accurately answer questions and help solve problems guide this training. This training will allow the local community to employ sustainable practices and secure these resources for their future generations.
17. **Research Problems:** Phenological shift of floral species and their impact on biodiversity must be assessed on priority basis so that extirpations can be avoided. Ecological baseline of the pastures to keep the biodiversity of the area must be developed. Similarly, potential farming sites for each medicinal plant should be identified. The predicted impacts of climate change on the pasture productivity are not known and need to be evaluated due to their high valued ecosystem services. Most utilizable and ecologically resilient entry points are needed to be identified and designated.

7.3 Water

People living in CKNP buffer zone afflict with different kinds of water contagious diseases because of the scarce access to clean drinking water. Even though glacier water is present in many areas however easy, access to clean water is very difficult for most of the population.

1. **Quality of drinking water:** The water testing facility already established at Karakoram International University provides the free testing but local community is not very interested in the procedure due to lack of awareness.
2. **Construction of small and medium sized reservoirs**: Construction of small or medium-sized reservoirs in the foothills and plains are quite necessary, so that water from streams can be harvested for use during the dry season and the winter, both for farming and domestic purposes.
3. **Common drinking water storage tank:** Shared water storage tanks should be built upon among the households to help them adapting drought conditions.
4. **Water pollution mitigation:** To ensure the water quality local community should be compelled to make separate pathways for grey water ensuring that it do not mix into the fresh water streams. Hotel owners should be trained to dump the trash elsewhere instead of water while adopting ecosystem friendly approaches.
5. **Early warning system:** But to give relief to the local community of CKNP valleys there must be system to give them timely alerts about their crops and livestock protection. This will accentuate the economic resilience of the community and natural resilience of the buffer area.

7.4 Forest and NTFP

1. **Up gradation and regulation of Forest laws:** Customary laws allow the fuel wood collection, timber and non-timber forest products unlike statutory laws, which increase their favor towards the customary laws. These customary laws don't address the conservation needs and allow harvesting at an unknown level. If this practice is continued, then community will shortly run out of their forest reserves. To ensure sustainability, an up-gradation of customary rules is recommended. Otherwise, implementation of statutory laws is integral.
2. **Promotion of farm forestry:** Local farmers should be trained to have small-scale farm forests, which along with revenue generation allow them to be independent of forests. This practice exists in a valley but very limited. Training will allow the farmers to take self-initiatives and entrepreneurship in forestry sector.
3. **Climate Change and Conservation Friendly Forestry projects:** To generate credible forestry and conservation offsets, projects must be additional to what would have occurred without the incentive supplied by the carbon market; they must be verifiable (i.e., measurable and enforceable); they must control or adjust for leakage; and they must address the issue of permanence. Forward crediting is proposed by some to accommodate the long period of carbon accumulation in forests, but others are concerned about assuring payments only for actual carbon sequestration.

4. **Restoration cum conservation:** Several sustainability practices are being carried out in CKNP but any of them hardly meet the conservation targets. Keeping in view the present environment sustainability changes, restoration is required along with conservation. Therefore, the upcoming forestry projects must come up with the forward crediting instead of required crediting.
5. **Research Projects:** Projected annual greenhouse gas emission counts provide baseline to identify required CO_2 sequestration offset. On the basis of this, it will be identified that which species is required and in how much amount to keep climate stable for each valley in the buffer zone of CKNP and its surrounding areas. Remote sensing to monitor the land use changes is very essential because of the location of valley around CKNP. In future due to CPEC, land use is expected to be altered and its environmental consequences seem negative. To neutralize these expected issues baseline data about land use will quantify the environmental impacts and truly determine the required type of actions with high accuracy.

7.5 Eco-tourism

Following interventions are recommended on the basis of the survey conducted for VCSDPs development.

1. **Interpretation of Resources:** In order to increase the revenues by tourism there is need to provide interpretation programs that are relevant to the public, further information is required. This information can be obtained through visitor surveys.
2. **Destination vulnerability hotspots:** The integrated effects of climate change will have far-reaching consequences for tourism businesses and destinations. Importantly, climate change will generate both negative and positive impacts in the tourism sector and these impacts will vary substantially by market segment and geographic region. There are disaster prone areas in and around CKNP, which are not mapped and disseminated to the tour operators. This inventory should be developed along with measured risks and challenges that tourist can face.
3. **Infrastructure:** Surge in tourist flow has been reported recently but related infrastructure such as accommodation, ecotourism facilities, are very short and needed to be developed to ensure the provision of facilities for tourist influx by public and private department.

7.6 Mining

Following interventions are recommended on the basis of the survey conducted for VCSDPs development.

1. **Training of Miners:** It is important for the miners to have hand on training on modern tools and techniques for quality mining. It is especially important for the valleys, which lie near mining deposits of Gemstones and other minerals.
2. **Entrepreneurship opportunities:** Small-scale business related to gemstones and its products will provide the local community an opportunity to earn good profit.

7.7 Wildlife and Protected areas

1. **Population assessment:** Database should be established to keep the systematic annual population assessment of all the near threatened and endangered animals. The protocols for population assessment of each species should be determined on ecological basis and kept same every year.
2. **Wildlife health:** There is some baseline data about the health of animals. Nevertheless, all such studies are either short term or based on only few components. Moreover, genetic health of the species have never been accounted which can be the culminating factor in the reproduction of the animals in addition to other stresses.
3. **Species Recovery Plan:** There is a growing consensus that habitat fragmentation has caused wildlife decline. However, what is the impact of this fragmentation is still unknown. There is need to study to study how the urbanization, habitat isolation, decline in vegetation has stressed the wildlife. How these impacts can be mitigated, which habitat areas need priority conservation actions such as habitat connectivity? All this information is possible from the properly designed studies unique to each class of wildlife based on which species recovery plan will be designed.
4. **Genetic Reserves:** Genetic reserves inside the protected areas of the threatened and endangered species are needed to be identified for their restoration. If the designated protected areas do not have by chance these genetically healthy populations then their boundaries should be adjusted according to these reserves.
5. **Climate change Indicators:** Several fungi and amphibian species are considered as an indicator of climate change. These species are experiencing decline in the population such as Deosai toad, which was once abundant in clean waters of the area. This species is now hard to find because of water pollution. These indicators are needed to be identified and used as climate change detection for the areas. This research will provide the real assessment unlike models, which sometimes fails to give real estimate.

LIST OF VCSDPS

Volume A: Gilgit region

1. Conservation and Sustainable Development Plan 2016-2026 Nagar valley Central Karakoram National Park Gilgit-Baltistan
2. Conservation and Sustainable Development Plan 2016-2026 Ghulmat valley Central Karakoram National Park Gilgit-Baltistan
3. Conservation and Sustainable Development Plan 2016-2026 Danyore valley Central Karakoram National Park Gilgit-Baltistan
4. Conservation and Sustainable Development Plan 2016-2026 Haramosh valley Central Karakoram National Park Gilgit-Baltistan

Volume B: Baltistan Region

1. Conservation and Sustainable Development Plan 2016-2026 Astak valley Central Karakoram National Park Gilgit-Baltistan
2. Conservation and Sustainable Development Plan 2016-2026 Tormik valley Central Karakoram National Park Gilgit-Baltistan
3. Conservation and Sustainable Development Plan 2016-2026 Shigar valley Central Karakoram National Park Gilgit-Baltistan
4. Conservation and Sustainable Development Plan 2016-2026 Lower Braldo valley Central Karakoram National Park Gilgit-Baltistan
5. Conservation and Sustainable Development Plan 2016-2026 Upper Braldo valley Central Karakoram National Park Gilgit-Baltistan
6. Conservation and Sustainable Development Plan 2016-2026 Daghoni valley Central Karakoram National Park Gilgit-Baltistan
7. Conservation and Sustainable Development Plan 2016-2026 Thalay valley Central Karakoram National Park Gilgit-Baltistan

Conservation and Sustainable Development Plan 2016 – 2026
Astak Valley
Central Karakorum National Park
Gilgit Baltistan

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PLAN EDORSEMENT

Signed by President LSO Astak .....

Endorsed Director CKNP .....

Approved by Deputy Commissioner/ .....
Chairman District Conservation Committee
For Skardu in ..... meeting
Held .....

Dated.....

CONTENTS

LIST OF EXHIBITS

Abbreviations

°C	Celsius
ABG	Annual Biomass Growth
CAI	Current Annual Growth
CKNP	Central Karakoram National Park
CPEC	China Pakistan Economic Corridor
E	East
EIA	Environmental Impact Assessment
FGD	Focus Group Discussion
GB	Gilgit-Baltistan
GLOF	Glacier lake outburst flood
HH	Households
INGO	International Nongovernmental Organization
Kg	Kilograms
KIU	Karakorum International University
LSO	Local Support Organization
m a.s.l.	Meter above sea level
Mg	Mega grams
MP	Management Plan
N	North
N/A	Not Applicable
NGO	Non-governmental Organization
NTFP	Non-Timber Forest Product
OP	Operational Plan
S	Summer
SEED	Social Economic Environmental Development
UC	Union Council
VCC	Valley Conservation Committee
VCF	Valley Conservation Fund
VCSDP	Valley Conservation and Sustainable Development Plan
VCSP	Valley Conservation Sustainable Plan
VO	Village Organization
W	Winter
WO	Women organization
Yr	Year

1. INTRODUCTION OF ASTAK VALLEY

1.1. History of Astak Valley

The human settlement in the area date back centuries told by local habitants. However, the exact date has not yet been traced. Once upon a time an elegant prince arrived in the valley, famous for his wisdom earned respect and fame among the locals. He was made the king of the valley. His name was "Rokh-Lol Shah" he was very kind towards his people and entire population admired him very much as the local considered him a super natural being.

Astak valley is named after the princess Stak api nong

(Pers. Comm.Wazir Imtiaz; Astak Rondu)

The king had a wise daughter, her name was (Stak Api nong) according to the local folk story, having extraordinary qualities, kindness and popularity among the people. There are local folk songs said to have narrated by her "Stak Api nong" in which she mentioned her age when different villages were brought under cultivation while constructing water channels.

Local people are of the view that during her era agriculture land was expended to meet the need of food of the increasing population. She brought new barren land under cultivation which made the area famous for the agriculture.

1.2. Location of Astak Valley

Astak valley is part of UC Astak, Tehsil Rondo and District Skardu, surrounded by the valleys of Nagar (N), Shigar (E), Skardu (S) and Haramosh (W). Astak valley lies on the Indus River along Gilgit-Skardu road and comprises of 16 main villages laying on both side of the bank of Astak Nullah (Stream) situated between 1800 to 2500 meters above sea level. However, Shangus village is situated on the left side of Indus River at an altitude of 1833 m above sea level.

Exhibit 1: Village locations of Astak Valley, 2016

Villages	Coordinates		Elevation m asl
	N	E	
Jamshed Abad	35□□□'22□□"	075□□□'□□□□"	2368
Xhoxum	35□□□'30□□"	075□□□'□□"	2590
Lagaf	35□□□'51□□"	075□□□'47□□"	2493
Kharchung	35□□□'04□□"	075□□□'53□□"	2490
Lachoo	35□□□'04□□"	075□□□'02□□"	2502
Riging	35°42'12.2"	075°02'15.6"	2575
Shano	35°42'51.4"	075°02'35.0"	2588
Gudapa/Ishkandas	35°43'28.0"	075°02'49.1"	2629
Tugla	35°43'49.1"	075°02'33.5"	2656
Soosa/Thangus	35°43'04.7"	075°02'21.8"	2593
Burdia	35°41'59.2"	075°01'54.9"	2561
Mopa	35□□□'41□□"	075□□□'46□□"	2545
Stonging	35□□□'26□□"	075□□□'42□□"	2513
Balaxong	35□□□'59□□"	075□□□'13.2"	2447
Khirzang	35□□□'59□□"	075□□□'47.6"	2388
Shangus	35□□□'45□□"	074□□□'05□□"	1833

Exhibit 2: Villages of Astak Valley

1.3. Ecological Profile of Astak Valley

Astak is located among the south western side of Central Karakoram National Park due to which it has dense vegetation as compared to valleys at north east side. Vegetation of the area is the mix of sub-tropical scrub type at lower elevations and dry temperate coniferous forest zone at higher elevations. Astak valley is representative of 13.8 % broad-leaved, 5.7% coniferous forest and 80.8% juniper trees (Ferrari, 2014). These forests are the sources of consumptive and non-consumptive uses as reported by the local community. Unlike other communities these forests are co-managed between the villages.

The biodiversity of Astak valley is adapted to harsh and varied climatic conditions and topography. Besides this, there is a rich diversity of habitats e.g., lakes, springs, small rivers and streams, sub alpine and alpine meadows, steep mountain slopes, cultivated fields, road sides and permanent glaciers etc., which support a rich and equally diverse floristic wealth. Wildlife species such as Markhor was once common but now it is no more in the area. Trophy hunting from Ibex contributed in the economic stability of Astak inhabitants by trophy hunting.

1.4. Socio-economic Profile of Astak Valley

1.4.1. Demography of Astak Valley

According to the survey results conducted for VCSDPs of CKNP villages, total number of households is 832 containing 6827 total populations (51% female and 49% male) with an average household size of 8.2 per HH. All these villages are based around buffer area of CKNP which spans 2757.88 m^2 and serves as reserves of natural resources for the local people and transitional area between park and local communities. This local community depends heavily upon natural resources both for subsistence and income.

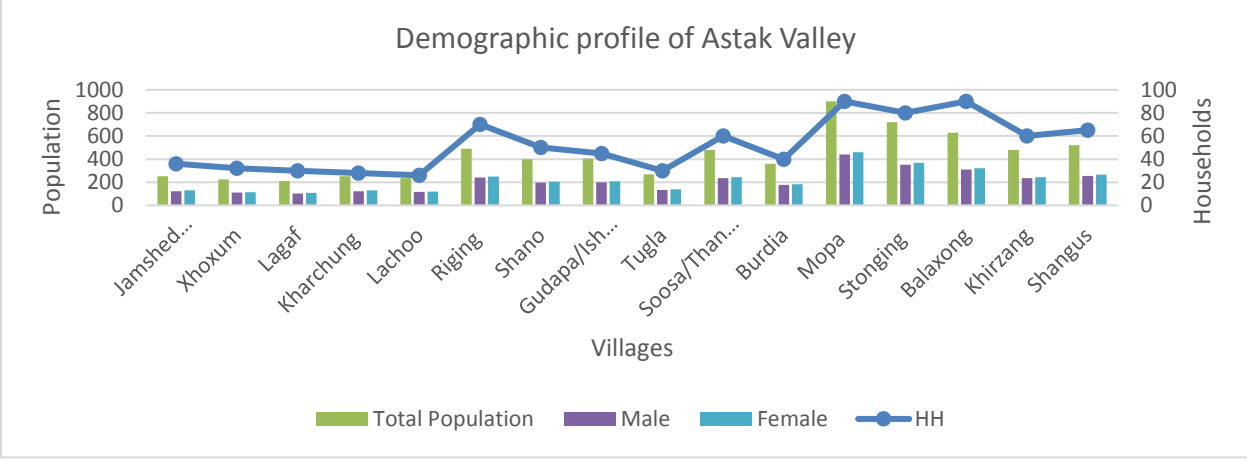
Exhibit 3: Demographic profile of the Astak Valley

Village	HH	Av. HH size	Population	Male	Female	Male: Female
Jamshed Abad	36	7	252	123	129	0.95:1.04878
Xhoxum	32	7	224	110	114	0.96:1.036364
Lagaf	30	7	210	103	107	0.96:1.038835
Kharchung	28	9	252	123	129	0.95:1.04878
Lachoo	26	9	234	115	119	0.96:1.034783
Riging	70	7	490	240	250	0.96:1.041667
Shano	50	8	400	196	204	0.96:1.040816
Gudapa/Ishkandas	45	9	405	198	207	0.95:1.045455
Tugla	30	9	270	132	138	0.95:1.045455
Soosa/Thangus	60	8	480	235	245	0.95:1.042553
Burdia	40	9	360	176	184	0.95:1.045455
Mopa	90	10	900	441	459	0.96:1.040816
Stonging	80	9	720	353	367	0.96:1.03966
Balaxong	90	7	630	309	321	0.96:1.038835
Khirzang	60	8	480	235	245	0.95:1.042553
Shangus	65	8	520	255	265	0.96:1.039216
Total	**832**	**8.2**	**6827**	**3345**	**3482**	**0.96:1.041876**

1.4.2. Road Accessibility

Accessibility is a key issue in mountain landscapes and goes far beyond access to basic infrastructures such as health services, schools, roads, transport, markets and communication with the outside world. This lack can be attributed to difficult topography and low population densities relative to lowland areas, factors that increase investment and maintenance costs. All the villages of Astak Valley except Shangus are connected through narrow unpaved road to the main Skardu road almost 45 minutes' drive. However, Shangus is situated on main Skardu road. Though the valley is connected to main Skardu road through link roads but risky landscapes on rugged mountainous terrain makes transportation of agriculture or other products to the market very costly.

Exhibit 4: Demographics profile of Astak Valley, 2016



1.4.3. Education Facilities

Most of the villages have primary level schools but only one government high school in Mopa village for boys only creates the depressing situation for aspiring male students of valley while halts the secondary education for female students. Students from the surrounding villages travel on average 4 km to attend high school. The community has high inclination towards education but facing lack of facilities and trained teachers. Dearth of educational facilities by local government is somewhat compensated by private school's initiative in three villages. These private schools have bridged the gap through offering classes up to middle level both for boys and girls (Exhibit No. 06). These private school have hired trained teachers from other parts of Gilgit Baltistan, particularly female teachers from Hunza and Ghizer districts to conceal the shortage of qualified female teaching faculty. There is no college in the valley and surrounding areas, therefore, students shift to Gilgit or Skardu for attending college. The literacy rate of women is almost half of the men population in all CKNP valleys. However, currently women education is encouraged in Astak valley and all young women are given right of entry in school, which will bring women literacy rate higher almost in a decade.

Health Facilities

Health facilities are very poor in the Astak valley. Four government dispensaries (Shangus, Mopa, Riging and Shano villages) have the patients from entire valley with meager facilities and equipment. These villages are located faraway from each other and posed toughest challenges in terms of access to the health facilities. However, in case of major health issues the community travels to Gilgit city located at four to five hours from these villages.

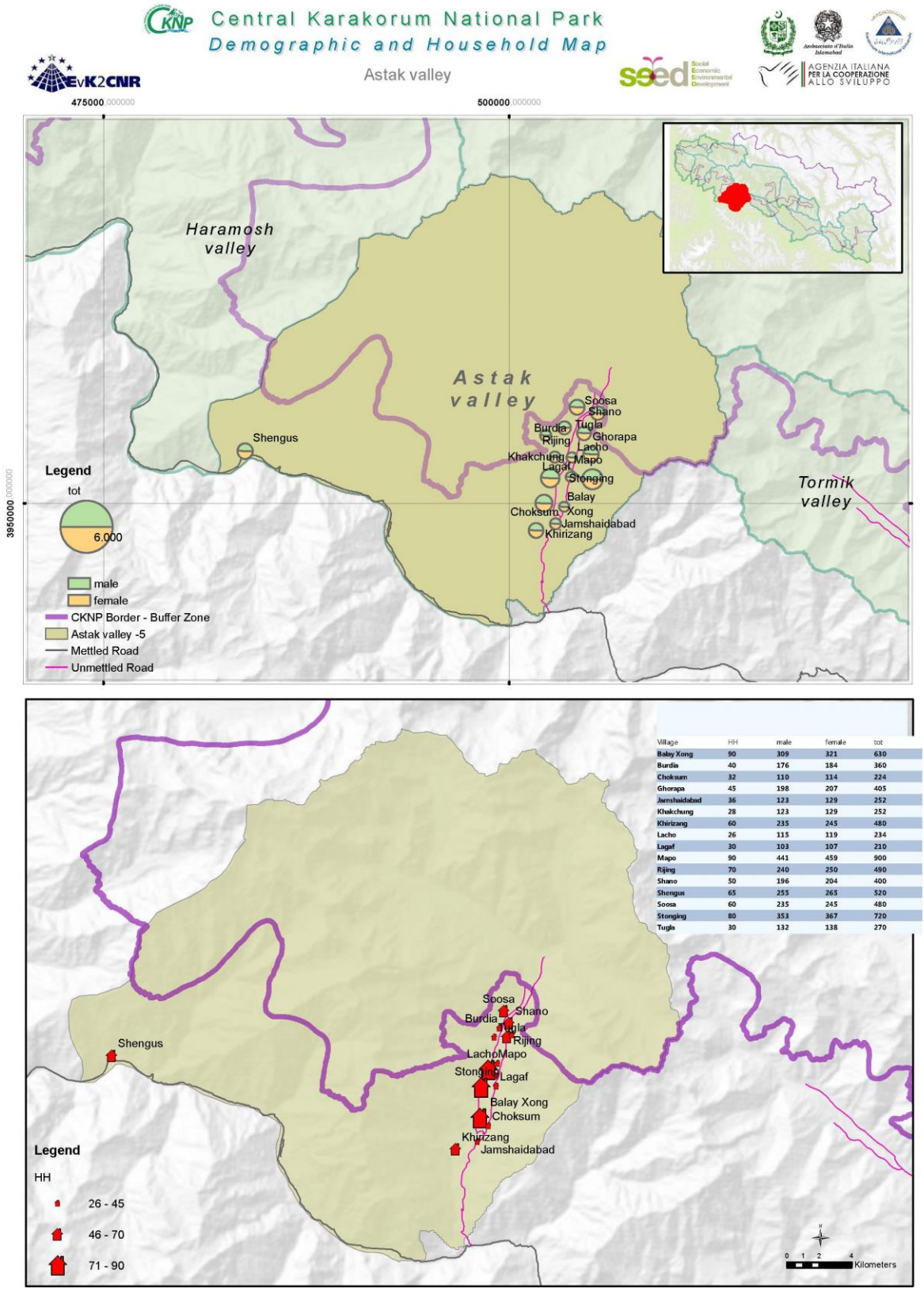


Exhibit 5: Demographic map of Astak Valley

1.4.4. Veterinary Facilities

Astak is among those valleys in Baltistan that devour high dependence on services provided by livestock but rapidly facing decline in its number due to unavailability of reasonable veterinary services and recurrent disease spread. Veterinary dispensary is located in Stonging only and presents very paltry picture in terms of services to local community. All other villages of Astak valley depend upon meagre services provided by Stonging veterinary facility. Most commonly reported livestock diseases are Goat pox, Interotoxemia (Goat, sheep and cattle), Black quarter, Mange (Large animals' cattle, yak, zozomo) as mentioned during FGD interviews. As an alternative to lack of vet facilities people of community purchase the vaccines without prescription from Dambodas Tehsil of Skardu District or Gilgit City and inject them by themselves devoid of proper training.

1.4.5. Electricity

All the villages in Astak valley has the access to electricity facility provided and managed by Water and Power Department, GB but supply-demand lapse is managed by load shedding (Exhibit No. 06). The frequency of load shedding increases in winter with increase in demand to maintain the indoor temperature. Local community residing around CKNP manages this electricity shortage by harvesting wood as a fuel source from the National Park.

1.4.6. Traditional Governance System

Traditional Governance system unfolds two tiers; within the households and within the village. Within the ambit of social structure at household level, the basic residential/economic unit is the joint family. Typically, this unit includes an elder's household with his married sons' families. Married sons generally live in their father's household with the latter or the eldest brother exercising authority over the extended family. The authoritative head of the household has the responsibility and authority to make decisions on behalf of the entire household members. It is within the joint family that the primary solidarities lie for daily economic activities. This customary practice of joint family system fairly justifies the lower average increase in households and higher average increase in population.

Exhibit 6: Socio-economic profile of Astak Valley

Villages	Education facilities				Health facilities		Veterinary facilities	Electricity
	Category / Level	Ownership	Geographic Location	Gender	Facility	Geographic Location		
Jamshed Abad	Primary	Private	N 36°55'04.9'' E 074°23'32.6''	N/A	Mopa village	-	Kharkhour Village	Yes
Xhoxum	--		N/A	Both	-do-	-	Mopa Village	-do-
Lagaf	Middle	Private	N 35°40'45.1", E 075°01'46.8" h 2513 m asl	Both	-do-	-	-do-	-do-
Kharchung	--		N/A	N/A	-do-	-	-do-	-do-
Lachoo	--		N/A	N/A	-do-	-	-do-	-do-
Riging	Primary	Private	N 35°42′03.0″, E 75°02′13.1″ h 2561 m asl	Both	Dispensary	N 35°42′11.2″ E 75°02′15.1″ h 2584 m asl	-do-	-do-
Shano	Primary	Govt	N 35°42′51.4″, E 75°02′32.6″, h 2592 m asl	Boys	First Aid Post	N 35°43′09.3″ E 75°02′32.6″ h 2612m asl	-do-	-do-
Gudapa Ishkandas	--		N/A	N/A	Mopa village	-	Kharkhour Village vet facility	-do-
Tugla	--		N/A	N/A	Mopa village	-	Mopa Village	-do-

Villages	Education facilities				Health facilities		Veterinary facilities	Electricity
	Category / Level	Ownership	Geographic Location	Gender	Facility	Geographic Location		
Soosa/Thangus	Primary	National Education Fund	N 35º42′58.4″, E 75º02′19.7″, h 2597 m asl	Both	Kharkhour village	-	Kharkhour Village	-do-
Burdia	--		N/A	N/A	-do-	-	Mopa Village	-do-
Mopa	Middle	Both Govt. and private	N35°41'32.0", E075°01'47.4" h 2523 m asl	Both	Yes	N 35°41'32.0", E 075°01'48.7", Alt h 2545 m asl	Mopa and Stonging valley	-do-
Stonging	High	Private	N35°41'19.3", E 75°01'38.3"	Both	Kharkhour village	N/A	-do-	-do-
Balaxong	Primary	Private	N35°41'00.8" E75°01'07.2", h 2491 m asl	Both	Kharkhour village	N/A	Stonging Village	-do-
Khirzang	Primary	Private	N 35°46'05.9", E 75°00'07.6", h 2388 m asl	Both	-do-	N/A	-do-	-do-
Shangus	Primary	Govt.	N35°43'13.9", E74°49'07.7" h 1674 m asl	Both	Yes	N 35°43'14.7" E 74°49'13.7", h 1658 m asl	Sassi Village of Haramosh Valley	-do-

The whole buffer zone of CKNP is full of villages having rugged topography, jagged mountains, harsh climate and disaster-prone areas. In this situation, local community helped themselves by establishing and maintaining the local support organization in order to explore and enhance the developmental opportunities for the areas. They were established back in 1980 under the awareness and efforts of working NGO's and INGO's at time but maintained and managed by the local communities as an integral social component. It serves as umbrella for VCCs, VOs, and WOs. This organization contains the members from all the regional organizations and jurisdiction spans upon the water sheds at the village/valley level. Their function is equivalent sharing and support of the developmental opportunities in the area.

Social organizations exist in the area but mostly dormant. An LSO is working in the area having its office in Rondo Tehsil but its intervention in Astak valley seem ineffective as the communities from all the villages do not own it. V/WOs in the area are completely dead by function, however some CSOs formed by individual, such as Jamshed Welfare organizations and religious organizations like ISO are actively rendering social services.

1.4.7. Gender Impact

In Astak valley gender roles are very similar to other CKNP valleys where each household usually comprises of two gender authorities, the oldest male member of a household is head of the household and the oldest women can be said as subordinate to the head. The division of labor is basically gender-based, the male members of the family including head of the family are responsible for both external and internal matters such as representing the household in the village as well as ensuring income earning and its management, such as decision making related to agriculture and livestock production, use and distribution of tasks. The females of the house are responsible for defining and organizing the tasks and handling household economic affairs, including managing storerooms, kitchen and handling/use the agriculture and livestock production. Women mobility within the village is open and they are allowed to participate in social and religious events, where a separate portion for women is defined and they have to stay within the defined boundary.

Primarily women are engaged in agriculture activities and other reproductive roles due to lack of income earning opportunity within the village and rare mobility opportunities outside the village. The primary reason for women's current role is lack of education and skill in women. A few women who earn cash income are either primary or secondary level teachers in the school or midwives in health facilities. Currently increasing enrolment of women in the schools is expected to increase number of educated women in few years, which will ultimately become a reason for changing women role

ASSESSMENT OF CUSTOMARY PRACTICES FOR SUSTAINABLE USE OF NATURAL RESOURCES IN CONTEXT OF INDIDENOUS KNOWLEDGE

2. ASSESSMENT OF CUSTOMARY PRACTICES FOR SUSTAINABLE USE OF NATURAL RESOURCES

Local community inhabited this land since forefathers and practices their own set of rules known as customary/custodian rules/practices which were formed before the statutory laws even before the creation of Pakistan. These laws passed from generation to generation by words and hardly been written anywhere. Local communities have long histories of interaction with the natural environment. With the passage of time the land use priorities changed and resulted in differential dependence upon natural resources by each community and even varied personally. Allied with many of these communities is a collective organization of knowledge, expertise, practices and emblematic depiction. These refined sets of understanding, elucidation and connotation are integral component of a cultural complex that incorporates language, nomenclature, resource use practice, cultural and worldview. This local and indigenous wisdom is a key resource for empowering communities to exploit natural resources in sustainable manners to ensure its continuation for next generations.

2.1. Requirement of Revitalization of Indigenous Knowledge

Indigenous people are the custodian of customary systems. These people are well informed about their own circumstances, their resources, what works and what does not work. They are also aware of the possible impact of a change in one factor on the other parts of the environment, but the issue highlighted by the local community during the interviews is that they are unable to assess and adapt to environmental changes as fast as its happening. This provokes the need of awareness raising and revitalizing the indigenous knowledge in a way that allows these people to adapt to their environment and let them able to reciprocate the disastrous changes steadily.

2.2. Water

Astak valley has adequate water supply from the main stream at the middle and small water streams from both sides of mountainous terrain. The overall water availability is sufficient to cater required need of the valley. Water distribution is dealt by customary laws which hardly had any changes since generations. The common distribution occurs family wise in turns for varied time ranging from 1 hour to 12 depending upon water availability, while other villages' shares it on the basis of landholding area. Other villages lying close to water channels do not practice these distribution rules due to its abundance. Owing to poor edifice of existing irrigation channels and absence of irrigation channels near agriculture areas productivity is affected.

2.3. Agriculture

Agriculture and livestock herding are two most preferred economic activities in the Astak valley. Open canopy forest especially in the upper sections of the valley provide enough arable land for crop and fodder Cultivation. The role of women is significant in agriculture farms. Division of labor exists between both genders throughout the summer. Men mostly perform the cultivation activities (land preparation and sowing) with minor assistance from women while in harvesting season both work. Agriculture activities, such as irrigation of farms, fodder collection and storage for winter season are performed by females of the house.

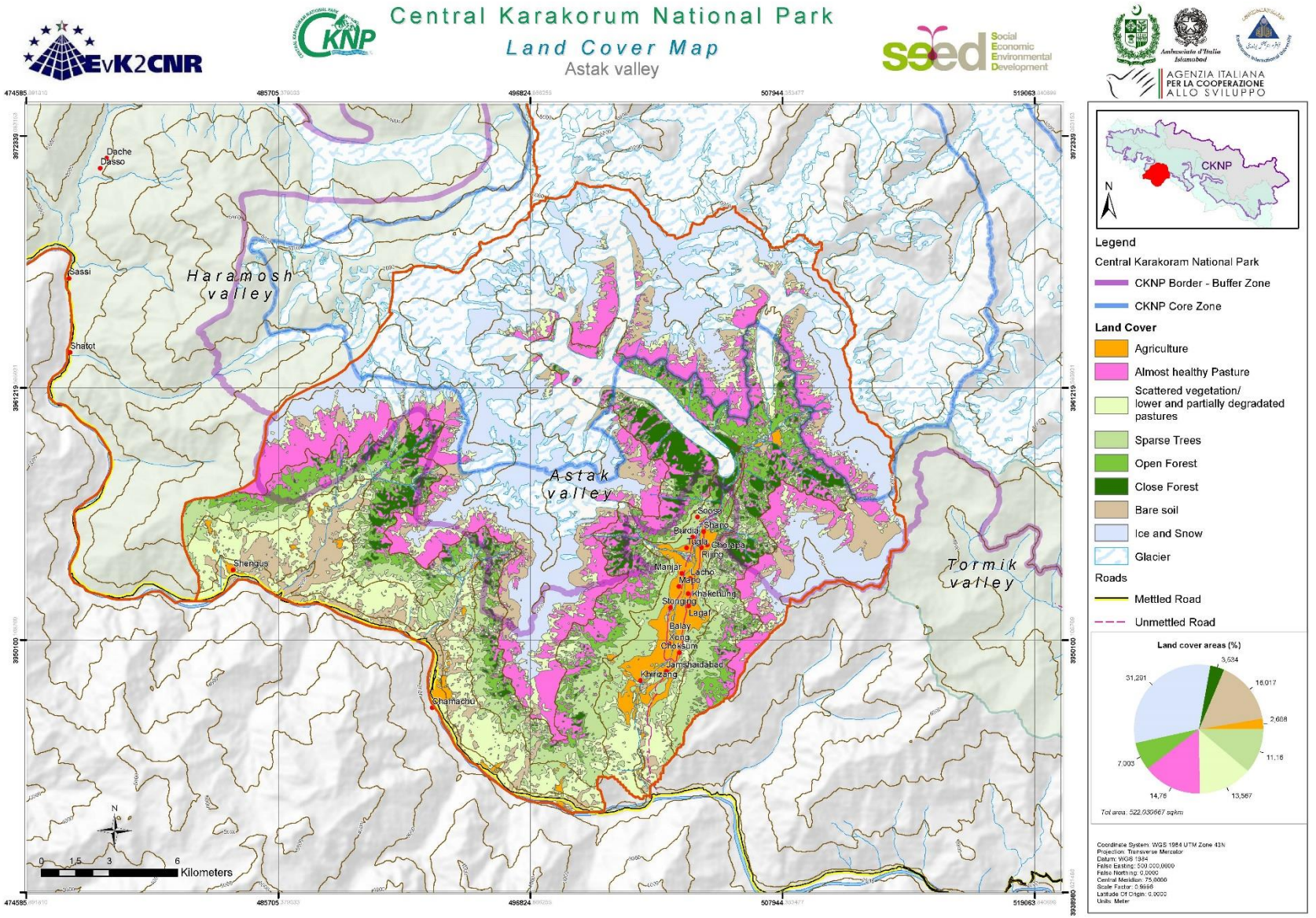


Exhibit 7: Land cover map of Astak Valley

Astak valley owing to its moderate elevation range and abundant water availability provides the opportunity of double cropping to farmers. Main crop are Wheat, Potato and Barley however Maize is cultivated as second crop. In spite of dependence on agriculture for subsistence wheat production hardly fulfill consumption per household for six to seven months and the gap is filled by purchasing wheat from government wheat reserve/subsidiary or market. Potato is the only cash crop which is sold in the market to cash earn income. Almost in all villages significant portion (approximately 75%) of potato is sold while rest is stored for household consumption. A part of the received income is spent on purchase of wheat from market to fill the gap. Although there is great potential available for fruit production in the valley but due to lack of awareness on value addition, packing and marketing fruit products and vegetable are not mostly not sold.

Though the valley is rich in water resources but due to poor irrigation infrastructure in many villages water is not largely available. Water wherever available mostly utilized in the day time for farm irrigation and in the night time it is used to irrigate orchards, plantation areas and farm fodder lands. A considerable area of cultivable/barren land is available in the core valley and some side areas but the community is lacking communal efforts coupled with scarcity of financial resources to bring it under cultivation. With increasing livelihood needs, individual households are working on land reclamation by expanding agriculture by altering land use. Land under natural forest and vegetation cover are being cleared for agriculture practices.

Exhibit 8: Income from agriculture production

Village	Kind of crops	Consumption (%)	Sale (%)	Av. Income/HH/yr	Av. Value/HH/yr
Jamshed Abad	Wheat	90	10	20,000	100,000
	Maize	100	0		
	Potato	100	0		
	Vegetable /Fruits	100	0		
Xhoxum	Wheat	100	0	15,000	90,000
	Maize	100	0		
	Potato	95	5		
	Vegetable /Fruits	100	0		
Lagaf	Wheat	100	0	45,000	80,000
	Barley	100	0		
	Maize	30	70		
	Potato	100	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Kharchung	Wheat	100	0	--	80,000
	Barley	100	0		
	Maize	100	0		

Village	Kind of crops	Consumption (%)	Sale (%)	Av. Income/HH/yr	Av. Value/HH/yr
	Potato	100	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Lachoo	Wheat	100	0	20000	35000
	Barley	100	0		
	Maize	100			
	Potato	80	20		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Riging	Wheat	100	0	38,700	50,000
	Barley	100	0		
	Maize	100	0		
	Potato	15	85		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Shano	Wheat	100	0	30000	50000
	Barley	100	0		
	Maize	30	70		
	Potato	-	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Gudapa/ Ishkandas	Wheat	100	0	50,000	70000
	Barley	100	0		
	Maize	20	80		
	Potato	0	0		
	Millet	100	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Tugla	Wheat	100	0	35000	150000
	Barley	100	0		
	Maize	10	90		
	Millet	100	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
	Wheat	N/A	0		
	Barley	N/A	0		
	Maize	20	80		
	Potato	N/A	-		

Village	Kind of crops	Consumption (%)	Sale (%)	Av. Income/HH/yr	Av. Value/HH/yr
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Burdia	Wheat	100	0	28,000	120,000
	Barley	100	0		
	Maize	20	80		
	Potato	N/A	0		
	Millet	100	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Mopa	Wheat	100	0	40000	150,000
	Barley	100	0		
	Maize	10	90		
	Potato	N/A	0		
	Millet	N/A	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Stonging	Wheat	NA	0	40,000	70,000
	Barley	100	0		
	Maize	5	95		
	Potato	N/A	0		
	Millet	N/A	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Balaxong	Wheat	N/A	0	50,000	150,000
	Barley	100	0		
	Maize	5	95		
	Potato	N/A	0		
	Millet	N/A	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Khirzang	Wheat	N/A	0	6000	16,000
	Barley	100	0		
	Maize	5	95		
	Potato	N/A	0		
	Millet	N/A	0		
	Buckwheat	100	0		
	Vegetable /Fruits	100	0		
Shangus	Wheat	N/A	0	N/A	55000

Village	Kind of crops	Consumption (%)	Sale (%)	Av. Income/HH/yr	Av. Value/HH/yr
	Barley	100	0		
	Maize	N/A	0		
	Potato	N/A	0		
	Millet	N/A	0		
	Buckwheat	100	0		

Exhibit 9: Need fulfillment by agriculture in Astak Valley, 2016

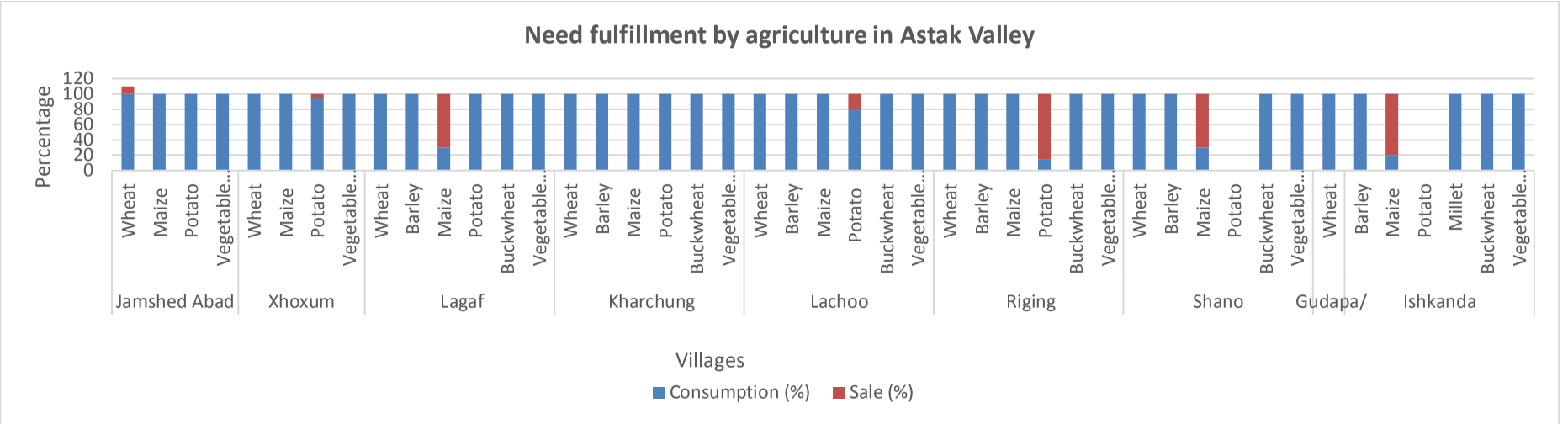
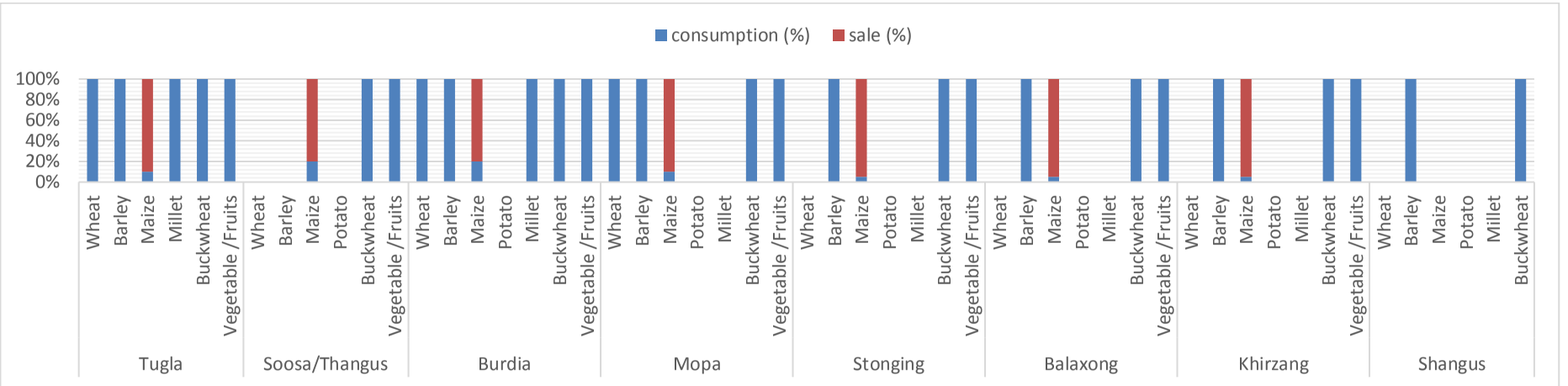


Exhibit 10: Need fulfillment by agriculture in Astak Valley, 2016



2.4. Livestock

Animal rearing serves as a "living bank" in terms of food and cash. Investment in livestock herding has a wide portfolio of animals: cattle, goats, sheep, donkeys, mules and poultry. This is supplemented in some areas with domestication of yak and hybrid yak. Livestock mobility, dispersion, shifting of households, utilization of pastures are adaptation strategies for livestock herding. Although forest cover is scarce but sufficient ground cover, especially in the upper sections of the valley provide ideal sites for livestock herding. Livestock population depends on alpine & subalpine pastures and range lands by the end of winter to next winter due to insufficient fodder from the agriculture fields. Moreover, the pastorals also collect fodder from pastures during late spring and summer season for over-wintering.

Livestock rearing trend decreased considerably during last ten years owing to less economic return for the following reasons.

1. Most working class of today have grown up and been educated. Many of them never return but stay in town and join alternative livelihood options.
2. Astak valley has prolonged winters and very short summer and spring season. The temperatures drop below the freezing point resulting dried out vegetation cover and snow covered pastures. Pastorals faces scarcity of fodder for livestock due to which animals produce a reduced amount of meat. Weak animals cause the economic capsizal for the owner.
3. Pastorals know about the changing climate but they are neither adapted to it nor do they know how to adapt and mitigate the effects of climate change for sustainability. New veterinary diseases are befalling in the villages at exponential rates during last 10 years due to climate change. Aided to this lack of sufficient vet facilities, medicines and vaccines increased livestock mortality. Pastorals have almost no or very little information about the precautionary measures and vaccines and faces economic loss ultimately.
4. Customary practices are not very efficient to control disease spread among herds. Infectious agents spread from common grazing areas such as pastures, water points and other such places. Pastorals that rear livestock often lack the information about the zoonotic diseases and get infected from diseased animals.
5. There is huge dependence of livestock on the pastures for fodder. With the increase in human population and ultimately livestock population the pressure has been increased, subsequently health of pastures is decreasing. There is no assessment about the carrying capacity of pastures and therefore no rules exist about the maximum number of livestock in the pastures neither in customary rules nor in statutory laws.

The observed decree in the livestock rearing has both positive and negative impacts. The need is to assess the direction of adaptations towards the actions that are more suitable for natural resources and its components. On one hand decreasing trend in livestock rearing is useful as it reduces the pressure on the pastures, by leaving space and food for the wild herbivores such as

Markhor, Ibex, and several small rodent species and ultimately increasing prey density for wild carnivores. But on the other hand decreased economic incentives by livestock in annual income per household increases the dependence of local community on the wood and non-wood products. This dependence of local community on natural resources needs to be evaluated in terms of monetary benefits during each season and their economic value in the area to make research-based decisions for ecosystem sustainability. No previous research addresses the comparison of the monetary share of natural resources for household and its own economic value in terms of sustainable ecosystem services has been explored. Therefore, it is the need of time to strengthen the management plan by such research and specifically its implementation in the operational plan to ensure sustainable use of land and its products.

Exhibit 11: Contribution of livestock in economics of Astak Valley

Villages	Kind of livestock	Population per village	Av. Income/HH/yr	Rearing trend
Jamshed Abad	Goat	150	80000	Decrease
	Sheep	150		
	Cattles	100		
	Yaks	0		
	Equids	60		
Xhoxum	Goat	960	20000	Decrease
	Sheep	960		
	Cattles	170		
	Yaks	32		
	Equids	320		
Lagaf	Goat	150	10000	Decrease
	Sheep	200		
	Cattles	300		
	Yaks	3		
	Equids	40		
Kharchung	Goat	100	50000	Decrease
	Sheep	100		
	Cattles	70		
	Yaks	0		
	Equids	50		
Lachoo	Goat	100	225000	Decrease
	Sheep	200		
	Cattles	50		
	Yaks	1		
	Equids	50		
Riging	Goat	500	55000	Decrease
	Sheep	550		
	Cattles	800		
	Yaks	2		
	Equids	100		
Shano	Goat	200	42000	Decrease

Villages	Kind of livestock	Population per village	Av. Income/HH/yr	Rearing trend
	Sheep	600		
	Cattles	200		
	Yaks	N/A		
	Equids	40		
Gudapa/Ishkandas	Goat	150	27000	Decrease
	Sheep	450		
	Cattles	200		
	Yaks	1		
	Equids	100		
Tugla	Goat	150	35000	Decrease
	Sheep	400		
	Cattles	150		
	Yaks	2		
	Equids	70		
Soosa/Thangus	Goat	480	450000	Decrease
	Sheep	780		
	Cattles	240		
	Yaks	1		
	Equids	180		
Burdia	Goat	300	30000	Decrease
	Sheep	600		
	Cattles	200		
	Yaks	0		
	Equids	100		
Mopa	Goat	400	5000	Decrease
	Sheep	500		
	Cattles	600		
	Yaks	5		
	Equids	50		
Stonging	Goat	1000	50000	Decrease
	Sheep	900		
	Cattles	250		
	Yaks	0		
	Equids	0		
Balaxong	Goat	250	25000	Decrease
	Sheep	300		
	Cattles	300		
	Yaks	0		
	Equids	100		
Khirzang	Goat	290	6000	Decrease
	Sheep	850		
	Cattles	600		
	Yaks	0		
	Equids	232		

Villages	Kind of livestock	Population per village	Av. Income/HH/yr	Rearing trend
Shangus	Goat	3700	6000	Decrease
	Sheep	2000		
	Cattles	570		
	Yaks	0		
	Equids	49		

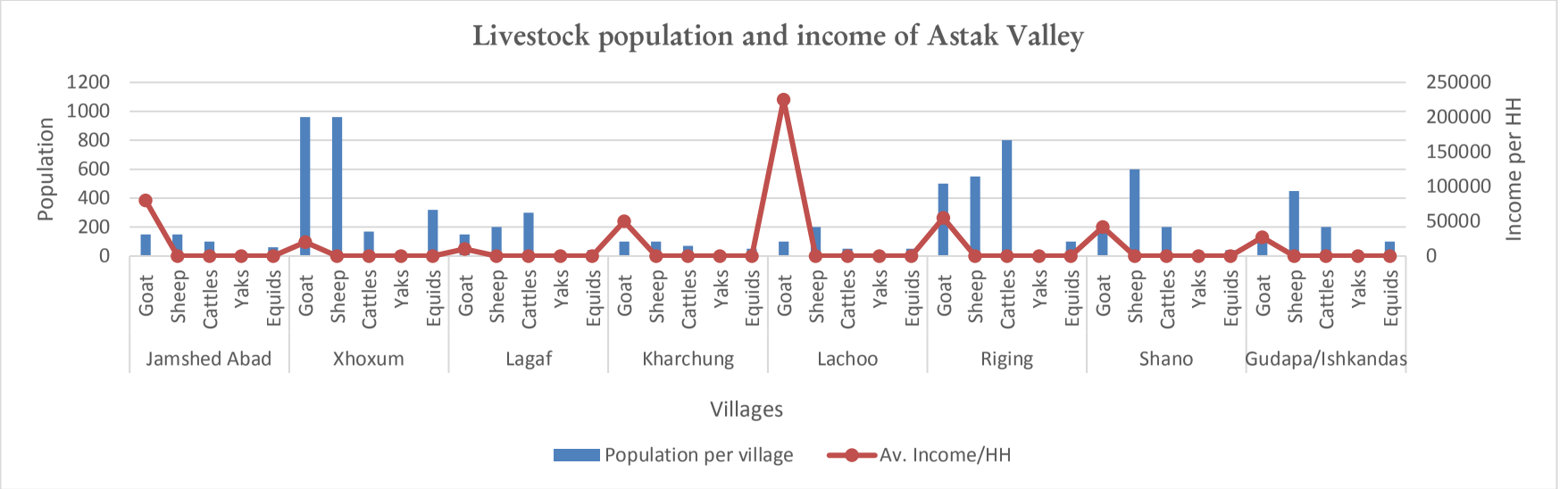


Exhibit 12: Livestock population and income of Astak Valley (Jamshed Abad – Gudapa/Ishkandas)

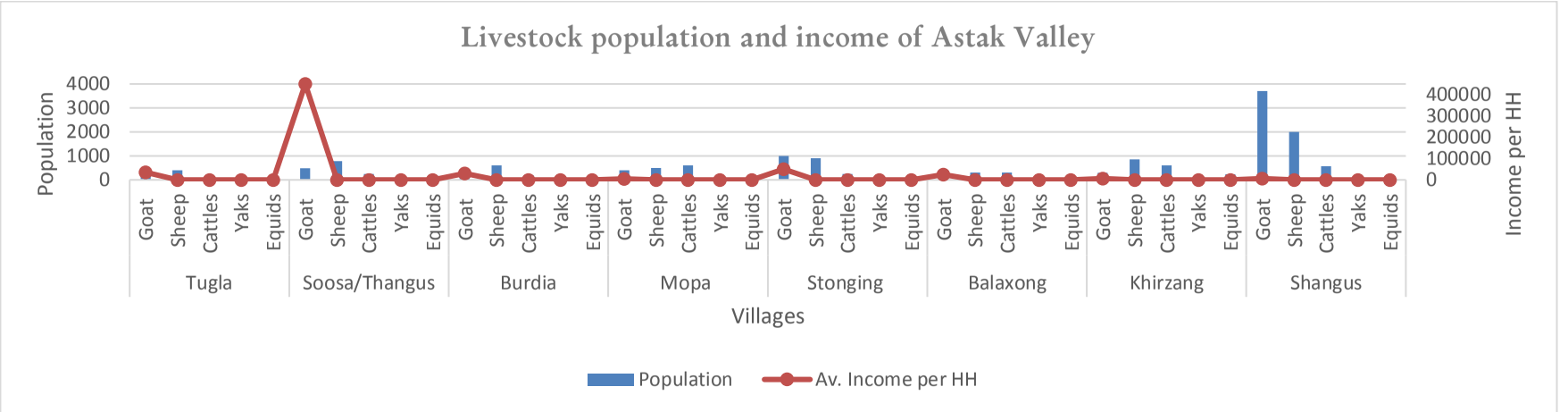


Exhibit 13: Livestock population and income of Astak Valley (Tughla - Shangus)

2.5. Pastures

Animal rearing dominates land use with pastures and water management being guided by customary rules in Astak Valley. Pasture shared within two or more villages ensuring the common access rights also guided by customary rules. Shared pasture often borders two or more villages. Local community depend upon pastures for livestock herding, fuel wood collection, medicinal plants harvest, honey and other consumable products on the basis of rights to access. Most of the pastures are located at the more or less same elevation and surrounds both sides of water sheds in the villages so in such cases same number of animals from each village have the chance to graze on all the pastures at same time which advocates the unique and un peculiar structure of Exhibit No. 14.

Local community of Astak valley reported only vertical transhumance patterns in the area during FGD interviews with seasonal movements from top mountain pastures to downside. Vertical transhumance either guided by shepherd or family members is customary practice to avoid grazing of livestock on fields. During springs, when the fields are ploughed and grains are sowed. Consequently, household's livestock is moved out of villages to the lower pastures, free of snow, to protect cultivated areas from animal browsing. As the season advance, livestock is gradually moved at higher elevation to the summer pasture (July-August) above the timberline (4500 m a.s.l.). In the meantime, crops are grown and finally harvested. Then, livestock gradually return to lower pastures and to stables at village levels (November). There, they stay during all winter (November – March) until successive spring, feeding on the crop residuals and hay collected during summer stored and dried by the households (Ferrari, 2014). For the farm protection from browsing prior to its movement during early spring, linear hedge of Russian olives is common on the terraces of agriculture patches.

It is customary to keep all the dairy products as a payment or exchange the 50% for a certain amount of grains in the case when livestock is herd by shepherd in the pasture. Such pastures have only few huts in them. Contrary to it, villages where number of animals is not very large, several families might join together their livestock, each keeping them for one/two weeks or pre-settled time. Usually several huts are located in such pasture zones.

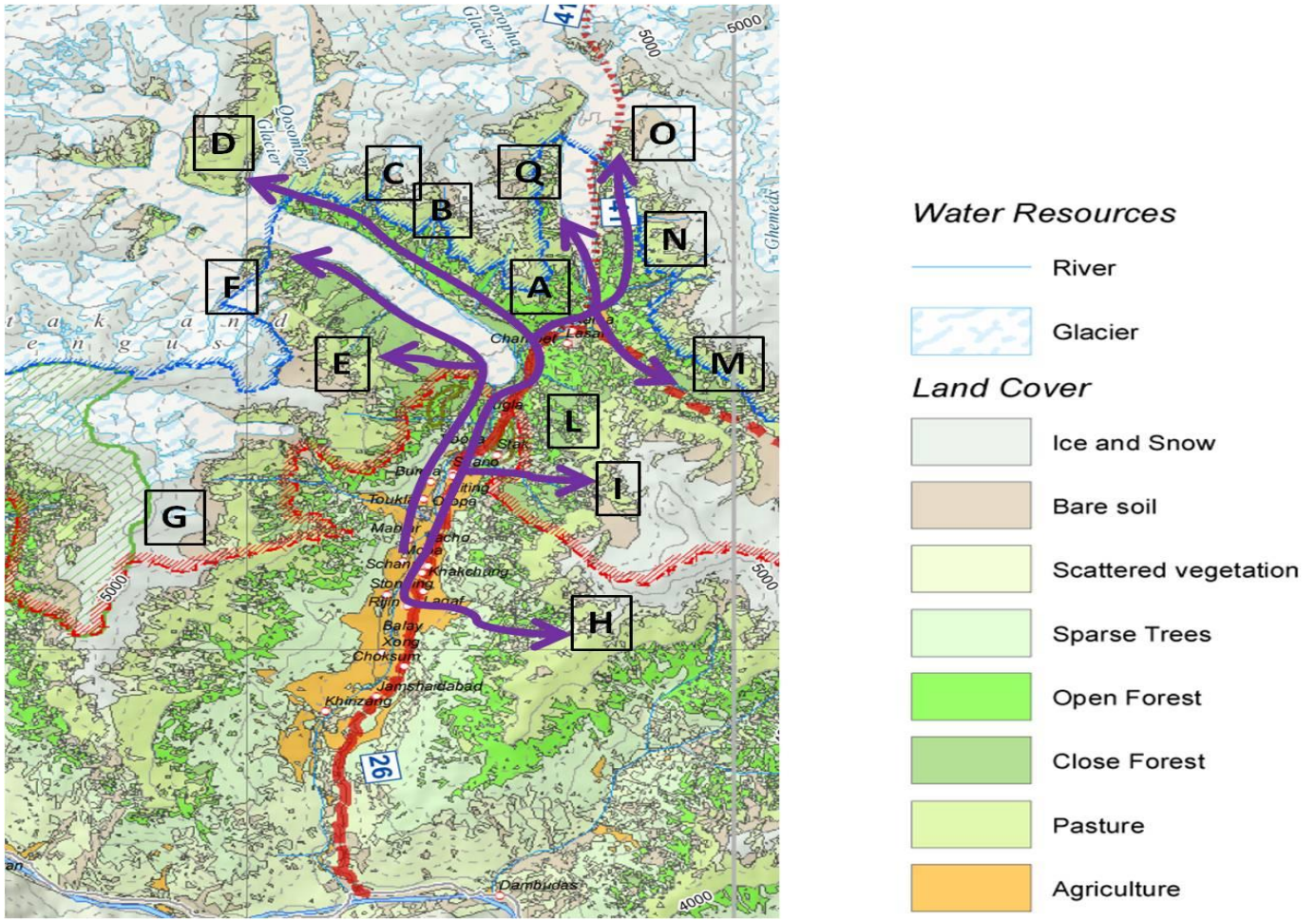
Another customary practice exercised to avoid the livestock of the neighboring villages which don't have access rights on particular pasture is the penalty. If livestock of one village moves to pasture of neighboring village intentionally then penalty has been fixed by village community according to the loss.

At present, highest concentrations of livestock fed upon pastures of Riging village. The FGD interviews indicates that 79% of the pastures in Astak valley are degrading gradually. Decline in health of pastures is direct indicator of unsustainable harvesting practices due to increasing local population fueled by climate change.

Uncontrolled grazing and other consumable products irrespective of decreasing productivity allows them to earn handsome amount for subsistence. Indirectly it also indicates the less snow and shift of rainy seasons which contributes to its low productivity. Barren patches among the

pastures are notable features indicating the removal of top soil as a result of flooding and landslides. Collecting all the facts mentioned by local community and commonly reported in literature provokes the need of managing zones of rotational grazing in the pastures and determining the maximum number of each kind of livestock according to carrying capacity of pastures as mentioned in the CKNP MP and OP while keeping pace for wild herbivores reptiles and rodents to thrive. In Astak valley, vaccination of livestock is an issue because of absence of sufficient veterinary facilities.

Exhibit 14: Movement of livestock at few Astak valley during the season



A) Chambet (April/May->Sept/Oct), B) Marphalungma (June/August), C) Saralpa (June-August), D) Chas polo (August); E) Kutja (May/September), F) Shkango (June/August); G)Tuglano (June/August); H)Servogir (July/August); I)Matumbur (July/August); L) Lassar (June/August); M) Lahamosh (June/August); N) Drumaso (June/August) O)Hlarzing (July/August), Q) Liglidlmo (June/August)

Exhibit 15: **Grazing pressure by livestock on pastures of Astak Valley**

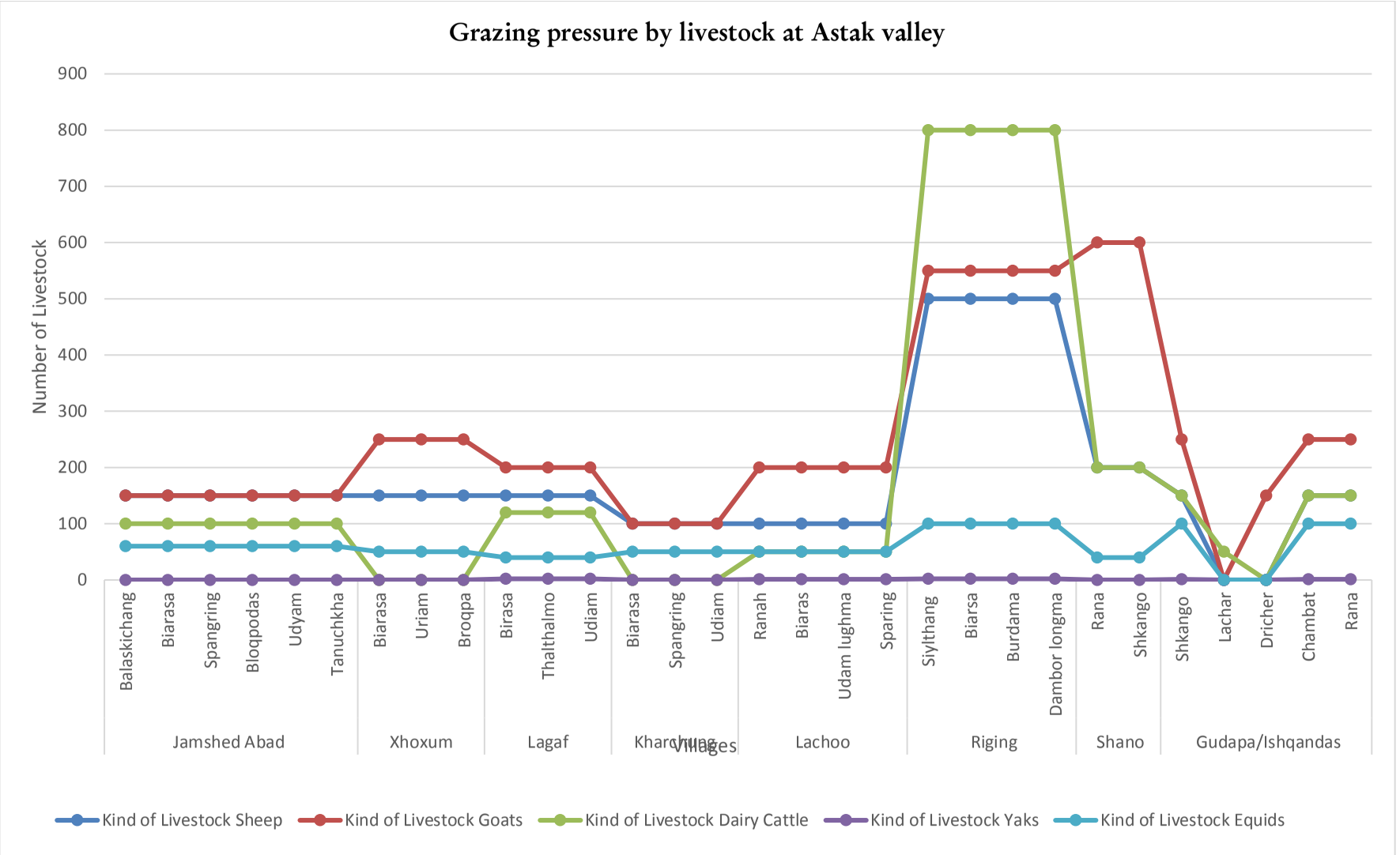


Exhibit 16: Grazing pressure by livestock on pastures of Astak Valley (Thogla-Shengus)

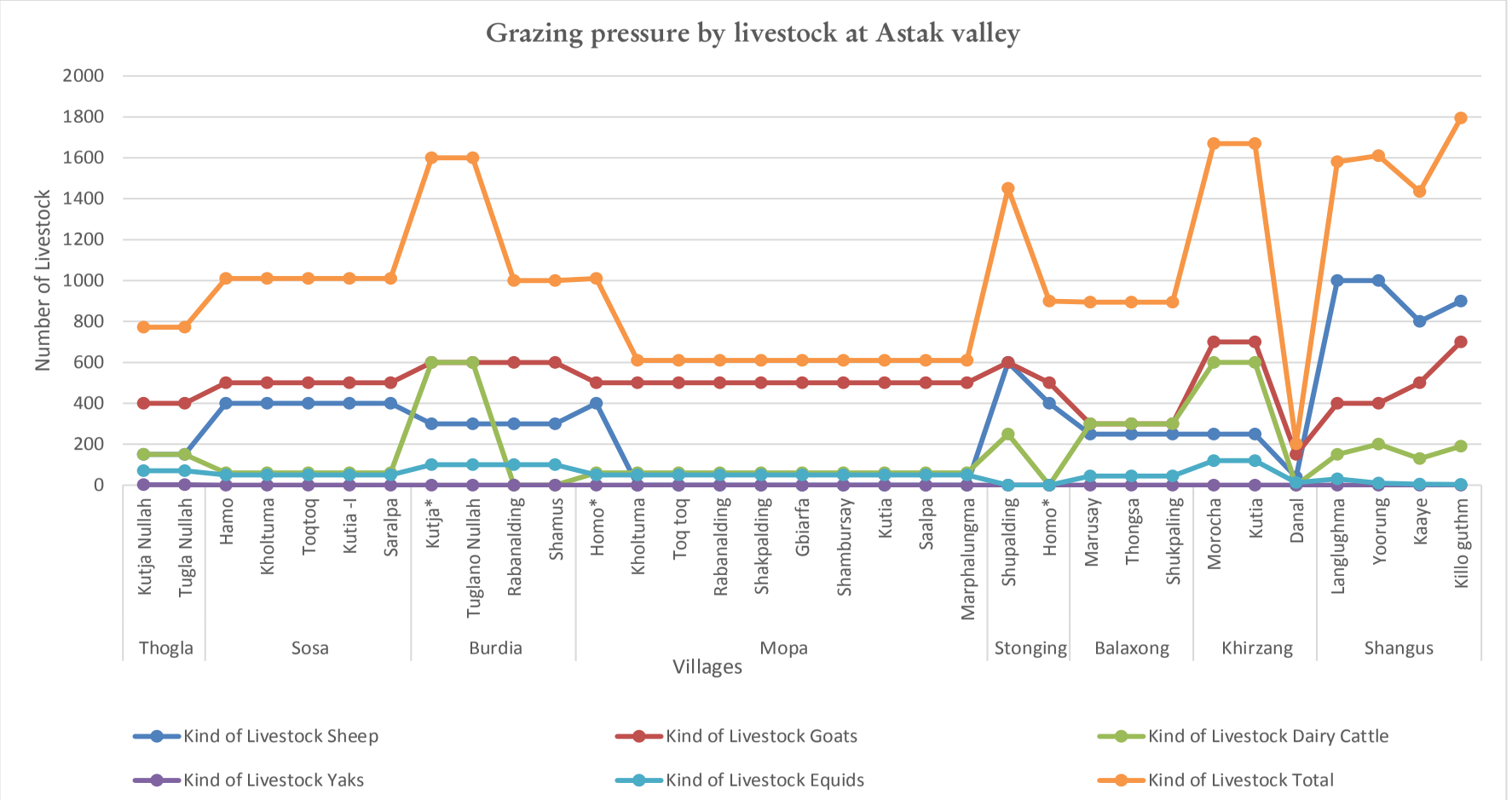


Exhibit 17: Assessment of grazing pressure from each livestock classes on pastures of Astak Valley

Pasture	Village	Other Uses	Status	Grazing Period	Kind of Livestock					
					Sheep	Goats	Dairy Cattle	Yaks	Equids	Total
Balaskichang	Jamshed Abad	Tumoro, Shapor wood	D	May-Oct	150	150	100	0	60	460
Biarasa		-do-	D		150	150	100	0	60	460
Spangring		-do-	D		150	150	100	0	60	460
Bloqpodas		-do-	D		150	150	100	0	60	460
Udyam		-do-	D		150	150	100	0	60	460
Tanuchkha		-do-	D		150	150	100	0	60	460
Biarasa	Xhoxum	-do-	PD	Jul-Sep	150	250	0	0	50	450
Uriam		-do-	PD		150	250	0	0	50	450
Broqpa		-do-	PD		150	250	0	0	50	450
Birasa	Lagaf	-do-	PD	Jun-Sep	150	200	120	2	40	512
Thalthalmo		-do-	PD		150	200	120	2	40	512
Udiam		-do-	PD		150	200	120	2	40	512
Biarasa	Kharchung	Medicinal plant collection and fire wood	PD	May-Jun	100	100	0	0	50	250
Spangring		-do-	PD		100	100	0	0	50	250
Udiam		-do-	PD		100	100	0	0	50	250
Ranah	Lachoo	Tumoro, fuel wood	D	May-Nov	100	200	50	1	50	401
Biaras		-do-	D		100	200	50	1	50	401
Udam lughma		-do-	D		100	200	50	1	50	401
Sparing		-do-	D		100	200	50	1	50	401
Siylthang	Riging	Medicine, fuel wood collection	PD	Mar-Sep	500	550	800	2	100	1952
Biarsa		-do-	PD		500	550	800	2	100	1952
Burdama		-do-	PD		500	550	800	2	100	1952
Dambor longma		-do-	PD		500	550	800	2	100	1952

Pasture	Village	Other Uses	Status	Grazing Period	Kind of Livestock					
					Sheep	Goats	Dairy Cattle	Yaks	Equids	Total
Rana	Shano	-do-	PD	May-Aug	200	600	200	0	40	1040
Shkango		-do-	PD	Aug-Sep	200	600	200	0	40	1040
Shkango	Gudapa/ Ishkandas	-do-	D	Jun - Aug	150	250	150	1	100	651
Lachar		-do-	D		0	0	50	0	0	50
Dricher		-do-	D		0	150	0	0	0	150
Chambat		-do-	D		150	250	150	1	100	651
Rana		-do-	D		150	250	150	1	100	651
Kutja Nullah	Thogla	-do-	PD	May- Sep	150	400	150	2	70	772
Tugla Nullah		-do-	PD		150	400	150	2	70	772
Hamo	Sosa	-do-	H	May- Nov	400	500	60	0	50	1010
Kholtuma		-do-	H		400	500	60	0	50	1010
Toqtoq		-do-	PD		400	500	60	0	50	1010
Kutia -I		-do-	PD		400	500	60	0	50	1010
Saralpa		-do-	PD		400	500	60	0	50	1010
Kutja*	Burdia	-do-	PD	Mar-Apr/Oct	300	600	600	0	100	1600
Tuglano Nullah		-do-	PD		300	600	600	0	100	1600
Rabanalding		-do-	PD		300	600	0	0	100	1000
Shamus		-do-	PD		300	600	0	0	100	1000
Homo*	Mopa	-do-	H	Mar- Sep	400	500	60	0	50	1010
Kholtuma		-do-	H		0	500	60	0	50	610
Toq toq		-do-	H		0	500	60	0	50	610
Rabanalding		-do-	H		0	500	60	0	50	610
Shakpalding		-do-	H		0	500	60	0	50	610
Gbiarfa		-do-	H		0	500	60	0	50	610
Shambursay		-do-	H		0	500	60	0	50	610

Pasture	Village	Other Uses	Status	Grazing Period	Kind of Livestock					
					Sheep	Goats	Dairy Cattle	Yaks	Equids	Total
Kutia		-do-	H		0	500	60	0	50	610
Saalpa		-do-	H		0	500	60	0	50	610
Marphalungma		-do-	H		0	500	60	0	50	610
Shupalding	Stonging	-do-	PD	Jun-Sep/Jul-Oct	600	600	250	0	0	1450
Homo*		-do-	PD		400	500	0	0	0	900
Marusay	Balaxong	-do-	PD	Jun-Sep	250	300	300	0	45	895
Thongsa		-do-	PD		250	300	300	0	45	895
Shukpaling		-do-	PD		250	300	300	0	45	895
Morocha	Khirzang	-do-	PD	May - Oct	250	700	600	0	120	1670
Kutia		-do-	H	May-Aug	250	700	600	0	120	1670
Danal		-do-	H		40	150	0	0	12	202
Langlughma	Shangus	-do-	PD		1000	400	150	0	30	1580
Yoorung		-do-	PD		1000	400	200	0	10	1610
Kaaye		-do-	PD		800	500	130	0	5	1435
Killo guthm		-do-	PD		900	700	190	0	4	1794

- Pastures marked with * are shared between two or more villages

2.6. Fuel Wood Collection/ Timber Harvesting

Astak valley which lies at humid south west side of CKNP has comparatively rich forest with approximately 37.5% km^2 vegetation cover and its average ABG is 3924.8 $MgKm^{-2}$ and CAI of 971.2 Mg/year (Ferrari, 2014). Vegetation cover is 52% (14.5% grasslands, 4.5% close forest, 5.7% open forests, 9.2 % for both scattered and sparse vegetation). High value timber (mainly Pine and Spruce) is located in Astak but its proportion is low as compared to other CKNP valleys in Gilgit district i.e. Danyore and Haramosh.

As a consequence of increasing population expansion of villages is common phenomenon in Astak like other valleys and thus construction of settlements/houses is also on rise. The timber for construction purposes is either purchased from Gilgit timber market or from natural/artificial plantations. Astak which is less rich in forest reserves timber harvesting is usually regulated for its harvest in few places at Astak valley and represent an important share in total household livelihood revenues. However, in practice, this is hardly happening and locals decide by themselves where and how much to cut (FGD interview, 2016). It is important noting that use rights are maintained even by households now residing in nearby villages/cities. The usual amount harvestable is around 100/200 logs per household per year in Astak valley. From a large tree, locals usually obtain around 50 logs. The trees harvested for timber in each village of Astak valley. The value of a large tree harvested, divided into logs and transported to the nearest city (Skardu), can vary between 100,000 Rupees (Picea) and 125,000 (Pinus) depending upon type and quality of wood.

Exhibit 19: Timber harvest by local community

Exhibit 18: Fuel harvest by local community

Among the alternative fuel wood resources, electricity, is the only source to alleviate pressure on forest for fuel wood. According to the survey result, in 43% villages of Astak

some households partially use electricity and on average which saves 432 kg firewood. The inhabitants of Astak highlighted available potential for electricity generation through small scale/micro hydel power unit to conserve the natural forests of Astak valley.

Customary laws are being followed in the valley for exploitation of natural resources. Community is allowed to collect only dead and fallen trees for fuel wood and timber up to need basis only both by customary rules and CKNP rules. Although it does not allow sale of timber but also not address the maximum amount of wood harvest from the buffer area. Juniper is harvested extensively by local community due to its frequent availability near the settlements in Astak without taking into consideration its slow growth. Customary laws do not address the way of harvest. It is specific to each floral class and needs to be followed as proposed in CKNP management plan. Following are the CKNP MP guidelines to ensure ecosystem intactness while harvesting.

1) Community use Juniper both as fuel wood and timber however its use is strictly prohibited as per MP of CKNP. If its harvest is necessary than only braches should be removed instead of whole tree due to its resilience. Local community uproot Juniper and use it as fuel and timber source.

2) Riparian vegetation e.g. Sea-buckthorn and Willows, community usually remove the whole plant/tree from soil which disturbs the ecosystem. It is suggested in CKNP MP to cut single basal shoots from each plant to preserve in its root system. By doing so, new shoots can re-grow rapidly producing new biomass to be harvested.

3) There are several other gaps in customary laws which provoke the need of revitalization of these laws in addition to reinforcement of statutory laws essential for natural resources conservation and restoration. There is strong need to quantify the magnitude of the chronic small-scale disturbances as well as large scale disturbance as a key component of landscape quality and incorporate the findings into laws to ensure sustainable and healthy environment in order to mitigate the haphazard changes of climate.

Exhibit 20: Timber harvesting and use at Astak valley

Village	Houses constructed in last 5 years (2010-2015)	Number of trees used	Tree species used
Jamshed Abad	15	50	Poplar, Willow
Xhoxum	10	3	Blue pine, Poplar
Lagaf	7	3	Pine
Kharchung	5	3	Pine
Lachoo	15	75	Poplar, Willow
Riging	35	5	Pine
Shano	8	5	Pine and Juniper
Gudapa/Ishkandas	25	25	Poplar
Tugla	12	2	Pine
Soosa/Thangus	35	7	Poplar, Pine
Burdia	20	2	Pine
Mopa	20	2	Blue pine, Poplar
Stonging	25	2	Blue pine, Poplar
Balaxong	5	3	Juniper and Pine
Khirzang	10	30	Poplar
Shangus	25	50	Poplar

Exhibit 21: Summary of fuel wood harvest and consumption in Astak Valley

Village	HH	Consumption Per Household (Mg yr-1)			Consumption Per Village (Mg yr-1)		
		S	W	Tot.	S	W	Tot.
Jamshed Abad	36	2.52	3.78	6.3	90.72	136.08	226.8
Xhoxum	32	2.915	4.185	7.1	93.28	133.92	227.2
Lagaf	30	2.144	3.216	5.36	64.32	96.48	160.8
Kharchung	28	1.61	2.39	4	45.08	66.92	112
Lachoo	26	2.56	3.84	6.4	66.56	99.84	166.4
Riging	70	0.718	1.002	1.72	50.26	70.14	120.4
Shano	50	4.32	6.48	10.8	216	324	540
Gudapa/Ishkandas	45	1.96	2.84	4.8	88.2	127.8	216
Tugla	30	1.12	1.68	2.8	33.6	50.4	84
Soosa/Thangus	60	2.88	4.32	7.2	172.8	259.2	432
Burdia	40	0.8	1.2	2	32	48	80
Mopa	90	1.556	2.324	3.88	140.04	209.16	349.2
Stonging	80	1.8	2.7	4.5	144	216	360
Balaxong	90	1.96	2.84	4.8	176.4	255.6	432
Khirzang	60	1.32	1.88	3.2	79.2	112.8	192
Shangus	65	2.96	3.84	6.8	192.4	249.6	442

Exhibit 22: Annual fuel wood harvest, Astak valley

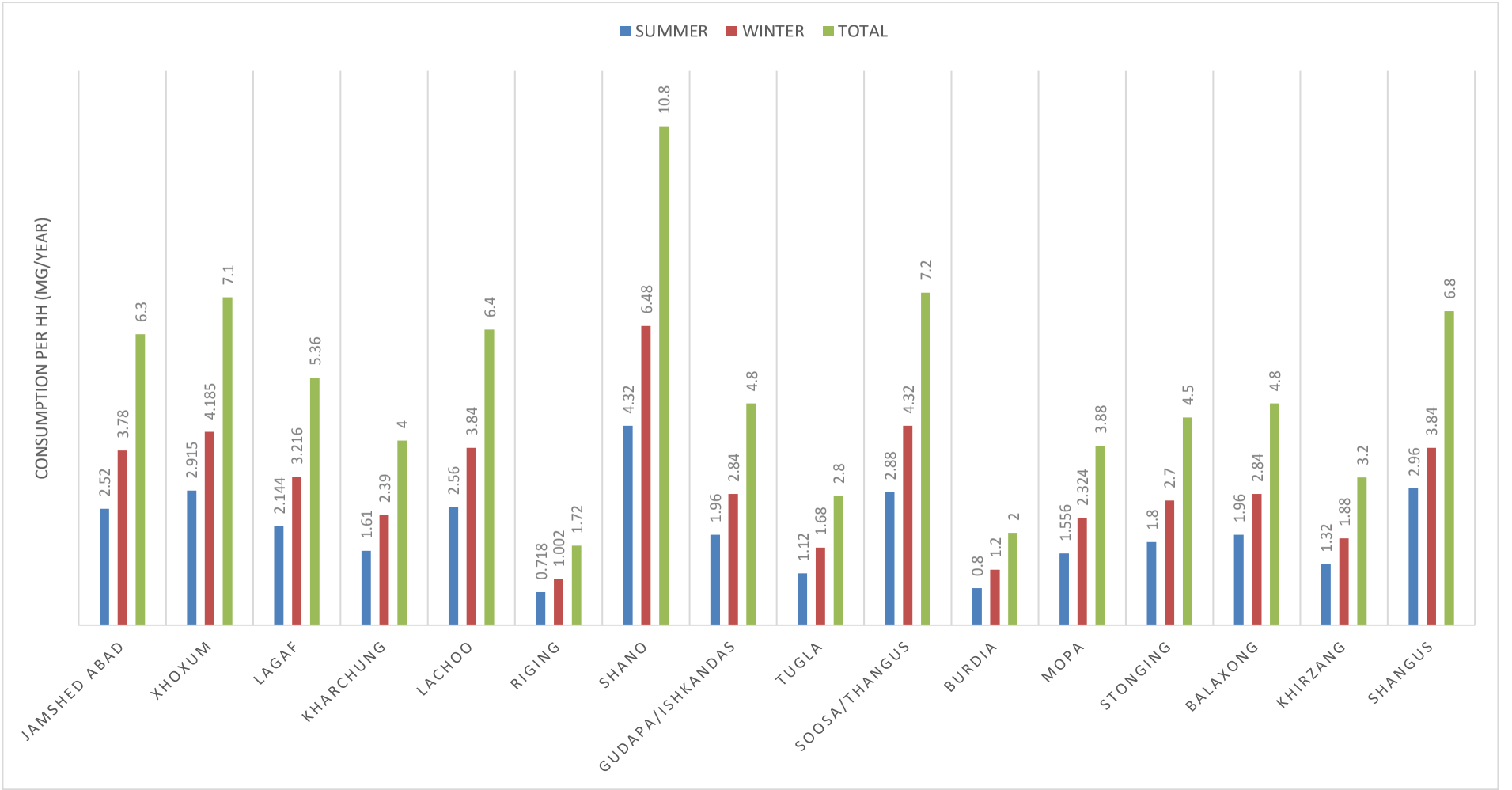


Exhibit 23: Details of fuel wood harvested per household from several sources (Kg/HH/yr)

Villages	Artemisia		Sea buckthorn		Juniper		Shrubs		Dung		Riverbank		Natural Forest		Fruit Trees		Plantation		Other Riparian	
	S	w	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W
Jamshed Abad	800	1200	0	0	80	120	0	0	320	480	40	60	0	0	1280	1920	0	0	0	0
Xhoxum	675	825	0	0	640	960	0	0	320	480	0	0	800	1200	480	720	0	0	0	0
Lagaf	0	0	64	96	800	1200	0	0	240	360	240	360	240	360	240	360	320	480	0	0
Kharchung	90	110	0	0	640	960	0	0	80	120	0	0	640	960	80	120	80	120	0	0
Lachoo	0	0	160	240	0	0	0	0	1280	1920	0	0	0	0	320	480	800	1200	0	0
Riging	270	330	0	0	80	120	0	0	160	240	48	72	0	0	160	240	0	0	0	0
Shano	0	0	0	0	1920	2880	0	0	640	960	0	0	1680	2520	0	0	80	120	0	0
Gudapa/ Ishkandas	360	440	0	0	240	360	320	480	160	240	0	0	880	1320	0	0	0	0	0	0
Tugla	0	0	0	0	240	360	0	0	0	0	0	0	640	960	160	240	80	120	0	0
Soosa/ Thangus	0	0	320	480	320	480	800	1200	800	1200	0	0	0	0	320	480	320	480	0	0
Burdia	0	0	0	0	160	240	0	0	160	240	0	0	320	480	80	120	80	120	0	0
Mopa	36	44	0	0	400	600	0	0	0	0	0	0	480	720	320	480	320	480	0	0
Stonging	0	0	0	0	640	960	0	0	0	0	0	0	1000	1500	160	240	0	0	0	0
Balaxong	360	440	0	0	640	960	0	0	160	240	0	0	640	960	80	120	80	120	0	0
Khirzang	360	440	0	0	0	0	0	0	240	360	0	0	0	0	720	1080	0	0	0	0
Shangus	2160	2640	480	720	48	72	0	0	80	120	32	48	0	0	160	240	0	0	0	0

Exhibit 24: Assessment of required reforestation to compensate fuel needs in Astak Valley

Valley	Average Fuel Consumption from Natural Forest (Mg/yr/valley)	Annual CAI (Mg/yr)	Required credit to sustain fuel needs	Harvest Pressure
Astak	30290.88	971	-29319.88	Unsustainable

2.7. Mining

The history of geological formation gifted the entire region of GB by most diverse and high-quality deposits of economic grade are being extracted. Adequate deposits of various precious and semi-precious stone mining activities are being excavated from Astak Valley. The major mining area is in upper mountain range of Thogla village which is shared as common mining area by all villages. However, the significant part of population involve in mining activity belongs from Thogla and Sosa villages, which are the nearest villages to the mining area. The mostly common mining stones in this very mining areas are aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, and Morganite. The mine was banned more than for a decade and some three years before reopened. Park rules allow only low impact blast techniques but community do not take care of these rules. Biodiversity loss from mining is never assessed and EIA are not available for most areas. Need of EIA is also mentioned in the Management plan of CKNP. Mining activities are carried out throughout summer season irrespective of obligation that park rules do not allow these activities during two months of wildlife births i.e. April, May.

Exhibit 25: Economic revenue from mining in Astak Valley, 2016

Village	Since	No of Mining Groups	Mining products	Revenue/Year /Village (PKR)	Revenue/Year /Group (PKR)
Jamshed Abad	-	-	-	-	-
Xhoxum	1980	1	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	-	-
Lagaf	1990	2	-	-	-
Kharchung	2006	1	-	-	-
Lachoo	-	-	-	-	-
Riging	1990	3	-	-	-
Shano	1980	4	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	-	-
Gudapa/Ishkandas	-	-	-	-	-
Tugla	1980	10	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	5,000,000	500,000
Soosa/Thangus	1988	55	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	8,250,000	150,000
Burdia	2008	3	-	-	-
Mopa	1980	2	-	-	-
Stonging	1970	7	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	5,000,000	714,286

Village	Since	No of Mining Groups	Mining products	Revenue/Year /Village (PKR)	Revenue/Year /Group (PKR)
Balaxong	2009	4	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	-	-
Khirzang	-	-	-	-	-
Shangus	1960	15	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite	-	-

2.8. Tourism

Astak is a beautiful valley having beautiful natural landscapes to fascinate the tourists. Valley offers diverse range of attractions such as treks, passes, wildlife sighting and gemstone mines, but intermittently visited by tourists. Major treks include Ganto La (4 days), Astak La (5 days) and Haramosh La (9 days) but these are extreme treks, suitable only for experienced and equipped adventurers. Hot water spring (39C) is specialty of Ganto La trek at Churtron. Tourist facilities include small hotels and restaurants including a PTDC Motel, a Public Call Office (PCO) and public transport for major towns of Gilgit-Baltistan. With the emerging domestic tourism in Baltistan, the current scenario of tourism can be improved by taking suitable actions as mentioned in the CKNP MP to offer the locals with an alternative earning opportunity.

ASSESSMENT OF CLIMATE CHANGE IMPACT FOR SUSTAINABLE USE OF NATURAL RESOURCES IN CONTEXT OF INDIGENOUS KNOWLEDGE

3. ASSESSMENT OF CLIMATE CHANGE IMPACT ON NATURAL RESOURCES

Climate change is projected to have a significant effect upon the future rate of biodiversity loss. There is a growing global consensus that the rate of climate change has already exceeded the capacity of some species and ecosystems to adapt naturally, and is close to exceeding that of many more. There is therefore an urgent need to identify the key mechanisms underpinning climate change impacts on natural resources in order to best select climate change adaptation strategies. It is also essential that the scale of these changes is clearly communicated to policy and decision-makers. Furthermore, it is recognized that climate change will have increasingly significant direct impacts on local communities, biodiversity and that increased rates of species extirpations are likely. The growth of many crops and weeds is being stimulated. Migration of plant and animal species is changing the composition and structure of local ecosystem. This will have negative consequences in terms of services provided by these species and ecosystems provide, especially in areas where the majority of the human population are the rural poor and dependent on direct exploitation of these ecosystem services.

3.1. Climate Change in the Perspective of Indigenous Knowledge

People at Astak valley were well aware of changes that are happening in their climate and responded all the questions effectively. The main concern of local community discussed during the FGD's was the adaptations strategies that are required to mitigate the effect of climate changing. Data obtained shows that local climate is changing but these changes are not very pronounced and can be reversed if we do proper and timely actions. Change in length of season has been reported by the local community with increased temperatures and prolonged summer. Local community has also reported an increase in the frequency of disastrous activities. According to scientific investigations these higher temperatures are degrading the permafrost layers, causing slope instability, rock falls, landslides and avalanches.

Although climate change has both positive and negative impacts, the issue is that the negative consequences may be more pronounced in mountains, both for the communities and for their environments, requiring more awareness, more attention and quicker reaction than elsewhere. Equally, the consequences of negative impacts may go beyond the boundaries of mountains and affect people and ecosystems in the surrounding lowlands.

3.2. Temperature Variability and Seasonal Shifts

Gradual increase in temperature has been reported by local community during last 30 years. Community reported a rapid increase of temperature during last 10 years. The most visible evidence of temperature increase is the earlier melt out of snow cover and glaciers across the region which has become more rapid over last one decade. This increasing temperature is responsible for disastrous activities and glacier recession which is getting frequent day by day according to the local community. Warming temperatures have led to effects as diverse as altered timing of bird migrations, increased evaporation, and longer growing seasons for wild and

domestic plant species. Increased temperatures often lead to a complex mix of effects. Warmer summer temperatures have led to longer forest growing seasons but have also increased summer drought stress, vulnerability to insect pests.

3.3. Precipitation

In addition, changes in climate, such as reduced snowfall and increased rainfall, are reported across the area by local community, but solid evidence of the impact is difficult to ascertain. Changes in precipitation level and the size of storms affect plant-available moisture, snowpack and snowmelt, stream flow, flood hazard, and water quality. Rainfall variability and periodicity has changed since last 30 years with most profound effect since last ten years. High speed and late rains have been observed by the local community which accelerates the crop diseases and infections. It shows that pests are getting adaptable to seasonal shift and variability more than other organisms and contribute to increased economic loss of crops and fruit trees.

According to local community snow season has also showed significant delay and is getting more delayed year by year in different valleys. Community reported 35% decline in amount of snow fall over last 10 years is reported. As result of this sharp decline in frequency and magnitude of snowfall locals are facing shortage of alpine pastures productivity which affects negatively both to natural resources sustainability and economy of valley.

3.4. Drought

Drought is considered as the most damaging and costliest type of natural disaster, especially in mountainous regions where water quality and quantity is regulated solely by the precipitation with a far-reaching economic, environmental and social impact leading to food and water insecurity, reduced agricultural productivity, damage to forests, pastures, wildlife, livestock, fish and food price hikes.

As a consequences of climate shift drought is at continuous increase from regional climate scenario as reported by local community. Due to warmer temperature the snow deposits are melting before time and increased speed. Altered timing of rain is presenting a cumulative effect on drought which results into the huge quantity of water by the start of summer. This quantity decreases and ultimately dries out as the season proceeds. The irregular availability of water halts not only the agricultural productivity but also natural regeneration of forest and pastures. It is difficult to mitigate the issue by water uplifting from rivers due to the required capital.

The local community so-far is unable to assess the intensity of drought and to adapt it accordingly. Therefore, to enhance the resilience of local community and ecosystem it is necessary to incorporate the following actions for CKNP operational plan.

a) Devise the research to determine natural indicators to measure the intensity of drought for local community.

b) Evaluate the proper management actions/ interventions to improve preparedness of community for drought.

3.5. Flood

Changes in the climate have had an influence on the magnitude and frequency of flooding in rivers in Gilgit-Baltistan. With respect to snow and glacier melt, the magnitude of temperature-changes during the spring and summer are sufficient to have caused a major change in the flood-potential of catchments. Changes in winter temperatures have influenced the amount and altitudinal distribution of snow available for melt in the subsequent season and this has increased the magnitude of the flood by 22.5% since last 30 years. However, the flood frequency was also reported to be increased by 20% since last 30 years. Since change in flood pattern is being observed over last three decades but over last half a decade, a sharp increase in both frequency and magnitude of flood is observed.

3.6. Landslides

Floods are the regulating factors of the land slides. With increase in the temperature and rain intensity, the soil patches lose their compactness. The increased Aeolian movements remove the top layer of soil and rain washes this layer from the mountains and move it to the nearby rivers and ultimately it becomes the part of Indus basin.

According to the survey conducted to gather information about the driving factors of climate events by local community, it is assessed that landslides have increased considerably (23%) since last 30 years. These landslides wither soil from mountains, pastures and less vegetated areas and make the land barren. It destroys the infrastructure facilities such as roads, bridge, and sometimes buildings along the edges. Agriculture is the most negatively impacted sector by land sliding, because the irrigation systems are mostly built along rough mountain ranges and are more prone to landslide. As a result of broken and disconnected irrigation channels community face water shortage sometimes even for months and subsequently decreased agriculture production.

Exhibit 26: Climate change at Astak Valley in the perspective of indigenous knowledge

Factors	Status	Change (days/ %age)	Trends		
			30 yr ago (1985)	10 yr ago (2006)	Future prediction
Rain	Decrease	25	Rain pattern was normal	Frequency increased but magnitude has become abnormal.	Decrease in the frequency of rain is expected
Snow	Decrease	35	Normal with slight decrease	Decreased drastically year by year.	Decreasing trend of snow is expected
Temperature	Increase	10	Increasing	Increasing	Temperature will increase
Summer season duration	Increase	12	Summer was slightly increasing	Increase	Crops reap some 10-15 days earlier then its normal time and this trend is increase, which indicates early

Factors	Status	Change (days/ %age)	Trends		
			30 yr ago (1985)	10 yr ago (2006)	Future prediction
					start and late end of summer
Winter season duration	Decrease	12	It was slightly decreasing but no considerable change seen	Decrease	Length of winter season is decreasing but magnitude of cold increasing
Glacier recession	Decrease	10	No visible change observed	Increase	Based on the indigenous knowledge of locals over last few years most of glaciers have receded or changed their place and this trend will keep increasing in the future as well in response to increasing temperature
Land slides	Increase	23	Normal	Increase	Land sliding in almost all villages are increasing and expected to be increased in the upcoming years
Flood frequency	Increase	20	Normal	Increase	The frequency of flood is increasing every year and supposed to be increasing in the future
Flood magnitude	Increase	25	Increasing	Increase	The local people confirmed that magnitude and devastation of flood is becoming powerful which indicates a high increase in the future
Drought	Increase	9	Normal but slight increase observed	Increase	In most of the villages in the valley drought is frequently observed. The Indigenous observation of locals show expected increase in drought in the future.
GLOF Frequency	increase	6	Normal	Increase	A very small frequency of change is being seen but compare to the past it is increasing and the trend shows increase in the future too.

Factors	Status	Change (days/ %age)	Trends		
			30 yr ago (1985)	10 yr ago (2006)	Future prediction
GLOF Magnitude	Increase	25	Normal	Increase	The magnitude of GLOF is observed increasing as more damage to infrastructure and agriculture land is happening, based on which it can be foreseen as increasing

3.7. Pastures

A regional climate scenario for CKNP valleys shows prolonged growing seasons and shifts in temperature and precipitation as currently happening in the Astak valley. Despite the better and prolonged growth seasons range lands that serve as pastures and grazing lands are degrading annually. In the alpine and sub alpine areas 21% degradation has been observed. Mid and low land grazing areas have declined 28%.

It can be assumed that many plant species are migrating vertically for lower temperature increasing the plant diversity at higher alpine regions and growing competition by highly productive species at low lands. The local community reported probable causes for pasture degradation as vertical shifts in plant growth and unsustainable livestock management.

On the other hand, warmer temperatures and increased microbial activity are likely to contribute in the loss of carbon from alpine soils. Since a higher amount of carbon is stored in soils than in the aboveground biomass above tree line. This indicates that alpine ecosystems may turn into carbon sources rather than sinks.

Exhibit 27: Impact of climate change on pastures of Astak Valley

Pastures	Status	Change (days/ %age)	Trend			Adaptation Measures by local community
			30 y ago (1985)	10 y ago (2006)	Future prediction	
Alpine and sub-alpine pastures	Degrading	21	Less degraded as compared to present	Degrading	More degradation is expected	Nil
Mid and low land grazing	Degrading	28	Less degraded as compared to present	Degrading	More degradation	Nil

3.8. Biodiversity

3.8.1. Agriculture and Fruits

Climate factors such as temperature, precipitation, CO_2 concentrations, and water availability directly impact the health and well-being of fruit trees and agriculture crops. With increased temperature and CO_2, crops such as wheat, maize, barley, buckwheat, fodder etc., and fruit trees are likely to grow more rapidly due to increased photosynthesis. It is also influencing insects, disease, and weeds, which in turn decreases agricultural production as currently happening in Astak. Aided to these additional stresses is offered by variable precipitation and irrigation water. Early and rapid snow melting accompanied by irregular rainfall followed by drought declines the productivity.

Farmers reported rapid increase in weeds and pests during last 10 years which shows positive correlation with the increase in temperature. Thriving chances increases for the pests in warm climate. Disease pressure on crops is continuously at increase with earlier and prolonged summers and warmer winters, which allowed proliferation and higher survival rates of pathogens and parasites. The marketable yield of many commercial crops e.g., potatoes, walnut, apricot, mulberry, almonds etc. is declined for Astak valley and become more sensitive to climate change than agriculture crops.

Local farmers observed the productivity and economic decline which shows that they are aware of climate change impacts but at the same time these people have no idea about the climate resistant seed varieties. To keep the tinge of organic farming and pristine local ecosystem the community must be trained about the natural and biological removal of pest and weed species.

3.8.2. Forest

Climate change directly and indirectly affects the growth and productivity of forests. Direct effect embraces the change in atmospheric carbon dioxide due to increased temperature and change in precipitation. The indirect effects account for the complex interactions in forest ecosystems. Climate also affects the frequency and severity of many forest disturbances such as cutting, removal of fruits etc. Natural forest stand of Astak valley represents a mix of woody and non woody vegetation. Major floral species are Pine, Junipers, Poplar, Fraxinus, Olea, Berberis, Wild Rose, Cotoneaster, Sea buckthorn, Artemisia, Stipa.

Local community has reported the following impacts of climate change on the forest:

a) Rising temperature and CO_2 as a consequence of climate change has impacted the local forest ecosystem of Astak by providing prolonged growth season which seems to enhance its productivity apparently. But this rising temperature can lead to phonological shifts of the alpine species and they will become locally or regionally extinct since they are unable to shift to higher altitudes. The increased CO_2 is becoming useless with increased temperature because of water unavailability throughout the season due to early and rapid melt out of snow and shift in rain season.

b) The Nullah branching out from glaciers and springs are the major irrigating channels for the agriculture crops and the forest species. With increasing temperatures these channels dry out and cause water stress augmenting the forest degradation in Astak valley.

c) Along with this, warmer springs has the chance to extend the range and lifetime of many pests that stress trees and crops and at the same time it decreases the available water quantity throughout the year.

Considering all these facts it can be concluded that local community knows about the impact of climate change on the forest but don't know about the mitigation strategies. These strategies are needed to be designed by thorough research and impact. Long term impact of the small-scale forest disturbances which cannot be observed via satellite systems must be assessed and counter measures should be adopted. With the increasing temperature and drought, it is obvious that some species will not be able to adopt and flourish in the ecosystem so there is need to assess that how long the present floral species will survive and which species should be planted to continue the forest sustainability. All these questions need research-based answer and capacity building of the community accordingly to ensure the ecosystem viability.

3.8.3. Wildlife and Associated Biodiversity

The multiple components of climate change are anticipated to affect all the levels of biodiversity, from organism to biome levels. Impact of Climate change is projected to become a progressively more significant threat in the coming decades. In addition to warming temperatures, more frequent extreme weather events and changing patterns of rainfall and drought can be expected to have significant impacts on biodiversity.

In Astak valley, faunal biodiversity which was once common is now at decline. During FGD sessions the participants reported that Markhor that existed in Astak over last 30 years the population of Markhor got completely washed-out which refers to out migration of species either due to climate change and rapid illegal poaching. Ibex population also irrespective of conservation efforts is continuously decreasing. It indicates that either climate is posing pressure on the survival of species or species may have the difficulty in adapting to the changing climate. In either case comprehensive study is required to assess the breeding potential and adaptability of the species in changing climate.

Considering the birds and butterflies it has been reported by the local community that these species were common a long time ago, but now several of them are not common and experiencing decline. The apparent reasons are the absence of favorable climate for prey species, decline in seed crops, removal of forests and floral species. No assessment has yet been done which provides the complete biodiversity information about the Astak valley. Therefore, it is difficult to prioritize the species for conservation actions and to monitor the effect of climate change on the small and large animals.

3.8.4. Fishery

Climate change is likely to affect fisheries and aquaculture, their dependent communities and related economic activities along three main pathways. Many fisheries-dependent communities already live a precarious and vulnerable existence because of poverty, lack of social services and essential infrastructure. The fragility of these communities is further undermined by overexploited fishery resources and degraded ecosystems. Astak valley is not dependent on the fishery for subsistence and therefore local community has no idea about the impact of climate change on the fishery. The implications of climate change for food security and livelihoods in the neighboring community of Astak are need to be evaluated.

3.9. Water

GB is the largest fresh water reservoir of Pakistan due to high precipitation rates. Owing to the recent climate changes the water availability has been changed. Snow fall has declined up to 35% according to the perception of local community but rain fall is abnormal increase. The altered precipitation pattern has caused the differential availability of water during different seasons. During end summer and winter season water become scarce and leads to unsustainable water management, however during the start of summer season flood in the streams increase and irrigation channels and creates water unavailability/scarcity coupled with poor water quality.

3.10. Tourism

Huge domestic tourism in GB over a couple of year has provided income earning opportunities for many remote communities and it is equally valuable for people of Astak valley to advertise their touristic points and manage proper facilities and services for tourist, which can help them in earning income from tourism.

Lower earnings in winter tourism are reinforcing economic disparities between the dependent communities and compel them to depend upon the natural resources of area as a mean of their livelihood. Astak valley is not a tourism dependent because of lack of tourist attractions and facilities. The difficult terrain of treks become rougher and more inaccessible with increasing extreme events and discourages the tourist activities.

Exhibit 28: Impact of climate change on biodiversity of Astak Valley

Biodiversity	Status	Altitudinal Shift	Trend			Adaptation Measures by local community
			10 yr ago	30 yr ago	Future prediction	
Agriculture crops and fruit trees	Degrading	N/A	Degrading as diseases increase and production is decreasing	No considerable change observed	Irregular water availability due to increased flood, diseases and irregular precipitation patterns will lead to productivity decline.	Nil
Natural Forest	Degrading	Increasing	Increasing	Forest patches were dense and healthy	More degradation is expected	Harvest from plantations and fruit trees residual
Wildlife						
Ibex	Decreasing	Increasing	The Ibex population almost depleted	Population was relatively good in number but illegal poaching proved a disaster	Populations will be increasing if conservation practices adapted strictly, otherwise complete depletion is expected. Astor Markhor was existing in the area some decade earlier but now the existence has finished in the area	Nil
Urial	N/A	--	–	--	–	–
Markhor	N/A	N/A	N/A	Population exist in the area but due to illegal poaching the species has completely depleted	N/A	Nil
Birds	Decreasing	N/A	Bird population is increasing	Population and diversity were good	Declining Natural resource and hunting can cause decrease in birds' population	Nil
Butterflies	Decreasing	--	Diversity of species has declined	Butterflies of several types were common	The trend seems to be decreasing in the future because some of the species are disappearing	Nil
Fishery	N/A					

CONSERVATION MANAGEMENT ISSUES & PROBLEM OF ASTAK VALLEY

4. MANAGEMENT ISSUES AND PROBLEMS

Present scenario of Astak valley has reflected several issues in customary practices and adaptation to climate change. Most of these issues have been the part of Management plan of CKNP and directly or indirectly affect the economic situation of each household and increase their dependence on natural resources which are free of cost and in vicinity to the community as compared to market. Therefore, in order to develop an effective strategy for adaptation, it is necessary to develop capacity of local community to adapt to the changes in a way that reduces their dependency on natural resources. These adaptation approaches must then be disseminated to the communities and relevant laws up-gradation. In Astak valley customary laws are being practiced in all villages for natural resource harvest but these laws are unable to sustain and address the suitable practices and continuously generating issues, therefore needs an up-gradation.

4.1. Agriculture

A smaller area of arable land is cultivated in Astak valley by traditional varieties of fodder, crops, fruit trees and commercial trees. Following issues are being reported by the local community. These issues although belongs to several sectors but all are aiding in decline of agriculture production.

1. **Small land pieces for agriculture:** With increasing population and emerging nuclear family system in Astak valley, arable land fragmentation is taking place and area of land holding per household is shirking year by year.
2. **Irrigation and Water Rights:** Customary a right about water sharing between villages and among the households is not documented anywhere. This generates confusion and rivalry among the land holders for water needed for irrigation. Situation becomes worse during the spring and autumn season which foster low availability of water in streams.
3. **Low productivity:** Farmers, technical personnel, and interviewee from relevant fields unanimously reported low productivity per unit area. The common issues underlying this fact is small land, thin soil cover due to erosion, increasing pest prevalence over the crops, low fertility, water unavailability, erratic and unpredictable precipitation times, warm temperature, disasters such as landslides, floods and several other. The most important among them is use of traditional methods and seeds for cultivation.
4. **Weeds and pest:** Organic farming is an important aspect that is valued all over the world for nutrition. Local farmers are lucky enough to manage the crops and fruit production without using pesticides, insecticides and inorganic fertilizers. Animal manure and ash to be used to enrich the soil with minerals. Moreover, water in the streams also provides sufficient quantity of mineral to sustain agriculture practices. Despite of these, farmers are facing difficulties now a day due to several insect and flies' pest species which feed on the grains, fruits and other such products. Indigenous people and their knowledge is blaming climate change for increasing pest infection on fresh as well as dry seeds and fruits.

5. **Traditional practices and non-certified seed varieties:** Local farmers rely upon the traditional farming and cultivation methods. Growing crops from farm saved seed is common practice around the world and same in Astak Valley. Farmers prefer this practice due to several reasons which includes certainty of quality, convenience, timeliness/availability, and cost. They also prefer this practice because farmers don't want to take risk on their productions. But with the progress of time keeping though cultivar performance remained same but productivity declined which demands the practices of modern farming techniques and new seed varieties.
6. **Climate change:** Climate change is exacerbating the challenges faced by the agriculture sector, negatively affecting both crop and livestock systems in Astak Valley. Climate change induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events are adding to pressure on the local agriculture system – which is already struggling to respond to rising pathogenic infections. The changing climate is also contributing to resource problems beyond food security, such as water scarcity, pollution and soil degradation. As resource scarcity and environmental quality problems emerge, so does the urgency of addressing these challenges. Farmers are really feel helpless against the inconsistent weather even they are thinking to abandon growing maize and wheat, and cultivate cash crops like potato because that are short-duration.

4.2. Pasture

Majority of the pastures Astak valley is declining at rapid rates. The pasture sustainability is also facing lot of pressures from livestock more than carrying capacity, medicinal plants extraction, landslides and floods. The most common factor over last ten years is infrequent snow fall which causes declining growth of natural vegetation in alpine & sub-alpine pastures and rangeland, and largely contributing to declining livestock raring trend in the valley.

1. **Baseline of flora and phenological shift:** There is no documented baseline data or inventory about the floral species of the pastures, their status and use. So, it is the need of time to develop such basic dataset which prioritize the species for conservation actions to mitigate the socioeconomic and environmental pressures. It is especially recommended on priority basis to monitor and conserve the floral species and medicinal plants affecting by climate change and showing phenological shifts. Only medicinal plants are explored and listed but there is no information on the predicted impacts of climate change over these medicinal plants and their adaptations.
2. **Gaps in customary practices:** Livestock grazing is an ecosystem service provided by the pastures and not allowed in the core zone of CKNP by park rules. Almost 77% pastures of Astak valley are showing decline in productivity due to unsustainable livestock grazing practices. There are no established rules about the maximum number of livestock heads in the customary rules. Carrying capacities of these pastures have never been estimated and that's why unsustainable pressures are fueling the degradation. Diseased animals are advised

to keep away from the pastures but their water points are shared which can induce the infection in whole herds and also there is a chance of disease transmissions.

3. **Grazing timing:** Lasting pastures can be improved only when herders understand plants' recovery needs and practice good grazing land husbandry to maintain plant health. As per management plan and CKNP rules grazing is not allowed in core zone except for free roaming yak and yak cattle hybrids. It also does not allow presence of pack animals is not allowed in core zone except Tourism Focused Zone. Community while keeping customary practices try to invade the un allowed park areas for grazing. The local community of Astak reported the problems like weed invasion, less productivity and weakened soil health. All these issues are indicators of impatient grazing by the herders i.e. they start to graze their animals before pastures are fully grown. Herders do so to provide animals with a high-quality diet but they are unaware that short plant growth reduces bite size and the nutrient intake. Moreover, it contributes to decline in pasture productivity which is lose-lose situation only.
4. **Livestock insurance scheme:** Livestock insurance scheme is an incentive equal to the loss for the herders if their livestock get killed or attacked by the wildlife and is already addressed by management plan and operational plan. The scheme was introduced in Astak valley but currently it is non-functional. Though very few livestock kill by predators were reported during the survey and no retaliatory killing reported by the community, but in the absence of insurance scheme retaliatory killing of wildlife is expected.
5. **Lack of zonation:** Pastures are degrading continuously but the customary laws don't have any hint of abandoning such pasture areas which hastens its decline. It is essential that grazing on pastures in the buffer area of CKNP should be controlled to maintain adequate vegetative cover that reduces erosion and permits adequate regrowth after each grazing period to ensure the health of grazed plants.
6. **Harvest of medicinal plants:** Astak pastures and forest areas the rich sources of these medicinal herbs. Local community uses them for disease cure. These drugs have anti-pyretic, analgesic, anti-cancerous, anti-diabetic and several other uses. Local community is fully aware of their uses but they don't have any understanding of ways of its extraction without damaging the whole herb. Training of local community for collection, drying and usage is important.

4.3. Water

Water is the key ingredient and symbol of life. All the changes in climate pattern are directly and indirectly playing with water quantity and quality. Altered precipitation patterns, warm temperatures and frequent air currents actually disturbed the water quality and quantity both. The local community in Astak valley depends directly upon the rain and indirectly upon annual snowfall. Due to delayed rain timings and less annual snowfall local community is frequently facing the drought and water shortage due to increasing glacier melting and flood causing blockage of irrigation system. Moreover, torrential rains are now more frequent which on one

hand increases water quantity but also cause floods and landslides in disaster prone areas thereby creating socio-ecological stress. Water pollution is increasing due to lack of sanitation /drainage system and animal sheds nearby water channels and drinking water sources. Grey water from the local community is also getting mixed in to fresh water and degrading its quality.

1. **Drinking water:** Local community depends on fresh water supplies from glaciers and springs for drinking purposes. Sediments are continuously increasing in the water supply due to weathering of rocks and mixing of soil and grit in the area. High mineral content can induce disease in local community and their livestock. The water testing facility already established at Karakoram International University provides the free testing but local community is not very interested in the procedure due to lack of awareness.
2. **Irrigation deficit:** Local community reported poor structure of irrigation channels or insufficient irrigation channels is the prime reason for irrigation deficit. "Either lot of water or no water" in the water sources, the communities cannot fully utilize it for irrigation purpose. The communities in the villages have constructed irrigation channels but with increasing land fragmentation and demand for water those irrigation channels have proven insufficient. The communities cannot construction of more irrigation channels due to lack of financial resources.
3. **Water pollution mitigation:** To ensure the water quality local community should be compelled to make separate pathways for grey water ensuring that it do not mix into the fresh water streams. Hotel owners should be trained to dump the trash elsewhere instead of water while adopting ecosystem friendly approaches.
4. **Disaster management:** Climate change is deeply reshaping the landscape of disaster risk. Weather extremes such as drought, flood and landslides cause the huge economic depressions in all sectors ranging from transport to land farms. No protocols are developed yet for the villages in the surrounding of CKNP. It is very necessary to take action because dependence of poor people on natural resources increases dramatically.

4.4. Forest and NTFP Issues

These sectors are as vulnerable from climate change as any other and therefore, there is strong need to assess and enhance the adaptive capacity of the forest and biodiversity.

1. **Mortality:** Drought has increased tree mortality and resulted degradation and reduced distribution of entire forest ecosystem. It increased the wood harvesting opportunity for the local community from Astak valley for subsistence purposes at the cost of degenerating forest.
2. **Harvest pressure:** Heavy collections of timber and non-timber products from the forests allow the community to fulfill their needs. With continuously increasing population dependence of local community is also increasing on these natural resources. Fuel wood harvest of Astak valley has showed an unsustainable approach. This harvesting is not limited to here only but includes the removal of foliage, branches and plants cutting for livestock

forage as well. Situation can be improved if communities harvest it according to the systems proposed by management plan of CKNP. Unsustainable practices and unguided approaches towards harvesting lead the ecosystem imbalance. Harvest of medicinal plants is prohibited in the CKNP rules as per management and operational plan but community harvests it in sustainable way.

3. **Forest regeneration:** Climate change has shown differential approaches for the propagation dependent upon the species ecology. Warmer temperatures and increased CO_2 increased the rate of photosynthesis and thus growth but increased the pest attack is seriously stressing the forest regeneration.

4.5. Eco-tourism

Ecotourism is nature-based tourism that fosters environmental appreciation and awareness. Three zones in and around CKNP are designated in the management plan of CKNP to allow sustainable tourism. Gilgit-Baltistan which is considered as the hub of eco-tourism incorporates a considerable number of tourists every year to generate the huge amount of revenues and alternative livelihood opportunities.

Following issues are being reported by the local community.

1. **Tourist Accommodation:** Limited accommodation facilities compel the tourists to opt for camping in open areas. This option becomes unsuitable during the adverse weather.
2. **Visitor facilities:** Site maps, information boards, sign board and other facilities are not available for tourists. However, open camping areas are the only option for the tourists stay in the valley due to lack of hotels.
3. **Climate Change:** Climate is a key resource for tourism and the sector is highly sensitive to the impacts of climate change and global warming, many elements of which are already being felt. Climate change is having adverse impacts on the number of tourists especially for the treks which Astak valley offers.

4.6. Mining

In and around CKNP in the sedimentary rocks of the mountains, huge reservoirs of gemstones and precious rocks are deposited. Local level mining is being carried out in and around CKNP. Mining area can be identified by having the holes in its mountains just like bee web.

"About 30,000 people associated with the mining sector are carrying out activities inside the Central Karakoram National park territory, adding that the act may result in the loss of habitat for various species" (Express tribune: June 27th, 2012).

This mining provides some of the valleys around CKNP with a good opportunity to earn livelihood. In Astak valley, mining opportunities are available but a small portion of the entire population is associated with it. On other hand people associated with mining cannot get maximum benefit out of it due to the following reason!

"Lack of alternative livelihood opportunities for communities and uncontrolled mining in mountains are some of the issues that require attention" (Express tribune: June 27th, 2012).

1. **Lack of modern tools and practices:** Local miners are not trained for mining. They use iron rods for excavation and mostly end up in the damaging the stones. It leads to loss of revenue not only on personal level but also on the regional and ultimately at national level.
2. **Lack of training:** Local miners have learned the methods of mining by hit and trial approach and succeeded somewhat. Nevertheless, due to lack of training they are unable to extract pure and high-quality rock. They accidently break these gemstones and thus lose the amount of profit.
3. **Value addition of gemstones:** Gemstones are sold in raw form by the local community to the dealers on low cost due to improper cutting and polishing. Therefore, local miners lose their chance to earn huge revenues and only get a minor share.

4.7. Wildlife and Protected Areas

Institutional structures to manage wildlife and protected areas experience lot of issues due to increasing urbanization, degrading forest and natural areas. The biodiversity of CKNP and its buffer zones has the species, which are of international and national importance. Wildlife plays an important role in both ecosystem sustainability and community economics. Although trophy hunting is a controversial subject, yet it enabled the community to earn millions of dollars since its start and contributed to conservation as well.

1. **Illegal hunting and Population trends:** Hunting of wildlife is strictly prohibited in the management plan and CKNP rules. However, our surveys meant for VCSDP development community mentioned the illegal hunt of wildlife. To track illegal hunting and poaching CKNP MP/OP advocates augmenting direct count of wildlife with DNA approach. The investigation of issues related to wildlife and protected areas normally consider the number of heads of animals irrespective of their health, annual recruitment. The overall trend of two trophy species; i.e. Markhor and Ibex seems to increase in their population according to the relevant government departments but population counts are not reliable and vary significantly. There is chance of reproductive deficit in mountain ungulates such as Ibex and other species due to the history of population surge.
2. **Population surge:** During the recent years of conservation, wild species has increased considerably. The sudden increase from small population are often culprits of inbreeding depression, which is most expected in the case of mountain ungulates and birds which are decreasing continuously. CKNP management plan has also
3. **Unidentified species:** GB hosts the diversity of wild fauna and flora most of which are unidentified and even un-discovered yet. The rapid environmental degradation is causing the extermination and extinction of the specialist species. It shows that biodiversity of the species is declining without recognizing their ecological and economic roles.

4. **Habitat degradation and isolation:** Population is continuously increasing in Astak and encroaching into the natural areas for settlements and agriculture. This land use changes affected wildlife both positively and negatively depending upon the species ecology. Habitat degradation has also pushed the species to isolated and low-quality habitats that caused additive stress on the wildlife heath, reproductive potential and genetic health and so on. There is no assessment for the impact of habitat degradation on genetic health of wildlife species.
5. **Genetic reserves of wildlife species:** Most wildlife surveys are based on the numerical assessment of the animals and do not account for their genetic viability. Designated areas such as national parks and sanctuaries are notified irrespective of the idea that particular area is either genetic bank of the particular species or not. Genetic reserves of forests and wild species are not identified and protected yet.

PROPOSED MANAGEMENT INTERVENTION FOR ASTAK VALLEY

5. PROPOSED MANAGEMENT INTERVENTIONS

5.1. Agriculture

In particular, there are different adaptation options in agriculture according to the involvement of different agents (producers, industries, governments); the intent, timing and duration of employment of the adaptation; the form and type of the adaptive measure; and the relationship to processes already in place to cope with risks associated with climate stresses finally the development of provincial climate change policy.

The adaptation options required for the local community needs four tiers. (i) Technological developments, (ii) government programs and insurance (iii) farm production practices, and (iv) Farm financial management.

1. **Population expansions:** Similar to other areas of GB, with increasing population construction is rapidly increasing and mostly houses, cattle shed and other required constructions are being built around the settlement and agriculture area, which is continuously shrinking arable land. To avoid these issue new settlements must be built on barren or abandoned parts of the land. This will keep the arable land available for cultivation.
2. **Certified seed varieties and crop insurance:** Certified seed is the only input that can get farmer more than just higher yields. Such varieties are resistant to climate related and pesticide issues. To introduce the concept and usage of certified seed varieties, relevant stakeholders must provide them on subsidized rates and premium insurance packages. Along with this one-time training of farmers of each village around CKNP is recommended to increase the agriculture production per unit area.
3. **Integrated farming and agriculture products:** Farmers are traditionally inclined to mono-cropping systems and earn the revenues from raw products. In Astak valley the farmers do not sale both fresh and dried fruits due lack of awareness on post harvesting techniques, processing techniques and proper storage facilities. The little economic innovation lies in the sale of potato only, while million rupees worth of fruit is being wasted annually due to lack of awareness, and skill for value addition and facilities for storage. Many end-users require specifically processed products such as Marmalades, Jams, Vinegar and Honey. Farmers need guidance on the value addition of products in order to be economically stable.
4. **Soil analysis:** It was unanimously reported by all the communities that land they are cultivating is never tested in the laboratory and scientifically they don't know which crop and fruit varieties are best for their soil type. Each crop is sensitive to soil type and productivity heavily depends upon the suitable soil. Practically there is requirement of soil testing facility within each agriculture information cell. This facility will provide information about several structures especially addressing the common question of farmers such as suitable seed varieties, microbiota of soil and its capacity of crop growth and several others.

5. **Secure water availability:** Water is central to agriculture productivity. Adaptation of climate-smart inputs and shifting to more efficient irrigation methods will help local farmers to maintain productivity levels. Water tanks for the storage purpose of agriculture are required to reduce the drought effects at some village.
6. **Training on climate friendly agriculture practices:** Farmers should be trained with the emphasis on targeted ingenuities such as outcome-based farmer incentives and knowledge transfer systems – that enhance farmer capacity to achieve sustainable productivity growth through mitigating and adaptive practices keeping the pace with climate change. These climate friendly and climate proof practices particular to each valley must be incorporated into the operational plan. As there are no previously approved practices so they are needed to be designed by methodically modelling the practices with climate change models.
7. **Introduction of climate resistant seed varieties:** Farm decision-making is seen as an on-going process, whereby producers/farmers are continually making short-term and long-term decisions to manage risks emanating from a variety of climatic and non-climatic sources. In this sense, adaptation is the result of individual decisions influenced by forces internal to the farm household (i.e. risk of income loss, environmental perception) will become reasonable and let them earn revenue to decrease pressure of local community on natural resources. To resist or at least minimize the pressure of ever-changing climate patterns and issues in relation to climate change, there is a need to develop an agriculture information cell for the farmers in each village. This information cell will raise the job opportunities for local community and will guide them about the climate resistant breeds, ways of cultivation, harvesting in detail. This information cell must have the tested varieties of climate resistant seeds and seedlings. Seed storage for potato in the harsh climatic condition is a challenge in the CKNP area, therefore input store for seed must be provided at least among every three villages.
8. **Spread of infestation to the wildlife:** Buffer area of CKNP harbor 230 villages. All of these villages have agriculture crops and tress which are getting infected manifolds since last decade. These pest species have the chance of transmission towards the wild medicinal herbs, forests, nests of birds and ultimately enter in fauna. This pathogenic transmission can induce infections in the flora and fauna and has a considerable potential to depress the specialist species. However, this issue has not yet been explored and needs a well-prepared monitoring procedure to estimate the estimate the annual economic laws.
9. **Research projects:** Without research adaptation to climate change is generally problematic for agricultural production and for agricultural economies and communities; but with adaptation, vulnerability can be reduced and there are numerous opportunities to be realized. Adaptation must be supported by the research of relevant components. Productivity is declining at a rapid pace due to some known and unknown reasons. Apparently, climate change seems responsible for this decline aided with ever increasing pest attacks during last 10 years. The recent changes in the climate are so unpredictable that it is becoming impossible for the farmers to work in agriculture farms for profit. Customary

practices for agriculture sustainability are losing their functionality. These practices must be updated by designating specific studies of seed variety, soil analysis, crop suitability analysis, bio-control of pests, projected impact of climate change on the crop's productivity and transport, optimum economic benefits from every suitable crop and several other inter-related components. As it is evident that the impacts of climate change on agriculture will vary depending on precipitation changes, soil conditions, and land use, therefore these impacts are required to be evaluated independently for each valley in the buffer zone of CKNP. This vast research is possible if included in the operational plan of the CKNP to provide support for updated management plan of CKNP.

10. **Key policy reforms:** Key policy reforms across three pillars are needed to strengthen farmer incentives to achieve productivity growth sustainably, and without sacrificing climate change mitigation and adaptation objectives. These three pillars are i) Farmer level, ii) Agriculture sector level, iii) Provincial level. The agriculture policy needs an up gradation to mitigate the effects of changing climate and devising the climate friendly strategies at an urgency to minimize the agriculture induced impacts on climate ultimately to protect the protected areas of GB, particularly its largest park the CKNP. The management plan which is already established has a huge gap about the laws of employing climate friendly approaches in villages residing in buffer areas for agriculture. Moreover, the climate is not only changing but it is also on stationary which means old knowledge can't be the thing to rely upon. So, gap of climate friendly approaches must be assessed via operation plan for CKNP and then addressed in to the revised version of CKNP management plan.

5.2. Pasture

1. **Upgradation of customary laws:** Customary practices should be amended in such a way that ensures sustainable use of pastures. Diseased animals must be kept away from the pastures to avoid the zoonosis and must be vaccinated. Extraction/cultivation of medicinal plants by the local community must account only for household purpose and should be cultivated in the amount equal to its removal. Encourage stall feeding/minimize grazing till the improvement of pastures. These strategies must be field tested and then included in the customary and statutory laws and CKNP revised management plan.
2. **Grazing management:** To enhance pasture productivity timing of grazing and grazing sites in each pasture are need to be designated to develop holistic grazing strategies with farmers/herders that include rotational grazing or intensively managed grazing as a regular grazing routine.
3. **Fodder cultivation:** Regionally adapted and high nutrition value fodder crops should be cultivated for fodder instead of traditional species. This will remove the stress of early grazing from the pastures and allow them to grow
4. **Training of herders:** Herders have no information about the sustainable practices of livestock grazing. They just sent their livestock with guards to feed upon the pastures.

Timing of grazing is integral for livestock. There are several other factors that need to be cared for the sustainable livestock grazing.

5. **Seeding of local flora and training of farmers:** Local flora should be collected and cultivated on the barren patches among the pastures. This will increase the pasture areas and productivity. Research on cultivating these species is required. After it dissemination of knowledge through training sessions, manuals and brochures will convince the farmers about the re-seeding of pastures.
6. **Local botanical garden to ensure existence of local flora:** Adaptable plants should be identified among the plants. These plants should be kept in botanical gardens to provide backup in case of avalanches, landslides, floods and barren land cultivations.
7. **Encourage the pasture extension services by other line departments:** Many forestry and livestock enterprises run by private farmers and the government depend on efficient, economical, and environmentally beneficial pasture use. Farmers need technically competent advisors to help them accomplish their objectives. Unfortunately, no advisory services for the pastures exist in the villages because of lack of pasture specialist technical advisor. Therefore, there is strong need to train the forest relevant personnel from each village or valley as a pasture specialist. CKNP biodiversity directorate staff can be a potential candidate for this training as they are both aware of natural resource use in and around CKNP.
8. **Cultivation and marketing of medicinal herbs:** Cultivation of these herbs should be promoted as alternative economic resources with appropriate site assessment and training on its cultivation, harvesting marketing and utilization. Economic uplift of the community will actually decrease their dependence on CKNP resources and allow them to grow.
9. **Ethno-botanical data base:** Development of consumer linked ethno-botanical databases of each village will not only enhance the market for the local farmer but also fosters the direct link to the consumer.
10. **Pasture awareness programs:** Hands-on training and field experience are two of the best, most rapid ways to increase farmer's/shepherd's awareness and local university students about the optimum pasture use for healthy livestock. Final outcomes will be best when this training is guided by technically competent professionals who can accurately answer questions and help solve problems. This training will allow the local community to employ sustainable practices and secure these resources for their future generations.
11. **Research problems:** Phenological shift of floral species and their impact on biodiversity must be assessed on priority basis so that extirpations can be avoided. Ecological baseline of the pastures to keep the biodiversity of the area must be developed. Similarly, potential farming sites for each medicinal plant should be identified. The predicted impacts of climate change on the pasture productivity are not known and need to be evaluated due to their high valued ecosystem services. Most utilizable and ecologically resilient entry points are needed to be identified and designated.

5.3. Water

People living in CKNP buffer zone afflict with different kinds of water contagious diseases because of the scarce access to clean drinking water. Even though glacier water is present in many areas however easy access to clean water is very difficult for most of the population.

1. **Quality of drinking water:** The water testing facility already established at Karakoram International University provides the free testing but local community is not very interested in the procedure due to lack of awareness.
2. **Construction of small and medium sized reservoirs**: Construction of small or medium-sized reservoirs in the foothills and plains are quite necessary, so that water from streams can be harvested for use during the dry season and the winter, both for farming and domestic purposes.
3. **Common drinking water storage tank:** Shared water storage tanks should be built upon among the households to help them adapting drought conditions.
4. **Water pollution mitigation:** To ensure the water quality local community should be compelled to make separate pathways for grey water ensuring that it do not mix into the fresh water streams. Hotel owners should be trained to dump the trash elsewhere instead of water while adopting ecosystem friendly approaches.
5. **Early warning system:** But to give relief to the local community of Astak valley, there must be system to give them timely alerts about their crops and livestock protection. This will accentuate the economic resilience of the community and natural resilience of the buffer area.

5.4. Forest and NTFP

1. **Up gradation and regulation of forest laws:** Customary laws allow the fuel wood collection, timber and non-timber forest products unlike statutory laws, which increase their favor towards the customary laws. These customary laws don't address the conservation needs and allow harvesting at an unknown level. If this practice is continued, then community will shortly run out of their forest reserves. To ensure sustainability, an up-gradation of customary rules is recommended. Otherwise, implementation of statutory laws is integral.
2. **Promotion of farm forestry:** Local farmers should be trained to have small-scale farm forests, which along with revenue generation allow them to be independent of forests. This practice exists in a valley but very limited. Training will allow the farmers to take self-initiatives and entrepreneurship in forestry sector.
3. **Climate change and conservation friendly forestry projects:** To generate credible forestry and conservation offsets, projects must be additional to what would have occurred without the incentive supplied by the carbon market; they must be verifiable (i.e., measurable and enforceable); they must control or adjust for leakage; and they must address the issue of permanence. Forward crediting is proposed by some to accommodate the long period of

carbon accumulation in forests, but others are concerned about assuring payments only for actual carbon sequestration.

4. **Restoration cum conservation:** Several sustainability practices are being carried out in Astak but any of them hardly meet the conservation targets. Keeping in view the present environment sustainability changes, restoration is required along with conservation. Therefore, the upcoming forestry projects must come up with the forward crediting instead of required crediting.
5. **Research projects:** Projected annual greenhouse gas emission counts provide baseline to identify required CO_2 sequestration offset. On the basis of this, it will be identified that which species is required and in how much amount to keep climate stable for each valley in the buffer zone of CKNP and its surrounding areas. Remote sensing to monitor the land use changes is very essential because of the location of valley around CKNP. In future due to CPEC, land use is expected to be altered and their environmental consequence seems negative. To neutralize these expected issues baseline data about land use will quantify the environmental impacts and truly determine the required type of actions with high accuracy.

5.5. Eco-tourism

Tourism inflow in the park is up to sustainable level as per CKNP management plan and rules and has the potential to be grown by following interventions which are recommended on the basis of the survey conducted for VCSDPs development.

1. **Interpretation of resources:** In order to increase the revenues by tourism there is need to provide interpretation programs that are relevant to the public, further information is required. This information can be obtained through visitor surveys.
2. **Destination vulnerability hotspots:** The integrated effects of climate change will have far-reaching consequences for tourism businesses and destinations. Importantly, climate change will generate both negative and positive impacts in the tourism sector and these impacts will vary substantially by market segment and geographic region. There are disaster prone areas in and around CKNP which are not mapped and disseminated to the tour operators. This inventory should be developed along with measured risks and challenges that tourist can face.
3. **Infrastructure:** Surge in tourist flow has been reported recently but related infrastructure such as accommodation, ecotourism facilities, are very short and needed to be developed to ensure the provision of facilities for tourist influx by public and private department.

5.6. Mining

Following interventions are recommended on the basis of the survey conducted for VCSDPs development.

1. **Training of miners:** It is important for the miners to have hand on training on modern tools and techniques for quality mining. It is especially important for the valleys, which lie near mining deposits of Gemstones and other minerals.

2. **Entrepreneurship opportunities:** Small-scale business related to gemstones and its products will provide the local community an opportunity to earn good profit.

5.7. Wildlife and Protected Areas

1. **Population assessment:** Database should be established to keep the systematic annual population assessment of all the near threatened and endangered animals. The protocols for population assessment of each species should be determined on ecological basis and kept same every year.
2. **Wildlife health:** There is some baseline data about the health of animals. Nevertheless, all such studies are either short term or based on only few components. Moreover, genetic health of the species has never been accounted which can be the culminating factor in the reproduction of the animals in addition to other stresses.
3. **Species recovery plan:** There is a growing consensus that habitat fragmentation has caused wildlife decline. However, what is the impact of this fragmentation is still unknown. There is need to study how the urbanization, habitat isolation, decline in vegetation has stressed the wildlife. How these impacts can be mitigated, which habitat areas need priority conservation actions such as habitat connectivity? All this information is possible from the properly designed studies unique to each class of wildlife based on which species recovery plan will be designed.
4. **Genetic reserves:** Genetic reserves inside the protected areas of the threatened and endangered species are needed to be identified for their restoration. If the designated protected areas do not have by chance these genetically healthy populations then their boundaries should be adjusted according to these reserves.
5. **Climate change indicators:** Several fungi and amphibian species are considered as an indicator of climate change. These species are experiencing decline in the population such as Deosai toad, which was once abundant in clean waters of the area. This species is now hard to find because of water pollution. These indicators are needed to be identified and used as climate change detection for the areas. This research will provide the real assessment unlike models, which sometimes fails to give real estimate.

6. STATUARY VS CUSTOMARY PRACTICES IN ASTAK VALLEY

S. No.	Consumptive uses of Park Resources.	Community practices	CKNP MP/OP rules	Recommendation
1.	Harvest of Forest and other natural vegetation	Juniper trees are cut and used as fuel wood and timber	Harvest of Juniper is banned; if harvest is necessary than only only braches should be removed instead of whole tree	Awareness of community is required
		Riparian vegetation e.g. Sea-buckthorn and Willows, community usually remove the whole plant/tree from soil	Cut single basal shoots from each plant to preserve in its root system. By doing so, new shoots can re-grow rapidly producing new biomass to be harvested	-do-
		Community harvests wood at unsustainable level both from buffer and core zone	Wood and shrub collection are allowed only in the buffer zone up to sustainable level	Afforestation, alternative fuel options and sustainable forest management areas are need to be designated. Along with this harvest rate compatible to annual growth of forest should be determined
2.	Medicinal Plants	Community harvests local medicinal herbs and aromatic plants from park for household purpose	Harvest is completely banned in core zone and allowed at sustainable level from buffer areas under license.	Community must be awarded the license and concerned department restrict the harvest without license.
3.	Livestock Grazing	Herd grazing is allowed only in buffer zone and tourism focused zones of the park.	Community graze their livestock in packs along with dogs inside core zone. Dogs and packs are not allowed inside parks	Improvement in watch and ward mechanism along with community awareness is necessary at urgency
		Equines (horses, mules, donkey) occasionally found in core zone of the park	Equines are allowed only in tourism focused zone	--
		Yaks and its hybrids freely graze in the park	Grazing of traditional free roaming yaks and yak-cow breeds is buffer and core zone is acceptable	--
		Herders graze livestock in pasture and core zones dispose plastic bags, bottles in nearby streams and also use burn wood from forest	Use of plastic bottles, glass bottles, plastic bags and match box is not allowed inside parks.	Movement must be restricted for the grazers.

S. No.	Consumptive uses of Park Resources.	Community practices	CKNP MP/OP rules	Recommendation
4.	Pastures	Community graze livestock in the pastures which are located in and around buffer zones.	Grazing is allowed only in buffer zone	--
		Indigenous system of grazing was sustainable. During previous times herders ensured to take livestock into the pastures, when vegetation becomes knee-length. Currently, herders have abandoned this practice and take their livestock to pastures even before its sprouting.	Indigenous grazing system should be revived	Awareness and training of herders is important
5.	Wildlife hunting	Community take advantage of inaccurate population counts of wildlife and poach/ hunt wildlife at family gatherings, holy occasions and on other such events	Reliable wildlife count by DNA analysis is recommended and also to track poaching for core zone management. Hunting except for "trophy hunting" is banned both for buffer zone and core zone.	Community awareness can serve the purpose. Moreover, genetic approach should be employed for accurate population counts and tracking of poaching

7. RECOMMENDED ACTION PLAN FOR ASTAK VALLEY

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
1.	CKNP Directorate	1.1. Improve CKNP functionality	Lack of enough support of local community for CKNP	Conflicts over the use of park resources	1.1.1 Manage the conflicting issues ensuring park conservation	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
				Community awareness is insufficient due to deprivation meetings, and awareness campaigns by CKNP Directorate	1.1.2. Awareness campaigns /training of local community about the significance, rules and regulations of the park and sustainable use of natural resources.	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
2.	Local Social Organizations	2.1. Develop Structural/ Institutional framework of social organizations	Insufficient support of LSO to CKNP directorate	Weak communication linkages Lack of effective conflict management mechanisms	2.1.1. Develop appropriate networking for existing social organizations under the umbrella of concerned LSO/CKNP	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
		2.2. Develop capacity for	Poor implementation	Lack of awareness	2.2.1. Preview the existing capacity of	Suggested for	All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
		Financial sustainability of local social originations	of conservation interventions implementations and subsequent sustainability	about sustainability avenues	relevant LSOs for the identification of gaps	inclusion in revised MP/OP activities			
					2.2.2. Capacity building of Social organizations to ensure conservation of park resources and sustainable resource used	Activity 5.2.1	All	Urgent	Short term
					2.2.3. Capacity building of LSO to generate funding for their sustainability	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
3.	Health	3.1. Promote health facilities	Prevalence of Diseases	Lack of basic health facilities in existing dispensaries Lack of sufficient dispensaries	3.1.1. Capacity building of existing staff 3.1.2. Provision of Medicines 3.1.3. Provision of new diagnosis equipment	Suggested for inclusion in revised MP/OP activities	Mopa and Shano	Urgent	Long term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
			Lack of access community health facilities		3.1.4. Establishment of new dispensaries	Suggested for inclusion in revised MP/OP activities	Riging, Sosa, Toghla	Urgent	Long term
			Unhygienic practices by locals		3.1.5. Awareness conferences about hygienic practices	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
					3.1.6. Dissemination of brochures and pamphlets to educate community about prevention from sporadic diseases. 3.1.7. Promotion of healthy and hygienic practices by women and children through workshops, campaign and social organizations	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
4.	Energy	4.1. To meet energy demand	Depletion of natural resources	Preference of fuel wood from forest by the local community due to free commodity Lack of alternative fuel options	4.1.1. Promotion of fuel-efficient stoves at high altitudes 4.1.2. Develop and Motivate usage of alternative sources	Activity No. 14.2 -do-	All All	Urgent Urgent	Short term Short term
5.	Education	5.1. Curb electricity	Prevalence of unsustainable practices	Lack of needful development infrastructure and human resource	5.1.1. Increase the capacity of existing schools	Suggested for inclusion in revised MP/OP activities	All	Medium	Long term
					5.1.2. Creation of new educational facilities	Suggested for inclusion in revised MP/OP activities	Riging, Sosa, Toghla	Medium	Long term
			Poor acceptability of messages/solution of conservation	Lack of awareness	5.1.3. Awareness of school staff and children about sustainable use of resources, respect of statutory laws and	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
					changing climate scenarios				
6.	Agriculture	6.1. Lack of sufficient food and future food security	Out-migration Malnutrition and related disease	Lack of financial and technical capacity to enhance agri-productivity	6.1.1. Introduction of Improved seed varieties for agriculture and other related crops adaptable to local climatic conditions 6.1.2. Capacity building of farmers about modern techniques to enhance productivity.	Suggested for inclusion in revised MP/OP activities Activity No. 17.1.1.	All All	Medium Urgent	Medium term Short Term
				Water Scarcity	6.1.3. Construction and repair of water channels and for barren lands	Suggested for inclusion in revised MP/OP activities	Gudapa, Skhandas, Khirzong, Balaxong, Shano, Jamshed Abad, Xoxhum and Lagaf	High	Medium Term
				Pests and diseases	6.1.4. Integrated pest management techniques	Suggested for inclusion in revised MP/OP activities	All	High	Medium Term
				Improper crop storage	6.1.5. Promotion of small-scale solar driers	Suggested for inclusion	All	Medium	Medium Term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
						in revised MP/OP activities			
				Lack of jobs and economic opportunities in agriculture and related crops	6.1.6. Improvement of existing economic opportunities	Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term
					6.1.7. Creation of new job to enhance economic capacity of the local community	Suggested for inclusion in revised MP/OP activities	All	Urgent	Long term
				Less arable land per household	6.1.8. Development of barren land patches	Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term
					6.1.9. Development of fruit park		Mopa/stongjing/Rigin g	-do-	-do-

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
7.	Livestock	7.1. To enhance income opportunities for locals from livestock	Livestock mortality due to diseases	Disease spread Poor breeds with lesser dairy productivity Lack of proper grazing management regeneration with lesser productivity	7.1.1. Improvement of existing vet facilities	Suggested for inclusion in revised MP/OP activities	Riging/Sosa/ Toghla	Medium	Medium Term
					7.1.2. Establishment of new vet facilities	-do-			
			Depredation of livestock by wildlife		7.1.3. Livestock insurance scheme	Activity No. 9.4	All	Medium	Medium Term
			Poor breeds with lesser productivity		7.1.4. Training regarding animal husbandry	Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term
			Disease out break		7.1.5. Training of herders to restrict zoonosis	-do-	All	Urgent	Medium Term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
8.	Pastures and Rangelands	8.1. To maintain ecologically healthy ecosystem	Loss of floral diversity Loss of pollinators	Water scarcity	8.1.1. New snow fed channels for pastures irrigation	-do-	All	Urgent	Short term
			Over grazing Degraded pastures resulting in loss of food for Wildlife	Uncontrolled number of livestock	8.1.2. Promotion of supplementation with stall feeding	-do-	All	High	Medium
				Insufficient growth time for pastures	8.1.3. Promotion of fodder cultivation on suitable land patches	-do-	All	Moderate	Medium term
				Poor and dangerous accessibility to pastures	8.1.4. Awareness of herders/professional shepherd about sustainable herding practices	-do-	All	High	Short term
					Revive the use of indigenous grazing system		All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
			Unknown Carrying capacity	Lack of Research studies	8.1.5. Research studies about the carrying capacity and adaptability of Pasture to climate change	-do-	All	Urgent	Long Term
					8.1.6. Establishment of enclosure to measure productivity with surrounding pastures	-do-	One healthy/least degraded pasture in whole valley	Urgent	Long Term
9.	Forest	9.1. To maintain appropriate forest cover	Run-off and landslides Less biodiversity Less fuel wood availability for local community	Lack of alternative fuel resources Lack of capacity to use fuel resources Lack of awareness on values and function of forests	9.1.1. Enhance productivity through reforestation and afforestation	Suggested for inclusion in revised MP/OP activities	All	Urgent	Long Term
					9.1.2. Promotion of farm forestry	-do-	All	Urgent	Long Term
					9.1.3. Develop restricted forest zones to ensure regeneration to strengthen ban on Juniper harvest as in MP	-do-	All	Urgent	Long Term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
					9.1.4. Training of farmers for farm forestry	-do-	All	Urgent	Long Term
					9.1.5. Improved Watch & ward (Capacity building and induction of more game watchers or community guards) to minimize illegal harvest	-do-	All	Urgent	Long Term
							All	Urgent	Long Term
10.	Wildlife	10.1. To improve and maintain healthy wildlife population	Unsustainable hunting Habitat degradation Diseases from livestock resulting in un-natural mortality	Habitat fragmentation and degradation Poaching Lack of awareness about significance of biodiversity of area	10.1.1. Dedicated zones for wildlife, restrict grazing in those areas	Suggested for inclusion in revised MP/OP activities	All	High	Long term
					10.1.2. Improve habitat connectivity in existing fragmented habitats	-do-	All	High	Long term
					10.1.3. Habitat modelling for near threatened wildlife species	-do-	All	High	Medium term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
				Lack of eco-tourism opportunities	10.1.4. Identification of healthy population of endangered species reintroduction	-do-	All	High	Medium term
					10.1.5. Establishment of water point	-do-	All	High	Short term
					10.1.6. Improve watch and ward mechanism with inclusion of local SOs	Activity No. 6.1	All	High	Long Term
					10.1.7. Awareness raising through seminars, and wildlife clubs in schools	-do-	All	High	Medium term
					10.1.8. Dedicated research projects	-do-	All	Moderate	Long term
11.	Tourism	11.1. Promotion of tourism as a sustainable economic avenue	Loss of economic opportunities Loss of support for conservation and development opportunities	Poor structure of Skardu – Askoli road Insufficient facilities of road and stay	11.1.1. Maintenance of road throughout the touristic season	Suggested for inclusion in revised MP/OP activities	All	High	Short term

S. No	Sector	Management Objectives	Conservation/ Development Issues/Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale (Short, Medium, Long term)
				Lack of interpretation of resources i.e. Hot springs Lack of mechanism to attract tourist/visitor	11.1.2. Development and dissemination of brochures for interpretation of tourist opportunities	-do-	All	High	Short term
					11.1.3. Water supply, waste disposal and improvement in washroom condition	-do-	-do-	Urgent	Medium term
					11.1.4. Community based residence and restaurants	-do-	All	Medium	Medium term
					11.1.5. Establishment of bath rooms, rest area and promotion of hot springs sites	-do-	All	Medium	Medium term
12.	Water	12.1. To maintain quality and quantity of water	Pollution Water shortage at source and point of end-user	Climate change Waste disposal into water channels	12.1.1. Water quality testing from all water channels 12.1.2. Awareness of local community with focus to keep water resources clean and its minimal usage	Suggested for inclusion in revised MP/OP activities	All	High	Long term

8. IMPLEMENTATION AND MONITORING MECHANISM

8.1 Implementation Mechanism

The whole process needs to be facilitated by Conservator- Baltistan in collaboration with CKNP Directorate and NGOs such as AKRSP, AKPBS, EvK2CNR, WWF etc. Following steps are important in this regard:

The first step should be the restructuring of the community organizations in the form of Community-based conservation and sustainable development organization's (CBCSDOs). Agreements should be signed with CBCSDOs for their proactive participation in conservation and sustainable use of natural resources. The local communities are now well mobilized in support of CKNP and the restructuring should not be a problem.

The second step is participatory conservation planning in which the draft CSDP should be shared with the respective communities (involving VCCs, UC members, President of VOs and WOs (where possible)): line departments at district level (Agriculture, LS&DD, Forest, Wildlife and Park, Tourism) and concerned NGOs such as AKRSP, AKPBS, EvK2CNR) to solicit their technical opinion and possible support during implementation of the plan.

The third step is approval of VCSDP from DCC Skardu, and facilitation of subsequent DCC meetings to facilitate and monitor implementation on VCSDP.

There are two cross-cutting themes. First is capacity-building involving awareness raising, trainings and exchange programmes. The second is financial sustainability which comes from various sources, primarily from government allocations and subsequently at community level from various sustainable use initiatives such as trophy hunting, ecotourism, CKNP entry fee etc. Community based organizations can also initiate small projects for that the capacity of the CBCSDOs can be enhanced so to conceive, develop, hunt and implement small initiative on their own. However, this kind of the implementation will be done in consultation with the CKNP directorate to avoid any duplication in the activities.

8.2 Monitoring Mechanism

8.2.1 CKNP Directorate

The major responsibility of monitoring all action of a CBCSDO carried out under the framework of VCSDP should be jointly with DFO Skardu and CKNP Directorate. The DFO Skardu and CKNP Directorate can monitor their progress in the following steps:

- Visiting individual CBCSDOs and checking their records and verifying physical progress on activities
- Attending DCC meetings and reviewing progress of CBCSDOs annual plans
- Monitoring CBCDSOs performance against their annual plans in the meetings of the CKNP Management Committee
- CKNP can call in meetings of the representatives CBCSDOs at the directorate on a periodic or need basis to review the progress against the tasks

8.2.2 District Conservation Committee Meetings

The VCSDP should be presented in DCC Skardu and endorsed by the chairman of DCC with recommendations from CKNP Director and DFO Skardu. The DCC Skardu in its bi-annual meeting should review the progress of implementation on VCSDP. Each village should have an annual plan to be presented and subsequently reviewed in DCC.

8.2.3 Community Agreements

DFO Skardu, CKNP Directorate or any supporting agency intending to initiate any activity with a CBCSDO should sign a letter of agreement explaining the roles and responsibilities of all parties involved in undertaking the activity. A copy of such an agreement should be made available in CBCSDOs office records.

8.2.4 CBCSDOs Audit and Record Keeping

DFO Skardu, CKNP Directorate or any supporting organizations should emphasize on proper record keeping of all activities undertaken by CBCSDOs. This can be done by checking monthly minutes' sheet, proceedings of the special meetings and financial records of CBCSDOs. It should be mandatory for every CBCSDO to have their annual audit report. Any financial support to a CBCSDO should be linked to availability of annual audit report. The community must have a separate file for all major activities to be undertaken as part of the VCSDP.

For all major initiatives the CBCSDO should constitute two committees: a) project execution committee and b) project audit committee. Most of the local communities are familiar of this system due to the projects of several orgainzations.

8.2.5 CBCSDO Visitor Diary

CBCSDO should maintain a visitor diary for noting comments, feedback and observations of all visitors coming to a village in connection with conservation and sustainable development initiatives. The CKNP Directorate, DFO Skardu and supporting agencies or organizations should clearly instruct their employees visiting any village/ valley to write down their notes in CBCSDO visitor diary. This way the supporting agencies can avoid duplicate of efforts and it will be helpful in carrying out the activities systematically and logically.

8.2.6 Relevance in Assignments

The CBCSDOs should find the relevant person for carrying out tasks including the finance and record keep, meeting minutes etc. The relevant persons will thus be able to keep a proper record that is a prerequisite for the sustainability of the community organizations. Channels should be found out, wherever possible for the capacity building of the technical persons closely coordinating with the government and private organizations.

8.2.7 Network of CBCSDOs

In order to learn from each other's best practices, it is worthwhile to develop a network of CBCSDOs. They may opt to meet led by some representatives facilitated by CKNP to discuss

the successes and failures. The learning can be shared that can help in avoiding failures, adopting models that lead to successes considering the relevancy.

Visitors Diary

Name of CBCSDO.....

Name of Visitor .....
Organization/institution .....
Date of visit .....
Purpose of visit .....
Venue of meeting .....
Meeting participants.....
Key discussions or decision points
.....
.....
.....
.....
...

Required follow up actions
.....
.....
.....
.....

Signature of the visitor.....

Conservation and Sustainable Development Plan 2016 – 2026
Tormik Valley
Central Karakorum National Park
Gilgit Baltistan

CONSERVATION AND SUSTAINABLE DEVELOPMENT PLAN 2016-2026

TORMIK VALLEY

CENTRAL KARAKORAM NATIONAL PARK

GILGIT-BALTISTAN

Citation: Naureen Mustafa, Muhammad Aurang Zaib, Ghulam Musa Shimshali, Ashiq Ahmad Khan, Maurizio Gallo, Arif Hussain, Riaz Ul Hassan, Elisa Vuillermoz, Luca Listo, Muhammad Raza, Nadeem Nazar, Yasir Abbas, Aman Ullah Khan, Ruby Pyara, Raja Abid and Yasir Abbas Rizvi. (2016). Conservation and Sustainable Development Plan for Tormik valley of CKNP. Ev-K2-CNR Pakistan.

Developed by Ev-K2-CNR-Pakistan in continuation of the management plan and operational plan of CKNP

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This is a working document to welcome your suggestions for further improvement prior to its approval.

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PLAN EDORSEMENT

Signed by President LSO Tormik .....

Endorsed Director CKNP .....

Approved by Deputy Commissioner/ .....
Chairman District Conservation Committee
For Skardu in ..... meeting of DCC Skardu
held .....

Dated.....

CONTENTS

LIST OF EXHIBITS

Abbreviations

°C	**Celsius**
ABG	Annual Biomass Growth
CAI	Current Annual Growth
CKNP	Central Karakoram National Park
CPEC	China Pakistan Economic Corridor
E	East
EIA	Environmental Impact Assessment
FGD	Focus Group Discussion
GB	Gilgit-Baltistan
GLOF	Glacier lake outburst flood
HH	Households
INGO	International Nongovernmental Organization
Kg	Kilograms
KIU	Karakorum International University
LSO	Local Support Organization
m a.s.l.	Meter above sea level
Mg	Mega grams
MP	Management Plan
N	North
N/A	Not Applicable
NGO	Non-governmental Organization
NTFP	Non-Timber Forest Product
OP	Operational Plan
S	Summer
SEED	Social Economic Environmental Development
UC	Union Council

VCC	Valley Conservation Committee
VCF	Valley Conservation Fund
VCSDP	Valley Conservation and Sustainable Development Plan
VCSP	Valley Conservation Sustainable Plan
VO	Village Organization
W	Winter
WO	Women organization
Yr	Year

1. INTRODUCTION OF TORMIK VALLEY

1.1. History of Tormik Valley

According to locals, they are not sure about when the valley embraced the first person. However, they are living for generations. The ruins of the old castles are found in the area namely Bong-ri-Khar, Rega Khar, Siperi Khar, Rong Khar, Bang ma Khar and Shahi Halchng Ra, which apparently show that human life has existed for centuries.

Exhibit 1: View of Tormik Valley

The locals say that in older time people of Tormik used to travel Yar Kan via Shigar, Basha valley to bring chai and salt because of lacking any other connecting route to Skardu. They used Haramosh Pass via Arandu Basha valley to reach Haramosh and Gilgit region.

1.2. Locality of Tormik Valley

Tormik valley is part of UC Tormik, Tehsil Rondu, Skardu District. It comprises of 16 main villages laying on both side of the bank of Tormik main water stream situated at an altitude of 2500-3000 meters high from the sea level with exception of Baghicha village; which is situated along Indus River at an altitude of 2036 m.a.s.l.

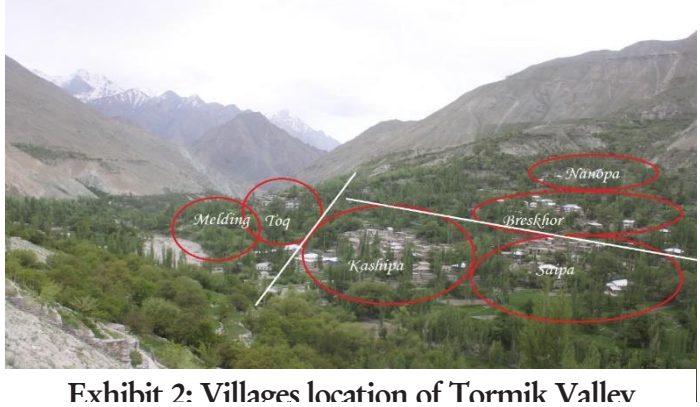


Exhibit 2: Villages location of Tormik Valley

1.3. Ecological Profile of Tormik Valley

Tormik is located among the south western side of Central Karakoram National Park due to which it has dense vegetation as compared to valleys at north east side. Vegetation of the area is the mix of sub-tropical scrub type at lower elevations and dry temperate coniferous forest zone at higher elevations.

Exhibit 3: Village locations of Tormik Valley, 2016

Villages	Coordinates		Elevation (m asl)
	N	E	
Kashipa	35°38'36.5"	075°18'11.9"	2746
Dassu	35°36'59.5"	075°18'06.5"	2512
Harimal	35°39'42.6"	075°17'17.3"	2858
Khalijang	35°38'13.5"	075°18'37.5"	2706
Gialskar	35°39'56.6"	075°17'24.8"	2853
Bazgang	35°38'28.5"	075°18'34.0"	2746
Melding	35°38'20.7"	075°18'22.3"	2775
Barisko/Nanaopa	35°38'22.8"	075°18'00.8"	2948
Khomera	35°36'37.7"	075°21'08.9"	2595
Pano	35°38'56.8"	075°17'54.4"	2904
Kushumal	35°39'06.3"	075°17'38.1"	2809
Baghicha	35°35'24.9"	075°19'58.0"	2036
Yunchung	35°37'37.9"	075°18'59.4"	2633
Badapa	35°37′56.4″	075°18′41.3″	2667
Surbo	35°39′56.3″	075°16′50.9″	2931

Tormik valley is representative of 15.1 % broad-leaved, 7.2% coniferous forest and 77.6% juniper trees (Ferrari, 2014). These forests are the sources of consumptive and non-consumptive uses as reported by the local community. Unlike other communities these forests are co-managed between the villages. The biodiversity of Tormik valley is adapted to harsh and varied climatic conditions and topography. Besides this, there is a rich diversity of habitats e.g., lakes, springs, small rivers and streams, sub alpine and alpine meadows, steep mountain slopes, cultivated fields, road sides and permanent glaciers etc., which support a rich and equally diverse floristic wealth.

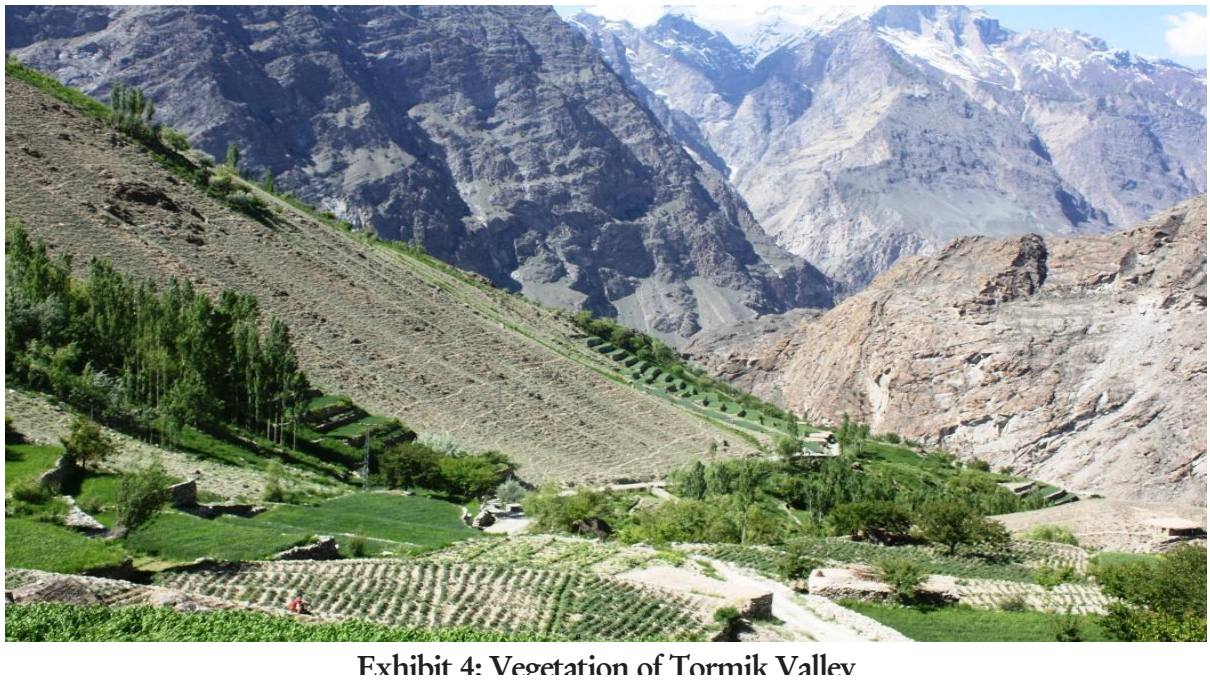


Exhibit 4: Vegetation of Tormik Valley

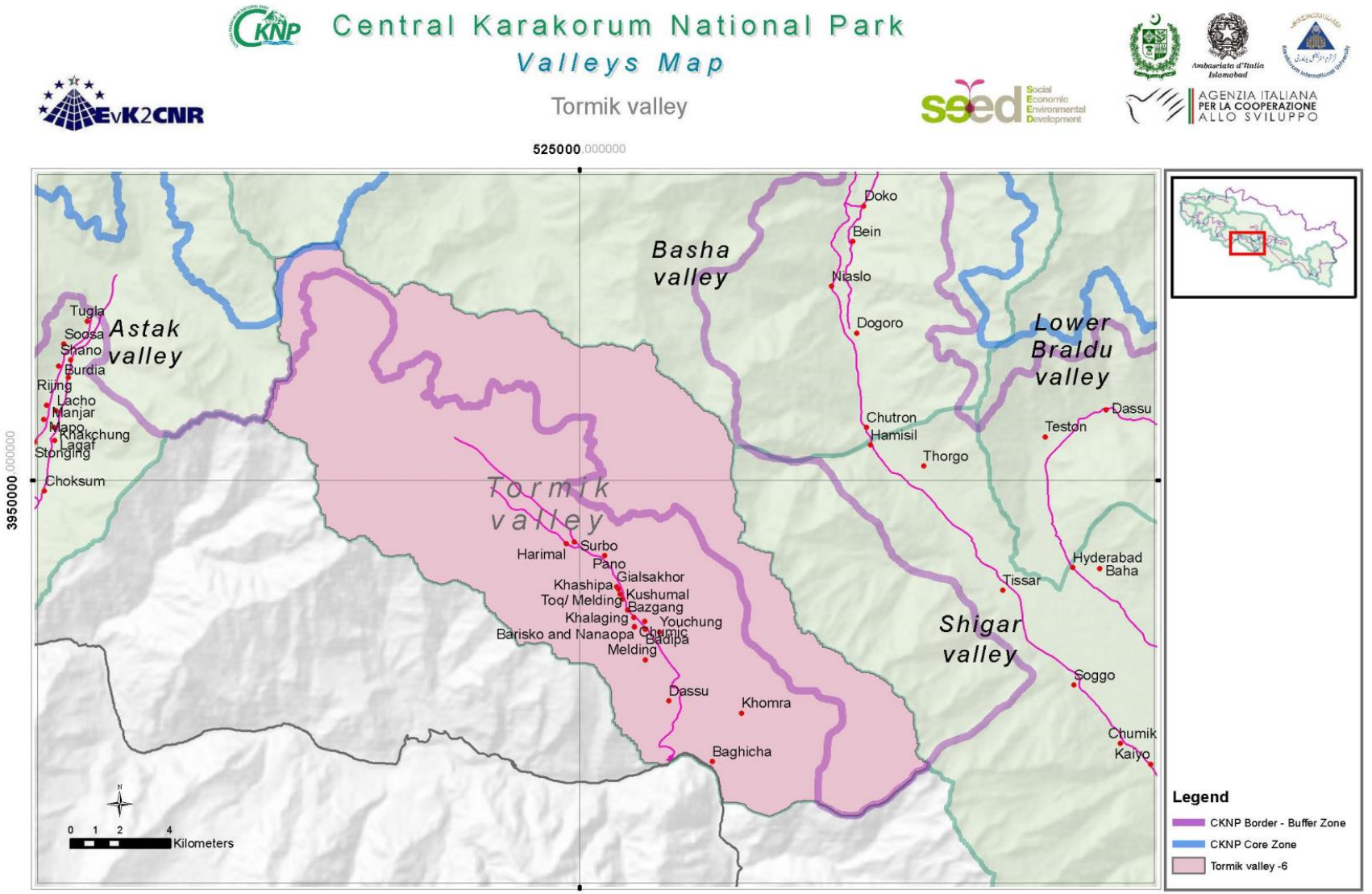
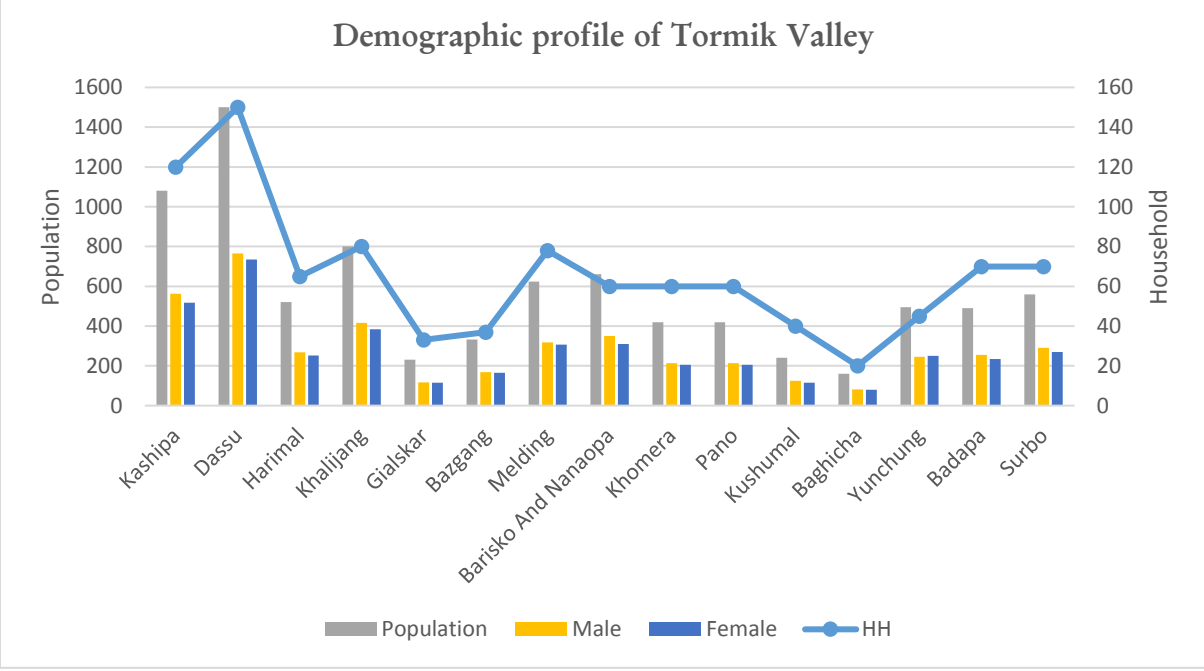


Exhibit 5: Villages of Tormik Valley

Exhibit 6: Demographic profile of the Tormik Valley

Village	HH	Av. HH size	Population	Male	Female	Male: Female
Kashipa	120	9	1080	562	518	1.084: 0.921
Dassu	150	10	1500	765	735	1.083: 0.923
Harimal	65	8	520	268	252	1.08:0.925
Khalijang	80	10	800	416	384	1.083:0.923
Gialskar	33	7	231	116	115	1.081:0.925
Bazgang	37	9	333	168	165	1.081:0.924
Melding	78	8	624	318	306	1.08:0.925
Barisko/Nanaopa	60	11	660	350	310	1.082:0.924
Khomera	60	7	420	214	206	1.079:0.926
Pano	60	7	420	214	206	1.079:0.926
Kushumal	40	6	240	125	115	1.086:0.92
Baghicha	20	8	160	81	79	1.077:0.927
Yunchung	45	11	495	245	250	1.079:0.926
Badapa	70	7	490	255	235	1.085:0.921
Surbo	70	8	560	291	269	1.081:0.924
Total	**988**	**8.4**	**8533**	**4388**	**4145**	**1.081:0.924**

Exhibit 7**: Demographics of Tormik Valley**



1.4. Socio-economic Profile of Tormik Valley

1.4.1. Demography of Tormik Valley

According to the survey results conducted for VCSDPs of CKNP villages, total number of households in Tormik valley is 988 containing 8533 total population with an average household

size of 8.4 and male to female ratio is 1.081:0.924. All these villages are based around buffer area of CKNP which spans 2757.88 m^2 and serves as reserves of natural resources for the local people and transitional area between park and local communities. This local community depends heavily upon natural resources both for subsistence and income.

1.4.2. Road Access

Accessibility is a key issue in mountain landscapes and goes far beyond access to basic infrastructures such as health services, schools, roads, transport, markets and communication with the outside world. This lack can be attributed to difficult topography and low population densities relative to lowland areas, factors that increase investment and maintenance costs.

Exhibit 8: Road to Tormik Valley

Tormik valley comprises of sixteen villages. Baghicha serves as entry point to Tormik owing to its low elevation and location on the main Skardu road, other fourteen villages' form core of Tormik valley and connected via narrow, unpaved and rough jeep able tracts to the main Skardu road. Khomra village is situated on some 30 km radius from Baghicha toward Skardu city. Like other remote valleys of Baltistan, transportation of products to market is difficult, economic and time-consuming task. Similarly, access to the outer world is not much frequent as people avoid risk on the road except only for most important purposes.

1.4.3. Education Facilities

All the villages have primary level schools except Khshumal, Yuncheng and Surbo which access the nearby primary schools. A middle school for girls is accommodating students from the neighboring villages in Pano village. Regarding high school only one facility supported by government for boys exist in Kashipa village but there is no high school for girls in the valley. Students from different villages travel on an average 4-5 km to attend high school. Facilities and teachers in the schools are very meager. During FGD, participants reported that community school in Sarbo village has only building but no teacher available which causes the students to travel to other villages. The community has high inclination toward education but facing lack of education facilities and trained teachers which causes increasing drop out ratio from schools.

1.4.4. Health Facilities

Regarding health facilities, only2 dispensaries with limited facilities, equipment and staff provide the basic services to the valley. Since the villages have poor link roads and not inter-connected through proper roads, therefore access to health facilities by patients is problematic

for old, serious and pregnant cases and several casualties have been reported often while in way to dispensary. A large portion of the population use a dispensary established in Khalaging, while people of Khomra village travel to Baghica dispensary and for major health cases people from all Tormik valley visit Dambodass or Skardu.

1.4.5. Veterinary Facilities

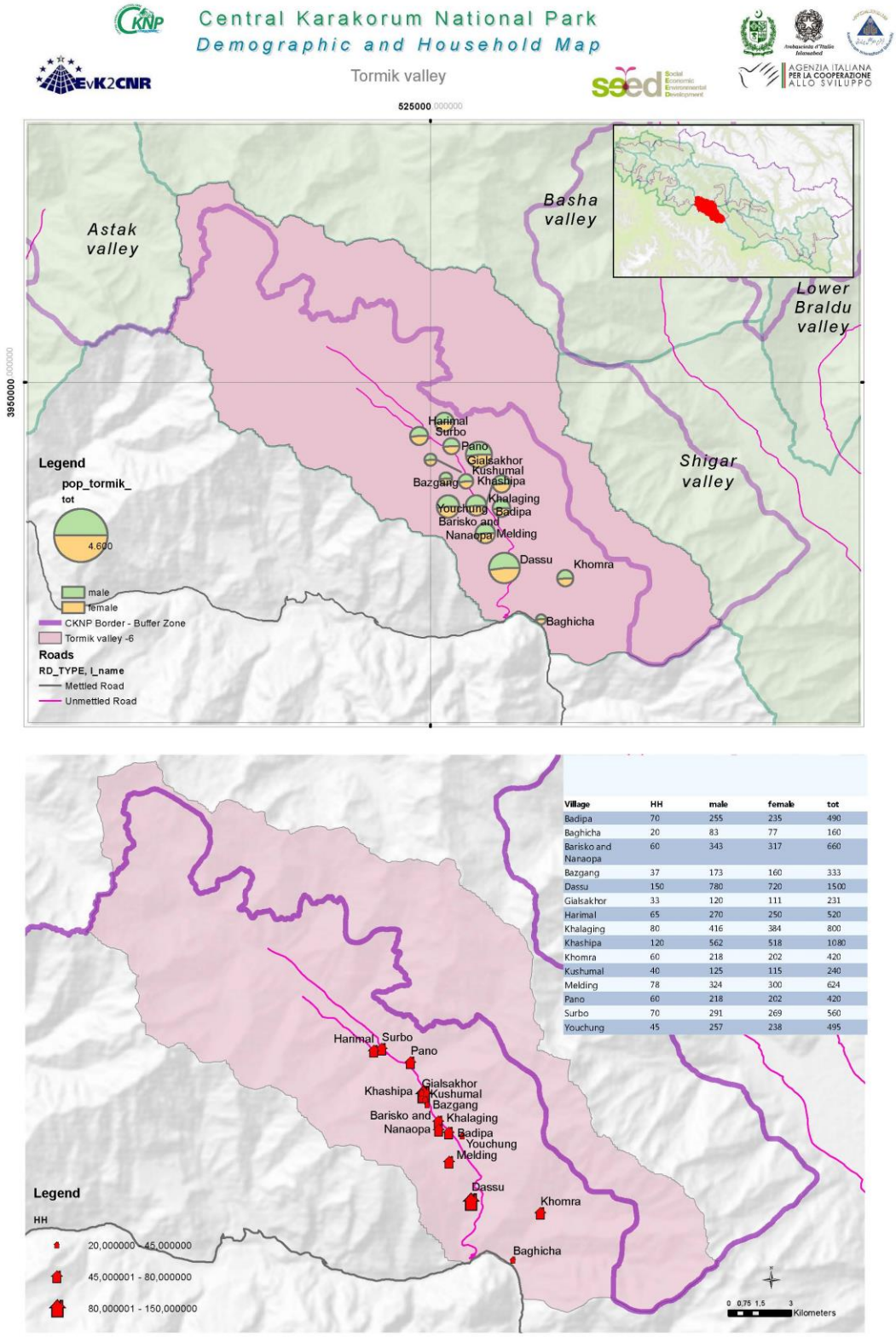
Khalejing village is consigned with vet facilities which is although unfurnished provides the community a facility of dispenser and vaccination of livestock once in a blue moon due to scarcity of required facilities. This veterinary dispensary presents very paltry picture in terms of services to local community. All other villages of Tormik valley depend upon meagre services provided by Khalejing veterinary facility. Most commonly reported livestock diseases are Goat pox, Interotoxemia (Goat, sheep and cattle), Black quarter, Mange (Large animal's cattle, yak, zozomo) as mentioned during FGD interviews. As an alternative to lack of vet facilities people of community purchase the vaccines without prescription from Dambodass Tehsil of Skardu District or Gilgit City and inject them by themselves devoid of proper training.

1.4.6. Electricity

All the villages in Tormik valley has the access to electricity facility provided and managed by Water and Power Department, GB but supply-demand lapse is managed by load shedding. The frequency of load shedding increases in winter with increase in demand to maintain the indoor temperature. Local community residing around CKNP manages this electricity shortage by harvesting wood as a fuel source from the National Park.

1.4.7. Traditional Governance System

Traditional Governance system unfolds two tiers; within the households and within the village. Within the ambit of social structure at household level, the basic residential/economic unit is the joint family. Typically, this unit includes an elder's household with his married sons' families. Married sons generally live in their father's household with the latter or the eldest brother exercising authority over the extended family. The authoritative head of the household has the responsibility and authority to make decisions on behalf of the entire household members. It is within the joint family that the primary solidarities lie for daily economic activities. This customary practice of joint family system fairly justifies the lower average increase in households and higher average increase in population.



Village	HH	male	female	tot
Badipa	70	255	235	490
Baghicha	20	83	77	160
Barisko and Nanaopa	60	343	317	660
Bazgang	37	173	160	333
Dassu	150	780	720	1500
Gialsakhor	33	120	111	231
Harimal	65	270	250	520
Khalaging	80	416	384	800
Khashipa	120	562	518	1080
Khomra	60	218	202	420
Kushumal	40	125	115	240
Melding	78	324	300	624
Pano	60	218	202	420
Surbo	70	291	269	560
Youchung	45	257	238	495

Exhibit 9: Demographic map of Tormik Valley

Exhibit 10: Socio-economic profile of Tormik Valley

Villages	Education facilities				Health facilities		Veterinary Facilities	Electricity
	Category/Level	Ownership	Geographic Location	Gender	Facility	Geographic Location		
Kashipa	High	Govt.	N 35°38'34.9" E 075°18'13.4	Boys	--	--	–	Yes
	Middle	Govt.	--	Girls	-	-	-	-do-
Dassu	Primary	-do-	-	-do-	--	--	–	-do-
	Primary	Govt	--	Boys	--	--	–	
Harimal	-do-	-do-	N 35°39'40.1" E 075°17'18.4"	Boys	--	--	–	-do-
Khalijang	-do-	SAP System	N 35°38'17.7" E 075°18'31.9"	Both	Dispensary	N 35°38'13.0" E 075°18'37.2"	Dispensary	-do-
Gialskar	–	--	--	--	--	--	–	-do-
Bazgang	Primary	Govt.	--	Boys	--	--	–	-do-
	Primary	-do	--	Girls				
Melding	-do-	-do-	N 35°38'22.4" E 075°18'22.9"	Girls	--	--	–	-do-
Barisko/ Nanaopa	-do-	-do-	N 35°38'22.8" E 075°18'00.8"	-do-	--	--	–	-do-
Khomera	-do-	-do-	N 35°36'35.5" E 075°20'59.9"	-do-	--	--	–	-do-
Pano	Middle school	-do-	N 35°38'47.8" E 075°17'48.9"	Girls	--	--	–	-do-
Kushumal	–	-do-	--	--	--	--	–	-do-
Baghicha	Primary	-do-	35°35'21.4" 075° 20'00.6"	Both	Dispensary	35°35'30.1" 075° 20'08.2"	NA	-do-
Yunchung	–	-do-	--	--	--	--	–	-do-
Badapa	Primary	Govt.	N 35°37′54.3″ E 075°18′41.3″	Boys	--	--	–	-do-
Surbo	Primary	NEF	--	Both	--	--	–	-do-

The whole buffer zone of CKNP is full of villages having rugged topography, jagged mountains, harsh climate and disaster-prone areas. In this situation, local community helped themselves by establishing and maintaining the local support organization in order to explore and enhance the developmental opportunities for the areas. They were established back in 1980 under the awareness and efforts of working NGO's and INGO's at time but maintained and managed by the local communities as an integral social component. It serves as umbrella for VCCs, VOs, and WOs. This organization contains the members from all the regional organizations and jurisdiction spans upon the water sheds at the village/valley level. Their function is equivalent sharing and support of the developmental opportunities in the area. LSO Tormik was established but conspiracies and conflicts of local bodies for its administration lead to its failure. The local people are of the view that social organizations are working according to the available capacities and resources, while a smaller segment of the community are rating its performance every poor. Currently VCCs are considered the most active setups which are playing leading role in implementation of customary practices but the performance has the margin of improvement through capacity building.

1.4.8. Gender Impact

In Tormik valley gender roles are very similar to other CKNP valleys where each household usually comprises of two gender authorities, the oldest male member of a household is head of the household and the oldest women can be said as subordinate to the head. The division of labor is basically gender-based, the male members of the family including head of the family are responsible for both external and internal matters such as representing the household in the village as well as ensuring income earning and its management, such as decision making related to agriculture and livestock production, use and distribution of tasks. The females of the house are responsible for defining and organizing the tasks and handling household economic affairs, including managing storerooms, kitchen and handling/use the agriculture and livestock production. Women mobility within the village is open and they are allowed to participate in social and religious events, where a separate portion for women is defined and they have to stay within the defined boundary.

Primarily women are engaged in agriculture activities and other reproductive roles due to lack of income earning opportunity within the village and rare mobility opportunities outside the village. The primary reason for women's current role is lack of education and skill in women. A few women who earn cash income are either primary or secondary level teachers in the school or midwives in health facilities. Currently increasing enrolment of women in the schools is expected to increase number of educated women in few years, which will ultimately become a reason for changing women role.

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ASSESSMENT OF CUSTOMARY PRACTICES FOR SUSTAINABLE USE OF NATURAL RESOURCES IN CONTEXT OF INDIDENOUS KNOWLEDGE

2. ASSESSMENT OF CUSTOMARY PRACTICES FOR SUSTAINABLE USE OF NATURAL RESOURCES

Local community inhabited this land since forefathers and practices their own set of rules known as customary/custodian rules/practices which were formed before the statutory laws even before the creation of Pakistan. These laws passed from generation to generation by words and hardly been written anywhere.

Local communities have long histories of interaction with the natural environment. With the passage of time the land use priorities changed and resulted in differential dependence upon natural resources by each community and even varied personally. Allied with many of these communities is a collective organization of knowledge, expertise, practices and emblematic depiction. These refined sets of understanding, elucidation and connotation are integral component of a cultural complex that incorporates language, nomenclature, resource use practice, cultural and worldview. This local and indigenous wisdom is a key resource for empowering communities to exploit natural resources in sustainable manners to ensure its continuation for next generations.

2.1. Requirement of Revitalization of Indigenous Knowledge

Indigenous people are the custodian of customary systems. These people are well informed about their own circumstances, their resources, what works and what does not work. They are also aware of the possible impact of a change in one factor on the other parts of the environment, but the issue highlighted by the local community during the interviews is that they are unable to assess and adapt to environmental changes as fast as its happening. This provokes the need of awareness raising and revitalizing the indigenous knowledge in a way that allows these people to adapt to their environment and let them able to reciprocate the disastrous changes steadily

2.2. . Water

Tormik valley is richly supplied with water via streams. Valley is segmented into two parts due to the passage of main stream through its center. Besides this small watershed fulfill the household needs. As villages are located at higher elevation than river, therefore is a mostly remains useless. Like other CKNP valleys, poor irrigation system mismanages the water supply for households.

Villages having abundant water supply do not practice customary practices for water distribution, however villages where water is scarce due to few irrigation channels, distribution is managed through customary practices. Distributions via customary practices either have water for fixed duration or it depends upon size of land holding per household.

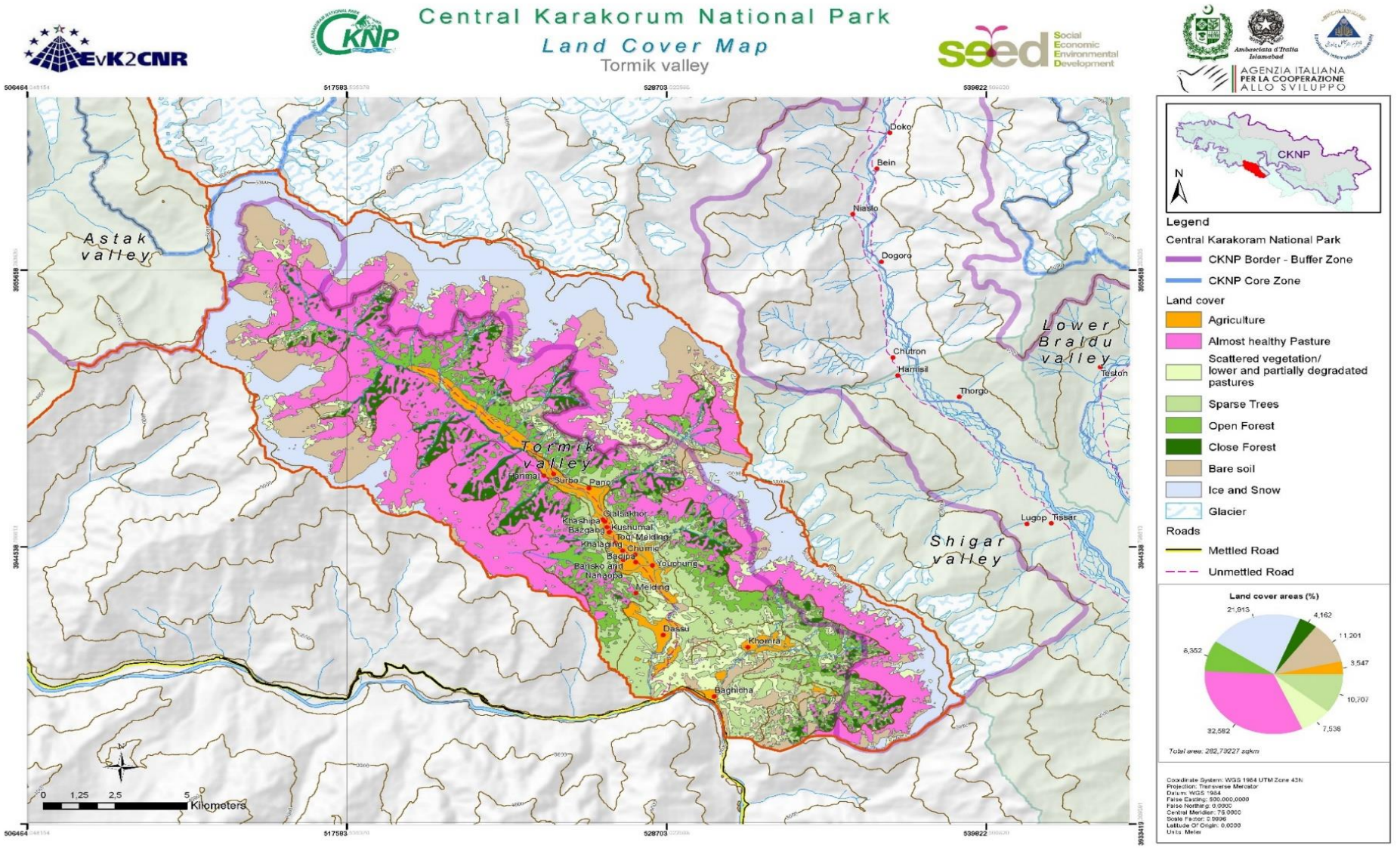


Exhibit 11: Land cover map of Tormik Valley

2.3. Agriculture

Agriculture and livestock herding are two most preferred economic activities in the Tormik valley. Open canopy forests especially in the upper sections of the valley provide enough arable land for crop and fodder cultivation. The role of women is significant in agriculture farms. Division of labor exists between both genders throughout the summer. Men mostly perform the cultivation activities (land preparation and sowing) with minor assistance from women while in harvesting season both work. Agriculture activities, such as irrigation of farms, fodder collection and storage for winter season are performed by females of the house.

Tormik valley owing to its moderate elevation range and abundant water availability provides the opportunity of double cropping to farmers. Main crop are Wheat, Potato and Barley however Maize is cultivated as second crop. In spite of dependence on agriculture for subsistence wheat production hardly fulfill consumption per household for six to seven months and the gap is filled by purchasing wheat from government wheat reserve/subsidiary or market. Potato is the only cash crop which is sold in the market to cash earns income. Almost in all villages significant portion (approximately 75%) of potato is sold while rest is stored for household consumption. A part of the received income is spent on purchase of wheat from market to fill the gap. Although there is great potential available for fruit production in the valley but due to lack of awareness on value addition, packing and marketing fruit products and vegetable are mostly not sold.

Though the valley is rich in water resources but due to poor irrigation infrastructure in many villages water is not largely available. Water wherever available mostly utilized in the day time for farm irrigation and in the night time it is used to irrigate orchards, plantation areas and farm fodder lands. A considerable area of cultivable/barren land is available in the core valley and some side areas but the community is lacking communal efforts coupled with scarcity of financial resources to bring it under cultivation. With increasing livelihood needs, individual households are working on land reclamation by expanding agriculture by altering land use. Land under natural forest and vegetation cover are being cleared for agriculture practices.

Exhibit 12: Economic benefits of agriculture production

Village	Crops	Consumption (%)	Sale (%)	Av. Income/HH
Kashipa	Wheat	100	0	30000
	Barley	100	0	
	Maize	0	0	
	Potato	5	95	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	60	40	
Dasso	Wheat	100	0	20000
	Barley	100	0	
	Maize	100	0	

Village	Crops	Consumption (%)	Sale (%)	Av. Income/HH
	Potato	5	95	
	Millet	0	0	
	Buckwheat	100	0	
	Vegetable /Fruit	50	50	
Harimal	Wheat	100	0	20000
	Barley	100	0	
	Maize	0	0	
	Potato	5	95	
	Millet	0	0	
	Buckwheat	100	0	
	Vegetable /Fruit	80	20	
Khalijang	Wheat	100	0	25000
	Barley	100	0	
	Maize	0	0	
	Potato	20	80	
	Millet	0	0	
	Buckwheat	100	0	
	Vegetable /Fruit	100	0	
Gialskar	Wheat	100	0	10000
	Barley	0	0	
	Maize	5	95	
	Potato	0	0	
	Millet	0	0	
	Buckwheat	80	20	
	Vegetable /Fruit	100	0	
Bazgang	Wheat	100	0	55000
	Barley	100	0	
	Maize	25	75	
	Potato	0	0	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	80	20	
Melding	Wheat	100	0	50000
	Barley	100	0	
	Maize	0	0	
	Potato	5	95	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	90	10	
Barisko/Bloqpa	Wheat	100	0	60000
	Barley	100	0	
	Maize	0	0	
	Potato	30	70	
	Millet	0	0	

Village	Crops	Consumption (%)	Sale (%)	Av. Income/HH
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	
Barisko/Bloqpa	Wheat	100	0	60000
	Barley	100	0	
	Maize	0	0	
	Potato	30	70	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	
Khomera	Wheat	100	0	100000
	Barley	100	0	
	Maize	0	0	
	Potato	25	75	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	
Pano	Wheat	100	0	35000
	Barley	100	0	
	Maize	0	0	
	Potato	5	95	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	
Kushumal	Wheat	100	0	25000
	Barley	100	0	
	Maize	0	0	
	Potato	10	90	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	
Baghicha	Wheat	100	0	18000
	Barley	100	0	
	Maize	0	0	
	Potato	5	95	
	Millet	0	0	
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	
Yuncheng	Wheat	80	20	15000
	Barley	100	0	
	Maize	100	0	
	Potato	0	0	
	Millet	5	95	
	Buckwheat	0	0	
	Vegetable /Fruit	0	0	

Village	Crops	Consumption (%)	Sale (%)	Av. Income/HH
Badapa	Wheat	0	0	25000
	Barley	0	0	
	Maize	100	0	
	Potato	100	0	
	Millet	0	0	
	Buckwheat	5	95	
	Vegetable /Fruit	0	0	
Surbo	Wheat	100	0	450000
	Barley	100	0	
	Maize	100	0	
	Potato	100	0	
	Millet	0	0	
	Buckwheat	30	70	
	Vegetable /Fruit	0	0	

Exhibit 13: Need fulfillment by agriculture in Tormik Valley (Kashipa—Melding)

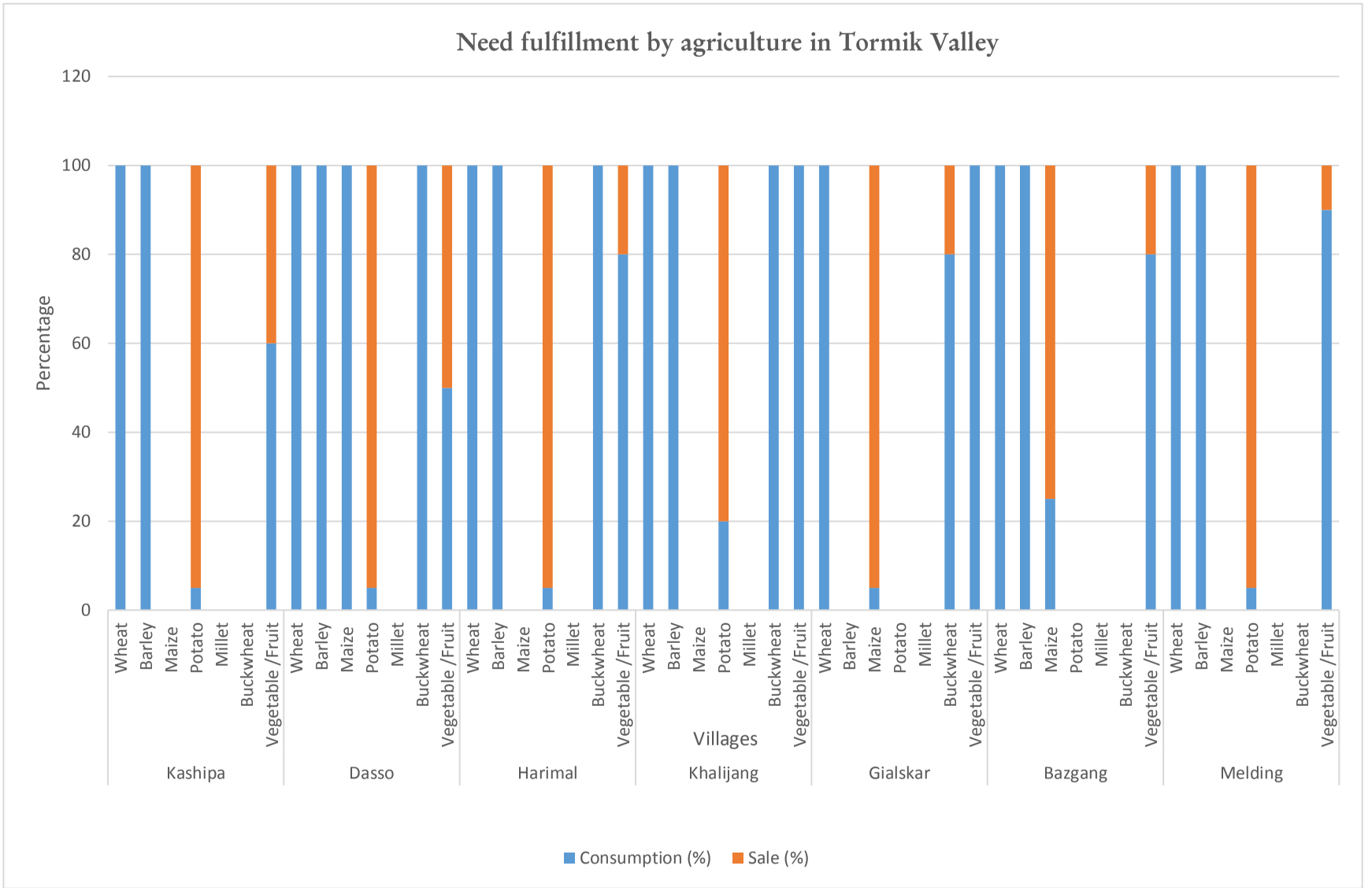
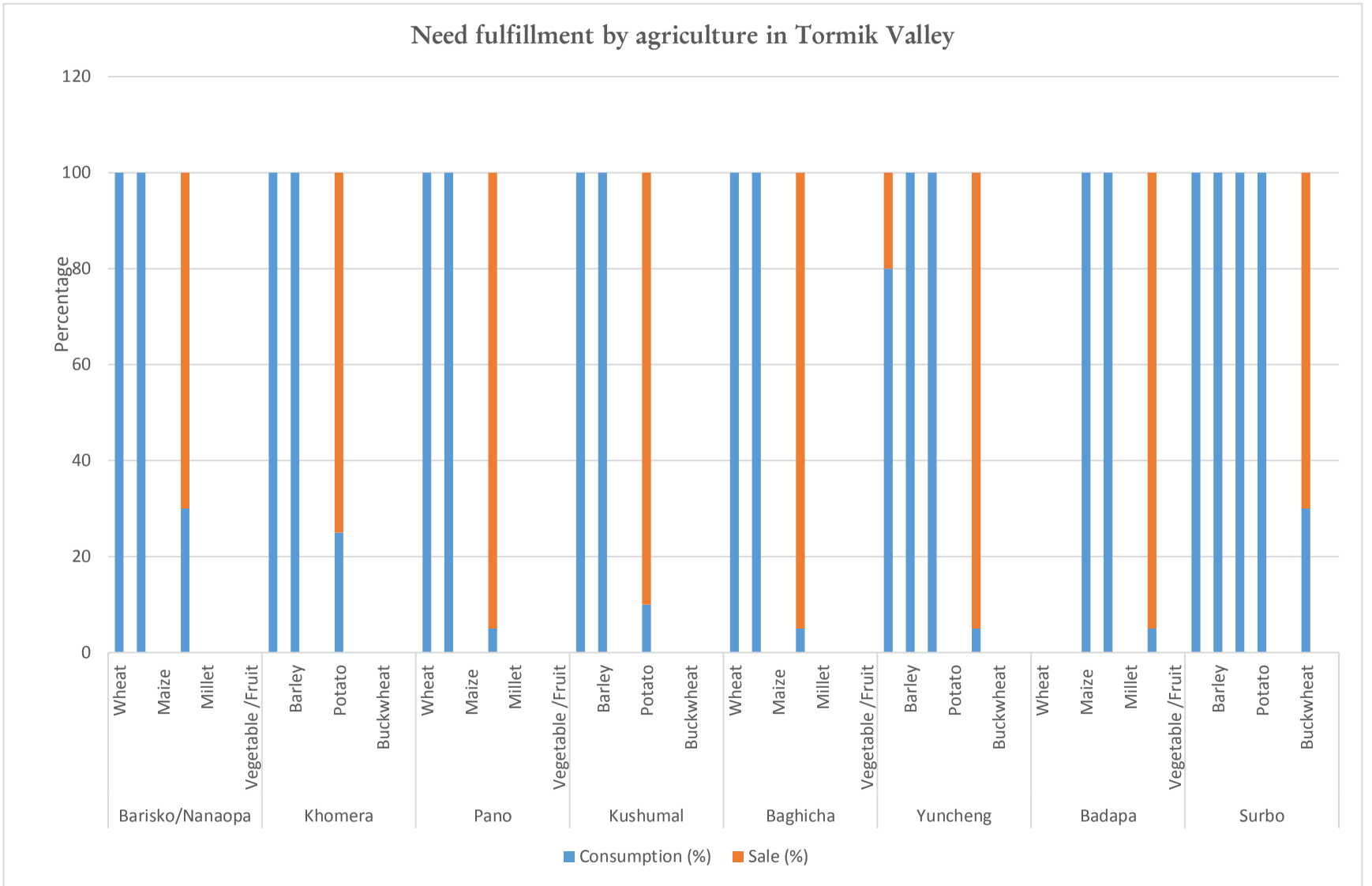


Exhibit 14: Need fulfillment by agriculture in Tormik Valley (Barisko/Nanopa-Surbo)



2.4. Livestock

Animal rearing serves as a "living bank" in terms of food and cash. Investment in livestock herding has a wide portfolio of animals: cattle, goats, sheep, donkeys, mules and poultry. This is supplemented in some areas with domestication of yak and hybrid yak. Livestock mobility, dispersion, shifting of households, utilization of pastures are adaptation strategies for livestock herding. However, the livestock population highly depends on alpine & subalpine pastures, and range land due to insufficient fodder from the agriculture fields. Moreover, the pastorals also collect fodder from pastures during spring summer season and store it for the over-wintering.

Livestock rearing trend decreased considerably during last ten years owing to less economic return for the following reasons.

1. Most working class of today have grown up and been educated. Many of them never return but stay in town and join alternative livelihood options.
2. Tormik valley has prolonged winters and very short summer and spring season. The temperatures drop below the freezing point resulting dried out vegetation cover and snow-covered pastures. Pastorals face scarcity of fodder for livestock due to which animals produce a reduced amount of meat. Weak animals cause the economic capsizal for the owner.
3. Pastorals know about the changing climate but they are neither adapted to it nor do they know how to adapt and mitigate the effects of climate change for sustainability. New veterinary diseases are befalling in the villages at exponential rates during last 10 years due to climate change. Aided to this lack of sufficient vet facilities, medicines and vaccines increased livestock mortality. Pastorals have almost no or very little information about the precautionary measures and vaccines and faces economic loss ultimately.
4. Customary practices are not very efficient to control disease spread among herds. Infectious agents spread from common grazing areas such as pastures, water points and other such places. Pastorals that rear livestock often lack the information about the zoonotic diseases and get infected from diseased animals.
5. There is huge dependence of livestock on the pastures for fodder. With the increase in human population and ultimately livestock population the pressures have been increased, subsequently health of pastures is decreasing. There is no assessment about the carrying capacity of pastures and therefore no rules exist about the maximum number of livestock in the pastures neither in customary rules nor in statutory laws.

The observed decree in the livestock rearing has both positive and negative impacts. The need is to assess the direction of adaptations towards the actions that are more suitable for natural resources and its components. On one hand decreasing trend in livestock rearing is useful as it reduces the pressure on the pastures, by leaving space and food for the wild herbivores such as Markhor, Ibex, and several small rodent species and ultimately increasing prey density for wild carnivores. But on the other hand decreased economic incentives by livestock in annual income per household increases the dependence of local community on the wood and non-wood

products. This dependence of local community on natural resources needs to be evaluated in terms of monetary benefits during each season and their economic value in the area to make research-based decisions for ecosystem sustainability. No previous research addresses the comparison of the monetary share of natural resources for household and its own economic value in terms of sustainable ecosystem services has been explored. Therefore, it is the need of time to strengthen the management plan by such research and specifically its implementation in the operational plan to ensure sustainable use of land and its products.

Exhibit 15: Contribution of livestock in economics of Tormik Valley

Villages	Kind of livestock	Population per village	Av. Income/HH	Trend
Kashipa	Sheep	700	55000	Decrease
	Goat	200		
	Cattle	200		
	Yak	2		
	Equids	75		
Dasso	Sheep	1200	30000	Decrease
	Goat	1300		
	Cattle	500		
	Yak	8		
	Equids	100		
Harimal	Sheep	600	80000	Decrease
	Goat	900		
	Cattle	250		
	Yak	1		
	Equids	200		
Khalijang	Sheep	200	18000	Decrease
	Goat	300		
	Cattle	160		
	Yak	2		
	Equids	20		
Gialskar	Sheep	200	50000	Decrease
	Goat	250		
	Cattle	70		
	Yak	1		
	Equids	40		
Bazgang	Sheep	400	10000	Decrease
	Goat	500		
	Cattle	150		
	Yak	NA		
	Equids	60		
Melding	Sheep	570	25000	Decrease
	Goat	450		
	Cattle	123		
	Yak	1		

Villages	Kind of livestock	Population per village	Av. Income/HH	Trend
	Equids	18		
Barisko And Nanaopa	Sheep	500	30000	Decrease
	Goat	400		
	Cattle	250		
	Yak	5		
	Equids	100		
Khomera	Sheep	400	80000	Decrease
	Goat	500		
	Cattle	150		
	Yak	1		
	Equids	150		
Pano	Sheep	1000	15000	Decrease
	Goat	1000		
	Cattle	600		
	Yak	1		
	Equids	60		
Kushumal	Sheep	300	20000	Decrease
	Goat	200		
	Cattle	40		
	Yak	1		
	Equids	15		
Baghicha	Sheep	350	15000	Decrease
	Goat	200		
	Cattle	150		
	Yak	1		
	Equids	60		
Yuncheng	Sheep	90	30000	Decrease
	Goat	80		
	Cattle	50		
	Yak	1		
	Equids	40		
Badapa	Sheep	16	25000	Decrease
	Goat	17		
	Cattle	2		
	Yak	2		
	Equids	1		
Surbo	Sheep	16	30000	Decrease
	Goat	17		
	Cattle	2		
	Yak	2		
	Equids	1		

Exhibit 16: Livestock population at Tormik Valley (Kashipa - Melding)

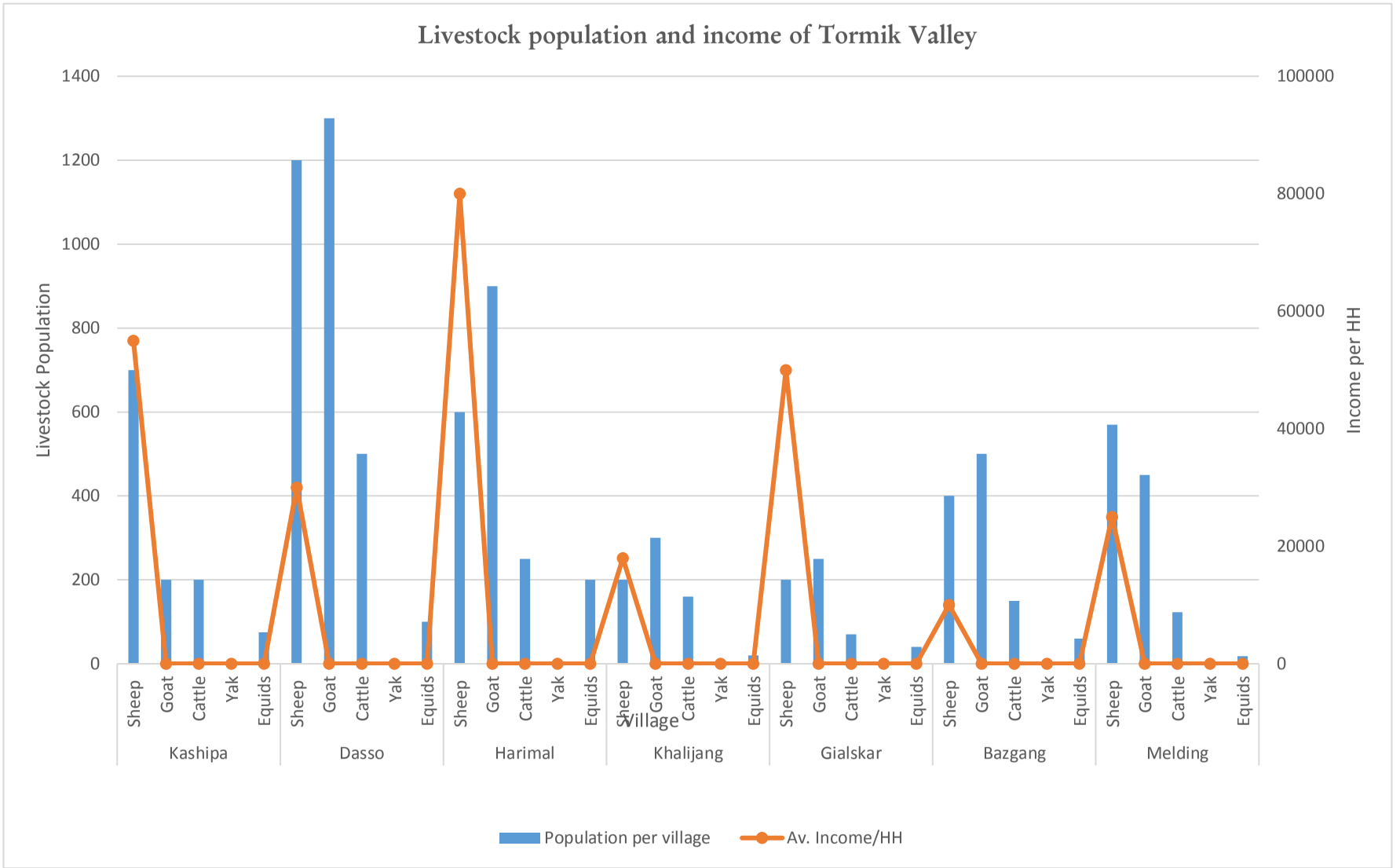
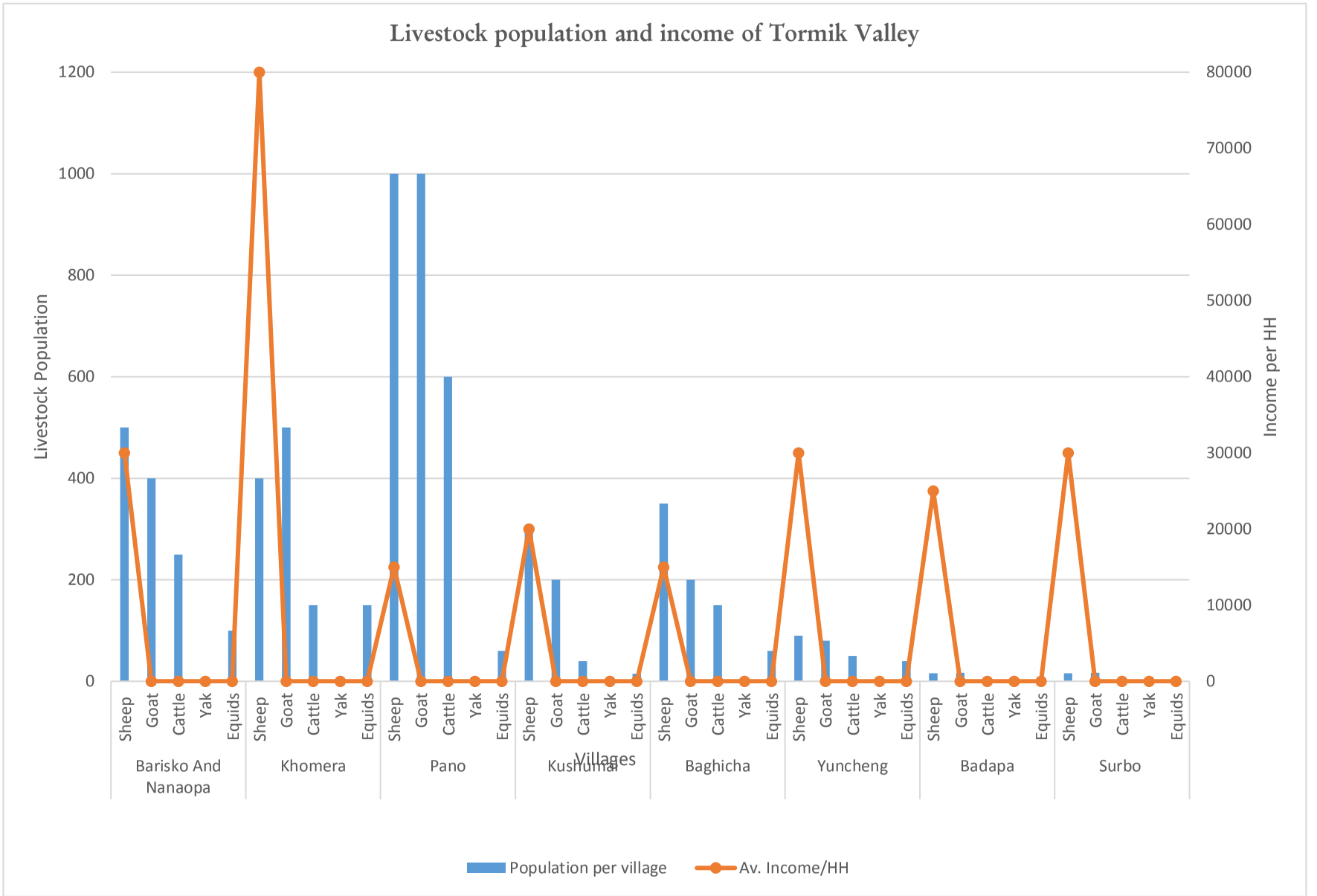


Exhibit 17:: Livestock population at Tormik Valley (Barisko/Nanaopa - Surbo)



2.5. Pastures

Animal rearing dominates land use with pastures and water management being guided by customary rules in Tormik Valley. Pastures haring within two or more villages ensuring the common access rights also guided by customary rules. Shared pasture often borders two or more villages. Local community depend upon pastures for livestock herding, fuel wood collection, medicinal plants harvest, honey and other consumable products on the basis of rights to access. Most of the pastures are located at the more or less same elevation and surrounds both sides of water sheds in the villages so in such cases same numbers of animals from each village have the chance to graze on all the pastures at same time which advocates the unique and un peculiar structure of Exhibit No.18.

Local community of Tormik valley reported only vertical transhumance patterns in the area during FGD interviews with seasonal movements from Top Mountain pastures to downside. Vertical transhumance either guided by shepherd or family members is customary practice to avoid grazing of livestock on fields. During springs, when the fields are ploughed and grains are sowed. Consequently, household's livestock is moved out of villages to the lower pastures, free of snow, to protect cultivated areas from animal browsing. As the season advance, livestock is gradually moved at higher elevation to the summer pasture (July-August) above the timberline (4500 m a.s.l.). In the meantime, crops are grown and finally harvested. Then, livestock gradually return to lower pastures and to stables at village levels (November). There, they stay during all winter (November – March) until successive spring, feeding on the crop residuals and hay collected during summer stored and dried by the households. For the farm protection from browsing prior to its movement during early spring, linear hedge of Russian olives are common on the terraces of agriculture patches.

It is customary to keep all the dairy products as a payment or exchange the 50% for a certain amount of grains in the case when livestock is herd by shepherd in the pasture. Such pastures have only few huts in them. Contrary to it, villages where number of animals is not very large, several families might join together their livestock, each keeping them for one/two weeks or pre-settled time. Usually several huts are located in such pasture zones.

Another customary practice exercised to avoid the livestock of the neighboring villages which don't have access rights on particular pasture is the penalty. If livestock of one village moves to pasture of neighboring village intentionally, then penalty has been fixed by village community according to the loss.

The FGD interview indicates that only 22% pastures of Tormik valley are healthy while other 78% are partially are degrading gradually. Decline in health of pastures is direct indicator of unsustainable harvesting practices due to increasing local population (Exhibit No. 11) fueled by climate change.

Uncontrolled grazing and other consumable products irrespective of decreasing productivity allow them to earn handsome amount for subsistence. Indirectly it also indicates the less snow and shift of rainy seasons which contributes to its low productivity. Barren patches among the pastures are notable features indicating the removal of top soil as a result of flooding and landslides. Collecting all the facts mentioned by local community and commonly reported in literature provokes the need of managing zones of rotational grazing in the pastures and determining the maximum number of each kind of livestock according to carrying capacity of pastures while keeping pace for wild herbivores reptiles and rodents to thrive.

Exhibit 18: Assessment of grazing pressure from each livestock classes on pastures of Tormik Valley

Pastures	Village	Other Uses	Status	Grazing Period	Kind of Livestock				
					Goat	Dairy Cattle	Yak	Equids	Tot
Dunser	Kashipa	Fuel wood and medicinal plants	PD	Jun-Sep	300	100	100	2	502
Yalmo		-do-	-do-	-do-	300	100	100	2	502
Burchang	Dassu	-do-	-do-	May-Oct	1200	1300	500	8	3008
Rabonlangthang		-do-	-do-	-do-	1200	1300	500	8	3008
Dafangus	Harrimal	-do-	H	-do-	600	900	250	11	1761
Pakora		-do-	-do-		600	900	250	11	1761
Mahlan		-do-	-do-		600	900	250	11	1761
Khitangmishang		-do-	-do-		600	900	250	11	1761
Shanichan		-do-	-do-		600	900	250	11	1761
Broq ral		-do-	-do-		600	900	250	11	1761
Tani		-do-	-do-		600	900	250	11	1761
Khalijang lass	Khalajing	-do-	PD	Mar-May Jun-Oct	200	300	160	2	662
Sarksa		-do-	PD		200	300	160	2	662
Schango		-do-	PD		200	300	160	NA	660
Blaghar	Gialskar	-do-	PD	Apr-Oct	200	250	70	NA	520
Railuma	Bazgan	-do-	PD	Dec-Apr	400	500	150	NA	1050
Soghas	Melding /Toq	-do-	PD	Jun-Aug Aug-Sep Sep-Oct	50	40	15	NA	105
Cerghoonma		-do-	PD		500	400	100	NA	1000
Saarska		-do-	PD		20	10	8	NA	38
Barooq	Bariskor/Nanopa	-do-	PD	Mar-Jun Jul-Oct	500	400	5	NA	905
Chahoo		-do-	PD		500	400	5	5	910
Siathang		-do-	PD		500	400	5	5	910
Nirmo		-do-	PD		500	400	5	5	910
Yalbroq	Khomera	-do-	PD	Mar-Jun Jul-Oct	400	500	150	1	1051
Khaishoo		-do-	PD		400	500	150	1	1051
Pakora		-do-	PD		400	500	150	1	1051

Broqzgo		-do-	PD		400	500	150	1	1051
Baraho	Pano	-do-	PD	May-Oct	NA	NA	NA	NA	0
Haltani		-do-	PD		NA	NA	NA	NA	0
Choghothagma		-do-	PD		NA	NA	NA	NA	0
Niarmo		-do-	PD		1600	1000	600	1	3201
Tani	Kushmal	-do-	PD	May/Jun-Nov	300	200	80	1	581
Laskorirantak	Baghicah	-do-	PD	May-Jun July-Oct	350	200	150	2	702
Pakora		-do-	PD		350	200	150	2	702
Blagzho Nala		-do-	PD		NA	NA	NA	NA	0
Carghonma		-do-	PD		NA	NA	NA	NA	0
Khampalas	Yunchung	-do-	PD	Mar-Jun/Oct	90	80	50	1	221
Sarfa Khar		-do-	PD		90	80	50	1	221
Zaghar	Badapa	-do-	PD	Mar-Oct	1100	1200	170	2	2472
Braghar		-do-	PD		1100	1200	170	2	2472
Skno		-do-	PD		1100	1200	170	2	2472
Blagxo	Surbo	Medical Plants, wood	PD	May-Oct	150	180	60	2	392
Gancer		-do-	PD		150	180	60	2	392
Torkilung		-do-	PD		150	180	60	2	392
Loqpar		-do-	PD		150	180	60	2	392

Exhibit 19: Grazing pressure by livestock on pastures of Tormik Valley

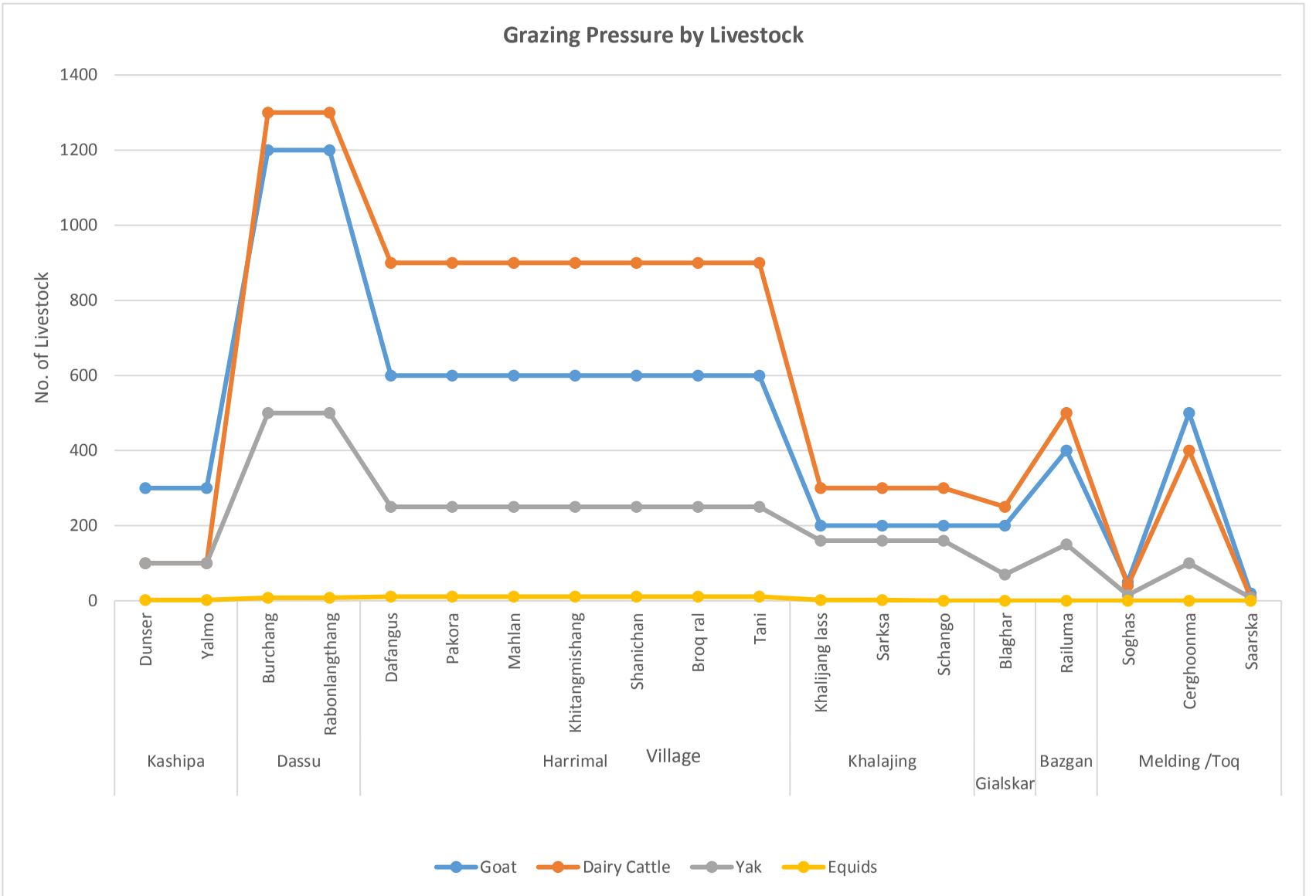
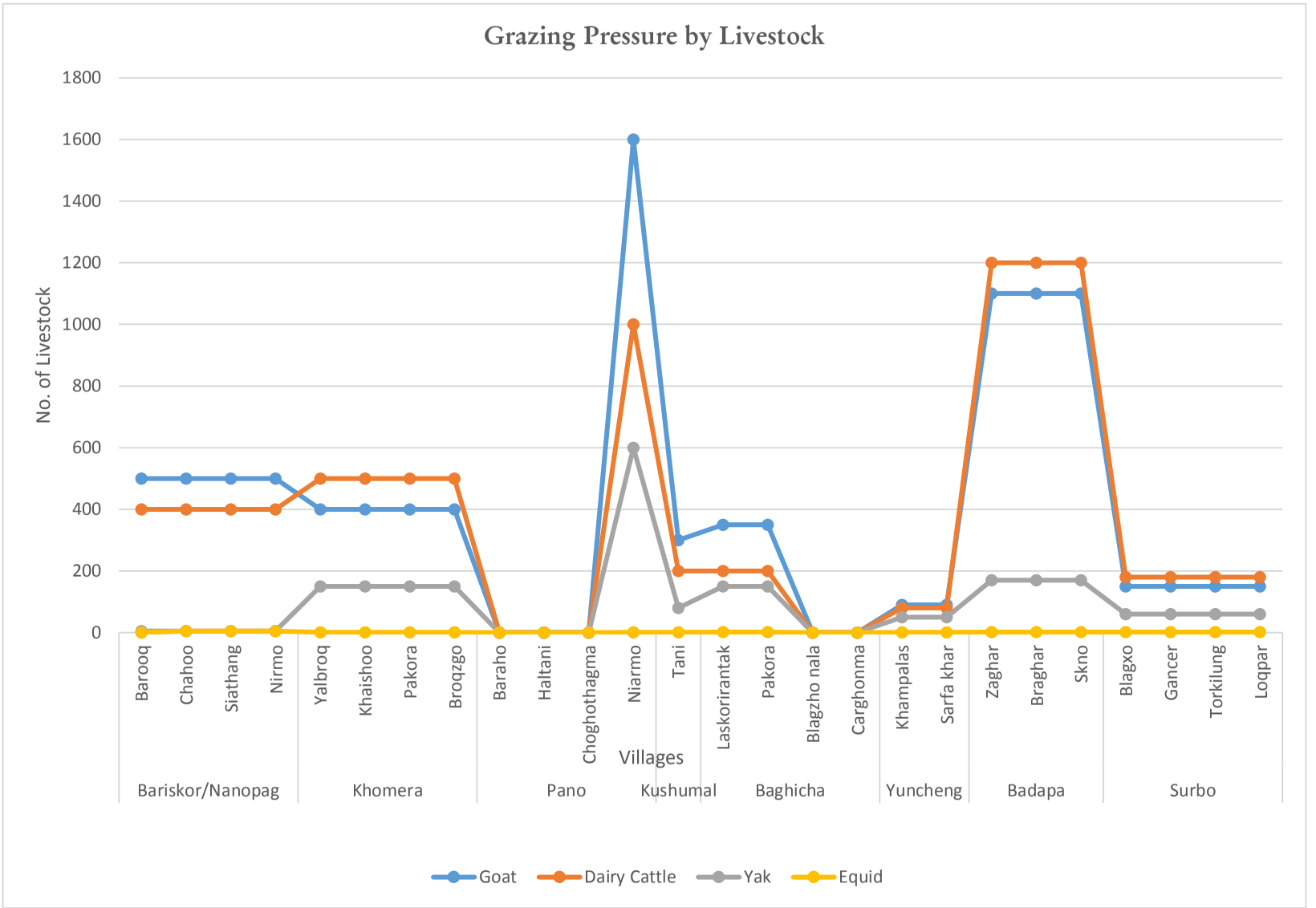


Exhibit 20: Grazing pressure by livestock on pastures of Tormik Valley



2.6. Fuel Wood Collection/ Timber Harvesting

Tormik valley which lies at humid south west side of CKNP has comparatively rich forest with approximately 41 km^2 vegetation cover and its average ABG is 3411.1$MgKm^{-2}$ and CAI of 902.3Mg/year (Ferrari, 2014). Vegetation cover is 60.1% (36.1% grasslands, 7.6% close forest, 4.4% open forests, 12% for both scattered and sparse vegetation).

As a consequence of increasing population expansion of villages is common phenomenon in Tormik like other valleys and thus construction of settlements/houses is also on rise. The timber for construction purposes is either purchased from local timber market or from natural/artificial plantations (Exhibit No. 21). Tormik which is less rich in forest reserves timber harvesting is usually regulated for its harvest in few places at Tormik valley and represent an important share in total household livelihood revenues. However, in practice, this is hardly happening and locals decide by themselves where and how much to cut (FGD interview, 2016). It is important noting that use rights are maintained even by households now residing in nearby villages/cities. The usual amount harvestable is around 100/200 logs per household per year in Tormik valley. From a large tree, locals usually obtain around 50 logs. The trees harvested for timber in each village of Tormik valley are listed in Exhibit No. 22. The value of a large tree harvested, divided into logs and transported to the nearest city (Skardu), can vary between 100,000 Rupees (Picea) and 125,000 (Pinus) depending upon type and quality of wood.

Tormik valley which lies at southern side of CKNP has comparatively vegetation as compared to northern sides of CKNP. The natural forest around Tormik comprised of 70% Junipers, 77.6% coniferous and 15.1% broad leaves and also the artificial plantation sites of *Poplar* spp. Poplar varieties are common plantations aided significantly to alleviate stress on natural forests. They are preferred due to high annual biomass, higher pest resistance, site adaptability, and easy vegetative propagation has made poplar a commercially valuable energy crop. Poplars also produce higher amounts of energy than other feed stocks and are predicted to displace more gasoline and diesel than shrubs and other crop remnants. Walnut (*Juglansregia*) is a slow growing tree with approximate increment of 1m in diameter per 60 years (Sheikh, 1993). It is also cultivated on the private lands for valuable timber and fruits. Old apricot trees either having low productivity due to age or disease is also harvested for same purpose. Among the natural forest community depend upon slow growing juniper species both for timber and fuel wood, Artemisia, Sea-buckthorn and other vegetation.

Among the alternative fuel wood resources, electricity is the only source which is partially used depends upon availability of electricity. According to the survey result, in 93 % villages of Tormik partially use electricity depends on availability of electricity which helps them to save 250kg firewood. Adequate potential for electricity generation is available in the valley and according to the local people it can be the best substitute firewood and easy/quickest way to reduce pressure on natural resource.

Customary laws are being followed in the valley for exploitation of natural resources. They allow the collection of fuel wood and timber up to need basis only. Although it does not allow sale of timber but also not address the maximum amount of wood harvest from the buffer area.

Moreover, customary laws have no rules regarding the types of floral species that can be harvested therefore juniper conservation is becoming an issue. Juniper is harvested extensively by local community without taking into consideration its slow growth. There are several other gaps in customary laws which provoke the need of revitalization of these laws in addition to reinforcement of statutory laws essential for natural resources conservation and restoration. There is strong need to quantify the magnitude of the chronic small-scale disturbances as well as large scale disturbance as a key component of landscape quality and incorporate the findings into laws to ensure sustainable and healthy environment in order to mitigate the haphazard changes of climate.

Exhibit 21: Timber harvesting and use at Tormik Valley

Village	Houses constructed in last 5 years (2010-2015)	Number of trees used	Tree species used
Kashipa	18	25	Poplar
Dasso	10	35	Poplar
Harimal	50	50	Poplar
Khalijang	20	50	Poplar
Gialskar	10	50	Poplar
Bazgang	8	30	Poplar
Melding	30	40	Poplar
Barisko/Nanaopa	25	50	Poplar
Khomera	10	45	Poplar
Pano	25	25	Poplar
Kushumal	10	55	Poplar
Baghicha	2	50	Poplar
Yuncheng	2	25	Poplar
Badapa	20	35	Poplar
Surbo	8	20	Poplar

Exhibit 22: Summary of fuel wood harvest and consumption in Tormik Valley

Village	HH	Consumption Per Household (Mg yr^{-1})			Consumption Per Village (Mg yr^{-1})		
		Winter	Summer	Total	Winter	Summer	Total
Kashipa	120	0.88	1.32	2.2	105.6	158.4	264
Dasso	150	0.816	1.224	2.04	122.4	183.6	306
Harimal	65	1.92	2.88	4.8	124.8	187.2	312
Khalijang	80	0.976	1.464	2.44	78.08	117.12	195.2
Gialskar	33	0.88	1.16	2.04	29.04	38.28	67.32
Bazgang	37	0.848	1.272	2.12	31.376	47.064	78.44
Melding	78	1.04	1.56	2.6	81.12	121.68	202.8
Barisko/Nanaopa	60	0.8	1.2	2	48	72	120
Khomera	60	1.12	1.68	2.8	67.2	100.8	168
Pano	60	0.96	1.44	2.4	57.6	86.4	144

Village	HH	Consumption Per Household (Mg yr^{-1})			Consumption Per Village (Mg yr^{-1})		
		Winter	Summer	Total	Winter	Summer	Total
Kushumal	40	1.52	2.28	3.8	60.8	91.2	152
Baghicha	20	1.776	2.664	4.44	35.52	53.28	88.8
Yuncheng	45	1.36	1.64	3	61.2	73.8	135
Badapa	70	1.2	1.6	2.8	84	112	196
Surbo	70	1.44	2.16	3.6	100.8	151.2	252

Exhibit 23: Annual fuel wood harvest, Tormik valley

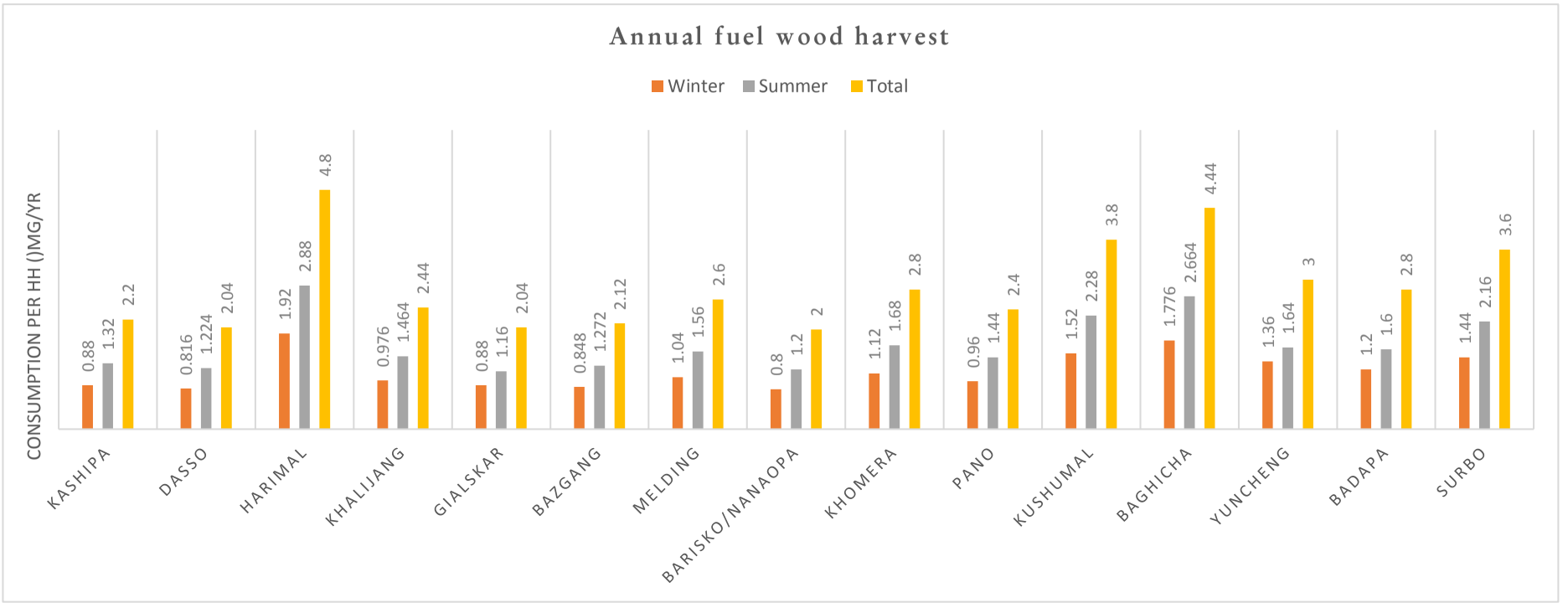


Exhibit 24: **Details of fuel wood harvested per household from several sources (Mg/HH/yr)**

Village	Artemesia		Seabuckthron		Juniper		Shrubs		Dung		Riverbank		Natural Forest		Fruit Trees		Plantation		Other Riparian Tree	
	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W
Kashipa	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0
Dasso	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0	0.0	0.0	0.4	0.6	0.1	0.2	0.1	0.2	0.0	0.0
Harimal	0.0	0.0	0.5	0.7	0.6	1.0	0.0	0.0	0.3	0.5	0.0	0.0	0.3	0.5	0.2	0.2	0.0	0.0	0.0	0.0
Khalijang	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.2	0.2	0.2	0.3	0.0	0.0	0.2	0.2	0.1	0.2	0.0	0.0
Gialskar	0.2	0.1	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.24	0.1	0.1	0.1	0.2	0.0	0.0
Bazgang	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.3	0.4	0.2	0.2	0.0	0.0	0.2	0.3	0.0	0.0
Melding	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.4	0.5	0.7	0.0	0.0
Barisko	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.4	0.0	0.0	0.2	0.4	0.2	0.2	0.0	0.0	0.0	0.0
Nanaopa	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.2	0.2	0.5	0.7	0.0	0.0
Khomera	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.4	0.0	0.0	0.2	0.2	0.2	0.4	0.2	0.2	0.0	0.0
Pano	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.2	0.4	0.0	0.0	0.4	0.6	0.3	0.5	0.2	0.4	0.0	0.0
Kushumal	0.0	0.0	0.0	0.0	0.6	1.0	0.2	0.4	0.2	0.4	0.0	0.0	0.0	0.0	0.3	0.5	0.3	0.5	0.0	0.0
Baghicha	0.5	0.3	0.2	0.2	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.2	0.2	0.0	0.0	0.0	0.0
Yuncheng	0.2	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.2	0.2	0.4	0.3	0.5	0.0	0.0
Badapa	0.0	0.0	0.0	0.0	0.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.0	0.2	0.2	0.0	0.0	0.0	0.0
Surbo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

2.7. Mining

The presence of unique and specialized geological features designates the entire region of GB having most suitable geological environments as compared to the rest of the world where mineral deposits of economic grade are being extracted. These include metallic, non-metallic, energy minerals, precious/dimension stones and different rocks of industrial use. Adequate deposits of dimension stones are found in Ghizer, Skardu, Hunza/Nagar and Gilgit Districts, besides Serpentinite deposits at District Skardu. Presently these are being mined using indiscriminate blasting techniques which not only destroy this natural resource but also result wastage of more than 75% of the total yield.

In Tormik valley various gemstones were identified in early nineties and group of people remained associated with mining but in comparison to other CKNP, such as Astak and Shiger it couldn't be materialized as income source. However, on average 3-4 groups from villages are involved in mining activities but income earning is low from mining due to lack of mining techniques.

Exhibit 25: Economic revenue from Mining in Tormik Valley, 2016

Village	Since	No of Mining Groups	Mining products	Revenue/Yr/ Village (PKR)	Revenue/Yr/ Group (PKR)
Kashipa	-	3	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite Zabarjat	NR	NR
Dasso	-	3	-do-	--	--
Harimal	-	3	-do-	--	--
Khalijang	-	5	-do-	--	--
Gialskar	-	5	-do-	--	--
Bazgang	-	4	-do-	--	--
Melding	-	5	-do-	--	--
Bariskо/ Nanaopa	-	5	-do-	500,000	100,000
Khomera	-	NA	NR	--	--
Pano	-	10	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite Zabarjat	600,000	60,000
Kushumal	-	NA	--	--	--
Baghicha	-	NA	--	--	--
Yuncheng	-	2	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite Zabarjat	700000	350,000
Badapa	-	2	Aquamarine, Tourmaline, Topaz, Ruby, Fluorite, Beroj, Quartz, Morganite Zabarjat	--	--

2.8. Tourism

Tourism can be vital source of revenues and employment if appropriate revenue-sharing mechanisms are put in place to enhance the benefits for local communities and pro-poor impacts of tourism.Infrequent visit of tourist is reported by the local community; however, the meadows and alpine pastures are stunning and can fascinate domestic and foreign tourist. Due to lack of interpretation, these meadows remained hidden for centuries. Projection of the meadows can turn it to famous touristic spots through interpretation which can help flow of tourist in the valley and create new livelihood opportunities.

ASSESSMENT OF CLIMATE CHANGE IMPACT FOR SUSTAINABLE USE OF NATURAL RESOURCES IN CONTEXT OF INDIGENOUS KNOWLEDGE

3. ASSESSMENT OF CLIMATE CHANGE IMPACT ON NATURAL RESOURCES

Climate change is projected to have a significant effect upon the future rate of biodiversity loss. There is a growing global consensus that the rate of climate change has already exceeded the capacity of some species and ecosystems to adapt naturally, and is close to exceeding that of many more. There is therefore an urgent need to identify the key mechanisms underpinning climate change impacts on natural resources in order to best select climate change adaptation strategies. It is also essential that the scale of these changes is clearly communicated to policy and decision-makers. Furthermore, it is recognized that climate change will have increasingly significant direct impacts on local communities, biodiversity and that increased rates of species extirpations are likely. The growth of many crops and weeds is being stimulated. Migration of plant and animal species is changing the composition and structure of local ecosystem. This will have negative consequences in terms of services provided by these species and ecosystems provide, especially in areas where the majority of the human population are the rural poor and dependent on direct exploitation of these ecosystem services.

3.1. Climate Change in the Perspective of Indigenous Knowledge

People at Tormik valley are well aware of changes coming as result of climate change The main concern of local community discussed during the FGD's was the adaptations strategies that are required to mitigate the effect of climate changing. Data obtained shows that local climate is changing but these changes are not very pronounced and can be reversed if we do proper and timely actions. Change in length of season has been reported by the local community with increased temperatures and prolonged summer. Local community has also reported an increase in the frequency of disastrous activities. According to scientific investigations these higher temperatures are degrading the permafrost layers, causing slope instability, rock falls, landslides and avalanches.

Although climate change has both positive and negative impacts, the issue is that the negative consequences may be more pronounced in mountains, both for the communities and for their environments, requiring more awareness, more attention and quicker reaction than elsewhere. Equally, the consequences of negative impacts may go beyond the boundaries of mountains and affect people and ecosystems in the surrounding lowlands.

3.2. Temperature Variability and Seasonal Shifts

Gradual increase in temperature has been reported by local community during last 30 years most visible evidence of temperature increase is the earlier melt out of snow cover and glaciers across the region which has become more rapid over last one decade. This increasing temperature is responsible for disastrous activities and glacier recession which is getting frequent day by day according to the local community. Warming temperatures have led to effects as diverse as altered timing of bird migrations, increased evaporation, and longer growing seasons for wild and domestic plant species. Increased temperatures often lead to a complex mix of effects. Warmer summer temperatures have led to longer forest growing seasons but have also

increased summer drought stress, vulnerability to insect pests. Like other valleys, survey result shows a swift increase in temperature has been observed over last one decade of Tormik. According to the locals, increasing temperature is reason for increasing summer season length. Local community assesses these changes through daily and seasonal activities e.g. ripping of crops, melting snow/glacier, human diseases etc.

3.3. Precipitation

In addition, changes in climate, such as reduced snowfall and increased rainfall, are reported across the area by local community, but solid evidence of the impact is difficult to ascertain. Changes in precipitation level and the size of storms affect plant-available moisture, snowpack and snowmelt, stream flow, flood hazard, and water quality. Rainfall variability and periodicity has changed since last 30 years with most profound effect since last ten years. High speed and late rains have been observed by the local community which accelerates the crop diseases and infections. It shows that pests are getting adaptable to seasonal shift and variability more than other organisms and contribute to increased economic loss of crops and fruit trees.

According to local community frequency of snow fall has significantly declined and diminishing year by year. As a resultant decline in natural vegetation growth at sub-alpine pastures more than alpine pastures. Besides it leads to declined water quantity and quality.

3.4. Drought

Drought is considered as the most damaging and costliest type of natural disaster, especially in mountainous regions where water quality and quantity is regulated solely by the precipitation with a far-reaching economic, environmental and social impact leading to food and water insecurity, reduced agricultural productivity, damage to forests, pastures, wildlife, livestock, fish and food price hikes.

In Tormik valley drought is not reported in all villages, but an increase is reported where it has been occurred. It is believed that due to warmer temperature the snow deposits are melting before time and in an increasing speed. Altered timing of rain is presenting a cumulative effect on drought which results into the huge quantity of water by the start of summer. This quantity decreases and ultimately dries out as the season proceeds. The irregular availability of water halts not only the agricultural productivity but also natural regeneration of forest and pastures. It is difficult to mitigate the issue by water uplifting from rivers due to the required capital.

The local community so-far is unable to assess the intensity of drought and to adapt it accordingly. Therefore, to enhance the resilience of local community and ecosystem it is necessary to incorporate the following actions for CKNP operational plan.

a) Devise the research to determine natural indicators to measure the intensity of drought for local community.

b) Evaluate the proper management actions/ interventions to improve preparedness of community for drought.

3.5. Flood

Changes in the climate have had an influence on the magnitude and frequency of flooding in rivers in Gilgit-Baltistan. With respect to snow and glacier melt, the magnitude of temperature-changes during the spring and summer are sufficient to have caused a major change in the flood-potential of catchments. Changes in winter temperatures have influenced the amount and altitudinal distribution of snow available for melt in the subsequent season and this has increased the magnitude of flood which is on average 29%, the flood frequency has also increased by 23%.Since sharp change has been experienced by local community over last half decade therefore infrastructure damage, land erosion cum damaging crops and plantations is more frequent now than last 30 years. Communities suggested actions are to mitigate damage flood risk through maturate the irrigation system with building concrete walls and also protective walls on the main river. It is also important to mitigate the high risk of flood through construction of protective wall along the arable land and side.

3.6. Landslides

Floods are the regulating factors of the land slides. With increase in the temperature and rain intensity, the soil patches lose their compactness. The increased Aeolian movements remove the top layer of soil and rains washes this layer from the mountains and move it to the nearby rivers and ultimately it becomes the part of Indus basin.

According to the survey conducted to gather information about the driving factors of climate events by local community, it is observed that landslides have increased considerably (25%) since last 30 years. These landslides wither soil from mountains, pastures and less vegetated areas and make the land barren. It destroys the infrastructure facilities such as roads, bridge, and sometimes buildings along the edges. Agriculture is the most negatively impacted sector by land sliding because landslides often cut down water supply by blocking/ damaging irrigation channels which are built on the mountainous slopes.

Exhibit 26: Climate change at Tormik Valley in the perspective of indigenous knowledge

Factors	Status	Change (days/ % age)	Trend		
			30 y ago (1985)	10 y ago (2006)	Future prediction
Rain	Decrease	22	Normal/No change	Decreasing	Decreasing
Snow	Decrease	40	No Change Observed	Sharply decreasing	Decreasing
Temperature	Increase	9	Normal	Increasing	Increasing
Summer season duration	Increase	15	No Change Observed	Increasing	Increasing
Winter season duration	Decrease	15	Slightly decreasing but no considerable change seen	Decreasing	Decreasing
Glacier recession	Decrease	17	No visible change observed	Decreasing	Increasing

Factors	Status	Change (days/ % age)	Trend		
			30 y ago (1985)	10 y ago (2006)	Future prediction
Land slides	Increase	25	Infrequent	Increasing	Increasing
Flood frequency	Increase	24	Normal/No change observed	Increasing	Increasing
Flood magnitude	Increase	29	Infrequent	Doubled since last decade	Increasing
Drought	Increase	15	Increasing	Normal but slight increase observed	Increasing
GLOF	N/A				

3.7. Pastures

Regional climate scenarios for CKNP valleys shows prolonged growing seasons and shifts in temperature and precipitation as currently happening in the valleys around CKNP are likely to affect plant phenology and growth. Despite the better and prolonged growth seasons range lands that serve as pastures and grazing lands are degrading annually. In the alpine and sub alpine pastures 14% degradation has been observed as result of climate change, such as declining amount of snow causing declining vegetation growth etc. Mid and low land grazing areas have declined 18.5%. Apparently, less degradation in alpine pastures are reported in response to changed climate scenarios that shows its more adaptability.

It can be assumed that many plant species are migrating vertically for lower temperature increasing the plant diversity at higher alpine regions and growing competition by highly productive species at low lands. The local community reported probable causes for pasture degradation as vertical shifts in plant growth and unsustainable livestock management.

On the other hand, warmer temperatures and increased microbial activity are likely to contribute in the loss of carbon from alpine soils. Since a higher amount of carbon is stored in soils than in the aboveground biomass above tree line this indicates that alpine ecosystems may turn into carbon sources rather than sinks.

Exhibit 27: Impact of climate change on pastures of Tormik Valley

Pastures	Status	Change (days/ %age)	Trend			Adaptation Measures by local community
			30 y ago (1985)	10 y ago (2006)	Future prediction	
Alpine and sub-alpine pastures	Degrading	14	Less degraded as compared to present	Degrading	More degradation is expected	Rotational grazing
Mid and low land grazing	Degrading	18.5	Less degraded as	Degrading	More degradation	Irrigation through construction of

Pastures	Status	Change (days/ %age)	Trend			Adaptation Measures by local community
			30 y ago (1985)	10 y ago (2006)	Future prediction	
			compared to present			irrigation channels

3.8. Biodiversity

3.8.1. Agriculture and Fruits

Climate factors such as temperature, precipitation, CO_2 concentrations, and water availability directly impact the health and well-being of fruit trees and agriculture crops. With increased temperature and CO_2, crops such as wheat, maize, barley, buckwheat, fodder etc. and fruit trees are likely to grow more rapidly due to increased photosynthesis. It is also influencing insects, disease, and weeds, which in turn decreases agricultural production as currently happening in Tormik valley. Aided to these additional stresses is offered by variable precipitation and irrigation water. Early and rapid snow melting accompanied by irregular rainfall followed by drought declines the productivity.

Farmers reported rapid increase in weeds and pests during last 10 years which shows positive correlation with the increase in temperature. Thriving chances increases for the pests in warm climate. Disease pressure on crops is continuously at increase with earlier and prolonged summers and warmer winters, which allowed proliferation and higher survival rates of pathogens and parasites. The marketable yield of many commercial crops e.g., potatoes, walnut, apricot, mulberry, almonds etc. is declined for Tormik valley and become more sensitive to climate change than agriculture crops.

Local farmers observed the productivity and economic decline which shows that they are aware of climate change impacts but at the same time these people have no idea about the climate resistant seed varieties. To keep the tinge of organic farming and pristine local ecosystem the community must be trained about the natural and biological removal of pest and weed species.

3.8.2. Forest

Climate change directly and indirectly affects the growth and productivity of forests. Direct effect embraces the change in atmospheric carbon dioxide due to increased temperature and change in precipitation. The indirect effects account for the complex interactions in forest ecosystems. Climate also affects the frequency and severity of many forest disturbances such as cutting, removal of fruits etc. Natural forest stand of Tormik valley represents a mix of woody and non woody vegetation. Major floral species are Pine, Junipers, Poplar, Fraxinus, Olea, Berberis, Wild Rose, Cotoneaster, Sea buckthorn, Artemisia, Stipa. Regeneration is also very slow and mostly browsed by livestock which is posing fuel fast degradation of natural forest.

Local community has reported the following impacts of climate change on the forest

a) Rising temperature and CO_2 as a consequence of climate change has impacted the local forest ecosystem of Tormik by providing prolonged growth season which seems to enhance its productivity apparently. But this rising temperature can lead to phonological shifts of the alpine species and they will become locally or regionally extinct since they are unable to shift to higher altitudes. The increased CO_2 is becoming useless with increased temperature because of water unavailability throughout the season due to early and rapid melt out of snow and shift in rain season.

b) The nullahs branching out from glaciers and springs are the major irrigating channels for the agriculture crops and the forest species. With increasing temperatures these channels dry out and cause water stress augmenting the forest degradation in Tormik valley.

c) Along with this, warmer springs has the chance to extend the range and lifetime of many pests that stress trees and crops and at the same time it decreases the available water quantity throughout the year.

Considering all these facts it can be concluded that local community knows about the impact of climate change on the forest but don't know about the mitigation strategies. These strategies are needed to be designed by thorough research and impact. Long term impact of the small-scale forest disturbances which cannot be observed via satellite systems must be assessed and counter measures should be adopted. With the increasing temperature and drought, it is obvious that some species will not be able to adopt and flourish in the ecosystem so there is need to assess that how long the present floral species will survive and which species should be planted to continue the forest sustainability. This entire question need research based answer and capacity building of the community accordingly to ensure the ecosystem viability.

3.8.3. Wildlife and Associated Biodiversity

The multiple components of climate change are anticipated to affect all the levels of biodiversity, from organism to biome levels. Impact of Climate change is projected to become a progressively more significant threat in the coming decades. In addition to warming temperatures, more frequent extreme weather events and changing patterns of rainfall and drought can be expected to have significant impacts on biodiversity.

In Tormik valley, once rich faunal diversity experienced rapid decline both in number and diversity. Ibex is the most common ungulate in the valley but its population is reported on decline with greater pace since last decade due to several unknown reasons. Conservation committees are though formed in the valley with purpose to enhance conservational practices but due to lack of capacity and knowledge about effective conservational practices their progress is unsatisfactory. It indicates that either climate is posing pressure on the survival of species or species may have the difficulty in adapting to the changing climate. In either case comprehensive study is required to assess the breeding potential and adaptability of the species in changing climate.

Considering the birds and butterflies it has been reported by the local community that these species were common a long time ago, but now several of them are not common and

experiencing decline. The apparent reasons are the absence of favorable climate for prey species, decline in seed crops, removal of forests and floral species. No assessment has yet been done which provides the complete biodiversity information about the Tormik valley. Therefore, it is difficult to prioritize the species for conservation actions and to monitor the effect of climate change on the small and large animals.

3.8.4. Fishery

Climate change is likely to affect fisheries and aquaculture, their dependent communities and related economic activities along three main pathways. Many fisheries-dependent communities already live a precarious and vulnerable existence because of poverty, lack of social services and essential infrastructure. The fragility of these communities is further undermined by overexploited fishery resources and degraded ecosystems. Tormik valley is not dependent on the fishery for subsistence and therefore local community has no idea about the impact of climate change on the fishery. The implications of climate change for food security and livelihoods in the neighboring community of Tormik are needed to be evaluated.

3.9. Water

GB is the largest fresh water reservoir of Pakistan due to high precipitation rates. Owing to the recent climate changes the water availability has been changed. Snow fall has declined up to 40% according to the perception of local community but rain fall is abnormal increase. The altered precipitation pattern has caused the differential availability of water during different seasons.

Exhibit 28: Impact of climate change on biodiversity of Tormik Valley

Biodiversity	Status	Altitudinal Shift	Trend			Adaptation Measures by local community
			30 y ago (1985)	10 y ago (2005)	Future prediction	
Agriculture crops and fruit trees	Degrading	N/A	No considerable change observed	The most common available fruit production is on decreasing due to diseases and windy weather in the blossom season	Irregular water availability due to increased flood, diseases and irregular precipitation patterns will lead to productivity decline.	The community is using pesticides and local ways to protect agriculture products from varies common diseases
Natural Forest	Degrading	Increasing	Forest patches were dense and healthy	Increasing	More degradation is expected	Community is working through VCCs, such as ban on deforestation, a specific amount of firewood from the forest is allowed per household.
Wildlife						
Ibex	Decreasing	Increasing	The Ibex population almost depleted	Population was relatively good in number but illegal poaching proved a disaster	Population will increase if conservation practices adapted strictly, otherwise complete depletion is expected. Astor Markhor was existing in the area some decade earlier but now the existence has finished in the area	Nil
Urial	N/A	–	--	--	--	--

Biodiversity	Status	Altitudinal Shift	Trend			Adaptation Measures by local community
			30 y ago (1985)	10 y ago (2005)	Future prediction	
Wildlife						
Markhor	N/A	N/A	N/A	Population exist in the area but due to illegal poaching the species has completely depleted	N/A	Nil
Birds	Decreasing	N/A	Bird population is increasing	Population and diversity were good	Declining Natural resource and hunting can cause decrease in birds' population	Nil
Butterflies	Decreasing	-	Diversity of species has declined	Butterflies of several types were common	The trend seems to be decreasing in the future because some of the species are disappearing	Nil
Fishery	N/A					

During end summer and winter season water become scarce and leads to unsustainable water management, while in the summer season flood in the streams increase, damage water supply system and creates water scarcity coupled with poor water quality. Water scarcity can be controlled through improving/reconstructing existing water channel and edifice of new channels.

3.10. Tourism

Mountain areas are sensitive to climate change. Implications of climate change include less snow, altered rain timings, receding glaciers, melting permafrost and more extreme events like landslides. However, climate change is a severe threat to snow related sports such as skiing, snowboarding and climbing. Lower earnings in winter tourism are reinforcing economic disparities between the dependent communities and compel them to depend upon the natural resources of area as a mean of their livelihood.

Tormik valley is not among tourism preferred sight dependent because of lack of tourist attractions and facilities. However, Tormik valley has some beautiful meadows and passes connecting it to other CKNP Valleys, which can be attracting points and routs for tourists, however the local institutions need to advertise those resources.

CONSERVATION MANAGEMENT ISSUES & PROBLEM OF TORMIK VALLEY

4. MANAGEMENT ISSUES AND PROBLEMS

Present scenario of Tormik valley has reflected several issues in customary practices and adaptation to climate change. These issues directly or indirectly affect the economic situation of each household and increase their dependence on natural resources which are free of cost and in vicinity to the community as compared to market. Therefore, in order to develop an effective strategy for adaptation, it is necessary to develop capacity of local community to adapt to the changes in a way that reduces their dependency on natural resources. These adaptation approaches must then be disseminated to the communities and relevant laws up-gradation. In Tormik valley customary laws are being practiced in all villages but these laws are unable to sustain and address the suitable practices and continuously generating issues, therefore needs an up-gradation.

4.1. Agriculture

A smaller area of arable land is cultivated in Tormik Valley by traditional varieties of fodder, crops, fruit trees and commercial trees. Following issues are being reported by the local community. These issues although belongs to several sectors but all are aiding in decline of agriculture production.

1. **Small land pieces for agriculture:** Tormik valley lies on sloppy areas with increasing population land holding per household is shirking year by year. On top of that, increasing flood in the river causes land erosion degrading the arable land.
2. **Irrigation and water rights:** Customary right sabout water sharing between villages and among the households is not documented anywhere. This generates confusion and rivalry among the land holders for water needed for irrigation. Situations become worse during the spring and autumn season which foster low availability of water in streams.
3. **Low productivity:** Farmers, technical personnel, and interviewee from relevant fields unanimously reported low productivity per unit area. The common issues underlying this fact is small land, thin soil cover due to erosion, increasing pest prevalence over the crops, low fertility, water unavailability, erratic and unpredictable precipitation times, warm temperature, disasters such as landslides, floods and several other. The most important among them is use of traditional methods and seeds for cultivation.
4. **Weeds and pest:** Organic farming is an important aspect that is valued all over the world for nutrition. Local farmers are lucky enough to manage the crops and fruit production without using pesticides, insecticides and inorganic fertilizers. Animal manure and ash to be used to enrich the soil with minerals. Moreover, water in the streams also provide sufficient quantity of mineral to sustain agriculture practices. Despite of these, farmers are facing difficulties now a day due to several insect and flies' pest species which feed on the grains, fruits and other such products. Indigenous people and their knowledge is blaming climate change for increasing pest infection on fresh as well as dry seeds and fruits.

5. **Traditional practices and non-certified seed varieties:** Local farmers rely upon the traditional farming and cultivation methods. Growing crops from farm saved seed is common practice around the world and same in Tormik Valley. Farmers prefer this practice due to several reasons which includes certainty of quality, convenience, timeliness/availability, and cost. They also prefer this practice because farmers don't want to take risk on their productions. But with the progress of time keeping though cultivar performance remained same but productivity declined which demands the practices of modern farming techniques and new seed varieties.
6. **Climate change:** Climate change is exacerbating the challenges faced by the agriculture sector, negatively affecting both crop and livestock systems in Tormik Valley. Climate change induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events are adding to pressure on the local agriculture system – which is already struggling to respond to rising pathogenic infections. The changing climate is also contributing to resource problems beyond food security, such as water scarcity, pollution and soil degradation. As resource scarcity and environmental quality problems emerge, so does the urgency of addressing these challenges. Farmers are really feel helpless against the inconsistent weather even they are thinking to abandon growing maize and wheat, and cultivate cash crops like potato because that are short-duration.

4.2. Pasture

Majority of the pastures Tormik valley is reported declining. The pasture sustainability is also facing lot of pressures from livestock more than carrying capacity, medicinal plants extraction, landslides and floods. Most significant factor over last ten years similar to surrounding valleys is infrequent snow fall which declined growth of natural vegetation in alpine & sub-alpine pastures and rangeland, and largely contributing to declining livestock raring trend in the valley. One major factor is increase in population expansion contributing to pasture degradation. Though overall status of per household shows decreasing trend but with increasing nuclear family system number of livestock reportedly increasing.

1. **Baseline of flora and phenological shift:** There is no documented baseline data or inventory about the floral species of the pastures, their status and use. So, it is the need of time to develop such basic dataset which prioritize the species for conservation actions to mitigate the socioeconomic and environmental pressures. It is especially recommended on priority basis to monitor and conserve the floral species and medicinal plants affecting by climate change and showing phenological shifts. Only medicinal plants are explored and listed but there is no information on the predicted impacts of climate change over these medicinal plants and their adaptations.
2. **Gaps in customary practices:** Livestock grazing is an ecosystem service provided by the pastures. 84% pastures of Tormik valley are showing decline in productivity due to unsustainable livestock grazing practices. There are no established rules about the maximum number of livestock heads in the customary rules. Carrying capacities of these pastures have never been estimated and that's why unsustainable pressures are fueling the degradation.

Diseased animals are advised to keep away from the pastures but their water points are shared which can induce the infection in whole herds and also there is a chance of disease transmissions.

3. **Grazing timing:** Growth rateof vegetation is low in the pastures for being situated on high altitude. The peak growing season starts from June while villagers start herding from May which poses serious threat to species survival and degrade pastures rapidly. Lasting pastures can be improved only when herders understand plants' recovery needs and practice good grazing land husbandry to maintain plant health. The local community of Tormik reported the problems like weed invasion, less productivity and weakened soil health. All these issues are indicators of impatient grazing by the herders i.e. they start to graze their animals before pastures are fully grown. Herders do so to provide animals with a high-quality diet but they are unaware that short plant growth reduces bite size and the nutrient intake. Moreover, it contributes to decline in pasture productivity which is lose-lose situation only.
4. **Livestock insurance scheme:** Livestock insurance scheme is an incentive equal to the loss for the herders if their livestock get killed or attacked by the wildlife. Project based effort resulted in development of scheme but terminated as soon as the project ended. Livestock kills by predators is a burning issue although no retaliatory killing has been reported by the community, but in the absence of insurance scheme retaliatory killing of wildlife is expected. Such schemes are need to be revitalized with some revolving fund for its sustainability.
5. **Lack of zonation:** Pastures are degrading continuously but the customary laws don't have any hint of abandoning such pasture areas which hastens its decline. It is essential that grazing on pastures in the buffer area of CKNP should be controlled to maintain adequate vegetative cover that reduces erosion and permits adequate growth rate after each grazing period to ensure the health of grazed plants
6. **Harvest of medicinal plants:** Tormik Valley pastures and forest areas also have these herbs. Local community uses them for disease cure. These drugs have anti-pyretic, analgesic, anti-cancerous, anti-diabetic and several other uses. Local community is fully aware of their uses but they don't have any concept of its extraction without damaging the whole herb. Training of local community for collection, drying and usage is important.

4.3. Water

Altered precipitation patterns, warm temperatures and frequent air currents actually disturbed the water quality and quantity both. The local community at Tormik depends directly upon the rain and indirectly upon annual snowfall. Due to delayed rain timings and less annual snowfall local community is frequently facing the drought and water shortage due to increasing glacier melting and flood causing blockage of irrigation system. Moreover, torrential rains are now more frequent which on one hand increases water quantity but also cause floods and landslides in disaster prone areas thereby creating socio-ecological stress. Water pollution is increasing due to lack of sanitation/drainage system and animal sheds nearby water channels

and drinking water sources. Grey water from the local community is also getting mixed in to fresh water and degrading its quality.

1. **Drinking water:** Local community depends on fresh water supplies from glaciers and springs for drinking purposes. Sediments are continuously increasing in the water supply due to weathering of rocks and mixing of soil and grit in the area. High mineral content can induce disease in local community and their livestock. The water testing facility already established at Karakoram International University provides the free testing but local community is not very interested in the procedure due to lack of awareness.
2. **Irrigation** deficit: Like other nearest valley in Tormik Valley local community reported unstable structure of irrigation channels as well as need of new irrigation channels which is the prime reason for irrigation deficit. "Either lot of water or no water" in the water sources, the communities cannot fully utilize it for irrigation purpose. The communities in the villages have constructed irrigation channels but with increasing land fragmentation and demand for water those irrigation channels have proven insufficient. The communities cannot construction of more irrigation channels due to lack of financial resources.
3. **Water pollution mitigation:** To ensure the water quality local community should be compelled to make separate pathways for grey water ensuring that it do not mix into the fresh water streams. Hotel owners should be trained to dump the trash elsewhere instead of water while adopting ecosystem friendly approaches.
4. **Disaster management:** Climate change is deeply reshaping the landscape of disaster risk. Weather extremes such as drought, flood and landslides cause the huge economic depressions in all sectors ranging from transport to land farms. No protocols are developed yet for the villages in the surrounding of CKNP.

4.4. Forest and NTFP Issues

These sectors are as vulnerable from climate change as any other and therefore, there is strong need to assess and enhance the adaptive capacity of the forest and biodiversity.

1. **Mortality:** Decrease in snowfall has increased tree mortality and resulted degradation and reduced distribution of entire forest ecosystem. It increased the wood harvesting opportunity for the local community from Tormik for subsistence purposes at the cost of degenerating forest.
2. **Harvest pressure:** Heavy collection of timber and non-timber products from the forests allows the community to fulfill their needs. With continuously increasing population dependence of local community is also increasing on these natural resources. Majority of the area in Tormik has open canopy coniferous tree species which are unable to cope with natural changes in climate and also facing threat due to the fuel wood and wild fruits collection. This harvesting is not limited to here only but includes the removal of foliage, branches and plants cutting for livestock forage as well. Unsustainable practices and unguided approaches towards harvesting lead the ecosystem imbalance.

3. **Forest regeneration:** Climate change has shown differential approaches for the propagation dependent upon the species ecology. Warmer temperatures and increased CO_2 increased the rate of photosynthesis and thus growth but increased the pest attack is seriously stressing the forest regeneration.

4.5. Eco-tourism

Ecotourism is nature-based tourism that fosters environmental appreciation and awareness. Gilgit-Baltistan which is considered as the hub of eco-tourism incorporates a considerable number of tourists every year to generate the huge amount of revenues and alternative livelihood opportunities. In case of Tormik valley eco-tourism opportunities are available but some difficulties are prevailing regarding promotion of eco-tourism.

Following issues are being reported by the local community.

1. **Tourist accommodation:** Limited accommodation facilities compel the tourists to opt for camping in open areas. This option becomes unsuitable during the adverse weather.
2. **Visitor facilities:** Site maps, designated camping areas, information boards, sign board and other facilities are rarely available. Tormik valley does not provide tourism services and therefore they don't have the opportunity to earn the livelihood from tourism.
3. **Climate change:** Climate is a key resource for tourism and the sector is highly sensitive to the impacts of climate change and global warming, many elements of which are already being felt. Climate change is having adverse impacts on the number of tourists.
4. **Winter sports:** Time period is shrinking for skiing and other snow related activities. Rising temperatures is also reducing the viability of winter sports destinations at high altitudes in and around CKNP.

4.6. Mining

In and around CKNP in the sedimentary rocks of the mountains, huge reservoirs of gemstones and precious rocks are deposited. Local level mining is being carried out in and around CKNP. Mining area can be identified by having the holes in its mountains just like bee web. Mining is not very common but mining opportunities exist in the valley. Some groups from different valley are associate with in mining activities but income earning is low due to following

1. **Lack of modern tools and practices:** Local miners are not trained for mining. They use iron rods for excavation and mostly end up in the damaging the stones. It leads to loss of revenue not only on personal level but also on the regional and ultimately at national level.
2. **Lack of training:** Local miners have learned the methods of mining by hit and trial approach and succeeded somewhat. Nevertheless, due to lack of training they are unable to extract pure and high-quality rock. They accidently break these gemstones and thus lose the amount of profit.

3. **Value addition of Gemstones:** Gemstones are sold in raw form by the local community to the dealers on low cost due to improper cutting and polishing. Therefore, local miners lose their chance to earn huge revenues and only get a minor share.

4.7. Wildlife and Protected Areas

Institutional structures to manage wildlife and protected areas experience lot of issues due to increasing urbanization, degrading forest and natural areas. The biodiversity of CKNP and its buffer zones has the species, which are of international and national importance. Wildlife plays an important role in both ecosystem sustainability and community economics. Although trophy hunting is a controversial subject, yet it enabled the community to earn millions of dollars since its start and contributed to conservation as well.

1. **Population trends:** The investigation of issues related to wildlife and protected areas normally consider the number of heads of animals irrespective of their health, annul recruitment. The overall trend Ibex seems be decreasing in their population according the survey results but there is no assessment on the reproductive output. There is chance of reproductive deficit in mountain ungulates such as Markhor, Urial and Ibex due to the history of population surge.
2. **Population surge:** During the recent years of conservation, wild species has increased considerably. The sudden increase from small population are often culprits of inbreeding depression, which is most expected in the case of mountain ungulates and birds which are decreasing continuously.
3. **Unidentified species:** GB hosts the diversity of wild fauna and flora most of which are unidentified and even un-discovered yet. The rapid environmental degradation is causing the extermination and extinction of the specialist species. It shows that biodiversity of the species is declining without recognizing their ecological and economic roles.
4. **Habitat degradation and isolation:** Population is continuously increasing In Tormikis increasing and encroaching into the natural areas for settlements and agriculture. This land use changes affected wildlife both positively and negatively depending upon the species ecology. Habitat degradation has also pushed the species to isolated and low-quality habitats that caused additive stress on the wildlife heath, reproductive potential and genetic health and so on. There is no assessment for the impact of habitat degradation on genetic health of wildlife species.
5. **Genetic reserves of wildlife species:** Most wildlife surveys are based on the numerical assessment of the animals and do not account for their genetic viability. Designated areas such as national parks and sanctuaries are notified irrespective of the idea that particular area is either genetic bank of the particular species or not. Genetic reserves of forests and wild species are not identified and protected yet.

PROPOSED MANAGEMENT INTERVENTION FOR TORMIK VALLEY

5. PROPOSED MANAGEMENT INTERVENTIONS

5.1. Agriculture

In particular, there are different adaptation options in agriculture according to the involvement of different agents (producers, industries, governments); the intent, timing and duration of employment of the adaptation; the form and type of the adaptive measure; and the relationship to processes already in place to cope with risks associated with climate stresses finally the development of provincial climate change policy.

The adaptation options required for the local community needs four tiers. (i) Technological developments, (ii) government programs and insurance (iii) farm production practices, and (iv) farm financial management.

1. **Population expansions:** Land fragmentation is considered as a major factor for shrinking landholding per household similar to other areas of GB. Due to increasing population, shelter demand is also at increase, mostly houses, cattle shed and other required constructions are being built around the settlement and agriculture area, which is continuously shrinking arable and naturally forested land.
2. **Certified seed varieties and crop insurance:** Certified seed is the only input that can get farmer more than just higher yields. Such varieties are resistant to climate related and pesticide issues. To introduce the concept and usage of certified seed varieties, there is need to provide those seed on subsidized rates and premium insurance packages. Along with this one-time training of farmers of each village in the valley is crucial and establishment of input stores among a cluster of villages within a valley would help them overcoming certified seed related issue.
3. **Integrated farming and agriculture products:** Farmers are traditionally inclined to mono-cropping systems and earn the revenues from raw products. In Tormik valley farmers mostly earn very minor revenue due to lack of awareness on post harvesting techniques, processing techniques and proper storage facilities. The little economic innovation lies in the sale of potato only, while million rupees' worth of fruit is being wasted annually due to lack of awareness, and skill for value addition and facilities for storage. Many end-users require specifically processed products such as Marmalades, Jams, Vinegar and Honey. Farmers need guidance on the value addition of products in order to be economically stable.
4. **Soil analysis:** It was unanimously reported by all the communities that land they are cultivating is never tested in the laboratory and scientifically they don't know which crop and fruit varieties are best for their soil type. Each crop is sensitive to soil type and productivity heavily depends upon the suitable soil. Practically there is requirement of soil testing facility within each agriculture information cell. This facility will provide information about several structures especially addressing the common question of farmers such as suitable seed varieties, microbiota of soil and its capacity of crop growth and several others.

5. **Secure water availability:** Water is central to agriculture productivity. Adaptation of climate-smart inputs and shifting to more efficient irrigation methods will help local farmers to maintain productivity levels. Water tanks for the storage purpose of agriculture are required to reduce the drought effects at some village.
6. **Training on climate friendly agriculture practices:** In Tormik people are highly dependent on traditional farming techniques and don't know to adapt with changing climate impacts on agriculture. It is therefore mandatory for agriculture concerning agencies to train farmers with the emphasis on targeted ingenuities such as outcome-based farmer incentives and knowledge transfer systems – that enhance farmer capacity to achieve sustainable productivity growth through mitigating and adaptive practices keeping the pace with climate change. These climate friendly and climate proof practices particular to each valley must be incorporated into the operational plan. As there are no previously approved practices so they are needed to be designed by methodically modeling the practices with climate change models.
7. **Introduction of climate resistant seed varieties:** As mentioned above that farmers are largely practicing traditional farming but they are having knowledge about climate change effects, however they are absent to know that how the knowledge could be materialized to coup up with climate change effects and sometime take poor decisions. Farm decision-making is seen as an on-going process, whereby producers/farmers are continually making short-term and long-term decisions to manage risks emanating from a variety of climatic and non-climatic sources. In this sense, adaptation is the result of individual decisions influenced by forces internal to the farm household (i.e. risk of income loss, environmental perception) will become reasonable and let them earn revenue to decrease pressure of local community on natural resources. To resist or at least minimize the pressure of ever-changing climate patterns and issues in relation to climate change, there is a need to develop an agriculture information cell for the farmers in each village. This information cell will raise the job opportunities for local community and will guide them about the climate resistant breeds, ways of cultivation, harvesting in detail. This information cell must have the tested varieties of climate resistant seeds and seedlings. Seed storage for potato in the harsh climatic condition is a challenge in the CKNP area, therefore input store for seed must be provided at least among every three villages.
8. **Spread of infestation to the wildlife:** Buffer area of CKNP harbor 230 villages. All of these villages have agriculture crops and tress which are getting infected manifolds since last decade. These pest species have the chance of transmission towards the wild medicinal herbs, forests, nests of birds and ultimately enter in fauna. This pathogenic transmission can induce infections in the flora and fauna and has a considerable potential to depress the specialist species. However, this issue has not yet been explored and needs a well-prepared monitoring procedure to estimate the estimate the annual economic laws.
9. **Research projects:** Without research adaptation to climate change is generally problematic for agricultural production and for agricultural economies and communities; but with

adaptation, vulnerability can be reduced and there are numerous opportunities to be realized. Adaptation must be supported by the research of relevant components. Productivity is declining at a rapid pace due to some known and unknown reasons. Apparently, climate change seems responsible for this decline aided with ever increasing pest attacks during last 10 years. The recent changes in the climate are so unpredictable that it is becoming impossible for the farmers to work in agriculture farms for profit. Customary practices for agriculture sustainability are losing their functionality. These practices must be updated by designating specific studies of seed variety, soil analysis, crop suitability analysis, bio-control of pests, projected impact of climate change on the crop's productivity and transport, optimum economic benefits from every suitable crops and several other inter-related components. As it is evident that the impacts of climate change on agriculture will vary depending on precipitation changes, soil conditions, and land use, therefore these impacts are required to be evaluated independently for each valley in the buffer zone of CKNP. This vast research is possible if included in the operational plan of the CKNP to provide support for updated management plan of CKNP.

10. **Key policy reforms:** Key policy reforms across three pillars are needed to strengthen farmer incentives to achieve productivity growth sustainably, and without sacrificing climate change mitigation and adaptation objectives. These three pillars are i) Farmer level, ii) Agriculture sector level, iii) Provincial level. The agriculture policy needs an up gradation to mitigate the effects of changing climate and devising the climate friendly strategies at an urgency to minimize the agriculture induced impacts on climate ultimately to protect the protected areas of GB, particularly its largest park the CKNP. The management plan which is already established has a huge gap about the laws of employing climate friendly approaches in villages residing in buffer areas for agriculture. Moreover, the climate is not only changing but it is also on stationary which means old knowledge can't be the thing to rely upon. So, gap of climate friendly approaches must be assessed via operation plan for CKNP and then addressed in to the revised version of CKNP management plan.

5.2. Pasture

1. **Upgradation of customary laws:** Customary practices should be amended in such a way that ensures sustainable use of pastures.
2. Diseased animals must be kept away from the pastures to avoid the zoonosis and must be vaccinated.
3. Extraction/cultivation of medicinal plants by the local community must account only for household purpose and should be cultivated in the amount equal to its removal.
4. Encourage stall feeding/minimize grazing till the improvement of pastures.
5. These strategies must be field tested and then included in the customary and statutory laws and CKNP revised management plan.

6. **Grazing Management:** To enhance pasture productivity timing of grazing and grazing sites in each pasture are need to be designated to develop holistic grazing strategies with farmers/herders that include rotational grazing or intensively managed grazing as a regular grazing routine.
7. **Fodder cultivation:** Regionally adapted and high nutrition value fodder crops should be cultivated for fodder instead of traditional species. This will remove the stress of early grazing from the pastures and allow them to grow.
8. **Training of herders:** Herders have no information about the sustainable practices of livestock grazing. They just sent their livestock with guards to feed upon the pastures. Timing of grazing is integral for livestock. There are several other factors that need to be cared for the sustainable livestock grazing.
9. **Seeding of local flora and training of farmers:** Local flora should be collected and cultivated on the barren patches among the pastures. This will increase the pasture areas and productivity. Research on cultivating these species is required. After it dissemination of knowledge through training sessions, manuals and brochures will convince the farmers about the re-seeding of pastures.
10. **Local botanical garden to ensure existence of local flora:** Adaptable plants should be identified among the plants. These plants should be kept in botanical gardens to provide backup in case of avalanches, landslides, floods and barren land cultivations.
11. **Encourage the pasture extension services by other line departments:** Many forestry and livestock enterprises run by private farmers and the government depend on efficient, economical, and environmentally beneficial pasture use. Farmers need technically competent advisors to help them accomplish their objectives. Unfortunately, no advisory services for the pastures exist in the villages because of lack of pasture specialist technical advisor. Therefore, there is strong need to train the forest relevant personnel from each village or valley as a pasture specialist. CKNP biodiversity directorate staff can be a potential candidate for this training as they are both aware of natural resource use in and around CKNP.
12. **Cultivation and marketing of medicinal herbs:** Cultivation of these herbs should be promoted as an alternative economic resource with appropriate site assessment and training on its cultivation, harvesting marketing and utilization. Economic uplift of the community will actually decrease their dependence on CKNP resources and allow them to grow.
13. **Ethno-botanical data base:** Development of consumer linked ethno-botanical databases of each village will not only enhance the market for the local farmer but also fosters the direct link to the consumer.
14. **Pasture awareness programs:** Hands-on training and field experience are two of the best, most rapid ways to increase farmer's/shepherd's awareness and local university students about the optimum pasture use for healthy livestock. Final outcomes will be best when this

training is guided by technically competent professionals who can accurately answer questions and help solve problems. This training will allow the local community to employ sustainable practices and secure these resources for their future generations.

15. **Research problems:** Phenological shift of floral species and their impact on biodiversity must be assessed on priority basis so that extirpations can be avoided. Ecological baseline of the pastures to keep the biodiversity of the area must be developed. Similarly, potential farming sites for each medicinal plant should be identified. The predicted impacts of climate change on the pasture productivity are not known and need to be evaluated due to their high valued ecosystem services. Most utilizable and ecologically resilient entry points are needed to be identified and designated.

5.3. Water

The water laboratory at KIU has carried out water quality assessment in all villages of CKNP, the result shows that people living in CKNP buffer zone afflict with different kinds of water contagious diseases because of the scarce access to clean drinking water. Even though glacier water is present in many areas however easy access to clean water is very difficult for most of the population.

1. **Quality of drinking water:** The water testing facility already established at Karakoram International University provides the free testing but local community is not very interested in the procedure due to lack of awareness.
2. **Construction of small and medium sized reservoirs**: Construction of small or medium-sized reservoirs in the foothills and plains are quite necessary, so that water from streams can be harvested for use during the dry season and the winter, both for farming and domestic purposes.
3. **Common drinking water storage tank:** Shared water storage tanks should be built upon among the households to help them adapting drought conditions.
4. **Water pollution mitigation:** To ensure the water quality local community should be compelled to make separate pathways for grey water ensuring that it do not mix into the fresh water streams. Hotel owners should be trained to dump the trash elsewhere instead of water while adopting ecosystem friendly approaches.
5. **Early warning system:** But to give relief to the local community of the Tormik Valley, there must be system to give them timely alerts about their crops and livestock protection. This will accentuate the economic resilience of the community and natural resilience of the buffer area.

5.4. Forest and NTFP

1. **Up gradation and regulation of forest laws:** Conservation committees are formed for protection of forest and wildlife but those are inactive. On other hand customary laws are not much strict on deforestation thus **cu**stomary laws allow the fuel wood collection, timber and non-timber forest products unlike statutory laws, which increase their favor towards

the customary laws. If this practice is continued, then community will shortly run out of their forest reserves. To ensure sustainability, an up-gradation of customary rules is recommended. Otherwise, implementation of statutory laws is integral which can be more enhanced by fostering statutory laws by the concern line department

2. **Promotion of farm forestry:** Resources should be provided and farmers should be trained to have small-scale farm forests, which along with revenue generation allow them to be independent of forests. This practice exists in a valley but very limited. Training will allow the farmers to take self-initiatives and entrepreneurship in forestry sector.
3. **Climate change and conservation friendly forestry projects:** To generate credible forestry and conservation offsets, projects must be additional to what would have occurred without the incentive supplied by the carbon market; they must be verifiable (i.e., measurable and enforceable); they must control or adjust for leakage; and they must address the issue of permanence. Forward crediting is proposed by some to accommodate the long period of carbon accumulation in forests, but others are concerned about assuring payments only for actual carbon sequestration.
4. **Restoration cum conservation:** Several sustainability practices are being carried out in Tormik Valley but any of them hardly meet the conservation targets. Keeping in view the present environment sustainability changes, restoration is required along with conservation. Therefore, the upcoming forestry projects must come up with the forward crediting instead of required crediting.
5. **Research projects:** Projected annual greenhouse gas emission counts provide baseline to identify required CO_2 sequestration offset. On the basis of this, it will be identified that which species is required and in how much amount to keep climate stable for each valley in the buffer zone of CKNP and its surrounding areas. Remote sensing to monitor the land use changes is very essential because of the location of valley around CKNP. In future due to CPEC, land use is expected to be altered and its environmental consequences seem negative. To neutralize these expected issues baseline data about land use will quantify the environmental impacts and truly determine the required type of actions with high accuracy.

5.5. Eco-tourism

Following interventions are recommended on the basis of the survey conducted for VCSDPs development.

1. **Interpretation of resources:** In order to increase the revenues by tourism there is need to provide interpretation programs that are relevant to the public, further information is required. This information can be obtained through visitor surveys.
2. **Destination vulnerability hotspots:** The integrated effects of climate change will have far-reaching consequences for tourism businesses and destinations. Importantly, climate change will generate both negative and positive impacts in the tourism sector and these impacts will vary substantially by market segment and geographic region. The Tormik valley is disaster

proven area which are not mapped and disseminated to the tour operators. This inventory should be developed along with measured risks and challenges that tourist can face.

3. **Infrastructure:** Tormik is among those valleys which has potential for tourism related infrastructure such as accommodation, ecotourism facilities, are zilch and needed to be developed to ensure the provision of facilities for tourist influx by public and private department. Surge in tourist flow has been reported recently but related infrastructure such as accommodation, ecotourism facilities, are very short and needed to be developed to ensure the provision of facilities for tourist influx by public and private department.

5.6. Mining

Following interventions are recommended on the basis of the survey conducted for VCSDPs development.

1. **Training of miners:** It is important for the miners to have hand on training on modern tools and techniques for quality mining. It is especially important for the valleys, which lie near mining deposits of Gemstones and other minerals
2. **Entrepreneurship opportunities:** Small-scale business related to gemstones and its products will provide the local community an opportunity to earn good profit.

5.7. Wildlife and Protected areas

1. **Population assessment:** Database should be established to keep the systematic annual population assessment of all the near threatened and endangered animals. The protocols for population assessment of each species should be determined on ecological basis and kept same every year.
2. **Species recovery plan:** There is a growing consensus that habitat fragmentation has caused wildlife decline. However, what is the impact of this fragmentation is still unknown. There is need to study to study how the urbanization, habitat isolation, decline in vegetation has stressed the wildlife. How these impacts can be mitigated, which habitat areas need priority conservation actions such as habitat connectivity. All this information is possible from the properly designed studies unique to each class of wildlife based on which species recovery plan will be designed.
3. **Genetic reserves:** Genetic reserves inside the protected areas of the threatened and endangered species are needed to be identified for their restoration. If the designated protected areas do not have by chance these genetically healthy populations then their boundaries should be adjusted according to these reserves.
4. **Climate change indicators:** Several fungi and amphibian species are considered as an indicator of climate change. These species are experiencing decline in the population such as Deosai toad, which was once abundant in clean waters of the area. This species is now hard to find because of water pollution. These indicators are needed to be identified and used as climate change detection for the areas. This research will provide the real assessment unlike models, which sometimes fails to give real estimate.

6. STATUARY VS CUSTOMARY PRACTICES IN TORMIK VALLEY

S. No.	Consumptive uses of Park Resources.	Community Practices	CKNP MP/OP Rules	Recommendation
1.	Harvest of Forest and other natural vegetation	Juniper trees are cut and used as fuel wood and timber	Harvest of Juniper is banned; if harvest is necessary than only only branches should be removed instead of whole tree	Awareness of community is required
		Riparian vegetation e.g. Sea-buckthorn and Willows, community usually remove the whole plant/tree from soil	Cut single basal shoots from each plant to preserve in its root system. By doing so, new shoots can re-grow rapidly producing new biomass to be harvested	-do-
		Community harvests wood at unsustainable level both from buffer and core zone	Wood and shrub collection is allowed only in the buffer zone up to sustainable level	Afforestation, alternative fuel options and sustainable forest management areas are need to be designated. Along with this harvest rate compatible to annual growth of forest should be determined
2.	Medicinal Plants	Community harvests local medicinal herbs and aromatic plants from park for household purpose	Harvest is completely banned in core zone and allowed at sustainable level from buffer areas under license.	Community must be awarded the license and concerned department restrict the harvest without license.
3.	Livestock Grazing	Herd grazing is allowed only in buffer zone and tourism focused zones of the park.	Community graze their livestock in packs along with dogs inside core zone. Dogs and packs are not allowed inside parks	Improvement in watch and ward mechanism along with community awareness is necessary at urgency
		Equines (horses, mules, donkey) occasionally found in core zone of the park	Equines are allowed only in tourism focused zone	--
		Yaks and its hybrids freely graze in the park	Grazing of traditional free roaming yaks and yak-cow breeds is buffer and core zone is acceptable	--
		Herders graze livestock in pasture and core zones dispose plastic bags, bottles in nearby streams and also use burn wood from forest	Use of plastic bottles, glass bottles, plastic bags and match box is not allowed inside parks.	Movement must be restricted for the grazers.

S. No.	Consumptive uses of Park Resources.	Community Practices	CKNP MP/OP Rules	Recommendation
4.	Pastures	Community graze livestock in the pastures which are located in and around buffer zones.	Grazing is allowed only in buffer zone	--
		Indigenous system of grazing was sustainable. During previous times herders ensured to take livestock into the pastures, when vegetation becomes knee-length. Currently, herders have abandoned this practice and take their livestock to pastures even before its sprouting.	Indigenous grazing system should be revived	Awareness and training of herders is important
5.	Wildlife hunting	Community take advantage of inaccurate population counts of wildlife and poach/ hunt wildlife at family gatherings, holy occasions and on other such events	Reliable wildlife count by DNA analysis is recommended and also to track poaching for core zone management. Hunting except for "trophy hunting" is banned both for buffer zone and core zone.	Community awareness can serve the purpose. Moreover, genetic approach should be employed for accurate population counts and tracking of poaching

7. RECOMMENDED ACTION PLAN FOR TORMIK VALLEY

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
1.	CKNP Directorate	1.1. Improve CKNP functionality	Lack of enough support of local community for CKNP	Conflicts over the use of park resources	1.1.1 Manage the conflicting issues ensuring park conservation	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
				Community awareness is insufficient due to deprivation meetings, and awareness campaigns by CKNP Directorate	1.1.2. Awareness campaigns /training of local community about the significance, rules and regulations of the park and sustainable use of natural resources.	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
2.	Local Social Organizations	2.1. Develop Structural/ Institutional framework of social organizations	Insufficient support of LSO to CKNP directorate	Weak communication linkages Lack of effective conflict management mechanisms	2.1.1. Develop appropriate networking for existing social organizations under the umbrella of concerned LSO/CKNP	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
		2.2. Develop capacity for financial sustainability of local social originations	Poor implementation of conservation interventions implementations and subsequent sustainability	Lack of awareness about sustainability avenues	2.2.1. Preview the existing capacity of relevant LSOs for the identification of gaps	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
					2.2.2. Capacity building of Social organizations to ensure conservation of park resources and sustainable resource used	Activity 5.2	All	Urgent	Short term
					2.2.3. Capacity building of LSO to generate funding for their sustainability	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
3.	Health	3.1. Promote health facilities	Prevalence of Diseases	Lack of basic health facilities in existing dispensaries Lack of sufficient dispensaries	3.1.1. Capacity building of existing staff 3.1.2. Provision of Medicines 3.1.3. Provision of new diagnosis equipment 3.1.4. Establishment of new health facilities	Suggested for inclusion in revised community development plans	Dassu, Khalijang Dassu, Khalijang -do- Kashipa, Badapa, Melding, Pano	Urgent	Long term
			Unhygienic practices by locals		3.1.5. Awareness conferences about hygienic practices	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
					3.1.6. Dissemination of brochures and pamphlets to educate community about prevention from sporadic diseases	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
					3.1.7. Promotion of healthy and hygienic practices by women and children through workshops, campaign and social organizations	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
4.	Energy	4.1. To meet energy demand	Depletion of natural resources	Preference of fuel wood from forest by the local community due to free commodity Lack of alternative fuel options	4.1.1. Promotion of fuel-efficient stoves at high altitudes	Activity 14.2	All	Urgent	Short term
					4.1.2. Develop and motivate usage of alternative sources	Activity 14.2			
5.	Education	5.1. Curb illiteracy	Prevalence of unsustainable practices	Lack of needful development infrastructure and human resource	5.1.1. Increase the capacity of existing schools	Suggested for inclusion in revised MP/OP activities	All	Medium	Long term
					5.1.2. Creation of new educational facilities	Suggested for inclusion in	Gialskar, Pano, Surbo	Medium	Long term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
						revised MP/OP activities			
			Poor acceptability of messages/solution of conservation	Lack of awareness	5.1.3. Awareness of school staff and children about sustainable use of resources, respect of statutory laws and changing climate scenarios	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term
6.	Agriculture	6.1. Lack of sufficient food and future food security	Out-migration Malnutrition and related disease	Lack of financial and technical capacity to enhance agri-productivity	6.1.1. Introduction of Improved seed varieties for agriculture and other related crops adaptable to local climatic conditions 6.1.2. Capacity building of farmers about modern techniques to enhance productivity. 6.1.3. Fruit Processing unit	Suggested for inclusion in revised MP/OP activities Activity No. 17.1.1.	All	Medium	Medium term
				Water Scarcity	6.1.4. Construction and repair of water channels and for barren lands	Suggested for inclusion in revised MP/OP activities	All	High	Medium Term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
				Pests and diseases	6.1.5. Integrated pest management techniques	Suggested for inclusion in revised MP/OP activities	All	High	Medium Term
				Improper crop storage	6.1.6. Promotion of small-scale solar driers	Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term
				Lack of jobs and economic opportunities in agriculture and related crops	6.1.7. Improvement of existing economic opportunities 6.1.8. Creation of new job to enhance economic capacity of the local community 6.1.9. Provision and Installation of fruit processing unit	Suggested for inclusion in revised MP/OP activities Suggested for inclusion in revised MP/OP activities	All All Dassu	Medium Urgent	Medium Term Long term
				Less arable land per household	6.1.10. Development of barren land patches	Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
7.	Livestock	7.1. To enhance income opportunities for locals from livestock	Livestock mortality due to diseases	Disease spread Poor breeds with lesser dairy productivity Lack of proper grazing management regeneration with lesser productivity	7.1.1. Improvement of existing vet facilities 7.1.2. Establishment of new vet facilities	Suggested for inclusion in revised MP/OP activities Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term
			Depredation of livestock by wildlife		7.1.3. Livestock insurance scheme	Activity No. 9.4.2	All	Medium	Medium Term
			Poor breeds with lesser productivity		7.1.4. Training regarding animal husbandry	Suggested for inclusion in revised MP/OP activities	All	Medium	Medium Term
			Disease out break		7.1.5. Training of herders to restrict zoonosis	Suggested for inclusion in revised MP/OP activities	All	Urgent	Medium Term
8.	Pastures and Rangelands	8.1. To maintain ecologically healthy ecosystem	Loss of floral diversity Loss of pollinators	Water scarcity	8.1.1. New snow fed channels for pastures irrigation	Suggested for inclusion in revised MP/OP activities	All	Urgent	Short term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
			Over grazing Degraded pastures resulting in loss of food for Wildlife	Uncontrolled number of livestock Insufficient growth time for pastures Poor and dangerous accessibility to pastures	8.1.2. Promotion of supplementation with stall feeding 8.1.3. Promotion of fodder cultivation on suitable land patches 8.1.4. Awareness of herders/professional shepherd about sustainable herding practices 8.1.5. Revive the use of indigenous grazing system	Suggested for inclusion in revised MP/OP activities Suggested for inclusion in revised MP/OP activities	All All All All	High Moderate High Urgent	Medium term Medium term Short term Short term
			Unknown Carrying capacity	Lack of Research studies	8.1.6. Research studies about the carrying capacity and adaptability of Pasture to climate change 8.1.7. Establishment of enclosure to measure productivity with surrounding pastures	Activity No. 9.2 Suggested for inclusion in revised MP/OP activities	All One healthy/least degraded pasture in whole valley	Urgent Urgent	Long Term Long Term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
9.	Forest	9.1. To maintain appropriate forest cover	Run-off and landslides Less biodiversity Less fuel wood availability for local community	Lack of alternative fuel resources Lack of capacity to use fuel resources Lack of awareness on values and function of forests	9.1.1. Enhance productivity through Reforestation and afforestation 9.1.2. Promotion of farm forestry 9.1.3. Develop restricted forest zones to ensure regeneration and a total ban on Juniper harvest 9.1.4. Training of farmers for farm forestry 9.1.5. Up gradation and regulation of customary practices 9.1.6. Improved Watch & ward (Capacity building and induction of more game watchers or community guards) to minimize illegal harvest	Suggested for inclusion in revised MP/OP activities Activity No. 9.1 -do- -do- -do- -do-	All Dassu, Kashapa All All All All	Urgent	Long Term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
10.	Wildlife	10.1. To improve and maintain healthy wildlife population	Unsustainable hunting Habitat degradation Diseases from livestock resulting in un-natural mortality	Habitat fragmentation and degradation Poaching Lack of awareness about significance of biodiversity of area Lack of eco-tourism opportunities	10.1.1. Dedicated zones for wildlife, restrict grazing in those areas	Suggested for inclusion in revised MP/OP activities	All	High	Long term
					10.1.2. Improve habitat connectivity in existing fragmented habitats	-do-	All	High	Long term
					10.1.3. Habitat modelling for near threatened wildlife species	-do-	All	High	Medium term
					10.1.4. Identification of healthy population of endangered species reintroduction	-do-	All	High	Medium term
					10.1.5. Establishment of water point	-do-	All	High	Short term
					10.1.6. Improve watch and ward mechanism with inclusion of local SOs	Activity No. 6.1.3	All	High	Long Term
					10.1.7. Awareness raising through seminars, and	-do-	All	High	Medium term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
					wildlife clubs in schools 10.1.8. Dedicated research projects	 -do-	 All	 Moderate	 Long term
11.	Tourism	11.1. Promotion of tourism as a sustainable economic avenue	Loss of economic opportunities Loss of support for conservation and development opportunities	Insufficient facilities of road and stay Lack of interpretation of resources i.e. Hot springs Lack of mechanism to attract tourist/visitor	11.1.1. Maintenance of road throughout the touristic season 11.1.2. Development and dissemination of brochures for interpretation of tourist opportunities 11.1.3. Water supply, waste disposal and improvement in washroom condition 11.1.4. Community based residence and restaurants	Suggested for inclusion in revised MP/OP activities -do- do- -do-	All All All All	High High Urgent Medium	Short term Short term Medium term Medium term
12.	Water	12.1. To maintain quality and quantity of water	Pollution Water shortage at source and point of end-user	Climate change Waste disposal into water channels	12.1.1. Water quality testing from all water channels 12.1.2. Awareness of local community with focus to keep water resources clean and its minimal usage	Suggested for inclusion in relevant community development planning	All	High	Long term

S. No	Sector	Management Objectives	Conservation,Development Issues, Gaps	Root Cause(s)	Proposed Management Action	Ref. to MP/OP	Village/s	Priority	Time Scale
13.	Gem stone Mining	13.1. To aware the local miners with true practices and value of mining with ultimate aim to increase livelihood	Low economic revenues from mining products	Lack of training Lack of Contemporary practices and tools Lack of Value addition service units	13.1.1. Training sessions for local miners under framework of local organization established. 13.1.2. Enhance the direct linkages between local miners and market 13.1.3. Establishment of local service units for gem cutting and polishing	Suggested for inclusion in relevant community development planning	All	Medium	Short term

8. IMPLEMENTATION AND MONITORING MECHANISM

8.1. Implementation Mechanism

The whole process needs to be facilitated by Conservator- Baltistan in collaboration with CKNP Directorate and NGOs such as AKRSP, AKPBS, EvK2CNR, WWF etc. Following steps are important in this regard:

The first step should be the restructuring of the community organizations in the form of Community-based conservation and sustainable development organization's (CBCSDOs). Agreements should be signed with CBCSDOs for their proactive participation in conservation and sustainable use of natural resources. The local communities are now well mobilized in support of CKNP and the restructuring should not be a problem.

The second step is participatory conservation planning in which the draft CSDP should be shared with the respective communities (involving VCCs, UC members, President of VOs and WOs (where possible)): line departments at district level (Agriculture, LS&DD, Forest, Wildlife and Park, Tourism) and concerned NGOs such as AKRSP, AKPBS, EvK2CNR) to solicit their technical opinion and possible support during implementation of the plan.

The third step is approval of VCSDP from DCC Skardu, and facilitation of subsequent DCC meetings to facilitate and monitor implementation on VCSDP.

There are two cross-cutting themes. First is capacity-building involving awareness raising, trainings and exchange programmes. The second is financial sustainability which comes from various sources, primarily from government allocations and subsequently at community level from various sustainable use initiatives such as trophy hunting, ecotourism, CKNP entry fee etc. Community based organizations can also initiate small projects for that the capacity of the CBCSDOs can be enhanced so to conceive, develop, hunt and implement small initiative on their own. However, this kind of the implementation will be done in consultation with the CKNP directorate to avoid any duplication in the activities.

8.2. Monitoring Mechanism

8.2.1. CKNP Directorate

The major responsibility of monitoring all action of a CBCSDO carried out under the framework of VCSDP should be jointly with DFO Skardu and CKNP Directorate. The DFO Skardu and CKNP Directorate can monitor their progress in the following steps:

- Visiting individual CBCSDOs and checking their records and verifying physical progress on activities
- Attending DCC meetings and reviewing progress of CBCSDOs annual plans
- Monitoring CBCDSOs performance against their annual plans in the meetings of the CKNP Management Committee

- CKNP can call in meetings of the representatives CBCSDOs at the directorate on a periodic or need basis to review the progress against the tasks

8.2.2. District Conservation Committee Meetings

The VCSDP should be presented in DCC Skardu and endorsed by the chairman of DCC with recommendations from CKNP Director and DFO Skardu. The DCC Skardu in its bi-annual meeting should review the progress of implementation on VCSDP. Each village should have an annual plan to be presented and subsequently reviewed in DCC.

8.2.3. Community Agreements

DFO Skardu, CKNP Directorate or any supporting agency intending to initiate any activity with a CBCSDO should sign a letter of agreement explaining the roles and responsibilities of all parties involved in undertaking the activity. A copy of such an agreement should be made available in CBCSDOs office records.

8.2.4. CBCSDOs Audit and Record Keeping

DFO Skardu, CKNP Directorate or any supporting organizations should emphasize on proper record keeping of all activities undertaken by CBCSDOs. This can be done by checking monthly minutes' sheet, proceedings of the special meetings and financial records of CBCSDOs. It should be mandatory for every CBCSDO to have their annual audit report. Any financial support to a CBCSDO should be linked to availability of annual audit report. The community must have a separate file for all major activities to be undertaken as part of the VCSDP.

For all major initiatives the CBCSDO should constitute two committees: a) project execution committee and b) project audit committee. Most of the local communities are familiar of this system due to the projects of several orgainzations.

8.2.5. CBCSDO Visitor Diary

CBCSDO should maintain a visitor diary for noting comments, feedback and observations of all visitors coming to a village in connection with conservation and sustainable development initiatives. The CKNP Directorate, DFO Skardu and supporting agencies or organizations should clearly instruct their employees visiting any village/ valley to write down their notes in CBCSDO visitor diary. This way the supporting agencies can avoid duplicate of efforts and it will be helpful in carrying out the activities systematically and logically.

8.2.6. Relevance in Assignments

The CBCSDOs should find the relevant person for carrying out tasks including the finance and record keep, meeting minutes etc. The relevant persons will thus be able to keep a proper record that is a prerequisite for the sustainability of the community organizations. Channels should be found out, wherever possible for the capacity building of the technical persons closely coordinating with the government and private organizations.

8.2.7. Network of CBCSDOs

In order to learn from each other's best practices, it is worthwhile to develop a network of CBCSDOs. They may opt to meet led by some representatives facilitated by CKNP to discuss the successes and failures. The learning can be shared that can help in avoiding failures, adopting models that lead to successes considering the relevancy.

Visitors Diary

Name of CBCSDO.....

Name of Visitor .....

Organization/institution .....

Date of visit .....

Purpose of visit .....

Venue of meeting .....

Meeting participants.....

Key discussions or decision points

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Required follow up actions

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Signature of the visitor.....